Learning to See in the Pietist Orphanage: Geometry, Philanthropy and the Science of Perfection, 1695-1730

by

KELLY JOAN WHITMER

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M.A., Western Washington University, 2002

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Abstract

This is a dissertation about the Halle method, or the visual pedagogies of the Pietist Orphanage as they were developed in the German university town of Halle from 1695 until 1730. A "Pietist" was someone who was affiliated with an evangelical reform movement first initiated by Philipp Jakob Spener in the 1670s. A long and deeply entrenched historiographical tradition has portrayed the Halle proponents of this movement—especially their leader August Hermann Francke—as zealous, yet practical, Lutheran reformers who were forced to directly confront the ideals of early Enlightenment in conjunction with the state-building mandate of Brandenburg-Prussia. This has led to a persistent tendency to see Halle Pietists as "others" who cultivated their collective identity in opposition to so-called Enlightenment intellectuals, like Christian Wolff, at the same time as they exerted a marked influence on these same persons. As a result of this dichotomous portrayal over the years, the impact of the Halle method on educational reform, and on the meanings eighteenth-century Europeans attached to philanthropy more generally, has been misunderstood. I argue that the Pietist Orphanage holds the key to remedying several problems that have impeded our ability to understand the significance of Pietist pedagogy and philanthropy. This was a site specifically designed to introduce children to the conciliatory knowledge-making strategies of the first Berlin Academy of Science members and their associates. These strategies championed the status of the heart as an assimilatory juncture point and were refined in the schools of the Pietist Orphanage, which itself functioned as a visual showplace that viewers could observe in order to edify and improve themselves. It was the material expression of Halle Pietists' commitment to a "third way" and marked their attempt to

assimilate experience and cognition, theology and philosophy, absolutism and voluntarism. The dissertation examines several personalities who had a direct bearing on this conciliatory project: namely E. W. von Tschirnhaus, Johann Christoph Sturm, Leonhard Christoph Sturm, Gottfried Wilhelm Leibniz and Christian Wolff. It also examines *how* the method was applied in the Halle Orphanage schools and extended elsewhere.

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Introduction

Pietist orphanages were both real and imagined spaces. They did and did not house orphans. Their founders were and were not Pietists. They were funded by everyone and no one (with the exception of God). They were and were not supported by the state. They were inclusive and exclusive. They existed to regulate both the environment and the soul. The educational programming in place within these sites aimed to create a world in which there was no difference between thinking and feeling, or between knowing and doing. Here the seemingly impassable fissure imagined as existing between the world of the mind and the world of the hand had been bridged and Cartesian dualism mediated. The founding of a Pietist orphanage, or application of its pedagogies in other institutional settings, signified the pursuit of a rigorous method of action and assimilation, a middle way. Following the example of the Jesuits, whose prowess as educators was widely known, Pietists cultivated the "visual aptitudes" of children and held up the eye as the perfect conciliatory, didactic and edificatory medium.[1] In the spaces touched by their methods, the eye and the heart became fused together into a single entity that observed, reconciled and loved.

This is a dissertation about the visual pedagogies of the Pietist Orphanage, or what was referred to collectively as "the Halle method" by the turn of the eighteenth century. In a manner markedly similar to that of its subject, which aimed to reconcile competing epistemological stances with each other, the dissertation weaves together and thereby contributes to several historiographical problems, conversations and disciplines at once. One could say that it does this simply by making a case for the Pietist

[1] For the phrase "visual aptitude" see Barbara Maria Stafford, *Artful Science: Enlightenment Entertainment and the Eclipse of Visual Education* (Cambridge, Mass: Harvard University Press, 1994).

Orphanage's significance beyond the specific moment or historical milieu that produced it at the same time that it demonstrates why and how a unique set of concerns about "seeing" and "reconciling" coalesced at this moment (in Brandenburg-Prussia, around 1700) to forge a universalizing edifice—something solid yet not entirely tangible. The edifice itself, the physical structure of the Pietist Orphanage building and the varied forms of practices it contained, signified a vision of universal benevolence, of philanthropy, to eighteenth-century contemporaries (see Appendix 1). It was a vision that placed the very act of making and transmitting knowledge—via experiment *and* demonstration, sensation *and* intuition—at the heart of a new, privately sponsored yet state-supported enterprise that set out to improve and ultimately perfect the world by subjecting individuals, one by one, to the rigors of conciliatory exercise.

Until now, the meaning and import of the "Halle method" has been little understood, no less for its impact on modern educational systems via the method's influence upon some of the first Prussian experiments in compulsory education than for its impact on a similar mandate of universal benevolence or improvement still very much at the heart of modern philanthropy. An altruistic concern for human welfare, including the circulation and distribution of private donations, is a vital part of widespread efforts to promote public health and educational programming in the world today. Philanthropy is a subject critical to contemporary debates around globalization, or the unprecedented degrees of global interconnectivity, international marketplaces and humanitarian issues that inspire private, voluntary associations of benefactors to become activists. Because the mandate of philanthropy still remains very much oriented around the idea of children's innocence and "improvement" as something visible, something universally

recognizable, we ought to pay careful attention to the relationship between visuality, pedagogy and evangelical voluntarism as it was imagined by some of the first "global" philanthropists in the histories we now write.[2]

The eighteenth century marked a pivotal moment in the history of philanthropy and education more generally. It saw debates concerning public versus private charity in Europe give way to new, privately sponsored institutions such as orphanages that were "evangelical" rather than "civic" in nature and global in scope as opposed to responding only to local needs.[3] The marked shift in ideas about charity and the role of those who dispensed it was spearheaded by revivalist religious movements both in the German states and in Great Britain. In Britain, the Society for the Promotion of Christian Knowledge (SPCK) was formed in 1698 with the hope of sponsoring spiritual regeneration in children through the founding of hundreds of charity schools. Its directors were in frequent contact with the radical Lutherans who supported Pietist orphanages.[4] Together, these groups would claim to be surmounting local problems of poverty, illiteracy and displacement by developing extensive faith-based networks,

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[2] Visuality connotes the idea, popularized by Descartes, that the images we see are not actual forms emitted by objects but perceptions that function like words or signs; they convey meaning and yet do not exactly resemble the objects they represent. As I will show, members of Halle's intellectual community sought to remedy this problem by promoting new strategies for producing resemblance. This required them to pay special attention to how images, words and signs acquire their meanings, including how individuals could better regulate this process.

[3] Renate Wilson has attempted to integrate Pietism into a global history of philanthropy; but because of her special interest and expertise in eighteenth-century pharmaceuticals, her work has not addressed the meaning and import of the Halle method for our understanding of Pietist philanthropy more generally. See Renate Wilson, "Philanthropy in 18th-Century Central Europe: Evangelical Reform and Commerce," *Voluntas: International Journal of Voluntary and Nonprofit Organizations* 9:1 (March, 1998): 81-102; Paul Slack, *From Reformation to Improvement: Public Welfare in Early Modern England* (Oxford: Clarendon Press, 1999); Mary Fissell, "Charity universal? Institutions and moral reform in 18th century Bristol," in L. Davison, T. Hitchcock, T. Keim, and R. B. Shoemaker (eds.), *Stilling the Grumbling Hive: the Response to Social and Economic Problems in England, 1689-1750.* (New York: St. Martin's Press, 1992); Hugh Cunningham and Joanna Ines ed., *Charity, philanthropy and reform from the 1690s to 1850* (Basingstoke: Macmillan; New York: St Martin's Press, 1998).

[4] Daniel L. Brunner. *Halle Pietists in England: Anthony William Böhm and the Society for Promoting Christian Knowledge*. Göttingen: Vandenhoeck & Ruprecht, 1993.

including teachers and missionaries who claimed to possess the secret to the perfection of mankind through the reconciliation of all faiths or all ways of knowing. A conciliatory pedagogy formed the crux of the secret, making it central to my story.

By exploring the context in which conciliatory visual pedagogies were imagined as "the Halle method" by a prominent Pietist leader and several of his associates in early eighteenth-century Halle (Part I), how the method worked (Part II) and how it was transmitted (Part III), I hope to fill a very large gap in our understanding of the origins of a universal, evangelical and child-centric philanthropy at the same time as I offer a new way of appreciating or situating the Pietist Orphanage's impact on eighteenth-century pedagogies and its effect on the circulation of knowledge more generally. These sites provide very powerful examples of exactly the kind of convergence between inquiry and invention that Simon Schaffer and Lissa Roberts have recently insisted was at the heart of knowledge making enterprises from the late Renaissance until early industrialization; the Pietist Orphanage invites new ways of understanding philanthropy as an extension of this pairing—that is, an attempt to embed a moral compass into the "handy minds" and "mindful hands" who also embraced the mandate of improvement as they observed, engineered and often radically altered their surroundings with the help of new technologies.[5]

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[5] Lissa Roberts, Simon Schaffer and Peter Dear eds. *The Mindful Hand: Inquiry and Invention from the late Renaissance to early Industrialization* (Amsterdam: Koninklijke Nederlandse Akademie van Wetenschappen, 2007). Universal benevolence, or improvement, is bound up with the concept of "utility," which, among others, Roger Chartier has argued was central to Enlightenment epistemologies. See Roger Chartier, *The Cultural Origins of the French Revolution* [transl. Lydia G. Cochrane] (Durham, NC: Duke University Press, 1991). I agree with Lissa Roberts, who insists that "utility" should be understood as encompassing "a multifaceted set of discourses that were deployed in keeping with the variety of meanings and purposes with which actors at the time charged the term." She continues, "Utility referred to a cluster of philosophical usages: (scientific) knowledge in the service of society and the furtherance of both secular and religious enlightenment. But it was also invoked to justify or criticize practices aimed more directly (though not always consciously) at extending institutional, cultural or socioeconomic power and control.

Aiming to contribute to several fields at once, especially the history of philanthropy, visuality, education and science, may seem overly ambitious for a single dissertation project; however, the subject it takes as its focus is uniquely suited for such an undertaking. Because the practitioners of the method it housed endeavored to engage and assimilate all forms of knowledge, the Pietist Orphanage is situated squarely at the intersection of several disciplinary trajectories. Yet virtually all of these fields or disciplines have collectively underestimated or ignored its significance. The reasons for this involve a tendency, already prevalent in early eighteenth-century texts, to deride Pietists as irrational (i.e. anti-reason, anti-Enlightenment) religious enthusiasts, who then got to serve as "foils" in the positivist historiographies of the late eighteenth and nineteenth centuries. Also, the archival materials so central for understanding Halle Pietism, not to mention the meaning and import of the "Halle method," were not readily accessible to the international academic community prior to collapse of the German Democratic Republic.[6] Fortunately, the situation is rapidly remedying itself, as we are currently in the midst of a kind of "Renaissance" of Pietism studies that is drawing scholars from all over the world to Halle and prompting vigorous discussions about how to understand Pietism's wider significance. Yet even in these very recent discussions,

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Finally… it provided a watchword for various forms of sociability that developed during the eighteenth century." In Lissa Roberts, "Going Dutch: Situating Science in the Dutch Enlightenment," William Clark, Jan Golinski and Simon Schaffer eds., *The Sciences in Enlightened Europe* (Chicago, The University of Chicago Press, 1999): 351-52. For a genealogy of the idea of "improvement" as it acquired various meanings in Britain and affected the construction of Empire see Richard Drayton, *Nature's Government: science, imperial Britain, and the 'improvement' of the World* (New Haven, Conn.: Yale University Press, 2000).

[6] In the second half of the nineteenth century, due to circumstances that remain unclear, over 10,000 pieces of archival material were removed from the Francke Foundation archive. A substantive portion of the materials found their way to the state library of Berlin, where they are now part of what is called the Francke *Nachlass*. They are available for use in Halle on microfilm.

Halle Pietists' preoccupation with visuality, including their interest in the eye-oriented mathematical sciences as conciliatory practices, has been almost entirely neglected.

The phrase "mathematical sciences" (*mathematische Wissenschaften*) was used often by Pietists and their contemporaries in conjunction with the phrase "useful sciences" (*nützliche Wissenschaften*) or "practical mathematics." Yet historians of science have tended to underestimate the status of the mathematical sciences as conciliatory or "middling disciplines" by preferring to focus on the very real tension between higher mathematics and experimental philosophy in this period.[7] Thomas Kuhn, Steven Shapin and Simon Schaffer have affirmed that a kind of "essential tension" had come to dominate Europe's epistemological landscape by 1700, separating practitioners of highly esoteric (i.e. hard to access) mathematical or geometrical methods from those like Robert Boyle and the earliest members of the British Royal Society, who preferred the new experimental method—a method rooted in the conviction that the only way to produce universal truths was to ground these same truths in collectively verifiable experience.[8] The various disciplines of the "mathematical sciences," including optics, dioptrics, perspective, mechanics, astronomy, architecture and fortification, drew readily from both mathematics and physics and had one striking feature in common: their reliance on practical geometry. This project shows how the technologies of geometrical

[7] See J.A. Bennett, "The challenge of practical mathematics" in Stephen Pumfrey, Paolo L. Rossi and Maurice Slawinski eds. *Science, Culture and Popular Belief in Renaissance Europe* (Manchester and New York: Manchester University Press, 1991). The practical mathematical sciences, "in which the practices and instruments of the new experimental strategies appeared, have too often been spurned." In Simon Schaffer, "Godly Men and Mechanical Philosophers: Souls and Spirits in Restoration Natural Philosophy," *Science in Context* 1 (1987): 56.

[8] Thomas S. Kuhn, "Mathematical versus Experimental Traditions in the Development of Physical Science" in *The Essential Tension: Selected Studies in Scientific Tradition and Change* (Chicago: the University of Chicago Press, 1977): 36, 39; Steven Shapin, "Robert Boyle and Mathematics: Reality, Representation, and Experimental Practice," *Science in Context* 2, 1 (1988): 41-42; Steven Shapin and Simon Schaffer's *Leviathan and the Air Pump: Hobbes, Boyle and the Experimental Life* (Princeton: Princeton University Press, 1985).

projection, including the practical methods of surveyors, architects and geometers, get held up in early eighteenth-century Halle as expressions of a conciliatory "middle way" that could help further the mandate of philanthropy and universal reform that Pietists championed.

Instead of seeing Halle Pietists as anti-rational enemies of all forms of knowledge that were not divinely inspired, I see them as passionate inquirers, observers, consumers and assimilators of the cacophony of materials and methods so characteristic of knowledge making in eighteenth-century Europe. Like Robert Boyle, Robert Hooke and other members of the Royal Society in England, they believed in the possibility of reconciling several forms of knowledge (and knowledge-making) by exploiting the potential of middling objects and instruments. In doing this, they participated in the same sorts of conciliatory knowledge-making as the polymaths they associated with: Ehrenfried Walters von Tschirnhaus, Gottfried Wilhelm Leibniz, Johann Christoph Sturm, Leonhard Christoph Sturm, Christian Wolff, Christian Thomasius, Friedrich Hoffman, Georg Ernst Stahl, Daniel Ernst Jablonski, even Frederick Slare (a former student of Boyle's and Royal Society member).[9] In its reliance on projective geometry, the mathematical sciences placed a great deal of emphasis on the eye's ability to reconcile magnitudes and perceptions with the help of several sorts of assimilatory tools. One could become adept in the art of using these tools and produce representations of objects that were proportionally perfect copies. Pietists accepted that as one's ability to do this improved, one also improved oneself; they were also convinced of the possibility that one could produce perfect, three-dimensional forms of representation if one

[9] Daniel Brunner notes that in Slare, Halle Pietists found their "closest friend." See idem, *Halle Pietists in England: Anthony William Böhm and the Society for Promoting Christian Knowledge* (Göttingen: Vandenhoeck & Ruprecht, 1993): 26 n.56.

incorporated geometry into an array of spiritual practices or practiced geometry while "illuminated" or filled with divine love.

Halle Pietists believed in the promise of helping individuals acquire "visual aptitudes" through training in the mathematical sciences, which provided a methodological point of orientation for solving the problem of dissonance between competing regimens of truth—including competing confessional systems. Although, as Lorraine Daston has noted, "the divergence, integration and transcendence of individual perspectives were the province of moral philosophy and aesthetics" in the eighteenth century more generally, in Halle, around 1700, this group of radical Lutheran theologians attempted to link moral philosophy and aesthetics to "primitive Christianity" or the idea of a universal faith.[10] Like Gottfried Wilhelm Leibniz, whose "perspectival metaphysics" and preoccupation with harmony is well documented, Halle Pietists pursued a pansophic vision of universal harmony, justice or benevolence; only they institutionalized their version of this vision in an orphanage and placed it at the center (or heart) of a self-enclosed "city of schools."[11] They were participants, like Leibniz and so many others, in a culture of reconciliation, or what the noted Professor of Medicine at the University of Halle, Friedrich Hoffmann, called a "culture of understanding," and their conciliatory and

[10] Daston carefully points to the "perspectival metaphysics" of Gottfried Wilhelm Leibniz's *Monadologie* as an exception to this; however, I think the entire Pietist program should be viewed as an exception to this—as an attempt to bridge the gap between philosophy and theology more generally. See her discussion of perspectival and aperspectival objectivity in "Objectivity and the Escape from Perspective" in the *Science Studies Reader* (New York, NY: Routledge Press, 1999): 114.

[11] Halle Pietists and Leibniz's understanding of philanthropy were very similar, yet they are consistently treated in entirely separate literatures and as ideological opposites. In order to make my case for the significance of the Halle method, my dissertation must, in part, attempt to mediate this rift. See Chapter Three for a thorough discussion.

vision oriented method was hugely influential precisely because of their ability to replicate it in new and existing institutional settings.[12]

To summarize and offer a roadmap for the discussion contained in the rest of this introduction, my project 1) offers a new way of understanding Pietist philanthropy as a conciliatory practice—an expression of one's ability to see correctly; 2) challenges the historiographical tendency to see Pietists as enemies of science, rationality and Enlightenment or the construction of "Pietism" and "Enlightenment" as oppositional categories; 3) challenges the characterization of early eighteenth-century Halle as conflict or controversy ridden (on the contrary, my research points to an overwhelming preoccupation with new methods for promoting friendship, reconciliation, union, illumination and love in this setting); and 4) offers a kind of corrective for a tendency among church historians and theologians to underestimate Philipp Jakob Spener and August Hermann Francke's interest in the conciliatory promise of visual exercise, including the overwhelmingly vision-oriented mandate of Johann Amos Comenius (1592-1670) and pansophy. Halle Pietists were just as concerned as generations of orthodox Lutherans with how to bring heads, hands and hearts together so as to infuse all human action with principles that were simultaneously ethical, rational and useful. Only they held up light, perspective, three-dimensional models, the mathematical sciences, motion and the medium of the eye as keys to producing the idealized *consilia* of thinking, feeling and loving that so many contemporaries sought. In other words, Halle Pietists' emphasis on the conciliatory qualities of seeing, including their emphasis on vision-

[12] Friedrich Hoffmann's Foreward to Johann Hecker's, *Einleitung in die Botanie, worinnen die Nöthigste Stücke dieser Wissenschaft kurzlich abgehandelt werden, mit einer Vorrede Herrn Friedrich Hoffmann's Med. D. Königl. Preussischen Hofraths und sowol der medicinischen Facultät, als auch der hiesigen Friederichs Universität Senioris, cet. Von der Rechten Anführung der Jungen auf Schulen zu Erlernung realer Wissenschaften und der wahren Weisheit* (Halle: Waysenhaus, 1734).

oriented pedagogies, is one way of understanding both what set their movement apart from orthodox Lutheranism (which stressed rote memorization and repetition of various catechisms in schools[13]) *and* what they held in common with the "enlightened" luminaries of their day—Ehrenfried Walthers von Tschirnhaus, Gottfried Wilhelm Leibniz, Christian Wolff, to name just a few. In effect, the Pietist Orphanage becomes a site for the resolving of paradoxes. And so it follows that in understanding the institutionalized "middle way" that Halle Pietists championed, we can actually acquire a better sense of just how much they had in common with other members of their community, including how deeply engaged they were with assessing and resolving the major problems of their age.

I have chosen to work my way backwards through the list presented above if only to more quickly address what is likely by now a pressing question for many readers. What is Pietism anyway? How do I define it? How have others defined it? And, more

[13] For the rudiments of Lutheran schooling see Gerald Strauss's *Luther's House of Learning: Indoctrination of the Young in the German Reformation* (Baltimore: John's Hopkins University Press, 1978); there is a huge literature around the concept of "social disciplining" or the technologies of "confessionalization" that Lutherans and other politically legitimated religious groups used to indoctrinate the members of their communities in the sixteenth and seventeenth centuries. Until fairly recently, social discipline (*Sozialdisziplinierung*) formed the central research paradigm for scholarship on seventeenth and eighteenth-century poor relief institutions – including prisons, workhouses and orphanages—and post-Reformation schooling. The concept itself is derived from the work of Gerald Oestreich who argued that the neo-stoicism of Justus Lipsius (a sixteenth-century humanist) provided early modern princes with an overtly secular philosophy for fostering new attitudes to state authority among their subjects. The term "confessionalization" (*Konfessionalisierung*) refers to a series of modernizing strategies employed by these princes (as heads of territorial states) in order to consolidate and reify confessional boundaries in Europe from roughly 1550 to 1750. Ernst Walter Zeeden first advanced the term *Konfessionsbildung* in *Die Entstehung der Konfessionen*: *Grundlagen und Formen der Konfessionsbildung* (München, 1965). See also Ronnie Po-Chia Hsia's discussion of Zeeden in *Social Discipline in the Reformation* (New York: Routledge, 1989): 3. Heinz Schilling and Wolfgang Reinhard have been the most outspoken advocates of confessionalization in Germany. See Reinhard's "Zwang zur Konfessionalisierung? Prolegomena zu einer Theorie des konfessionallen Zeitalters," in *Zeitschrift für historische Forschung* 10 (1983): 257-77 and Schilling's *Religion, Political Culture and the Emergence of Early Modern Society: Essays in German and Dutch History* (Leiden: Brill, 1992). For a short summary see Carl Härter, "Sozialdisziplinierung" in Annette Völker-Rasor ed. *Frühe Neuzeit* (München: R. Oldenbourg, 2000): 294-298. Recent scholarship has challenged the totalizing effects of the paradigm and attempted to offer more nuanced treatments. See James Van Horn Melton ed., *Cultures of Communication from Reformation to Enlightenment. Construction Publics in early modern German lands* (Burlington VT: Ashgate Press, 2002): 5-6.

specifically, what is the relevance of its portrayal over the years by church historians and theologians for my own concern with visual pedagogies? Most scholars working on Pietism today would agree that it was a grassroots movement or collective reaction to Lutheran orthodoxy that was oriented around the personality of Philipp Jakob Spener, a Lutheran minister active in Frankfurt am Main, in and around 1670.[14] Predominantly North American historians who have dealt with some aspect of Pietism in their work have tended to portray the movement as a deliberate response to the chaotic aftermath of the Thirty Years War, or a need to sanctify and regenerate a "fallen" society, torn apart by religious strife, that God had punished severely from 1618 to 1648.[15] Revealingly, this juxtaposition has been noticeably absent in the German literature on Pietism, which has emphasized the twenty-year gap between the war and Spener's movement, as well as the verifiable continuity of orthodox Lutherans' ongoing interest in carrying out the project of Reformation, including a general preoccupation with regeneration, reconciliation, lay Bible reading and personal edification—both before and after Westphalia.

Recent debates have revolved around identifying the peculiar qualities of Lutheran Pietism in comparison with other pan-European quietist movements, for example. Martin Brecht especially has emphasized its origins in a general "crisis of piety" that affected all Protestants in the seventeenth century, eliciting similar reactions in

[14] Andreas Depperman's study of Johann Jakob Schütz and his influence on Spener offers some much needed contextualization of the circles in which the new movement blossomed. See his *Johann Jakob Schütz und die Anfänge des Pietismus* (Tübingen: J.C.B.Mohr, 2002).

[15] A good example is James Van Horn Melton's discussion of Pietism in *Absolutism and the Eighteenth-Century Origins of Compulsory Schooling in Prussia and Austria* (Cambridge: Cambridge University Press, 1988): 24-25. This may have a lot to do with the way in which Pietism was portrayed by German historians after World War I; having experienced the war firsthand, for example, Karl Holl argued in 1923 that the Thirty Years War made the zeal for a realization of the Reformation project grow stronger for Spener and other members of his circle, who became convinced that the orthodox Lutheran church was not doing enough to bring about the true church. See Karl Holl, "Die Bedeutung der grossen Krieg für das religiöse und Kirchl. Leben innerhalb Deutschlands" *Gesammelte Aufsätze zur Kirchengeschichte,* Vol. 3 (Tübingen: Mohr, 1923).

England (Puritanism, Quakerism), the Netherlands (*nadere Reformatie*) and Germany (*Arndtsche Frömmigkeitsbewegung*). All represented an intensification of piety that emphasized repentance, sanctification and *imitatio* – seeking to resemble God.[16] In opposition to Brecht, Johannes Wallmann has insisted upon the historicity of Spenerian reform and sees it as distinguishable from these other piety movements. [17] When Spener's protégé, August Hermann Francke, acquired a pastorate and professorship in Halle in the 1690s, he adopted the special mandate of the movement and associated the city of Halle with Spenerianism. According to Wallmann, the three defining features of Spenarian Pietism included 1) "ecclesiola in ecclesia," i.e. the formation of conventicles or small, private gatherings of believers who met regularly and outside of sanctioned church times to discuss the scriptures in conjunction with their own spiritual development; 2) the chiliastic hope for better times or general improvement of society; and 3) biblical devotion and exegesis.[18] Yet those who participated in the movement rarely called themselves Pietists. Spener described the word Pietist for the first time in a

[16] See Martin Brecht, "Die Umstrittenheit des Gegenstandes und die Begründung der vorliegenden Konzeption," *Geschichte des Pietismus* ed. Martin Brecht (Göttingen: Vandenhoeck & Ruprecht, 1993) and *idem* "Probleme der Pietismusforschung," *Dutch Review of Church History* 76 (1997): 227-37. Brecht sees parallels between Pietism and Jansenism in Catholicism or Hassidism in Judaism, but does not consider them part of the same movement. Albrecht Ritschl was the first German scholar to link Pietism to Reformed piety movements in the Netherlands and Germany. See his *Geschichte des Pietismus* 3 vols. (Bonn, 1880-86) and *Three Essays* (Philadelphia: Fortress Press, 1972): 53-147. For a summary of these debates see Jonathan Strom, "Problems and Promises of Pietism Research," *Church History* 71:3 (September 2002): 537-38.

[17] Johannes Wallmann, "Was ist Pietismus?" *Pietismus und Neuzeit* 21(1994): 220-231 and *idem* "Vom Katachismuschristentum zum Bibelchristentum. Zu Bibelverständnis im Pietismus," in *Die Zukunft des Schriftprinzips* ed. Richard Ziegert (Stuttgart: Deutsche Bibelgesellschaft, 1994): 30-56. He insists that Spener was not as reliant on the writings of Johann Arndt (1555-1621) as scholars have seen him to be. For Brecht's critique of Wallmann specifically, see his "Zur Konzeption der Geschichte des Pietismus. Eine Entgegnung auf Johannes Wallmann," *Pietismus und Neuzeit* 22 (1996): 228.

[18] See Strom, 539-40. Wallmann has insisted that Spener was not as reliant on the writings of Johann Arndt (1555-1621) as scholars have seen him to be, however Arndt's influence cannot be denied. Arndt promoted "True Christianity" (*Wahres Christentum*, his principle work) but steered away from advocating lay Bible reading; see Strom, 540.

letter from 1680 as a "term of abuse and derision."[19] He urged those receptive to his efforts to rejuvenate or revive the Lutheran church to avoid employing the term openly so that his movement would not be labeled a sect. But the term never went away.

Following Wallmann, I too see Halle Pietism as a distinct movement comprised of men, women and children whose spiritual identity was somehow, even loosely, aligned with Spener or with Francke and the orphanage he established in the city of Halle in 1694. At the same time, Wallmann's assessment of Pietism is based almost entirely on his reading of Spener's letters and texts. His definition overlooks the way in which Francke adapted and added to Spener's vision, often borrowing from the philosophical practices of the "heathen philosophers" (to use Francke's words), the didactic and edificatory strategies of Johann Amos Comenius (which Comenius himself admitted were sometimes directly drawn from Jesuit teaching manuals), E.W. von Tschirnhaus (who stood in direct contact with Spinoza, Leibniz and several members of the Royal Society) and several of his famous colleagues (Stahl, Hoffmann, Thomasius, Wolff) at the University of Halle. When Francke's contributions to Spenerian Pietism are taken into consideration in conjunction with the broader epistemological context in which the movement blossomed, a much more dynamic portrait of Halle Pietism emerges.

Ongoing discussions among historians and philosophers of science, when juxtaposed with the work of other theologians and church historians who have looked closely at Pietism and its precedents have much to offer this portrait. In a recent study

[19] Carter Lindberg, "Introduction," to *The Pietist Theologians: An Introduction to Theology in the Seventeenth and Eighteenth Centuries* (Oxford: Blackwell Press, 2005); Lindberg cites the often quoted verse by Joachim Feller (1628-91), who used the term shortly after Spener in a poem composed for the funeral of a young theology student and member of a Spenerian conventicle in Leipzig. "Pietists—the name is now well-known throughout the world. What is a Pietist? One who studies God's Word and also leads a holy life according to it." Also quoted in Peter Schicketanz, *Der Pietismus von 1675 bis 1800.* (Leipzig: Evangelische Verlagsanstalt, 2001): 17.

that draws from the insights of the French philosopher Pierre Hadot, Matthew Jones makes a compelling case for the juxtaposition of mathematics, natural philosophy and self cultivation (improvement, moral regeneration) as spiritual exercise in the philosophies of Descartes, Pascal and Leibniz.[20] Jones shows how each one of these figures was convinced that rigorous cognitive exercise was necessary in order for one to know or to begin to understand how one might come to recognize truth. Each offered new mathematical mechanisms, including new geometries, for exercising the mind that were derived from age-old concerns about the fate of humanity and man's moral obligation to improve and apply his mind to the solution of some pressing social problem—or at the very least to the perfection of himself. A climate conducive to the articulation and refinement of spiritual exercise was precisely what A.H. Francke set out to achieve in his educational institutes and it is in keeping with these aims that the Pietist Orphanage, a symbol of eighteenth-century philanthropy, emerged.

The work of several theologians and church historians confirms that a general preoccupation with "spiritual exercise" animated both orthodox and radical Lutherans alike in the seventeenth century. The church historian Udo Sträter, for example, has studied the climate of orthodox Lutheranism that gave way to Spenerian reform and has stressed the enormous interest in meditation, spiritual exercise or *praxis pietatis* in

[20] Pierre Hadot, *Philosophy as a Way of Life: Spiritual Exercises from Socrates to Foucault*. Edited by Arnold Davidson; Translated by Michael Chase (Oxford: Blackwell Press, 1995) and Pierre Hadot, *What is Ancient Philosophy?* Translated by Michael Chase (Cambridge, MA: Belknap Press, 2002); Matthew L. Jones, *The Good Life in the Scientific Revolution: Descartes, Pascal, Leibniz and the Cultivation of Virtue* (Chicago: University of Chicago Press, 2006). Jones distinguishes "religious" spiritual exercise from what he calls its more "philosophical guises," noting that "religious" or "mystical" spiritual exercises like prayer and meditation fall outside the scope of his study. I would not so rigidly distinguish between "religious" and "other" spiritual exercises in the case of the Pietists, who, as I will show, saw the observation of models, machines and other forms of mathematical exercise as an opportunity to meditate, to cultivate "pious desires" and to acquire certain kinds of spiritual gifts. I am not a Leibniz scholar, and yet I question whether the exercises contained in Leibniz's vision can be fully appreciated without a careful look at the theological context (including his close ties to Spener) in which he created his metaphysical system.

Germany by 1600.[21] Sträter's work also explores the very real impact that translations of English devotional literature (or *Erbauungsmaterialen*) had on the German book market in the seventeenth century. "Hot sellers" included short postilles by English Jesuits intended to walk individuals through the steps of meditation, imitation and edification. An especially popular collection of exercises was Emanuel Sonthom's *Göldenes Kleinod*, which was mostly a translated copy of the Jesuit Robert Parson's *Book of Christian Exercise*.[22] Lewis Bayly's *Praxis Pietatis* and Joseph Hall's *Arte of Divine Meditation* were also quite widely distributed.[23] Sträter has also dealt with the reception of Johann Amos Comenius and Johann Valentin Andreae (1586-1654) by Spener and Francke, who were especially interested in establishing a utopian city, or a "Christian-opolis" (closely mirroring both Andreae and Comenius's visions), where individuals proficient in their own exercises would live in harmony and, in turn, perfect the world around them.[24]

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[21] Udo Sträter, *Meditation und Kirchenreform in der lutherischen Kirche des 17.Jahrhunderts* (Tübingen: J.C.B.Mohr (Paul Siebeck) 1995). See also his essay „Wie bringen wir den Kopf in das Herz?" in Gerhard Kurz ed. *Meditation und Erinnerung in der Frühen Neuzeit* (Göttingen: Vandenhoeck & Ruprecht, 2000): 11-35.

[22] Udo Sträter, *Sonthom, Bayly, Dyke und Hall: Studien zur Rezeption der englischen Erbauungsliteratur in Deutschland im 17. Jahrhundert* (Tübingen: Mohr, 1987): 61. Robert Parsons, *Gülden Kleinod der Kinder Gottes, Das ist: Der wahre Weg zum Christenthum, Herrn Emanuel Sonthoms [d.i. Thomson], Aus dem Englischen, in das Teutsche versetzet, u. jetzo aufs neue, ... an vielen Orten geändert, und mit zwey herrlichen neuen Tractätlein vermehret, deren das I. von dem Gespräch deß Hertzens. II. von der geistlichen Hoffart handelt ; Benebens zweyen nothwendigen Registern; Samt einem Bericht Johann Michael Dilherrns, an den christlichen Leser* (Nürnberg: Endter, 1696).

[23] Lewis Bayley, *Praxis Pietatis: Das ist, Übung der Gottseligkeit ... Anfänglich in Englischer Sprach beschrieben Durch Doct. Ludwig Bayli, ... Hernacher auch in unsere Teutsche Sprach übersetzet ... Theil 1: Darinn begriffen, wie ein Christgläubiger Mensch in wahrer Erkanntnuß Gottes und seiner selbst zunem[m]en, sein Leben täglich ... beschliessen könne. Theil 2: In sich begreiffend die fürtreffliche Ubung gottseliger und andächtiger Meditation* (Basel, 1692); Joseph Hall, *The Arte of Divine Meditation: profitable for all Christians to know and to practice* (London, 1606); Joseph Hall, *Himmels-Lust auff Erden Oder Die wahre Seelen-Ruh* (Helmstädt, 1677). See also Frank Livingstone Huntley, *Bishop Joseph Hall and Protestant Meditation in Seventeenth-Century England: a Study with the Texts of the Art of Divine Meditation (1606) and Occasional Meditations (1633)* (Binghamton, N.Y.: Medieval and Renaissance Texts and Studies, 1981).

[24] See Johannes Wallmann's discussion in *Philipp Jakob Spener und die Anfänge des Pietismus* (Tübingen, 1986).

Because of the longstanding reputation of Pietists as enemies of science in eighteenth- and nineteenth-century historiography, however, the link between imagining the mathematical sciences as spiritual exercise has been left underutilized and unexplored by these theologians and in Pietism studies more generally. My project marks an attempt to connect what theologians and church historians have long confirmed about the widespread interest among early modern contemporaries (not only Pietists!) in how to articulate and to improve their spirituality with what Jones and others are showing was extremely influential in the construction of the new technologies, geometries and skills sets that we now take for granted as modern science. Jones's work especially invites one to think carefully about Leibniz's juxtaposition of mathematical exercise with the mandate of universal justice, charity and improvement and lays the groundwork for imagining how a similar juxtaposition may have worked itself out in early eighteenth-century Halle. Jones writes, for example, that Leibniz sought to institutionalize "prudential techniques for reforming others," and described in several late seventeenth-century proposals "an order of charity" or "a society of the love of God" modeled after the Jesuits.[25] He continues:

> This society would use 'God's works worthy of astonishment' as well as medical cures and chemical mysteries to attract people, fight atheism, and lead them toward the love of God. Members of this society were to speak 'without scholastic style' and to strive 'for the manner of common speech'—to pursue decorous, if sometimes temporarily deceptive, means to bring as many people into the fold of proper belief and Christian action as possible…[26]

Leibniz's vision, as Jones' describes it here, was the Pietist Orphanage, in theory and in practice. It was a site for the realization of a higher, prudential vision only rooted in visibly accessible gestures. It was a site of reconciliation—a place for marrying together

[25] Jones, 255. Jones notes that Leibniz even developed a set of rules ["Societas sive ordo caritatis" and "Societas theophilorum ad celebrandas laudes Dei" (1678)] for the society, see pg. 325, n.137.
[26] Ibid., 255.

exercises of the hand, head and heart. The "society of the love of God" that Francke directed in Halle was oriented around the honing of a specific set of spiritual exercises imagined as uniquely suited to early modern cultures of perspective.[27] It was a "vision-oriented" society, like the Jesuit order, that linked the perfection of perception to the anatomy of heart at every turn. This requires some explanation and only makes sense when the Pietist preoccupation with Christian perfection,[28] with love or "the heart," including the cultivation of "pious desires" (*pia desideria*), is situated alongside the swirling debates about reconciliation, perspectivism and the mechanics of seeing that were occurring precisely at the moment when the Pietist Orphanage, and Pietist philanthropy, came into being.

Historians have only really begun to write the history of visuality. Several studies have appeared in recent years that have emphasized the unique combination of skill, technology and cultural practice that determine a given historical epoch's relationship to sight.[29] Stuart Clark's new study of vision in early modern culture posits that it was early modern individuals' fears about the intrinsic unreliability of sight, i.e. their eyes were always deceiving them, which led them to embrace linear perspective and develop new

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[27] Jones has stressed the importance of perspective for Leibniz, including his interest in new technologies for "seeing all at once." I am contextualizing Jones' deliberately focused treatment of Leibniz here, showing specifically how Francke picked up on several of these ideas and employed them in order to perfect the visual aptitudes of individuals.

[28] See August Hermann Francke, "On Christian Perfection," in Peter Erb ed., *Pietists: Selected Writings*. (New York: Paulist Press, 1983): 114-116.

[29] For some examples see B. M. Stafford and F. Terpak, *Devices of Wonder: From the World in a Box to Images on a Screen* (Los Angeles, 2001); B. M. Stafford "Presuming Images and Consuming Words: the visualization of knowledge from the Enlightenment to post-modernism," in John Brewer and Roy Porter eds. *Consumption and the World of Goods* (London: Routledge Press, 1993); D.M. Levin ed. *Sites of Vision: the Discursive Construction of Sight in the History of Philosophy* (Cambridge, MA: Harvard University Press, 1997); C. Swan, "Eyes Wide Shut: Early Modern Imagination, Demonology and the Visual Arts," *Zeitsprünge: Forschungen zur frühen Neuzeit* 7 (2003): 560-80; Kate Flint, *The Victorians and the Visual Imagination* (Cambridge: Cambridge University Press, 2000); Jutta Schickore, *The Microscope and the Eye: A History of Reflections 1740-1870* (Chicago: University of Chicago Press, 2007).

techniques of geometrical projection.[30] By the end of the seventeenth century though, Pyrrhonic skeptics had mounted a significant attack on what they felt was the entirely naïve and unrealistic promise of perspective.[31] In other words, they renounced the very possibility of ever reconciling viewer and object. Clark explains that in response to this attack, many intellectuals adopted a "constructive skepticism." This means that they accepted the subjective qualities of seeing at the same time as they insisted that "modest levels of certainty" could still be attained by using tools God had given mankind to remedy this problem after the Fall—the senses, intellect and new instruments like the microscope.[32] But for some early eighteenth-century intellectuals, Christian Wolff for example, a constructive skepticism was not enough. Accepting the impossibility of resemblance, including the ability of geometrical projection techniques to reconcile objects and their images, was a fundamentally hopeless act; it went against the very mandate of improvement at the heart of pansophy. Viewer and object, objects and images *could* be reconciled. It was simply the visual aptitudes of individuals that needed honing. And it was through the conciliatory mathematical sciences that they could be honed, or that individuals could learn how to see correctly. During Wolff's tenure in Halle, Pietists devised an ambitious program of visual education that drew readily from Wolff's own attempts to standardize training in the mathematical sciences.

Wolff, Leibniz and other early eighteenth-century intellectuals' (including Francke's) interest in reconciliation, especially the refinement of conciliatory gestures,

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[30] Stuart Clark, *Vanities of the Eye: Vision in Early Modern European Culture* (Oxford: Oxford University Press, 2007).
[31] For an introduction to skepticism see Richard Popkin, *The History of Scepticism from Savonarola to Bayle* (Oxford: Oxford University Press, 2003).
[32] Ibid., 350-51. For a study of the myriad problems Protestant reformers had with skepticism in the sixteenth- and seventeenth-centuries, see Robert Rosin, *Reformers, the Preacher and Skepticism: Luther, Brenz, Melanchthon* (Mainz: Verlag Philipp von Zabern, 1997).

was closely connected to the peculiar contours and concerns of the culture they lived in. The city of Halle was, in this period, one of the most vibrant university towns in Central Europe but was also reputed to have been extremely conflict-ridden, with constant animosities brewing between the members of the Theology faculty and everyone else. While I certainly do not deny that there were several kinds of ideological or epistemological disputes going on between the various faculties and personalities active in Halle in this period, historians' and philosophers' interest in the nuances of these squabbles has meant that they have underemphasized the overwhelming interest in love and reconciliation in Halle in precisely this period. This was an interest that captivated *all* members of a consistently fractious literati.

Halle's university, founded in 1694, was deliberately constructed to become Prussia's flagship centre of higher learning—one that would rival the leading European universities of the day. It was, like the city of Halle itself, strategically located on the fringes of an expanding Brandenburg Prussia—on the border of the Kingdom of Saxony, with France and the Netherlands to the west, the kingdoms of Denmark and England to the north, Russia, the Kingdom of Poland, Pomerania and Silesia to the east and Switzerland, Italy and Austria-Hungary to the south.[33] It was in the middle. Some would say Brandenburg-Prussia was perfectly located at a kind of literal and figurative crossroads; it was not only poised to mediate the confessional diversity of the Holy Roman Empire but the diversity of Europe in general. The rulers of Brandenburg

[33] For Halle's status as a *Residenzstadt* for the Bishops of Magdeburg and the role that its precarious "borderland" position played in urban politics before the Electors of Brandenburg gained control of it, see Andrea Thiele, "Grenzkonflikte und soziale Verortung in der 'Residenz auf Abruf: Halle unter dem letzten Administrator des Erzstifts Magdeburg, Herzog August von Sachsen-Weiβenfels (1614-1680)" in Christian Hochmuth, Susanne Rau eds. *Machträume der frühneuzeitliche Stadt* (Konstanz: UVK Verlagsgesellschaft, 2006): 239-258.

(Frederick I, whose official title was Elector from 1688 to 1701 and King *in* Prussia from 1701 to 1713, and his son Fredrick William I, who was king from 1713 to 1740) were often likened to the Biblical figure of Solomon, whose wisdom had allowed him to reconcile competing points of view and to rule according to universal principles that were just and true. Both were extremely interested in the conciliatory potential of their territories' strategic geopolitical position, which they knew could only be strengthened by confessional and cultural cohesiveness.

By this point Brandenburg-Prussia was a Calvinist dynasty whose electors were also convinced that there were political gains to be had by allowing persecuted Protestants from other parts of Catholic Europe settle in their territories.[34] It had adopted and pursued a formal policy of religious toleration amicably disposed to the promise of irenicism since the early seventeenth century.[35] In 1685, after the revocation of the Edict of Nantes (which had allowed French Protestants to practice their faith without fear in French territory), Friedrich I issued the Edict of Potsdam, inviting those effected by the revocation to come to Brandenberg-Prussia. Approximately 40,000 French Huguenots took him up on the offer and relocated to Berlin. Several rapidly acquired elite posts in the Prussian governing apparatus and became involved in attempts to found an academy

[34] While the story of the Hohenzollerns' strategic conversion to Calvinism, their interest in Protestant union and alliance with Spener and Francke has been told several times, it has mostly been viewed as an opportunity to measure how the marriage of religion and political authority determines social change and has contributed to "the rise" of modernity. For an example of studies that have participated in this kind of project, see Robert Merton, "Puritanism, Pietism and Science, *Sociological Review* 28 (1936): 1-30; Mary Fulbrook, *Piety and Politics: Religion and the Rise of Absolutism in England, Württemberg and Prussia* (Cambridge: Cambridge University Press, 1983); Marc Raeff, *The Well-Ordered Police State: Social and Institutional Change through the Law in the Germanies and Russia, 1600-1800* (New Haven: Yale University Press, 1983); Richard Gawthrop*, Pietism and the Making of Eighteenth-Century Prussia* (Cambridge: Cambridge University Press, 1993); and most recently Phil Gorsky, *The Disciplinary Revolution: Calvinism and the Rise of the State in Early Modern Europe* (Chicago and London: University of Chicago Press, 2003).

[35] See Bodo Nischan, "John Bergius: Irenicism and the Beginning of Official Religious Toleration in Brandenburg-Prussia," in *Church History* 51:4 (1982): 389-404.

of science there; A.H. Francke was in contact with some of these individuals.[36] And during his tenure in Halle, Francke interacted with intellectuals like Christian Thomasius, who had been profoundly influenced by Samuel Pufendorf's and Hugo Grotius's efforts to produce laws that were universally applicable and, therefore, better suited to increasingly pluralistic metro poles.[37] This was a culture especially attuned to the ever increasing varieties of difference in the world and consumed with the problem of how to mediate this difference by creating truths that everyone could agree upon.[38]

The need for universal truth manifested itself in every discipline, every situation, including faith. The electors of Brandenburg-Prussia, while nominally Calvinist, prided themselves on the confessional pluralism of their lands, as the Edict of Potsdam clearly shows. In a similar gesture (1731), Fredrick William I would relocate a group of Protestants who had been driven out of Salzburg to Halle, where they too were integrated

[36] Francke corresponded with Charles Ancillon (1659-1715), for example, who had produced a first hand account of the Hugenot removal to Brandenburg-Prussia soon after settling in Berlin: *Histoire De L'Etablissement Des François Refugiez Dans Les Etats De Son Altesse Electorale De Brandenbourg* (Berlin, 1690). For a discussion of Ancillon's impact on local efforts to start a science academy see A.v. Harnack, *Geschichte der Kgl. Preussischen Akademie der Wissenschaften zu Berlin*, Vol. 1-3 (Berlin, 1900). For the important and often overlooked role of the Swiss diplomat, Ezechiel von Spanheim in these efforts, including his impact on Leibniz, see Ines Böger, "Der Spanheim-Kreis und seine Bedeutung für Leibniz' Akademie pläne" in Hans Poser und Albert Heinekamp, *Leibniz in Berlin: Symposion der Leibniz-Gesellschaft*... (Stuttgart: Albert Heinekamp, 1990).

[37] Thomasius was a law professor who also directed the University and frequently associated with Francke. See Thomas Ahnert, *Religion and the Origins of the German Enlightenment: faith and the reform of learning in the thought of Christian Thomasius* (Rochester, N.Y.: University of Rochester Press, 2006) and Max Fleischmann, *Christian Thomasius: Leben und Lebenswerk* (Halle, 1931; Aalen: Scientia-Verlag, 1979). For some recent work on Pufendorf that explores his influence on Thomasius (Leibniz and Wolff too) see Timothy Hochstrasser, *Natural law theories in the early Enlightenment* (Cambridge: Cambridge University Press, 2000). For Grotius' influence on Pufendorf see Knud Haakonssen ed., *Grotius,Pufendorf and modern natural law* (Aldershot [u.a.]: Ashgate/Dartmouth, 1999). Pufendorf's *On the duty of man and citizen according to natural law* has been translated in printed by Cambridge press (2000). For Grotius and skepticism see Thomas Mautner, "Grotius and the Skeptics" in *Journal for the History of Ideas* 66:4 (October 2005): 577-601. Hugo Grotius was a famous child prodigy from Holland who wrote *De veritate religionis Christianae* [*On the Truth of the Christian religion*] (Paris, 1627)—which was widely distributed and translated.

[38] Lorraine Daston and Peter Galison, *Objectivity* (New York: Zone Books, 2007).

into a multi-confessional landscape.[39] Early eighteenth-century Halle had a fairly large Jewish community, a Reformed community, a few Catholics and a substantial population of Lutherans—many of whom were not interested in actively participating in the Spenerian reforms Francke was initiating there. It was a microcosm of the entire Prussian principality and the Empire; a place where new strategies or methods for enforcing unilateralism, cohesiveness and universality could be tried out. The debates about which methods to adopt were often fierce and divisive but, in principle, they were mostly debates about how to get along—how to create a society where violent conflict no longer existed and where people of every imaginable creed, culture and class, could join together in love and harmony.[40]

One can see this interest in even just a cursory glance at the kinds of texts being published by the wide assortment of intellectuals—and these literally were some of Central Europe's most brilliant minds—who were lured to Halle in the first decades of the eighteenth century to participate in what must be understood as a collective experiment in the institutionalization of love. Francke preached and wrote often about love in Halle, following in the footsteps the early advocates of spiritual regeneration who had influenced him, like Johann Arndt.[41] Christian Thomasius urged the members of the

[39] For an enjoyable account of this story see Mack Walker's *The Salzburg Transaction: Expulsion and Redemption in the Eighteenth Century* (Ithaca: Cornell University Press, 1992).

[40] To be clear, I am not insisting that a preoccupation with methods of reconciliation was an exclusively Prussian phenomenon. However, given Brandenburg-Prussia's interest in institutionalizing various expressions of reconciliation at this time, it became an especially powerful force here. Several texts promoting a *consilia* of theologians had come out of Wittenberg University in the 1660s, for example; Joachim Pollio had written about this already in the 1620s. See *Consilia Theologica Witebergensia* (Frankfurt, 1664) and Joachim Pollio, *Consiliorum Theologicorum Centuria ... Oder Theologisch Fragbuch* (Leipzig, 1622).

[41] For example Arndt's, *Vier uralte geistreiche Büchlein ... II. Von der holdseligen Liebe Gottes* (Frankfurt, 1704); August Herman Francke, *Philotheia, Oder Die Liebe zu Gott : Der Jugend in den Schulen des Wäysen-Hauses zu Glaucha an Halle, Als ihre allerhöchste und theureste Pflicht, nach gehaltenem Examine, den 20. Martii 1706 vorgestellet und übergeben* (Halle: Waysenhaus, 1706); idem, *Die erste Liebe zum Herrn Jesu: Aus dem Evangelischen Text Luc. II, 33-40 ; Am Sonntag nach dem Christ-Tage In*

new University community that he addressed in a 1694 inaugural speech to pursue union (*Einigkeit*) and conciliation (*Vermahnung*) at every turn.[42] These metaphors figure extensively in his writings as well—including, for example, a 1720 treatise that offered tips for cultivating impassioned reason, or linking up the mind and the heart.[43] Johann Franz Buddeus, who taught theology in Halle from 1695 to 1705 before accepting a post in nearby Jena, produced an introduction to contemporary religious controversies, an introduction to Caspar Sandhagen's *Harmonie of the Four Evangelists*, a dictionary of the patriarchs, prophets and apostles emphasizing their love and divinely inspired wisdom, a dissertation on imposing religious concord among Christians via civil statutes (published by the Halle Orphanage press), a "discourse on the causes and ways of freeing intellectuals from their defects and misery" through love, a preface to Martin Musig's treatise on the *Light of Wisdom*, and several introductions to the elements of an "eclectic philosophy"—which I will explore in Chapter Two.[44] Suffice it to say that Buddeus, like

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der S. Ulrichs-Kirche in Halle (Waysenhaus, 1716); idem, *Die Beschauung der geoffenbarten ewigen Liebe Gottes ... : am Tage der Verkündigung Mariae 1717 in der St. Ulrichs-Kirchen in Halle vorgestellet* (Waysenhaus, 1717).

[42] Christian Thomasius,. *Bey der Inauguration der Friederichs-Universität zu Halle, denen gesamten Professoribus so theuer anbefohlenen Einigkeit, Sich selbst Eine nachdrückliche und scharffe Lection, und wiederholet als ein Wiederhall Die Empfehlung gleicher Einigkeit in einer treugemeinten Vermahnung An die gesamte studierende Jugend* (Halle, 1694).

[43] Ibid. *Von Der Artzeney Wieder die unvernünftige Liebe, und der zuvor nöthigen Erkäntniß Sein Selbst. Oder: Ausübung Der Sitten-Lehre...* (Halle, 1720). For the meaning of *consilia* as a legal term in the first half of the eighteenth-century, see Werner Kellner, *Consilia Hallensium Jureconsultorum: die Spruchpraxis der Halleschen Juristenfakultät in der ersten Hälfte des achtzehnten Jahrhunderts* (Magdeburg, 1908).

[44] Johann Franz Buddeus, *Historische und Theologische Einleitung In die vornehmsten Religions-Streitigkeiten* (Jena, 1728); Caspar Hermann Sandhagens, *Kurtze Einleitung Zur Harmonie Der Vier Evangelisten Und der Geschichte der Apostel: ... Auch einem Vorberichte von denen Scriptoribus harmonicis vermehret*; Nebst einer Vorrede Tit. Hrn. Jo. Franc. Buddei, (Berlin, 1724); *Allgemeines Historisches Lexicon: in welchem das Leben und die Thaten derer Patriarchen, Propheten, Apostel ... in Alphabetischer Ordnung mit bewehrten Zeugnissen vorgestellet werden* (Leipzig, 1709-1714); *De Concordia Religionis Christianae Statvsqve Civilis* (Halae Saxonum: Orphanotropheum, 1712); Martin Musig, *Licht der Weißheit: In denen nöthigsten Stücken der Wahren Gelehrsamkeit, Zur Erkänntniß menschlicher und göttlicher Dinge, Nach Anleitung der Philosophischen und Theologischen Grund-Sätze* (Frankfurt/Leipzig, 1709-11); For some treatment of the metaphors of reconciliation and unity in Buddeus'

so many of his colleagues, spent his entire academic career patching together a coherent philosophical framework for reconciling competing epistemologies via a return to the basic, moral principles contained in the Bible, or the fundamental and unifying love and obedience of the apostles.[45] He embraced and helped construct a moral philosophy that was fundamentally theological; he and his colleagues aimed for no difference between the two disciplines. His contributions found their institutional outlet in the Halle Orphanage, which published several of Buddeus's writings and assimilated his formulation of a "Christian philosophy" into its complex epistemological landscape. Like Francke, Buddeus was also a member of the Berlin Academy of Science.[46]

Buddeus, Francke and his colleague Christoph Semler, whose efforts to start a school for the teaching of the mathematical and mechanical sciences in Halle coincided with Francke's tenure there, were interested in what they often called "true Christianity" (*wahres Christentum*) but what was also sometimes referred to as "original" or "primitive" Christianity.[47] In his *Primitive Christianity Revived*, William Whiston (1667-1752) had defined a primitive Christianity as one that was oriented around intensive scrutiny of the words of Christ and those that were closest to him.[48] This was a central

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work see Friederike Nüssel, *Bund und Versöhnung: zur Begründung der Dogmatik bei Johann Franz Buddeus* (Göttingen: Vandenhoeck & Ruprecht, 1996).

[45] This was not only a preoccupation of German theologians. The French mathematician and theologian, Bernard Lamy (1640-1715) also produced a tract about the harmony or *concordia* of the four gospels that was quite influential: *Harmonia, sive Concordia quatuor Evangelistarum* (Paris, 1689).

[46] Francke joined the Berlin Academy on October 12, 1701 and Buddeus shortly after, on December 1st. See Chapter Three.

[47] Primitive Christianity also involved careful attention to the patriarchs and prophets of the Old Testament; see, for example, Christoph Semler's *Antiquitäten der Heiligen Schrifft, oder biblische Fragen, Von dem Paradise, Archa Noä ... welche der Jugend zum Unterricht und denen Gelehrten zur repitition* (Halle: Renger, 1708; 1715; 1732; 1752-54) or his description of Solomon's Temple, *Der Tempel Salomonis* (Halle: Waysenhaus, 1718).

[48] William Whiston, *Primitive Christianity reviv'd: in four volumes. Vol. I. Containing the Epistles of Ignatius, ... Vol. II. The Apostolical constitutions, ... Vol. III. An essay on those Apostolical constitutions. Vol. IV. An account of the primitive faith …* (London, 1711); William Whiston, *Primitive Christianity reviv'd. Volume V, Containing the recognitions of Clement: or the travels of Peter* (London, 1712).

preoccupation for Francke, who, following in the footsteps of the theologian Johann Conrad Dannhauer (1603-66) and Spener, placed a rigorous method of interpretation, or hermeneutics, at the centre of their reformative programs. If "true Christianity" or love held the key to the reconciliation of all forms of knowledge, then understanding every aspect of the actual words of Christ, love incarnate, and those who knew him best was exceedingly important. Only when these words were grasped more effectively would reconciliation be more likely to occur. Francke endeavored to teach his students how to access the "living" word of God by seeking out the spirit behind the text, including the affective state in which the text itself had been written.[49] He was a hermeneutical master and extended his careful scrutiny of the words of Christ and his apostles to interpretations of Old Testament texts as well. Hermeneutics offered Francke a means of actively participating in ongoing efforts to construct the perfect conciliatory methodology in Halle because adopting a hermeneutical approach in any context involves opening oneself up to the intrinsic subjectivity of interpretation. Francke's central contribution to his colleagues' collaborative (but not always congenial) attempts to produce perfect universal truths was his insistence on the intrinsic subjectivity of the entire project. If competing epistemologies, including creeds, could only be reconciled in the heart, then the entire project could only be carried out by using the heart to assimilate the literal, figurative and affective messages of God's word. This meant being open or receptive to the myriad

[49] To interpret the "literal meaning" of a biblical text, Francke argued that one needed to "distinguish between the concrete intention of the author (*literalis*) and the hidden intention of God in the historical matters of fact (*mysticus*)." Those who had not experienced a true conversion could still do this kind of exegesis at the theoretical level (*cognitio literalis*) but only those who were reborn could obtain a higher, "living" knowledge (*cognitio spiritualis*) that would allow them to "assimilate" the subjective *scopus* they brought to bear on the scriptures (or the own unique edificatory needs stemming from the state of their will—a province of the passions or affections) with the objective *scopus* of the scriptures themselves. See Markus Matthias, "August Hermann Francke," in Carter Lindberg ed., *The Pietist Theologians*. I am grateful to Simon Grote for his help with navigating the often strenuous terrain of Franckean theology.

personalities one encountered in the Bible in order to discern the truths that their words and their deeds offered the reader. It follows that those theologians who offered hermeneutical readings of texts usually attached a great deal of importance to the act of being able to understand something from someone else's point of view.

Seeing, understanding, accepting and assimilating a rival stance was an act of love and the key to reconciliation. To help individuals understand and appreciate this, several introductions to the fundamentals of *consilia*—which can mean a collaborative advisory body or council and also sense, invention or the capacity for judgment—began circulating at this time. Philip Jakob Spener, who spent the last years of his life in Berlin as a court preacher and could therefore closely monitor (and influence) the climate in Halle, wrote about *consilia*, especially the pressing question of how to bring together the mind and the heart.[50] If people thought with their hearts, or became entirely unselfish and loving creatures, then their inquiries into nature and forms of insight always, without fail, would improve and perfect the world, not denigrate or corrode it. Sträter is one of the few scholars to have actually addressed this specific concern of Spener's in a broader context and has noted that it was also a pressing concern of Veit Ludwig von Seckendorff, for example, who was active in Halle in the years immediately preceding the founding of the University.[51] We see it represented in Carl Hildebrand von Canstein's version of the *Harmonie of the Four Evangelists*, printed by the Halle Orphanage press in 1718 and often associated with Francke's movement.[52] We also see

[50] Philipp Jakob Spener, *Consilia et Judicia Theologica Latina* (Frankfurt, 1709)
[51] Especially in Veit Ludwig von Seckendorff's *Christen Staat* (Leipzig, 1685; 1716).
[52] Carl Hildebrand Freyherrn von Canstein, *Harmonie und Auslegung der Heiligen vier Evangelisten. oder Die Schriften der Evangelisten,in eine Zusammenfügung gebracht, und nach ihrem Wort-Verstande von Versicul zu Versicul erkläret, Samt daraus gezogenen Lehren und erbaulichen Anmerckungen* (Halle: Waysenhaus, 1718).

it in the writings and preoccupations of Daniel Ernst Jablonski, who would establish, with Leibniz, the Berlin Society for the study of mathematics and physics in 1701 as an expression of this conciliatory ethos.[53] Jablonski also routinely stressed his conviction that the Anglican liturgy held the key to unifying all Protestants. Situated in a formally Calvinist principality that was increasingly receptive to the Spenerian reform of orthodox Lutheranism, Jablonski tried to introduce a third and tangible object, the liturgy of the Church of England, which could serve, like the orphanage, as a neutral space for the reconciliation of dogmas.

With all of this in mind, it becomes especially hard to separate Pietists out of the early Enlightenment context in which they operated. And yet, this is precisely what has happened. Despite recent attempts by David Sorkin, James Bradley, Dale Van Kley and several others to illustrate how the Enlightenment itself was "a product of religious debate and not merely a rebellion against it," that it emerged out of theological discussions and controversies, there remains a very persistent tendency to want to see Pietism as something distinctly different from Enlightenment, in a kind of contest with it.[54] In effect, Pietism has its own, entirely separate historiography that has been relegated to the margins of a much broader historiography of Enlightenment—one that readily accepts figures like Thomasius but not Francke because, well, he was a "Pietist." Those working on the problem today will willingly talk about the "reception" of what

[53] Dietrich Meyer, "Daniel Ernst Jablonski und seine Unionspläne" in: Harm Klüting ed. *Irenik und Antikonfessionalismus im 17. und 18. Jahrhundert* Hildesheim: Olms, 2003): 153-175.
[54] James E. Bradley and Dale K. Van Kley eds. *Religion and Politics in Enlightenment Europe* (Notre Dame, 2001); David Sorkin, "Reclaiming Theology for the Enlightenment: the Case of Siegmund Jacob Baumgarten (1706-1757)" in *Central European History* 36:4 (2003): 503-530. Evidence of the retinence of the Pietism/Enlightenment dichotomy include: Martin Gierl, *Pietismus und Aufklärung: Theologische Polemik und die Kommunikationsreform der Wissenschaft am Ende des 17.Jahrhunderts* (Göttingen, 1997) and Josef Neumann und Udo Stäter eds.. *Das Kind in Pietismus und Aufklärung* (Tübingen: Max Niemeyer Verlag, 2000).

they imagine as solid, active and preordained "Enlightenment ideas" affiliated with figures like Thomasius and Christian Wolff on a Pietist collective that then gets portrayed as passive, predictable and otherworldly. Some insist on even exchange between the two sites, between "the Pietists" and "the enlightened luminaries," with "the Pietists" sometimes getting to serve as the active agents. But I think my project demonstrates that neither of these configurations works very well. On the contrary, it shows that what we now like to call Enlightenment, or "Enlightenment ideas," were by no means solid or pre-determined "truths" that somehow, through a series of complicated circumstances, get "discovered" and held up in the early eighteenth century.[55] Instead, my project offers an opportunity to see how these ideas—this unique configuration of knowledge that coalesced to produce the first Pietist Orphanage and the practices it contained—get constructed and how Pietists were intimately involved in constructing them.

In eighteenth-century Halle, some Pietists got to be enlightened luminaries and vice versa. There were not two distinct sites or insurmountable boundaries between individuals like Thomasius and Francke; or even Francke and Wolff. This does not mean, of course, that there were not differences. But when situated within a wider culture of reconciliation, the lines between Pietism and Enlightenment dissolve into a set of problems that all learned individuals in the early eighteenth century felt urgently called upon to resolve. Their methods of resolution were frequently pedagogical in nature but very often emphasized the need for neutrality and universality, for untouched third

[55] And then parsed up into smaller categories like "religious Enlightenment," "radical Enlightenment," "moderate Enlightement" or "mainstream Enlightenment." I agree with David Sorkin, who laments the manner in which eighteenth-century theology has been treated both by theologians (who have presented it as largely derivative) and students of Enlightenment, who have considered as "beyond their purview." This neglect has adversely affected our understanding of eighteenth-century Halle and its significance. See David Sorkin, "Geneva's 'Enlightened Orthodoxy'" the Middle Way of Jacob Vernet (1698-1789)" in *Church History. Studies in Christianity and Culture* 74 (March 2005): 287.

spaces, where competing programs, ideologies, epistemologies could be made to cohere in entirely new ways. I think that this is why the program of Spenerian reform held such an enormous appeal to usually pious intellectuals in this context; it held up the heart as that third space. This is one way of explaining why three-dimensional models became so important to this community as well (see Chapter Five). Models were neutral, third sites, where individuals could see reconciliation occurring before their eyes—a process that increased their desire, their ability to love and ultimately helped them obtain higher modes of understanding. Comenius's ability to link the heart and eye in his scheme of pansophic regeneration appealed to a culture absolutely enthralled with perspective, with light, with projective technologies, microscopes and with the eminent possibility resident in the very act of observation.

If we try for a moment not to think of Pietism and Enlightenment as separate categories and situate early eighteenth-century Halle in the culture of conciliatory observation and exercise that I think more accurately defines it, several new ways of understanding the differences that let to the famous ousting of Christian Wolff from the University of Halle emerge as well. By the middle of the eighteenth century, Christian Wolff had acquired an international reputation as one of Europe's premier philosophes; for many he was literally *the* symbol of Enlightenment, the physical embodiment of reason's victory over superstition. But during the years upon which this study is focused, Wolff was a young, gifted and ambitious mathematician, whose tenure in Halle (he arrived in 1707) coincided with Francke's efforts to grow and perfect his project. The extent of their conversations and interaction with each other is mostly unknown; however, considering Francke's role in securing Wolff's banishment, it would seem that

they did not get along very well. According to the traditional telling of the story, on July 2nd, 1721, Christian Wolff gave a speech marking the end of his tenure as pro-rector of the University of Halle that he dedicated to the "practical philosophy" of the Chinese.[56] Wolff had long championed the merits of "practical philosophy" and his thoughts about Chinese morality represented no major departure from Leibniz and Francke's own thoughts on the issue (see Chapter Three).[57] The speech was instantly sensationalized. Two years after he delivered it, he would be charged with corrupting the youth through the proffering of dangerous, atheistic doctrines and ordered to leave the city.[58]

The bold quality of the Confucius speech, combined with the dramatic circumstances surrounding Wolff's leaving, was great entertainment. It became a legend while Wolff was still alive because it perfectly illustrated the kind of story many contemporaries believed needed to be told. It even had a happy ending. Wolff, the persecuted and wise protagonist, would eventually be asked to come back to Halle in what was heralded as reason's triumphant return—and eminent victory—over religious enthusiasm, dogma and ignorance. Pietists in Halle were portrayed as having lost their battle to prevent reason's "rise" above all other existing forms of knowledge. In the wake of the controversy, several anti-Wolff texts were printed on the Halle Orphanage press and widely distributed. Francke's colleague in the University Theology faculty, Joachim Lange, was especially indisposed towards Wolff (for reasons that to date have not been adequately explained) and saw the speech as an opportunity to take action. He led an all

[56] It was later published as *Oratio de Sinarum Philosophia Practica* (Frankfurt am Main: Andreae & Hort., 1726); idem. *Rede über die praktische Philosophie der Chinesen*, trans. Michael Albrecht (Hamburg: Felix Meiner, 1985).
[57] See his *Philosophia practica Universalis, Mathematica methodo conscripta* (Leipzig, 1703) for example.
[58] When the decree came down from Friedrich Wilhelm, Wolff was given 24 hours to remove himself from Prussian territory under penalty of death; he fled almost immediately and found refuge in the University town of Marburg, where he held a professorship until his return to Halle in 1740.

out campaign against Wolff, both before and after the ousting, and was able to mobilize certain members of Francke's organization, including the Halle Orphanage printing press, around his cause.

Francke's role in this entire incident is noticeably and mysteriously minor; it is clear from a letter Wolff wrote to him in 1721 that he found something about Wolff "distasteful" and he was willing to use his influence at court in Berlin to persuade the king to take action.[59] But why? Again, to adequately explain this, the traditional categories of Francke vs. Wolff (i.e. Enlightenment) do not work. On the eve of Wolff's departure, Francke frequently visited his colleague Christoph Semler, who reportedly remained neutral throughout the controversy, to learn about the mechanical models Semler was building; his schools had integrated Wolff's *Beginner's Guide to the Mathematical Sciences* into their curriculum.[60] Both Francke and Wolff were members of the Berlin Academy of Science. In the early years of his project, Francke had also personally met and corresponded with two individuals who had both played pivotal roles in Wolff's own intellectual development and orientation—E.W. von Tschirnhaus and G.W. Leibniz (see Chapters One and Three, respectively).

A major clue for understanding the tension between Wolff and Francke that allows us to escape illusory polarities can be found in Wolff's autobiography. He states quite clearly that Francke's main problem with him or the "cause of the whole thing was" that the Pietist professor had become convinced, "through experience," that "he could not

[59] AFST/H C 836:12 [July 14, 1721] "Warum meine neulich gehalten Oration allen Membris ihrer Facultät anstössig vorkommen, kan ich nicht begreiffen. ... Solte Ihnen bleiben meine Oration zu schelten, so kann ich es willig geschehen lassen, und versichere dass ich deswegen kein beschwerde Schweren will. Ich will sie nur drucken lassen und an alle Orte in Europa wo Gelehrte sind hinschicken: ich trage keine Zweiffel, sie wird so wohl aufgenommen wurden, wie meine ubrige Sachen die nicht nach Ihren geschmack sind....".
[60] I am grateful to Udo Sträter for pointing me to the various sections in Francke's diary where he notes his visits with Semler.

make someone into a Christian by handing them Euclid."[61] While this statement is quite revealing, it is also misleading in that it implies that Francke had a radically different (anti-mathematics, anti-reason) program than Wolff. But Wolff's program, as I will show in Chapter Four and throughout most of Part II, fit in many ways quite nicely with Francke's own. His was also a universalizing program that privileged the unifying and perfecting potential of "the mathematical sciences" because of their ability to reconcile through visual exercise. Just as Leibniz championed the materiality of philosophy—concrete strategies for making knowledge useful and beneficial to society as a whole—Wolff saw his systematization of the mathematical sciences as a set of conciliatory, visual practices that were useful or widely applicable. Geometrical projection was a perfect expression of the union between a divinely inspired, intuitive reason needed to grasp higher mathematics *and* experience, or the properties of a substance that presented itself to be measured; and it was through rigorous exercise in the mathematical sciences that one perfected one's self—both the higher and lower faculties of one's spirit or soul.

Wolff, following Tschirnhaus, wrote often in his early years in Halle about the potential of the mathematical sciences, and of measurement, to produce virtuous, Christian subjects by enhancing their ability to understand.[62] Training in these sciences conditioned conciliatory personalities or made one predisposed to consilia *first* and produced virtuous, moral, loving or Christian subjects *second*, as the end or net result;

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[61] Heinrich Wuttke, *Christian Wolffs Lebensbeschreibung* (Leipzig, 1841): 189-190. "Unter den Theologis war ohnedem H. Francke der Meinung, er könnte einen zu keinen Christen machen, der den Euclidem studirte, wie er solches ausdrücklich gegen den seel.H.Prof.Mathes.zu Erfurt Rudolph sagte, als er ihm rieth, er möchte der Jugend auf dem Waysenhause und Paedagogio den Euclidem in die Hand geben, ob er ihm gleich keine raison geben konnte, sondern sich blos auf die Erfahrung berufte."

[62] ChristianWolff, *Wie die Messkunst den menschlichen Verstand ausnehmend bessere* [October, 1713] in Wolffs *Gesammlete kleine philosophische Schriften,* (Halle, 1737): 357-424. Reprinted in Christian Wolff, *Gesammelte Werke* (hereafter *Gesammelte Werke*) J.École, H. W. Arndt, Ch. A. Corr, J. E. Hoffmann and M. Thomann eds. (Hildesheim: Georg Olms, 1965) Part One: Volume 21-3.

geometrical exercise turned people into Christians, in Wolff's view. The curricula of his schools suggest that Francke was willing to initially accept or to assimilate this point of view; however, by 1721, his organization was not willing to endorse it entirely.[63] The mathematical sciences remained embedded in the curricula of the *Stiftungen* schools, even the lower ones, throughout the Wolff controversy, and I think Francke appreciated their ability to bring together cognition and experience as "middling," vision-oriented disciplines. However, the Pietist professor's understanding of spiritual exercise seems to have become less hierarchical than Wolff's, whose comments also confirm that experience had convinced Francke that a rigorous training program in geometry was not enough to turn anyone into a virtuous, Christian subject. By 1713, his organization began requiring letters of introduction by a family member or patron who could vouch for the spiritual gifts already visually manifest in a potential pupil.[64] Not just anyone would benefit from the conciliatory exercises of Francke's schools. Only those who had been designated, on account of the things they said and did (visible signs), as especially gifted could come and train here. I do not think this was intended to always be the case. As the project grew, intensified and more orphanages were built, more children could train and participate. But in this initial stage, Francke had learned from experience, it was best not to orient the conciliatory program around just anybody—only those who seemed

[63] It is not a coincidence that this same year, the Halle Orphanage press produced an updated or improved version of the new method; Hieronymous Freyer, *Verbesserte Methode der ädagogium Regium*, Glaucha (Halle: Waysenhaus, 1721): 118.

[64] Francke stipulated that even poor children now needed proof of legitimate birth to be considered for admittance and a letter from their patrons or guardians; see August Hermann Francke, *Kurzer Nachricht von den Ordinairen und Extraordinairen Tischen im Waysenhause zu Glaucha an halle*, in Rosemarie Ahrbeck-Wothge, "Über die Tischordnung und die Aufnahmebedingungen des Waisenhauses aus dem Jahre 1713," *A.H.Francke: Das humanistische Erbe des grossen Erziehers* (Halle, 1965): 77-79. Several letters describing the special gifts and potential of children by their parents and patrons still reside in Francke's archive.

exceptionally promising or whose parents could finance their children's stay in the *Schulstadt*.

Francke was also convinced, as Leibniz was at one time, of the necessity for a third, neutral or extended space (an orphanage, a voluntary society of the love of God) for reconciliation to occur. This neutral space mimicked or signified the manner in which the heart reconciled. In Wolff's view, reconciliation occurred *in the act* of geometrical projection; when one used an instrument to take precise measurements, the act itself was a single and unifying conciliatory gesture that improved or made the actor more virtuous or loving as the net result. In Francke's view, we could not be certain that love and virtue would result. Love needed to be integrated into the act of measuring, into the very moment of the gesture—otherwise the gesture itself was not truly conciliatory. One needed to measure, to practice the mathematical science, *in* love—in a third, extended site or state. One did this by embracing the "seeing heart," following Comenius and Spener, as the neutral space where reason and experience came together. Like a three-dimensional model, or a Pietist orphanage, the site itself—in this case the heart, which served as a kind of eye—offered new opportunities to bring one's desire, one's passion or affections, one's aesthetic sensibility to bear upon mathematics, physics and the entire project of reconciliation.

The problem was that the passions, while powerful, were unpredictable—and even dangerous. They also had a bad reputation as something that religious enthusiasts, or *Schwärmer*, let get the better of them, which explained why they claimed to see and know things that others did not. Fears concerning the devastation, even madness, that an unhabituated passion could cause kept most people from seeing, realizing and drawing

upon the potential of their passions.[65] Spener and Francke's movement promised to help people do just this. Francke's institutes offered exercises that were intended to "stir up," in a controlled or carefully regulated manner, individuals' passions, their love, and help them undergo an authentic conversion to "true" Christianity *at the same time* as these individuals were offered training in the mathematical sciences. Geometrical exercise was only one expression of a set of unifying spiritual exercises, such as singing arias or meditating on the Bible, which needed to be engaged in all at once. For Francke and the *Theologis,* as Wolff called them, geometry alone could not produce Christians; it contributed to a much more broadly conceived but always vision oriented project that also involved rigorous exercise of the body, or motion, and manipulation of the active principles of various substances. True Christians embraced and exploited both the teachings of the Aristotelians and the Platonists—assimilating them in their hearts. True Christians, whose senses and cognition had been enhanced by geometrical exercise, *felt* geometry—for them thinking and experiencing were conjoined in the same act, and it was an act of love.

When the mathematical sciences are situated at the centre of attempts to explain the differences between Wolff and Francke, we see that it was not necessarily their oppositional stances relative to some universal standard of Enlightenment that animated them but their differing opinions about how to reconcile, about how to construct universally valid, sustainable and ethical ways of knowing the world. They had much

[65] See Adrian Johns' discussion of the passions in the *Nature of the Book: Print and Knowledge in the Making* (Chicago: University of Chicago Press, 1998): esp. 402-408. Descartes also intensively studied the passions; like many others, he wanted to understand the manner in which the passions mingled (in the common sense or some neutral, third site) with the perceptions of images contained in the brain. See Gary Hatfield "Descartes' Physiology and its Relation to his Psychology" in John Cottingham ed. *The Cambridge Companion to Descartes* (Cambridge: Cambridge University Press, 1992).

more in common with one another than they did antagonisms; however, one can see how in stressing the love of Christ and conversion (which he did often) as central to his own project, it was easy for non-theologians to disregard Francke as someone who had deliberately placed himself in opposition to modernity. This was, of course, simply not the case; and I think the chapters that follow illustrate quite clearly how and why training in geometrical projection (as well as mechanics, astronomy etc.) was a central part of Pietist pedagogy. Pietist philanthropy, then, becomes a visible extension or expression of the conciliatory exercises contained in the Halle Orphanage, or the city of schools it signified. Participating in this new philanthropic enterprise as a teacher, as a student or pupil, as a missionary, as a benefactor or even simply as an interested observer, was a conciliatory gesture because it arose out of and engendered more love.

When Pietist philanthropy is understood (as its contemporaries understood it) as a collection of vision-oriented conciliatory practices, the Halle Orphanage's status as assimilatory edifice and not a civic "relief institution" also becomes clearer. Those who have studied its institutional structure, such as Thomas Müller-Bahlke and Juliane Jacobi, have already called into question Francke's interest in and ability to house "poor orphans."[66] The detailed lists of children who were housed in the facility show minimal numbers of truly destitute and abandoned children and instead present large numbers of children from the middling and higher estates—many of whom often had living family members and whose fathers were clergymen. In some ways this should come as no surprise since most early modern German orphanages were built to house children of

[66] Juliane Jacobi, "'Man hatte von ihm gute Hoffnung'. Die soziale Kontur der Halleschen Waisenkinder" and Thomas Müller-Bahlke, "Die frühe Verwaltungsstrukturen der Franckeschen Stiftungen," in Udo Sträter, Joseph N. Neumann and Renate Wilson eds., *Waisenhäuser in der Frühen Neuzeit* (Halle: Verlag der Franckeschen Stiftungen, 2003): 41-70. See also Benjamin Marschke's review in *Pietismus und Neuzeit* 31 (2005): 231-33.

"legitimate" or "honorable" parentage, whose parents were members of the civic community; truly destitute and abandoned children were usually taken care of in hospitals and sometimes even prisons.[67] In this case, the status of Francke's orphanage as a "relief institution" has been complicated by the legacy of P. J. Spener's founding of an orphanage/workhouse in Frankfurt a. M. in 1679 that actually endeavored to service destitute communities.[68] Because of Francke's status as Spener's protégé, he was able to align himself with Spener's commitment to solving the problem of poverty at the same time as he, as Udo Sträter has also confirmed, founded a very different kind of orphanage.[69]

Long standing hagiographic portrayals of Francke have tended to stress his compassion for the poor and destitute children he encountered playing in the slums outside of Halle when he first arrived there and insisted that this is why he decided to build his orphanage.[70] Obviously my work directly challenges this assertion in light of

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[67] Thomas Safely's work on the city orphanages of Augsburg offers an overview of how civic orphanages worked. See his *Charity and Economy in the Orphanages of Early Modern Augsburg* (Atlantic Highlands, NJ: Humanities Press International, 1997) and his most recent *Children of the Laboring Poor: Expectation and Experience among the Orphans of early modern Augsburg* (Leiden; Boston: Brill, 2005). Otto Ulbricht has argued that before 1760 there were few foundling hospitals in Central Europe that would accept illegitimate or otherwise dishonorable children. They were often "sent to houses of correction to live with criminals and the insane," he writes. See his "Foundling Hospitals in Enlightenment Germany: Infanticide, Illegitimacy and Infant Mortality Rates," *Central European History* 18 (1985): 215. However, Safely (*Ibid*.) provides some evidence that city orphanage inspectors often looked the other way and took in dishonorable children when no other alternative existed.

[68] Udo Sträter, "Pietismus und Sozialtätigkeit: Zur Frage nach der Wirkungsgeschichte des 'Waisenhauses' in Halle und des Frankfurter Armen-, Waisen- und Arbeitshauses" in *Pietismus und Neuzeit* 8 (1982): 203.

[69] Ibid., esp. 201-203.

[70] Examples of nineteenth-century hagiographic portrayals of Francke include Karl Richter's introduction to A.H. Francke's *Schriften über Erziehung und Unterricht* (Berlin, 1871), Gustav Kramer, *August Hermann Francke: Ein Lebensbild*. Two Vols. (Hildesheim, 1880-82); and Gerhard Uhlhorn's *Die Christliche Liebestätigkeit* (Darmstadt, 1959): 656-660. Contemporary historians have continued to rely on these portrayals for their own understanding of Francke's project. Melton (relying on Richter) writes that Francke's first orphanage school "was originally a charitable institution for the children of beggars and similarly destitute parents" that "gained such a reputation for piety and orderliness that artisans and middle-class parents began enrolling their children as well;" in *Absolutism and the eighteenth-century Origins of Compulsory Schooling in Prussia and Austria*, 34-35. On the contrary, I contend that from the very beginning, Francke set out to construct a educational community modeled after Jesuit colleges and saw

recent scholarship and my own discovery, while working in the *Geheimes Staatsarchiv Preußischer Kulturbesitz* in Berlin, that in 1713 a very detailed proposal was drawn up by civic authorities in Halle that involved the construction of a city orphanage.[71] Clearly, Francke's orphanage was not meeting local needs. As we have already seen, Francke required letters from patrons and proof of status to gain entry into the enclosed *Schulstadt*, which functioned more like an elite boarding school than a relief institution. Most of the children housed there came from places well beyond Halle: including Leipzig, Dresden, Berlin, Magdeburg, Hamburg, Heidelberg, Frankfurt am Main, Gotha, Erfurt, Weimar, and Zörbig. Four thirteen-year-old boys arrived from London on December 12, 1706; they were housed in the orphanage and would attend Halle's University.[72] By 1701, Francke's organization had taken in four boys from Schlesien, one from Prague and one from Holland; his international contacts continued to send gifted children from as far away as Moscow, Sweden and Denmark.[73] Clearly, the Halle Orphanage is better understood as an assimilatory showplace (*Schauplatz*) that signified the set of conciliatory practices contained inside of it. It was associated with Halle's University and the Berlin Academy of Science as a kind of visual "trophy" of the ruling elite who had allowed it to exist, often referred to as an *Orphanotropheum*. Pietists were not the only builders of *Orphanotropheums* but they seem to have been the first to have seized upon the use of this specific terminology. Following their lead, the Catholic

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potential in the edifice of the orphanage as a symbol of universal benevolence. Like other contemporary orphanages, it housed mostly children from legitimate families. While I concede that at the very beginning there were some attempts to house and educate poor children (such as Nikolaus Krell, whose story is conveyed in the *Waisenalbum*), this was always done in conjunction with the original vision.

[71] GSPK I H Rep. 52 Nr. 159b (1700-12): 1708 4 Bilder, 394-97.

[72] Discussed by Thomas Müller-Bahlke in "Introduction," *Um Gott zu Ehren und zu des Landes Besten. Die Franckeschen Stiftungen und Preußen: Aspekte einer alten Allianz* (Halle: Franckesche Stiftungen, 2001): 5.

[73] Juliane Jacobi ed., *"Man hatte von ihm gute Hoffnung": Das Waisenalbum der Franckeschen Stiftungen, 1695-1749* (Halle: Franckesche Stiftungen, 1998): 16.

prince-bishop of Breslau, Franz Ludwig von Pfalz-Neuburg (1664-1732), opened one in 1702—at precisely the same moment the new Catholic University of Breslau (Christian Wolff's home town) opened its doors.

This same year, Francke published two thorough descriptions of the *Organization and Teaching Art of the Schools that belong to the Orphanage* and the *Pädagogium*.[74] He wanted to show his reader "how the children in and outside of school, are directed in Christian behavior (*Zucht*), reading, writing, calculating, music and other useful things."[75] By this point, still in the early stages of the project, there were approximately 13 schools operating on the premises of the *Schulstadt* plus the *Pädagogium*. In the first three or most advanced orphanage schools, Francke explained, "The boys are not only taught to write and to calculate, but are also given lessons at certain hours in history, geography, physics and botany, as well as music and mathematics (*Mathesis*)."[76] Because his plans had included the establishment of an elite boarding school for children of titled parents, who were paying for their education, Francke seems to have been compelled to add the following note, "It is important to know though that even though the boys in these three schools or classes are taught the same languages and sciences, they do not belong to the *Pädagogium*. This is another institution (*Anstalt*) wherein only those boys are taught who can pay for their lessons so that they do not entirely belong to the

[74] A.H. Francke, *Ordnung und Lehr-Art, wie selbige in denen zum Wäysen-Hause gehörigen Schulen eingeführet ist: Worinnen vornemlich zu befinden, Wie die Kinder in und ausser der Schul in Christlicher Zucht zu halten, und zum Lesen, zierlichen Schreiben, Rechnen, wie auch zur Music und andern nützlichen Dingen anzuführen sind* (Halle: Waysenhaus, 1702); A.H. Francke, *Ordnung und Lehr-Art: Wie selbige in dem Pädagogio zu Glaucha in Halle eingeführet ist: Worinnen vornemlich zu befinden, Wie die Jugend, nebst der Anweisung zum Christenthum, in Sprachen und Wissenschaften, als in der Lateinischen, Griechischen, Ebräischen und Französischen Sprache ... auf eine kurtze und leichte methode zu unterrichten, und zu denen studiis Academicis zu præpariren sey* (Halle: Waysenhaus, 1702).
[75] A.H. Francke, *Ordnung und Lehr-Art... Waysenhaus Schulen* (1702): 4-5.
[76] Ibid.

orphanage."[77] The statement is characteristically oblique, meaning it expressed what likely needed to be said in order to justify the fees Francke was charging the ennobled parents of his *Pädagogium* pupils; it also clearly signaled that boys who had been deemed capable of studying were still being introduced to exactly the same forms of knowledge as those who were paying for it. The statement, and Francke himself, skillfully negotiated between acknowledging the *Pädagogium* as an extra special school only for the elite, while indicating that it was connected to the orphanage and offered a curriculum similar to the most advanced "orphanage schools."

It is important to keep in mind that a very distinct hierarchy of knowing was in place in the landscape of Francke's educational complex, despite his interest in exposing all children, regardless of their backgrounds, to several forms of knowledge at once. Eventually the three "advanced" orphanage schools would be merged together and referred to simply as a Latin school—second only to the elite *Pädagogium* within the complex. The next group of schools included "one school for orphan boys who can read perfectly and who will soon teach other children in the German school… only they also learn a bit of Latin, History, Geography and Physics," and one school for younger boys who "cannot quite read yet," but who were being groomed for the same occupation. There were several other lower schools for "poor boys" and "poor girls" as well but (unfortunately) their orientation and length of existence is difficult to determine in any great detail. What does emerge from the 1702 descriptions of the orphanage schools and *Pädagogium*, however, is a very clear summary of the kinds of exercises important to Francke and those involved in carrying out this project. The pedagogical regimens of the *Schulstadt* are notable for their sheer diversity. Self-cultivation, Francke knew, required

[77] Ibid., 6.

training in several ways of knowing that would become progressively more challenging the further one proceeded down the path of wisdom.

I have divided the dissertation into three parts in order to most effectively make my case for the Pietist Orphanage's status as a signifier of the conciliatory gestures perfected there—gestures that wove together loving and seeing while generating wisdom and consensus. Part I examines the origins of the Halle method by focusing on the five figures whose preoccupations—usually conveyed in their writings—and interactions with Francke and other members of his community most profoundly influenced its orientation. These five figures—Ehrenfried Walthers von Tschirnhaus, Johann Christoph Sturm, his son Leonhard Christoph Sturm, Gottfried Wilhelm Leibniz and Christian Wolff—are generally not placed alongside or in dialogue with Francke, but they very much were so. All five of these figures have been treated in varying degrees by philosophers, who have done much to further our understanding of what were highly cohesive philosophical systems (especially in the case of Leibniz and Wolff). But their accounts often tend to detach these savants from the social and cultural contexts that gave way to their ideas. When their philosophies are appreciated as practices that were intended to be actualized, several points of convergence between their goals and the goals of Francke's orphanage—a material expression of an idea, a house defined by the practices contained inside of it—emerge.

In Chapter One I look at Francke's relationship with E.W. von Tschirnhaus, who arrived in Halle after having met and collaborated with Leibniz and Spinoza in Paris and several members of the Royal Society in England. I argue that Tschirnhaus's interest in Pietism stemmed from his interest in mediating mathematics and physics through the

cultivation of instinct—or a drive capable of assimilating competing strategies for producing truth. Spener and Francke's movement claimed to offer the keys to understanding and cultivating this instinct. They had something to offer him and he, in turn, offered his support and advice. In Chapter Two I argue that the eclectic methodology of J.C. Sturm, which would later be extended by his son, also profoundly influenced the orientation of Francke's project, as it had influenced Tschirnhaus. Eclecticism marked a serious attempt to construct a foolproof method of reconciliation that involved accepting all positions as true and then mediating them in the soul. It involved a set of practices that several Jesuits were proficient in as well—especially Andreas Tacquet, whom Tschirnhaus and Sturm cite frequently. Chapter Three offers a new assessment of Leibniz and Francke's relationship; here I argue that, in some ways, the Halle Orphanage or the new method must be understood as an arm of the Berlin Academy of Science, of which Francke was also a member. And finally, in Chapter Four I demonstrate how both Francke and Wolff valued the mathematical sciences as intrinsically conciliatory areas of inquiry and appreciated their status as forms of spiritual exercise or *paideia*.

After exploring *why* it came into being, in Part II I focus exclusively on a collection of handwritten lesson plans (approximately 700 pages) that now reside in the Francke Foundation archive and that help us to understand *how* the Halle method was supposed to work. The majority of the lesson plans originated with Francke's colleague Christoph Semler, who produced them in conjunction with his own attempts to start a *Realschule* (a school specifically oriented around the teaching of the mathematical and mechanical sciences) in 1707—literally at the same moment Wolff arrived in Halle.

Several of the lesson descriptions are in Semler's hand but some appear to have been written by the university students that he enlisted as his co-instructors. The school did not stay open for long and we know that Semler eventually gave the lesson plans to Francke for use in his own schools. Because of this, I have proceeded, carefully, on the assumption that the plans themselves have something to tell us about how Francke and other members of his organization understood and allowed that the mathematical sciences be taught. The plans beautifully illustrate how a *consilia* of mathematics and physics could be brought about through the observation of three-dimensional models especially. Models of all kinds were to be seen on the grounds of Francke's city of schools and, as I have indicated, Francke himself regularly recorded in his journal his visits to Semler's house to look at the new ones his colleague was building.

I argue in Chapter Five that the use of three-dimensional models was perhaps the hallmark of Pietist pedagogy because these objects perfectly illustrated the way in which the new method was supposed to work. Models linked together experience and intuition in a neutral, third site. One's senses "were opened up" upon viewing them, Semler explained, and at the same time, one's cognitive abilities were heightened as one began to recognize certain truths "more clearly and distinctly." This does not mean that Halle Pietists did not duly appreciate the techniques of geometrical projection that Wolff was advocating; on the contrary, they seemed to have appreciated the value of these technologies as long as they were conjoined with attempts to include the affections in the representations of objects or experiences. In Chapter Six, I analyze two texts on painting and drawing—one contained in the Semler lesson plans and one printed by the Halle Orphanage press—and argue that Halle Pietists, like Wolff, were endeavoring to improve

the science of perspective by standardizing (thereby making easier) painting and drawing techniques because they believed in its ability to condition conciliatory gestures.

Chapter Seven presents other ways in which the Halle method linked together hearts, hands and minds. Using remaining sections of the Semler lessons in conjunction with several published descriptions of the curricula of Francke's schools, I argue that Halle Pietists attached special significance to the visual and conciliatory properties of motion; they were interested not only in the machine's ability to represent the union of body and soul but the love or motion that was affected by this union. They were interested in the promise of perpetual motion, like so many of their contemporaries, because they were in the business of sculpting perpetually moving machines—young men mainly, whose every movement was an intrinsically assimilatory act of love. I situate this discussion alongside my (admittedly all too brief) discussion of the plans' treatment of the visualization of substance or *naturalia* and music—itself a kind of substance, made accessible through signs that came together in the arias or Pietist *Lieder* (another third site) for which the Halle Orphanage was famous for.

Part III represents my first foray into what will have to remain mostly uncharted terrain for now. In order to illustrate the impact and significance of the Halle method, I consider its extension and replication though the founding of new orphanages and the reconfiguration of existing orphanages' own educational programming. New Pietist orphanages visibly marked or demarcated a region in which reconciliation was supposedly occurring, where the conciliatory gestures of the seeing heart were being implemented and local forms of knowledge were being assimilated into a single, universalizing edifice. They too were idealized spaces in which all the scattered objects,

ideas, practices and problems of the outside world be gathered up, assembled and reoriented around a single point of light, love and universal goodness. Also in these spaces, I contend, the ability of Halle Pietists to extend or replicate their method in other parts of the world hinged on visualization—on the ability of the potential donor to observe, thereby instinctively understanding, the value of the conciliatory exercises these institutions offered in addition to the power of the objects (including the hard currency) that made the entire enterprise possible.

Part I: Making a Conciliatory Method

Yes, this [commune] would be a kind of *unrestricted orphanage* where all poor orphans and foundlings could be fed, put to work and either raised to study or to participate in mechanics or commerce…

-Gottfried Wilhelm Leibniz (1671)

All wisdom (*Klugheit*), whether true or false, rests upon two main pillars, namely knowledge (*Wissenschaft*) or cognition (*Erkenntnis*) and experience (*Erfahrung*); either pillar can be misused on its own but together they can both be used correctly. And *the true wisdom is nothing other than the eye in people*, through which one sees what serves the best and protects oneself from damage.

-August Hermann Francke (1702)

Chapter One: Tschirnhaus's *Medicine for the Mind* and the New Method

> *You, oh worthy one, have asked for a detailed description of how the real Method works, how to bring habile Subjects to cognition and how to introduce the study of Mathematics (which is one of the most useful studies of the youth when they first learn the fundamentals from Mathesis and then experience the application—like the Neoterici applied the study of physics.) All of this I recognize as a gesture of special friendship and trust.*
>
> -E. W. von Tschirnhaus to A. H. Francke (1698) [1]

In early January of 1698, a dashing, well traveled and highly learned visitor stopped in Halle to see A.H. Francke's new educational complex, his city of schools, with his very own eyes. It was a complex that took a great deal of seeing to believe and, even then, often escaped description. It was difficult for contemporaries and even for Francke to capture with words and seems to have been changing its composition from month to month. By 1702, Francke had published what would become a standard work of Pietist propaganda, his *Marvellous Footsteps of Divine Providence*, in which he gave a blow by blow account of the miracles and wondrous gifts of God that had allowed him to found his organization. This portrayal mainly focused on the status of the new orphanage he had founded in Glaucha as a site for housing orphans and other "poor people." But in his *Outline of All the Institutes at Glaucha near Halle* (1698), he had made of point of explaining that the institutes were to "provide special blessings partially for the education of youth and partially for the maintenance of the poor."[2] In another one of the earliest descriptions he offered of this project, titled the *Historical News of the Care of the Poor and Education of the Youth in Glaucha*, Francke noted that the schools he was developing would do more than simply produce children who knew the basic tenets of

[1] AFST/H C 263: 1 [January 17, 1698]
[2] August Hermann Francke, *Outline of All the Institutes at Glaucha near Halle* (Halle: Waysenhaus, 1698)

Christianity and could read, write and calculate, "like other children." Instead, he explained that "what is intended here is to search out the individual talents that God and nature had instilled in each one and through true instructions to lead them to their intended purpose." In these schools, children who were being groomed to become apothecaries, printers and merchants would be taught the fundamentals of Latin "because it is needed in these professions." In the periods when they were not in school, Francke continued, they would either be taught how to make socks with the help of a local sewing master, or they would be "taught the fundamentals of geometry, geography, history, astronomy and physics "so that when they are apprenticed in a particular craft they will have at least some knowledge of the useful sciences, which are very important to the common way." [3] The mysterious guest who arrived at Francke's door in 1698 knew a little something about these "useful sciences." He was Ehrenfried Walters von Tschirnhaus (1651-1708).

E.W. von Tschirnhaus was one of the most famous German intellectuals of the seventeenth century—yet he left behind relatively few original traces of this thinking. He published a very small amount, burned most of his personal papers before he died and never held a formal post at a University. Despite this, he wielded a remarkable influence over all those who came into contact with him. Especially the German literature on early Enlightenment has consistently judged the nobleman from Saxony to be an especially charismatic figure who paved the way for the introduction of "Enlightenment ideas" in

[3] August Hermann Francke, "Historische Nachricht von Verpflegung der Armen und Erziehung der Jugend in gedachtem Glaucha" in Philip Jakob Spener's *Christliche Verpflegung der Armen, als aus Churfürstl.gnädigester Verordnung das Gassen Bettlen in den Churfl. Residenz Städten abgeschaft…* (Frankfurt a.d.O., 1695): 43-44.

the German states especially.[4] After leaving Saxony at the age of eighteen to study in Leiden, the young Tschirnhaus spent several years traveling extensively throughout Europe, collecting ideas and building friendships with some of its brightest minds—especially Pieter van Ghent, Baruch Spinoza and Gottfried Wilhelm Leibniz. Notably, he spent a year or so in England (1674-75) where he met with members of the Royal Society, including Robert Boyle, Denis Papin, John Collins, Henry Oldenbourg, Isaac Newton and John Wallis; but despite their repeated requests for him to join the Royal Society, Tschirnhaus refused .[5] He probably became best known for his secret work on developing a recipe for porcelain that would result in Germany's first porcelain factory in Meissen (Saxony). Recent scholarship has also reiterated the importance of Tschirnhaus's writings on the young Christian Wolff, who himself tells a short but captivating story in his autobiography about his pilgrimage to meet the famous nobleman at the Leipzig book fair in 1705.[6]

Tschirnhaus's relationship with August Hermann Francke has received some scholarly attention; however, most accounts have tended to gloss over why these figures were interested in each other in the first place. Why would one of the most famous intellectuals of the hour, with contacts in virtually every major centre of learning, bother to "drop by" Halle specifically to visit Francke? Why was Francke interested in playing

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[4] Siegfried Wollgast, *E.W.v.Tschirnhaus und die deutsche Frühaufklärung* (Berlin: Akademie Verlag, 1988): 21.

[5] Uwe Mayer "Am Rande der Gelehrtenrepublik—Tschirnhaus als Mathematiker," *Ehrenfried Walther von Tschirnhaus (1651-1708): Experimente mit dem Sonnenfeuer; Sonderausstellung im Mathematischen-Physikalischen Salon im Dresdner Zwinger vom 11. April 2001 bis 29. Juli 2001*. (Dresden: Staatliche Kunstsammlungen, 2001): 26-27. John Collins famously described Tschirnhaus as the "most knowing algebraist in Europe;" see Mayer, 25. Gottschling remarks that the young nobleman got to know Wallis, Oldenbourg and Newton especially well. Per Caspar Gottschling's *Lebens-Beschreibung 4 gelehrter und geschickter Edelleute: Jacob Wellers von Molsdorff, Wolffgangs von Bock, Ehrenfried Walthers von Tschirnhaus, Hans Albrecht von Hengel* (Brandenburg, 1722).

[6] Also retold by Wollgast, 41-42.

host? What was it that Tschirnhaus was actually suggesting Francke do in his schools and why was it so important? Here I take a closer look at Tschirnhaus's description of a "new method" for introducing children to mathematics and physics and attempt to explain why he (and Francke) may have felt it was the perfect fit for Francke's universal project. This requires, of course, some discussion of Tschirnhaus's mandate. One major problem in the literature around Tschirnhaus has been its tendency not to critically examine his writings, but instead to simply link him up with Leibniz, label him a closet Spinozist or place him firmly within an "Enlightenment tradition" that is never explicitly defined. To remedy this tendency, I offer a much needed reassessment (and contextualization) of two underutilized Tschirnhaus texts in which he attempts to explain his mandate. When the participation of Tschirnhaus via these texts in Francke's city of schools is considered, they help bolster my case for the Pietist professor's interest in imagining the "useful" or mathematical sciences as a way of mediating all forms of knowledge. The texts include Tschirnhaus's *Medicine for the Mind, or general guidelines for the art of invention* and his *Basic Guide to the Useful Sciences, especially Mathematics and Physics (Gründliche Anleitung zu nützlichen Wissenschafften absonderlich zu der Mathesi und Physica)*, portions of which are directly derived from the *Medicina Mentis*.[7] The *Medicina Mentis* was first published in Amsterdam in 1687 and then again in Leipzig in 1695 with the additional title: *for explaining the generation of curves through focal points* (*zur Erläuterung der generatio cuvarum per focus*).

[7] Tschirnhaus published a sequel to his *Medicine for the Mind* that same year entitled *Medicina Corporis,* or *Medicine for the Body* (Amsterdam, 1687) and planned a third volume that he never finished. A handwritten copy of the *Gründliche Anleitung zu nützlichen Wissenschafften absonderlich zu der Mathesi und Physica. Wie sie anitzo von den Gelehrsten abgehandlet worden* first surfaced in Halle in 1698 and still resides in Francke's archive: AFST/H D 85. The *Medicina Mentis, sive Artis Inveniendi praecepta generalia* has been translated into German by J. Hausleiter (Leipzig, 1963); my discussion is based on the translated text.

Tschirnhaus wrote *The Basic Guide to the Useful Sciences* upon Francke's request in 1698; two additional printed versions of the guide were published in Halle in 1700 and in Frankfurt am Main and Leipzig in 1708 (see Appendix 3).

Once it becomes clearer what Tschirnhaus was trying to do, including the kind of curriculum he imagined for Francke's schools, several features of the science of perfection under construction in Halle will emerge. Perhaps the most important feature of this curriculum was its interest in reconciling what had by 1700 become two divergent programs for producing knowledge: the experimental method (advocated most famously by Robert Boyle) and the geometrical method. Steven Shapin, following Thomas Kuhn, has defined experimental philosophy and non-experimental mathematical science as two separate cultural forms, each exhibiting "divergent procedures for regulating access to their communities and for defining who was competent to participate."[8] While my argument relies heavily on this distinction, it also probes its validity for understanding the application of Tschirnhaus's method in Halle, where methods of conciliation dominated (the subject of Chapter Two). Tschirnhaus's innovation lay in his attempt to find concrete ways of making sensory data – subject to the powers of the imagination– more reliable. By training the imagination *and* the intellect, one would be better able to integrate new methods of inquiry (such as Boyle's) that relied primarily on sensory experience with truths derived from interior acts of "concipi"–conceiving or grasping

[8] Steven Shapin, "Robert Boyle and Mathematics: Reality, Representation, and Experimental Practice," *Science in Context* 2, 1 (1988): 41-42. Shapin draws specifically from Thomas S. Kuhn, "Mathematical versus Experimental Traditions in the Development of Physical Science" in *The Essential Tension: Selected Studies in Scientific Tradition and Change* (Chicago: the University of Chicago Press, 1977): 36, 39.

cognitively.[9] Tschirnhaus was especially interested in adapting insights from the Jesuit mathematician, Andreas Tacquet's *Elements of Geometry*, Archimedes' work on conic sections and Isaac Barrow, whose geometrical principle of image location fascinated him.[10] His recommendations to Francke constituted a select body of texts that linked the study of mathematics with the study of experimental physics in innovative ways. Texts from Archimedes, such as *De centris gravium* (*On the Equilibrium of Planes*) and *de insidentibus aquae* (*On Floating Bodies*), actually introduced a system based on pure mathematics into mechanics, for example.[11] This is precisely what Tschirnhaus was after; his strategy for bringing about reconciliation involved the application of principles derived from Archimedes' geometry (which Descartes had discarded) and optics.[12]

Tschirnhaus and Pietism

Long before Tchirnhaus paid Francke a visit in that first week of January, 1698, both figures had come into contact—each of his own accord—with the charismatic founder of Pietism, Philipp Jakob Spener. Francke's first encounter with Spener was dramatic. He professed to having undergone an emotional conversion experience in

[9] My appraisal of the singularity of Tschirnhaus's method is indebted to C.A. van Peursen's assessment of the *Medicina Mentis* (in 1993); it is the only one currently available in English or German. See his "E.W. von Tschirnhaus and the Ars Inveniendi," *Journal of the History of Ideas* 54:3 (July 1993): 395-410.
[10] It is important to recognize that after 1550, Euclid's geometry had become so mainstream that mathematicians were turning to other classical sources and developing new geometries. These sources included the *Conica* of Apollonius, *Arithmetica* of Diophantus, various writings from Archimedes and the *Collectiones mathematicae* of Pappus, all of which contained problems that could not be solved by a compass or ruler. In Kirsti Andersen and Henk J.M.Bos, "Pure Mathematics," in Katherine Park and Lorraine Daston eds., *The Cambridge History of Science* Vol. 3: *Early Modern Science* (Cambridge: Cambridge University Press, 2006): 712.
[11] This according to Domenico Bertoloni Meli, "Mechanics," in Park and Daston eds. *Cambridge History of Science* Vol. 3 (Cambridge: Cambridge University Press, 2006): 634-35.
[12] Kirsti Andersen and Henk J.M. Bos explain how Descartes' *Geometry* contains a classification of all geometrical problems, including curves; those with algebraic equations he classified as "truly geometrical." At the same time, "he expelled other curves (now called transcendental) from geometry, excluding explicitly Archimedes' spiral, the quadratix and the cycloid." In Park and Daston eds. (2006): 718.

Lüneburg shortly after having met Spener in Leipzig (in 1686). That same year Spener had taken up a coveted post as senior court chaplain to the Saxon Elector, Johann Georg III, in Dresden, where he would wield a commanding influence.[13] Spener took a liking to Francke and invited him to stay with him in Dresden in 1689. Upon emerging from this extended stay at the Saxon Elector's court, Francke became a passionate spokesperson for Spenerian reform—often preaching spontaneously in public spaces and drawing huge crowds to his lectures back at the University of Leipzig. Rumor had it that after hearing Francke speak, students burned their textbooks, formed conventicles and were openly undermining the authority of their professors. Francke was eventually forced to leave Leipzig in 1690, took up a pastorate in Erfurt for a year (where he was mostly looked upon unfavorably) and then, with the help of Spener, landed in Halle in 1691. Spener's tenure in Dresden was short lived as a result of his constant clashes with the Saxon Elector over what Spener considered an excessively secular court culture; he was invited to serve as the Hohenzollerns' court preacher in Berlin, where he learned of Friedrich III's plans to found a new university. Spener saw to it that Francke was offered a pastorate in Halle as well as a Chair in Greek and Oriental Languages when the new university opened in 1694. It was upon commencing the duties of his professorship that Francke would found his Orphanage and begin seeking input from individuals like Tschirnhaus regarding the methodological orientation of his *Schulstadt*'s curricula.

Tschirnhaus also openly aligned himself with the mandate of Spenerian reform and had long stood in contact with the prolific pastor. In the introductory pages of his *Basic Guide to the Useful Sciences*, Tschirnhaus explained that Spener had offered a

[13] See Tanya Kevorkian, "Piety Confronts Politics: Philipp Jacob Spener in Dresden, 1686-1691" *German History* 16:2 (1998): 145-146.

similar description of the "faith" he was setting out to describe in this text. They were both interested in strategies for cultivating an "instinct" or "drive" (*Trieb*) so one could feel and experience the divine. Because we "so often only pay attention to outward appearance," Tschirnhaus wrote, "we miss the feeling of godly operations (*göttliche Operationes*) and often even find ourselves diametrically opposed to them, so that they bear no fruit." He said he developed his method to show

> the right way to recognize the unchangeable instinct of God's peace for oneself, how to follow it and not to detract from this way or to hinder it. This involves the active reading of the Holy Scriptures, especially the New Testament and the speeches of Christ, which can teach us a lot. And we also have many writings of spiritually rich people—praise God!—such as Gerhard, Arndt, Lükemann, Scriveri, Müller etc. … but the spiritually rich writings of the theologian Herr D. Spener, especially his "Teaching-Fruits and Treasures of Belief"… are recommended here, in which the attentive reader will easily acquire things that require a lot of energy and work to acquire in many other books—and that sometimes still cannot be found. One will find [in Spener] a thorough and clear description of the same faith I am speaking about here…[14]

In Spener, Tschirnhaus recognized a similar calling and method for experiencing the meaning of divine revelation by learning to recognize divine messages or operations instinctually. Instinct helped one acquire the powers of discernment necessary to distinguish between true from the false or to assimilate several, seemingly contradictory points of view. Cultivating one's instinct could help one overcome the errors of perception. But for Tschirnhaus and Spener, perfecting this instinct required that one practice a certain kind of faith—one rooted in meditation or the observation of the Holy Scriptures.

In the *Theologische Bedenken,* a posthumous collection of his writings, Spener's interest in defining practices for engaging the Scriptures in order to make one more attuned to the subtleties of divine operations is manifest. His central concern, following in the footsteps of Johann Arndt (d.1621) and Lewis Bayley (1565-1631), was with

[14] Tschirnhaus, *Gründlich Anleitung* (1708): 8-9.

forging a "practice" of piety (i.e. *praxis pietatis*).[15] One practiced one's faith internally through a combination of meditation & erudition, *and* externally through manifold outward expressions.[16] The *Theologische Bedenken* contain his description of the "proper use of Reason, meditation and erudition," in addition to several sections on the how to engage in material or practical forms of piety. These outward expressions were rooted in the senses in that they required one to rely on the imagination's assimilation of material impressions in order to determine where and how to direct a pious act. They were visible acts, easily witnessed and engaged in with help from the intellect in order to affect a visible change. But since the imagination was notoriously unreliable—often misreading or misinterpreting incoming sensory impressions—this presented a bit of a problem. What if the senses perceived a need to direct a pious action where there was none? So Spener provided instructions for discovering how divine operations felt; the *Theologische Bedenken* contain a section on how to properly recognize sensations from the Holy Spirit while reading the scriptures, for example.[17] This required learning to distinguish true operations from other feelings generated by our senses' distortions of

[15] Lewis Bayley is a figure sometimes overlooked in Pietism studies; he was instrumental in popularizing the phrase *praxis pietatis* on the Continent in the seventeenth century. This phrase became the mantra of Pietist circles in the German states. Bayley's treatise entitled the *Practice of Piety: Directing a Christian how to walk that he may please God* was widely circulated. It was printed in French in 1644 (Jean Verneuil) and in German in 1649 & 1654 (Lüneburg), 1717 (in Basel) and 1742 (Berlin). Carl Hildebrand von Canstein noted in his preface to Spener's *Theologische Bedenken* (Halle: Waysenhaus, 1709) that in his youth, Spener was especially influenced by Lewis Bayley's *Praxi Pietatis*; see 10-12. See also Sträter, *Sonthom, Bayly, Dyke und Hall* (1987).

[16] The best formal statement of Spener's interest in improvement as an expression of piety is his *Pia Desideria or Heartfelt Desires for an Improvement of the True Evangelical Church Pleasing to God; Pia Desideria: Oder Hertzliches Verlangen nach Gottgefälliger Besserung der wahren Evangelischen Kirchen* (Frankfurt, 1676). In this text, Spener talked about the importance of "verifying faith" through action. Internal and external modes of faith coexisted in active state of dialectical exchange. The dialectical qualities of Pietism have been acknowledged by James Van Horn Melton, *Absolutism and the Eighteenth-Century Origins of Compulsory Schooling in Prussia and Austria* (Cambridge: Cambridge University Press, 1988): 28-29 and Jonathan Sheehan, *The Enlightenment Bible: Translation, Scholarship, Culture* (Princeton: Princeton University Press, 2005): 58-59.

[17] Philipp Jakob Spener, *Theological Bedenken* (1709): 28. "Von der Erleuchtung des heil. Geistes bey lesung der heil. Schrift."

truth. For Tschirnhaus, separating the true from the false involved the cultivation of instinct and the mediation of perception; Spener preferred to talk about instinct as an inner light, or illumination (*Erleuchtung*) of the senses.

Without light—a material medium that began in the soul and projected outward—and the intellect to direct light rays to proper ends, there was only darkness. Spener's brand of spirituality was firmly rooted in visual metaphors:

> Admittedly, the person is darkness before he receives this light; I also confess that he does not receive light through prayer alone, instead the Holy Spirit makes the light happen through preparation of the heart…. So speaks this light, as does my understanding and my will, and it becomes love. For this reason the soul must be brightly illuminated und born again so that such things can happen inside of it and take hold. The inner light or the new way … is not belief alone but all of godly nature… Belief is the "causa instrumentalis" of blessedness (*Seeligkeit*) but love is blessedness itself…. When we see love as the light of heaven, understand the essence of this light and "the new nature,' then the love has taken us over from within.[18]

For Spener, light emanated (actively) from a divine source, was the essence of love, spoke through the scriptures and was manifest in nature. It was a material substance that introduced real change and helped the senses properly intuit divine messages. His stance here is similar to that of Descartes, who conceived of light as an active material substance, or "the action of a subtle matter or ether filling the whole of space;" the sun or another light source inside of this matter "produced a tendency to motion" that was then transmitted along straight lines (or light rays) in the ether until it hit the eye.[19] For Spener, the divine constituted "another light source" that was constantly in motion and capable of being transmitted between individuals or directed towards pious acts—which

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[18] Ibid., 132-133.

[19] Caspar Hakfoort, *Optics in the Age of Euler. Conceptions of the Nature of Light, 1700-1795* (Cambridge: Cambridge University Press, 1995): 12. According to A. Rupert Hall, "Descartes taught that light is 'a certain motion, or prompt and vivid action, in the luminous body' (*Dioptrique*, Ch. I, Section 3) transmitted instantaneously through the optical aether and penetrating all transparent bodies until it reaches the eye (it is like a quick blow transmitted down a rigid stick from one end to the other.) The aether consists of very small, perfectly spherical particles, which rotate as they move." See A. Rupert Hall, *All Was Light. An Introduction to Newton's Opticks* (Oxford: Clarendon Press, 1993): 10.

were manifestations of it. To fully exploit the power of this light, the pious acts it inspired had to be directed by reason. One engaged in interior exercises of the intellect in order to learn how and where to direct material expressions of divine love. Suffice it to say at this point, that Tschirnhaus saw some very clear parallels between Spener's "faith" and his own method for conditioning the senses *and* the intellect, or for linking mathematics and physics.

The spirit of camaraderie Tschirnhaus detected between himself and Spener was apparently mutual. In response to stinging criticisms of the *Medicina Mentis* published by Christian Thomasius (Halle, 1688), Spener defended Tschirnhaus's method enthusiastically.[20] In 1687, he also recommended and sent a copy of Tschirnhaus's sequel to the *Medicina Mentis*, the *Medicina Corporis* to Anna Elisabeth Kissner in Frankfurt am Main.[21] Udo Sträter reports that in a letter Spener wrote to his son, Johann Jakob (1669-1692), while the latter was taking advanced courses in mathematics at University, the eager father mentioned Tschirnhaus as someone his son should consider studying with for a time. He described Tschirnhaus as "a man, to whom few can hold a candle to in Mathematics" and who had already offered his support of Johann Jakob's

[20] Thomasius accused Tschirnhaus of being a Spinozist even though Spinoza's name is never mentioned directly in the text. Wollgast, Van Peursen and Israel all suggest Tschirnhaus carefully references his friend, but van Peursen sees the *Medicina Mentis* as Tschirnhaus's attempt to remedy or improve upon Spinoza's method, not to further it. Spener makes his support of Tschirnhaus clear in a letter from September 20, 1688; see Philipp Jakob Spener, *Briefe aus der Dresdner Zeit: 1686 – 1691.* Vol. 2: 1688. Johannes Wallmann et al eds. (Tübingen: J.C.B. Mohr Siebeck, 2008): letter 95. The letter also appeared in Philipp Jakob Spener's *Theologische Bedenken* (1709): 192-195. Christian Thomasius's remarks appeared in his *Schertz- und Ernsthafter, Vernünfftiger und Einfältiger Gedancken über allerhand Lustige und nützliche Bücher und Fragen dritter Monat oder Martius. In einem Gepräch vorgestellet durch E.D.F.U.K.* (Halle, 1688): 354-362, 386-443.

[21] Philipp Jakob Spener, *Briefe aus der Dresdner Zeit: 1686-1691.* Vol. 1: 1686-87 (Tübingen: J.C.B. Mohr Siebeck, 2003): 651-52. E. W. von Tschirnhaus, *Medicina Corporis seu cogitations admodum probabiles de conservanda sanitae* (Amsterdam, 1686).

endeavors.[22] Before his untimely death in 1692, Johann Jakob Spener was to become the first mathematics professor at the new University of Halle; this was the position that Christian Wolff would eventually fill.[23]

Spener also often emphasized the ability of mathematics to serve as a "propaedeutisches Mittel," which suggests another reason he was so interested in the *consilia* of mathematical practice and experience Tschirnhaus's *Medicina* offered. Sträter points to a passage from Spener's introduction to the study of theology as an example:

> While practicing our understanding through Physics or Natur-Lehre, it would be better if we concerned ourselves with more than just the outer shell and let the underlying seed move us. We have to praise it as a well intended, godly deed that in this age more and more progress in the investigation of the properties of natural things has been made…. And it is praiseworthy that famous men not only rely on their own abilities, but from year to year through certain experiences present things to us that we can see with our eyes and touch with our hands, so that we are forced to make known the things those before us did not…Therefore, this kind of learning, next to the growth of the mathematics, is the largest contribution of this time.[24]

This is an especially revealing passage because it offers proof of Spener's own awareness of two distinct means of acquiring knowledge about the natural world—one that relied on "abilities" of famous men (i.e. mathematics) and one that relied exclusively on the experience of things that could be seen and heard. He presents the two modes as not necessarily existing in competition with each other, but rather as complimentary. In a 1666 letter to Gottlieb Spitzel, Spener describes Cartesian philosophy as ignorant of the inward and articulates a need to more clearly define the relationship between

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[22] "Ein Mann, dem in der Mathematik wenige das Wasser reichen könnten." See Udo Sträter, "Zum Verhältnis des frühen Pietismus zu den Naturwissenschaften," in *Pietismus und Neuzeit* 32 (2005): 88.
[23] Mentioned in Sträter, "Zum Verhältnis" (2005): 89 and in Wilhelm Schrader, *Geschichte der Friedrichs-Universiät zu Halle* Vol. 1 (Berlin, 1894): 61.
[24] Quoted in Sträter, "Zum Verhältnis" (2005): 87. The passage is taken from Philipp Jakob Spener, *Von den Hindernissen der Gottesgelahrtheit* (De impedimentis studii theologici) in Johann Adam Steinmetz ed. *Kleine geistliche Schriften* Vol. 1 [Magdeburg and Leipzig, 1741] (Reprinted in Hildesheim [u.a.]: Olms, 2000).

mathematics and demonstration.[25] As we will see, an interest in celebrating and drawing from both modes is what animated Tschirnhaus's presentation of an antidote, or medicine, for the mind.

After their initial meeting in the first week of 1698, Francke and Tschirnhaus began to correspond.[26] Four letters in Tschirnhaus's hand and addressed to Francke indicate that by the end of the 1690s, they had taken up a lively correspondence. In a particularly revealing letter from January 17, 1698 (shortly after his first visit to Halle) Tschirnhaus told Francke:

> I have felt for a while now with great contentment that like the right way to achieve *Gottseeligkeit,* in order to raise up a fallen Christendom your high worthy and diligent efforts and concern about how to provide the youth with a truly useful education are greatly needed. You have founded your seminars so that over time we will not lack virtuous subjects. I am particularly excited about your plans to teach other good sciences, including the study of Mathematics: … what an unbelievably horrible shame for the youth that Euclid and Archimedes are currently as good as banned from the Gymnasiums…. [27]

It is especially clear from this letter that Tschirnhaus saw in Francke's efforts to provide a "useful education" to the youth some clear alliances with the method at the heart of his *Medicina Mentis*. How to most effectively organize a study of mathematics—one that introduces young people to Euclid and Archimedes' geometry so they are prepared to undertake a study of natural phenomenon —was the central subject of their correspondence. As Tschirnhaus indicated in the passage quoted at the outset of this

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[25] Philipp Jakob Spener, *Briefe aus der Frankfurter Zeit 1666-1686. Volume 1: 1666-1674* (1992): to Gottlieb Spitzel (September 21, 1666) .

[26] Mathias Ullmann, "August Hermann Francke und Ehrenfried Walter von Tschirnhaus. Eine Bekanntschaft im Spiegel der Quellen im Achiv der Franckeschen Stiftungen Halle/Saale" in Thomas Müller-Bahlke, ed.., *Um Gott zu Ehren und zu des Landes Besten. Die Franckeschen Stiftungen und Preussen: Aspekte einer alten Allianz*. Katalog der Austellung in den Franckeschen Stiftungen zu Halle vom 26.Juni bis 28.Oktober 2001 (Halle: Verlag der Franckeschen Stiftungen, 2001): 318. Carl Hinrichts, *Preußentum und Pietismus*, 70. See also Thomas Müller-Bahlke's discussion in "Naturwissenschaft und Technik. Der Hallesche Pietismus am Vorabend der Industrialisierung" in *Geschichte der Pietismus* Band 4 (Halle: Verlag der Franckeschen Stiftungen, 2005): 368.

[27] AFST/H C 263: 1 [January 17, 1698] E. W. von Tschirnhaus to A. H. Francke

chapter, Francke had "asked for a detailed description of how the real Method works, how to bring habile Subjects to cognition and to introduce the study of mathematics." Mathematics, he explained to Francke, should be considered "one of the most useful studies of the youth when they first learn the fundamentals from Mathesi and then experience the application—like the Neoterici applied the study of physics."[28] His reference to the Neoterici, a group of avant-garde poets from (first-century) Rome who experimented with evocative poetic forms, and their "application" of these forms to physics is especially suggestive—albeit cryptic. Both Boyle and Descartes had pointed to the value of rhetorical exercise, or learning to evoke clear and distinct images or *enargeia,* as having much to offer their studies of natural phenomena; Tschirnhaus is gesturing towards a similar pairing here.[29] Finally, Tschirnhaus indicated that Francke had asked him to provide a "detailed description of how the real Method works;" the *Basic Guide to the Useful Sciences* was his response to this specific request.[30]

Close associates of Francke, namely Johann Julius Elers (1667-1728) and Baron Carl Hildebrand von Canstein (1667-1719), were also in contact with Tschirnhaus regarding plans to manufacture glass in Francke's Orphanage. Francke and his circle were interested in producing their own lenses for optical instruments and wanted to know more about Tschirnhaus's secret experiments surrounding the recipe for porcelain.[31] Elers made at least one trip to Dresden to learn from Tschirnhaus about how the process worked. In his remarkably preserved "Journal about the Trip to Dresden" from 1704,

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[28] Ibid.
[29] For Boyle see Michael Wintroub, "The Looking Glass of Facts: Collecting, Rhetoric and Citing the Self in the Experimental Natural Philosophy of Robert Boyle" *History of Science* 35 (1997): 189-211, esp. 210. For Descartes see Jones, "A Rhetorical History of Truth" in *The Good Life* (2006): 55-86.
[30] Müller-Bahlke and Ullmann also take the letter quoted above as evidence that Tschirnhaus composed the *Gründliche Anleitung* specifically for Francke. Müller-Bahlke, "Naturwissenschaft und Technik" (2005): 368.
[31] This per Müller-Bahlke (2005) and Ullmann.

Elers recorded very specific descriptions of what he observed. He noted, for example: "on July 16th I was with Tschirnhaus for four hours in the afternoon; he asked if I had any new strategies for making the fire grow hotter…. July 17th, four hours with Tschirnhaus in the Glashütte…. July 18th, Tschirnhaus showed me the oven built into the wall of the Glashütte…" and so on.[32] On June 23, 1703, Canstein reportedly told Francke about a conversation he had with Tschirnhaus, where the nobleman "began to speak about the secret to making porcelain;" according to Ullmann, Francke was one of several individuals who tried to pressure Tschirnhaus into revealing the secret to him.[33] After his death, Tschirnhaus's name still appeared frequently in Francke's correspondence. For example, in a letter from 3rd of November, 1714, Canstein wrote to Francke: "It occurred to me that I wanted to send you one of Tschirnhaus's large burning mirrors. Herr John could use it in the *Pädagogium* in the experiments undertaken by the youth there."[34]

Printed descriptions of the curricula of Francke's schools also reveal much about the nature of Tschirnhaus's influence. Again, these influences have not gone completely unnoticed but they have not been utilized to their fullest potential. Richard Klüger wrote (in 1913) that "we not only know a meeting took place between [Tschirnhaus and Francke] in January of 1698 during the period of the swift construction of the Foundation, but the influence of Tschirnhaus can be seen in many of the different school ordinances, which already in 1698 relied on Tschirnhaus's philosophy in explaining the value of mathematical and mechanical lessons."[35] An anonymous tract from 1700 called

[32] AFST/H D 99a Heinrich Julius Eler's Journal über die Reise nach Dresden
[33] Ullmann, 329-333.
[34] In Peter Schicketanz ed., *Der Briefwechsel Carl Hildebrand von Cansteins mit August Hermann Francke. Texte zur Geschichte des Pietismus* III, 1 (Berlin, 1972): 666. Reprinted in Müller-Bahlke, "Naturwissenschaft und Technik" (2005): 372 n. 57.
[35] In a letter to Spener from January 8, 1698, Francke mentioned that Tschirnhaus visited the Orphanage; see Gustav Kramer, *Beiträge zur Geschichte A.H. Franckes: enthaltend den Briefwechsel Francke's und*

The Founding of the Pädagogium of Glaucha in Halle reported that Tacquet's *Geometry* was being taught, "according to the advice of Herr von Tschirnhaus;" and in another anonymous text from 1702, entitled *Rules and Style of Teaching employed in the Pädagogium of Glaucha in Halle,* the author explained that "following the advice of Herr von Tschirnhaus, Andreas Tacquet's *Introduction to the Elements of Geometry* is used as the main Mathematics textbook."[36] The author also noted that "we are trying (in Mathesi) to develop the Method that has been published by one well versed in this knowledge and a certain very famous statesman who knows our *Pädagogium*."[37]

Developing Tschirnhaus's method involved a conscious choice to follow a new path or to go "the other way." This according to the final passage of the letter from January of 1698 already quoted above, where Tschirnhaus explained to Francke the following:

> In this program of study, as in other useful sciences, many unnecessary and ostentatious things, not useful to solid erudition, are taught. There are especially two ways of acquiring knowledge in the world: one way may take ten years where one learns a lot, but this way is not worth much in respect to the other way. The other way is cast aside by most but it is the best. One learns the genuine method of demonstration and how to distinguish the true from the false through practical experience (per ipsam praxin). In a way that does not happen through the teaching of logic, one acquires the right method for finding the truth inside oneself—including how to meditate well, to sit still and to be attentive (strange qualities for youth). Finally, one learns how to treasure the truth against all other 'gods'…Making this happen requires time to bring into order all the many conversations of your thoughts…[38]

Going the "other way" involved acquiring proficiency in a "genuine method of demonstration" that taught one how to "distinguish the true from the false" by going

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Spener's (Halle: Waysenhaus, 1861) and Richard Klüger, *Die pädagogischen Ansichten des Philosophen Tschirnhaus: Inaugural-Dissertation* (Leipzig, 1913): 54-56.

[36] August Hermann Francke, *Einrichtung des Pädagogii zu Glauch an Halle* (Halle: Waysenhaus, 1700); *Ordnung und Lehrart wie selbige in dem Pädagogio zu Glaucha an Halle durchgefuhrt ist* (Halle: Waysenhaus, 1702). Andreas Tacquet's *Elementa Geometriae* (1654, 1701) is specifically referenced.

[37] Ibid. (1702) "Man suchet aber hierinne (in der Mathesi) die Methode also einzurichten wie sie ein vornehmer und in dieser Wissenschaft sehr berühmter Staatsmann unserm Pädagogio vor zuträglich erkannt und in öffentlichen Druck herausgegeben." The statesmen referred to here is likely Tschirnhaus.

[38] AFST/H C 263: 1 [January 17, 1698] E. W. von Tschirnhaus to A. H. Francke

"inside oneself." In that sense embracing the "other way" was also about illumination. It was a way "frequently cast aside" that linked the study of mathematics to experience. It placed "the useful sciences" at the heart of both cultures of demonstration and experience thereby reconciling them with each other.

The New Method

Tschirnhaus was extremely attuned to the latest natural philosophical debates, trends and the respective intellectual communities that produced them; his method for reconciling the study of mathematics and physics is a result of direct engagement with the most pressing issues of his time. C.A. van Peursen has argued that the significance of the *Medicina Mentis* lies in Tschirnhaus's stated interest in developing a new method of invention (in keeping with a Baconian configuration of *ars inveniendi*) that would extend and correct the philosophies of Descartes, Malebranche and Spinoza.[39] Even a cursory glance at the text itself reveals Tschirnhaus's preoccupation with Descartes; references to Spinoza are inexplicit, although van Peursen does make a convincing case for their resonance. Tschirnhaus's interest in application—specifically the application of geometry to physics—and reconciliation has not been sufficiently emphasized. While indebted to the ideas of Descartes, Spinoza and Boyle (and many others), Tschirnhaus's method claimed to be able to interweave these philosophies in new and highly productive ways.

Matthew Jones has recently pointed to the profound impact that René Descartes' geometry had on the pedagogical regimens for teaching mathematics throughout Europe—regimens very much in tune with Descartes' conviction that one should view

[39] Van Peursen, 396.

geometry as a form of spiritual exercise that could train and sharpen the mind.[40] "Late-seventeenth-century figures," Jones writes, "saw Descartes as more than a mathematician, epistemologist, natural philosopher and metaphysician; he was understood as a philosopher offering a way of life with a central mathematical practice."[41] Bernard Lamy, a Jesuit teacher of mathematics who taught the young Jean-Jacques Rousseau and produced an *Elements of Geometry* textbook in 1685, as well as Nicolas Malebranche, Pierre Nicole and Antoine Arnauld, "all developed Descartes' account of the power of mathematics to train the intellect and sought to put it into institutional practice."[42] Each of these thinkers was interested, like Descartes, in developing and drawing upon new geometrical methods that would not simply provide a "chain of demonstrations" or a "series of formally true propositions" but instead would "make evident the interconnections of ideas." This was a mode of geometrical practice or exercise that could be used to gauge and promote the health of the soul by teaching the intellect to discern order, or truth. Jones continues:

> With his new geometry, Descartes did not offer algorithms that mechanically yielded certain knowledge about mathematical objects and a world governed by mathematical laws. His geometry offered exemplary practice in seeing and thinking clearly, in experiencing with a healthy soul. Such practice was essential both to improve mathematics and to heal the self. Geometrical exercise could help cultivate discernment needed for choosing among philosophical doctrines and practices, for finding purpose for one's life, and for prescribing the means necessary to achieve that purpose…[43]

Geometrical exercise as a tool for the cultivation of discernment for the learned subject was to promote the soundness of individual judgment or to render human judgment infallible–a frightening prospect, Jones notes, for those who did not believe such infallibility was possible.

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[40] See Jones, 5 & 18 and especially Pierre Hadot's *What is Ancient Philosophy?* (2002).
[41] Ibid., 52.
[42] Ibid., 50-52.
[43] Ibid. 17.

Following in the footsteps of contemporaries who heeded Descartes' call to use geometric exercises to feed the soul and to foster a heightened awareness of individual perfectibility through rigorous cognitive training, Tschirnhaus put geometrical exercise at the center of his *Medicina Mentis*. And like Descartes and Leibniz, in developing his method he was influenced by the rhetorical strategies of Cicero, to whom the phrase *medicina mentis* actually belonged.[44] Descartes derived his emphasis on the importance of training people to grasp ideas clearly and distinctly from the Roman rhetorician Quintilian's characterization of evidence.[45] Jones notes that Quintilian (and Descartes) used the term *Evidentia* as a translation of the term *Enargeia*; Cicero defined *Enargeia* as "certain experiences, which the Greeks call *phantasias*, and the Romans call *visions*, whereby things absent are presented to our imaginations with such extreme vividness that they seem actually to be before our very eyes."[46] The imagination had a crucial role to play in determining the quality of virtual experience; it also was, as Descartes knew, especially sensitive to poetic or beautiful forms of knowledge—ones that stirred the passions. These forms were to be preferred, in fact, precisely because of their capacity to enhance vividness and, by extension, experience. But they needed to be used carefully, for the passions were unpredictable and the imaginations they influenced easily swayed. In invoking Cicero, as Tschirnhaus does throughout the *Medicina Mentis*, the nobleman hitched himself to a similar set of discussions about how to harness the imagination's ability to inspire, to assimilate instinctual drives or essences and even to invent entirely

[44] Van Peursen, 401. n.18; see also Matthew Jones' treatment of Leibniz's text entitled "The Utility of Geometry as a Medicine for the Mind" (1676) in *The Good Life* (2006): 224.
[45] Jones, 64-65. Jones notes that Stephen Gaugkroger has also argued for the influence of classical rhetoric, namely the rhetorician Quintilian, for conditioning Descartes' lingering interest in the psychological processes through which clear and evocative images are produced in people's minds. See Stephen Gaukroger, *Descartes: An Intellectual Biography* (Oxford: Oxford University Press, 1995).
[46] Ibid., 64.

new forms of knowledge. Cicero also coined the phrase *ars inveniendi,* van Peursen notes, and "changed the sequence of the traditional logic of demonstration and of invention by giving priority to invention" over justification. This is precisely what Tschirnhaus was interested in.

Van Peursen contends that Tschirnhaus developed "original methodological directives," based on the claim that "a person can perform intellectual and other operations without knowing how they actually work;" to illustrate this he "frequently gives the example of the way in which we use our hands without any knowledge of their physiological structure."[47] While Descartes' method involved the refinement of various mental processes to facilitate man's understanding of mechanical practices, Jones explains that Descartes' account of intuition rejected the imagination's contributions to these processes "if their products were held by minds that were not clear and attentive."[48] Tschirnhaus was convinced that in the interest of making philosophy more useful to people, certain mechanical operations needed to be grasped intuitively, or by inattentive minds. Whereas Descartes had emphasized "not trying to intuit complex things immediately," because "whoever tries to look at many objects together with one and the same intuition sees none of them directly,"[49] Tschirnhaus's method was about doing precisely this—intuiting complex things instantly by using one's instinct or drive without a full understanding of the rules informing the operations themselves. This is why he was so interested in Spenerian Pietism's claims to be able to help individuals cultivate their instincts by initiating and deriving benefits from the process of divine illumination.

[47] Van Peursen, 398. He cites pgs vi-vii, 1 and 129 of the *Medicina Mentis* as evidence of this tendency.
[48] Jones, 62.
[49] Ibid.

Tschirnhaus believed, for example, in the possibility of intuiting a whole series of mathematical relationships by glancing at a single curve without necessarily understanding the intricacies of those same relationships. In the first section of the *Medicina Mentis*, he commented on the utility of straight lines. "These alone are very easy for us to imagine," he explained; "we can trace back all subjects of mathematics to these lines…straight lines present the entire proportion or relationships most easily." He then drew a series of straight lines, one below the other, all with varied lengths. Drawing the reader's attention to the endpoints of lines he noted:

> the end points of lines g, h, i, k, l begin to make a curve. From this it becomes clear to me that in order to discover everything that is still not known (or only partially known) in mathematics, it is important to look at all possible curves, as much as we can understand them. By doing this, I hope to show all of the possible relationships between all subjects of mathematics so that if there is later some difficulty in some portion of this science, all that will be needed to remedy this is to display the relevant curve. Since a curve contains an infinite number of points, with one stab (the drawing of a single curve), we can solve an infinite number of problems. In this way we will call the science that relies on the recognition of such objects, or curves, *mathesis universalis*—for us curved lines will become rational essences.[50]

Tschirnhaus positions himself throughout the *Medicina* as in a kind of discussion with those interested in the project of universal mathematics more generally. Descartes had discussed *mathesis unviersalis* in the fourth rule of his *Rules for Direction of the Mind* but he was certainly not the first; this was a project already long underway. It owed much to the figure of Archimedes and the "great universal art" of combinatorics popularized by Raymunus Lullus in the thirteenth century.[51] Tschirnhaus's quest to extend the project of universal mathematics relied exclusively on intuitively assimilating various simple impressions. At one point in the *Medicina Mentis* he insists that Descartes had made startling progress in this realm by offering "so many new curves and had added

[50] E. W. von Tschirnhaus, *Medicina Mentis* (1963): 111.
[51] See Eberhard Knoblauch, "Mathesis—the Idea of a Universal Science," in Rudolf Seising, Menso Folkerts, Ulf Hashagen eds. *Form, Zahl, Ordnung* (Franz Steiner Verlag, 2004): 87-88.

so many astounding things to our ability to recognize their interior qualities," but he had not gone far enough. He had opened the door and then closed it again or not opened it as widely as he could have, and for no comprehensible reason.[52] Tschirnhaus argued that all humans were perfectly capable of instinctively recognizing all of the myriad connections manifest in all curves, and not just the ones Descartes had designated. The possibilities were endless. We simply needed to realize the possibilities of our instincts, our abilities to invent or to capitalize on our passions. Yes, our passions and the imaginations they affected were fallible, but if we could remedy this fallibility by training our cognitive faculties and our sensitive ones as well, then we were one step closer to perfection.

Tschirnhaus, like Spener and Francke, was interested in more intensively probing and refining the ability of instinct to mediate the relationship between man's imagination and intellect; and in going down this road, he was taking issue with some of the boldest claims of his mentor and friend, Baruch Spinoza. Van Peursen points out that Tschirnhaus simply did not accept Spinoza's strict separation of the intellect from the imagination. This careful separation in Spinoza's philosophy lay at the heart of Spinoza's criticism of Boyle's experimental philosophy, which Spinoza felt relied much too heavily on the faculty in humans most prone to producing errors and "did not put forward any mathematical proofs." Shapin writes that "there was, in Spinoza's view, a fundamental contrast between experiment and mathematics in their respective abilities to secure conviction;" because Boyle did not offer mathematical proofs of his experiments,

[52] "Daher hat Herr Descartes am besten von allen unendlich viele neue Kurven dargeboten und vieles Ausgezeichnete zur Erkenntnis ihrer innersten Natur hinzugefügt; aber wie er in der Tat begonnen hatte, hier eine vortreffliche Tür zu öffnen, durch die man zu dem sehr weiten Gefilde der Spekulationen abschweifen kann, so hat er diese gleichsam zum zweiten Mal völlig verschlossen oder sie wenigstens nicht so weit, wie er konnte, geöffnet, indem er eben hierdurch alle übrigen Kurven, die nicht eine solche Natur haben, wie er sie bei den von ihm geometrisch genannten Kurven fan, ausschloss, und zwar nach meinem Urteil aus keineswegs ausreichenden Gründen." E. W. von Tschirnhaus, *Medicina Mentis* (1963): 113.

they could not convince. Boyle countered that he was right to be "wary" of mathematical proofs and to "consult sense" in order to check "whether men have not been mistaken in their hypotheses and reasonings."[53] Tschirnhaus claimed to be offering a way of mediating the tension between Spinoza and Boyle.[54] He staunchly advocated "the use of a good method in which the intellect, imagination and senses cooperate," which, in a way reminiscent of Leibniz's interest in the same phenomenon, "would lead to the ideal situation where the 'school' can become 'ludus' or 'play'."[55] Children would be inspired to learn via their instincts; they would use these instincts to assimilate formal mathematical proofs and experience, which would lead to new inventions. The *Medicina Mentis* taught one how to successfully negotiate the tension between cognition and sensation.[56] It offered ways of training cognition through geometry and experiments for training the senses. Spener and Francke's movement would help individuals train and sharpen their instincts—or internal mediators.

In keeping with the embodied triad of cognition, drive, experience he was interested in championing, Tschirnhaus identified three essences (*Wesenheiten*) in the world: *Imaginables*, *Mathematical/Rationales*, and *Physical/Reales*. Imaginable essences corresponded to the functions of the imagination: to feel, to create pictures and to perceive truth.[57] A brief summary of how he understood the distinctions between these essences followed:

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[53] In Steven Shapin, "Robert Boyle and Mathematics" (1988): 46-47.
[54] Van Peursen, 402-03.
[55] Ibid., 403-04. Discussed in detail in E. W. von Tschirnhaus, *Gründliche Anleitung* (1708): 8, 63-64. Van Peursen also points out that Tschirnhaus's interest in the 'elimination of errors' represents an extension of Malebranche who had argued in *Recherche de la vérité* (1675) that there could be no investigation, no discovery of truth unless errors of the senses, imagination, intellect and passions were entirely eliminated.
[56] Van Peursen, 405.
[57] E. W. von Tschirnhaus, *Medicina Mentis* (1963): 108.

> When I think about everything that I have become acquainted with since childhood through seeing, reading or hearing, and I reflect awhile on the order in which I acquired these thoughts, a kind of chaos emerges…. Some of these thoughts are strong essences, which, it appears, are taken as truth by me earlier than they are understood. These often influence my spirit…as appearances that act upon me from the outside… in active ways…. I will name such appearances that act upon me in this way "imaginables" or "feel-able" or, if one prefers, *Phatasmen*.
> …
> Some things are grasped by me in different ways, for example, what I know from figures, numbers, movements and similar things…. Such essences, which… appear to have no existence outside of my person and of which I grasp only the clean or very abstract… I will call "Rationales" or "Mathematical."
> …
> Finally, I observe that I have thoughts from some essences, which, unlike the preceding Rationales, can be grasped in multiple ways rather than in singular and unchangeable ways…. For example, all that we grasp as material, unclean or non-transparent. These essences I will name "Reales" or "Physisches."[58]

Imaginables or *phantasias* (i.e. *enargeia*) were more than vivid pictures or experiences that could be harnessed by a gifted rhetorician to make events "appear" real. *Phantasias* were real or essential. They made impressions upon the spirit; their presence could be physically felt. If their effects on the individual could be harnessed and errors of perception remedied, anything would be possible. Tschirnhaus would later explain to Francke in his *Basic Guide to the Useful Sciences* that one of his most basic concerns in the *medicina* had been to "expose the obstacles and what comprise the largest and most comprehensive errors" in the act of "recognizing Truth," both "through the senses and through the power of the intellect."[59] His program was concerned with geometry's potential to produce an increasingly infallible intellect and experiment's ability to remedy perception.

To alleviate the tendency of the senses to produce errors, Tschirnhaus offered his readers a set of rules for conducting experiments. The experiments would help

[58] Ibid., 115. Points, Lines and Curves are the only rational essences.
[59] "Because it is my intent to show the best way to teach the youth how to recognize Truth through the senses and through the power of the intellect, it is very important to expose the obstacles and what comprise the largest and most comprehensive errors." E. W. von Tschirnhaus, *Gründliche Anleitung* (1708): 9.

individuals better understand their *phantasias*. "One learns about imaginable essences by doing countless careful experiments," he wrote, "which should be performed according to specific rules."[60] The performance of an experiment offered a great opportunity to improve upon the senses, including their ability to serve as a point of access to real essences, while learning about how sensation affects the creation of Imaginable essences. First, one needed to consider the room in which an essence is going to be observed, Tschirnhaus wrote, "in part so that we can see the nature of the outer or surrounding body and its influence upon another;[61]… and in part so that we recognize in which order the experiments, or attempts, should be made;" carving out a space to investigate *phantasias* was also important to Tschirnhaus because "when someone sets aside a room for the teaching of some thing, that thing is more quickly learned."[62] The next step involved "recognizing through experiments" what was necessary for the production of an Imaginable essence. Those who performed experiments in an "empirical manner" (like Boyle) were so concerned with understanding the properties or operations of some thing that they did not use the site of the experiment to recognize how *phantasias* were produced. They missed or disregarded the connection and the broader opportunities that better understanding this connection could offer the world. Finally, Tschirnhaus explained:

> one must keep trying and not give up until the eyes (and if its not possible with the naked eye then dioptric lenses can be used to enhance vision) become aware of an opening. And when as much as possible is discovered through this art it will not be difficult to observe that which is resident in the many products….[63]

[60] Ibid., 114.
[61] Ibid.
[62] Ibid.
[63] Ibid.

Cognition was implicated in this set of practices by virtue of its role in helping to make sense of the relationship between real and imaginable essences (or experience and *phantasias*). Even if one grew discouraged and convinced that it would be "impossible for the intellect to take something further because of the multidimensionality of the particular thing," Tschirnhaus advised that one should "think about the universal guidelines that are presented to us through the true physics … from this something will be achieved that is absolutely impossible for *Empirkern* to accomplish because they order their experiments without the direction of reason," he wrote.[64]

Tschirnhaus offered a kind of corrective to a purely empirical or a purely mathematical program. In the *Basic Guide to the Useful Sciences*, he emphasized that the corrective lay in juxtaposing the study of mathematics with the practice of experiment and taking them both as true. Doing this involved championing the cause of useful or practical mathematics. First, and "above all," Tschirnhaus wrote, "one must teach the beginners the most important practices from all of the mathematical disciplines." To "awaken a love of mathematics," the teacher must appeal to children's tendency to accept without questioning information revealed to them by their senses; the end goal was to remedy this tendency in the end, but at least in the beginning one could use it to the teacher's advantage. They were to be taken outside to measure fields (using Schwenter's *Geometry*) or taught how to make their own sundials and optical lenses. The full implications of Cicero's insistence that the context of discovery was more important than the context of justification became clear in Step One; here lay the engine of invention and, as Cicero recognized, the beginning of practices (for Cicero rhetoric) so central to

[64] Ibid., 115.

the healing of the mind.[65] Step Two involved making use of the passion for the mathematic sciences awakened in Step One and starting with mathematical theory. Here select exercises from Archimedes' *Theoremata* and Andreas Tacquet's *Seciones Conicas* as well as Bernard Lamy's *Nouveaux Elements de Geometrie* were essential. Step Three was about application and learning the *numerosam Analysin*, with the help of Descartes' *Geometrie*. But in Step Four, one would be ready to begin an intensive study of physics; Tschirnhaus remarked that when one had advanced to this point, it would be "worth consulting *the utilitas Philosophiae Experimentalis* of the learned Englander, Robert Boyle" (see Appendix 2 for a complete list of recommended texts).[66]

He also recommended studying Altdorf professor Johann Christoph Sturm's *Collegium Experimentale* (see Chapter Two) and studying mechanics, because it was held "in such high esteem" by the Neoterici and "almost became the most important area of study for them."[67] Just as they recognized how certain rhetorical forms affected the production of *phantasias* in barely discernable ways, the Neoterici also understood that the subtleties of the operations produced through mechanical processes were often undetectable to the senses. Following their lead, Tschirnhaus was convinced that the study of mechanics could also be used to condition a kind of instinctual grasping of complex phenomena, without understanding each individual part. Studying mechanics, a middling mathematical science, could help one instinctually mediate rational and real

[65] Van Peursen, 401 n. 18.
[66] E. W. von Tschirnhaus, *Gründliche Anleitung* (1708): 30. "The uses for the study of physics I deal with extensively in the third part of the *Medicina Mentis*… By considering that through natural recognition we can derive the fullest ethics, the best medicine for the body and the best mechanics, one can easily form a general idea of the present state of physics."
[67] Ibid., 33.

essences—via imaginable essences, via feelings.[68] Tschirnhaus was integrating several insights from Archimedes and what historians of technology refer to as "pre-classical mechanics" and bringing them to bear on his own project.

Sixteenth-century Italian writers on mechanics, like Guidobaldo del Monte, liked to talk about how those who understood machines did so through a combination of their intuition and their bodies. They did not necessarily need a full understanding of rational causes. Henniger-Voss writes that according to Guidobaldo:

> Theoretical understanding of the causes behind the effects of mechanics was beyond the ken of workers. In fact, the mechanic as a human agent is of minimal importance… Perhaps extrapolating from the pseudo-Aristotle's prologue to the *Questions on Mechanics*, Guidobaldo holds that the common mechanic could understand the machines with which he worked only intuitively, while the man of erudition had knowledge of causes. The difference between the learned response to machines and that of the common people is a kind of leit motif in Guidobaldo's prefatory essays. The essays introducing both the *Equilibrium of Planes* and his last work, *On Screws* (*De cochlea*) discuss in detail the very different responses of admiration (*admiratio*) expected of people who only know effects, and of reason (*ratio*) anticipated from the speculative philosopher who knows causes. [69]

Tschirnhaus's method drew readily from the idea that individuals who worked with their hands often had an intuitive grasp of how machines functioned but could usually not explain the reasons for these functions. He wanted to make the cultivation of this intuitive grasping a central component of schooling regimens *at the same time* as children were trained to know causes by honing their intellects. There would be, in the end, no distinction between "the people who only know effects" and the "philosopher who knows causes." Each individual would instinctually know both by making his instinct the assimilatory site of all his knowing.

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[68] Ibid., 34. "Das Studium Mechanicum. Dieses ist zwar bey ordinair Gelehrten fast das allerverachteste Studium. Es ist aber von den Neotericis in solche hohe Würde gesetzt dass es fast zu dem allervornehmsten worden. Massen die Physica nach ihnen fast alle ihre Operationes durch Mechanische Wirckungen verrichtet. Und ist nur dieser Unterscheid dass hier die operationes so subtil, dass sie von den Sensibus nicht, wie in den ordinair Machinen die Räder können bemercket werden."

[69] Mary Henniger-Voss, "Working Machines and Noble Mechanics: Guidobaldo del Monte and the Translation of Knowledge" *Isis* 91:2 (June, 2000): 244.

Tschirnhaus was also especially interested in the promise of a "geometrical optics" for reconciling mathematics and physics. He was likely influenced in this regard by his stay in England, where he met with Newton and seems to have become especially enamored with the work of Newton's teacher and mentor Isaac Barrow. Antoni Malet has shown how Barrow was championing a "geometrical optics" as a way of remedying errors of perception by making it possible to predict, through a series of calculations, the physical location of objects.[70] "Barrow's optics rested on a mathematically construed notion of optical images," Malet explains; in collaboration with his colleague James Gregorie, Barrow developed a mathematical principle of image location that relied on "a debated interpretation of a well-established phenomenon, ocular accommodation:

> The Gregorie-Barrow principle of image location describes mathematically where the object A should be perceived… The theoretically derived location of the image, A', will change as A is removed to another location, or the shape of the reflecting surface is changed, or the eye gains a new situation, or the light is refracted instead of reflected. This provides innumerable occasions to test the "definition" of images, and that is what we find in Barrow's *Optical Lectures*. He highlighted results that explained observational facts, particularly those concerned with the working of lenses and telescopes, but it was one of Barrow's main concerns to show that the geometrical image agrees with the observed image. He allowed that some evidence did not support his mathematical characterization of images, but dismissed it as being inconsiderable vis-à-vis the evidence supporting it. [71]

As Alan Shapiro has also explained, Barrow's theory actually made it possible to mathematically determine the physical location of optical images "for any refraction or reflection on plane and spherical surfaces."[72] He was one of the most vocal proponents of the idea that mathematics was actually a causal science and was joined by John Wallis,

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[70] Antoni Malet, "Isaac Barrow on the Mathematization of Nature: Theological Voluntarism and the Rise of Geometrical Optics," *Journal of the History of Ideas* 58:2 (1997): 265-287.
[71] Ibid., 285. n.66
[72] This per Paolo Mancosu's discussion of both Malet and Shapiro's work on the Barrow-(Gregorie) principle. Paolo Mancosu, "Acoustics and Optics," in Park and Daston eds., (2006): 623. See also Alan E. Shapiro, "The Optical Lectures and the Founding of the Theory of Optical Imagery," in Mordechai Feingold ed., *Before Newton: the Life and Times of Isaac Barrow* (Cambridge: Cambridge University Press, 1990): 105-78.

who was engaged in a similar project of geometrical motion (or geometrical mechanics) in reiterating this claim.[73]

Peter Dear also confirms that Barrow, following Aristotle, "had allowed that knowledge of a universal in geometry could be acquired through experience of a single example—as, for example, in the inspection of the properties of a single triangle."[74] This is reminiscent of Tschirnhaus's interest, discussed above, in intuiting the three variations of essences he identifies by glancing at a single curve without necessarily understanding the operations behind the production of the curve itself. Isaac Barrow's *Lectiones Opticae et Geometricae* (1st ed.1669), from which his mathematical principle of image location is derived, were republished in 1675 with an added section entitled *On Conic Sections*, *derived from Apollonius of Perga, as well as a lengthy commentary on Archimedes*.[75] Clearly, Archimedes also had a direct bearing on Barrow's project. Direct evidence of Tschirnhaus's engagement with Barrow's principle comes to us from Christian Wolff, who remembered how during his legendary meeting with the nobleman

[73] R.J. Searjeanson notes that Barrow's *Lectiones mathematicae* (delivered in 1665) were supposed to be a direct challenge to Pierre Gassendi, who had argued in Part II of his *Exercitationes paradoxicae adversos Aristoteleos* in 1658 that no science, including mathematics, could be said to provide causal knowledge in Aristotle's terms. See his "Proof of Persuasion" entry in Park and Daston eds. (2006): 155. Wallis's *Mechanica sive de motu tractatus geomtericus* (*Mechanics or Geometrical Treatise on Motion*, 1670-1) was supposed to be provide a mathematical solution to the problem of motion. See Kirsti Andersen and Henk J.M.Bos, "Pure Mathematics" in Park and Daston eds. (2006): 712. See also D.M. Jesseph, *Squaring the Circle: the War between Hobbes and Wallis* (Chicago: University of Chicago Press, 1999); P. Beeley and C. J. Scriba eds., *The Correspondence of John Wallis* (1606-1703), Vol. 1: 1641-1659 (Oxford: Oxford University Press, 2003); A. G. Debus, *Science and Education in the Seventeenth Century; the Webster-Ward Debate* (London: Macdonald, 1970).

[74] Peter Dear, "The Meanings of Experience," in Park and Daston eds. (2006): 129.

[75] M. Feingold and J. Gascoine in *Before Newton: The life and times of Isaac Barrow*, ed. M. Feingold (Cambridge, 1990); Barrow's three main scientific works are the *Mathematical Lectures* (1665), *Optical Lectures* (1669), and *Geometrical Lectures* (1670). See also W. Whewell ed., *The Mathematical Works of Isaac Barrow* (Cambridge, 1860); John Kirkby, *The Usefulness of Mathematical Learning explained and demonstrated* (London, 1734); *Optical Lectures from Isaac Barrow's Optical Lectures*, A. G. Bennett, D. F. Edgar eds., tr. H. C. Fay (London, 1987).

in Leipzig, Tschirnhaus recommended that he study Barrow's *Lectiones Geometricas* if he wanted to take his study of mathematics further.[76]

In the third section of the *Medicina Mentis*, Tschirnhaus discussed a passage from Isaac Newton's *Mathematical Principles of Natural Philosophy*, where he says Newton offered "beautiful meditations about the development of curves." But, he continued:

> What I have against this is that I want to know how all possible geometrical curves can be taught in the easiest way, and after thinking it over in some basic terms, I have observed that there is no easier way than through focal-points (*Brennpunkte*). As I have tried the same with mechanical curves, I have learned that most importantly here the focal-points are not actually points but curves….[77]

In the second edition of his *Medicina Mentis* (Leipzig, 1695), Tschirnhaus added a section about furthering the generation of curves with focal points where he claimed to introduce new and universally applicable ways of constructing curves. The key was the *Brennspiegel,* or burning mirror.[78] Tschirnhaus's numerous experiments with burning mirrors also formed a part of his conciliatory program. Canstein's report of sending one of Tschirnhaus's mirrors to the *Franckesche Stiftungen* in service of the "experiments undertaken by the youth" there confirms the significance of the instrument for members of Francke's organization as well.[79]

Tschirnhaus concluded that his method could either be inculcated in a very short time but with concerted effort by someone who appreciated its value, or one could

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[76] Christian Wolff explains that while questioning the nobleman about some of the *Medicina Mentis's* specific claims, Tschirnhaus conceded that he had not followed his method through to its fullest conclusion. In fact, he had a third volume planned, he said, where he more thoroughly applied his method to physics and this tome would truly astound people. Wolff also notes that Tschirnhaus recommended he study Nieuwentiit's *Analysin infinitorum* (1695) and Jacques Ozanam's *Nouveaux Elements d'Algebre* (1702). Ozanam was a French mathematician who became a member of Académie des Sciences in 1701; Tschirnhaus was especially fond of his *Récréations mathématiques et physiques* (1694, 2 Vols), which he also recommends in the *Gründliche Anleitung* (1708).

[77] E. W. von Tschirnhaus, *Medicina Mentis* (1963): 277.

[78] Uwe Mayer briefly discusses the importance of the burning mirror for E.W. von Tschirnhaus in "Am Rande" (2001): 30-31.

[79] Peter Schicketanz ed. *Der Briefwechsel Carl Hildebrand von Cansteins mit August Hermann Francke* (1972): 666. Reprinted in Thomas Müller-Bahlke, "Naturwissenschaft und Technik" (2005): 372 n. 57.

acquire the understanding it promised with the help of "a small book by Andre Tacquet entitled: *Elements of Plane and Solid Geometry with Selected Excerpts from Archimedes*.[80] In Tacquet, Tschirnhaus emphasized in the *Medicina Mentis*, "everything is explained so transparently, that I know many who attack him and think that they can happily achieve awareness (*Kenntnis*) by themselves without the instruction of some kind of teacher." But these people, who held such differing opinions from Tacquet's and his own, he argued, "have not yet properly formed the natural idea of physics, of which I speak here, in their Spirit (*Geist*)."[81] The careful study of Tacquet could actually function as a viable substitute for his own method but one had to accept its status as a product of Jesuit learning—a problem for some in a multi-confessional landscape fraught with several kinds of tensions. Taught by St. Vincent and Francois d'Aguilon, the Jesuit mathematician Andre Tacquet is also famous for influencing John Wallis, Newton and Leibniz.[82] While the *Opera Mathematica* (Antwerp, 1669) was probably his best known work, he also sought to further Aguilon's active attempts to apply geometry to the study of perception.[83] In the Optica section of the *Opera*, Tacquet attempted to establish a mathematical law of reflection that was universally applicable. Vanpaemel points out that despite his interest in understanding physical processes, for Tacquet "the mathematical disciplines were a genuine science about the real world, not just an abstract

[80] Andreas Tacquet, *Elemente der ebenen und festen Geometrie mit ausgewählten Abschnitten aus Archimedes* (Anvers, 1654; Amsterdam, 1701).
[81] E. W. von Tschirnhaus, *Medicina Mentis* (1963): 230. "Ich weiss, das viele, die dieses lessen, andere Meinung als ich sein werden, und die Ursache hierfür ist mir keines wegs verborgen; denn sie haben natürlich die Idee der Physik, von der ich spreche, bis jetzt nicht richtig genug in ihrem Geist gebildet."
[82] William Whiston, frequenter of the Royal Society and member of the Society for the Promotion of Christian Knowledge, also published an English translation of Tacquet's *Geometry* in 1703: *The Elements of Euclid with Select Theorems out of Archimedes* (London, 1703 & 1719).
[83] Henri Oldenbourg called it "one of the best books ever written about mathematics;" Aguilon published the *Opticorum libri sex philosophis juxta ac mathematicis utiles* (Anvers, 1613) or *Book of Six Optics, useful for mathematicians and philosophers alike*.

model of it. They were not based on fictitious hypotheses to save the appearances, but on statements believed to be true in nature."[84]

Further evidence of Tschirnhaus's interest in Andreas Tacquet's *Geometry* appears throughout the *Gründliche Anleitung*. After awakening the passion for mathematics through praxis in the first step, Tschirnhaus explained that "one must soon begin with a *Theorica* in order to show what all of the practices flow out of; this works if one teaches Euclid and here no book is better to start with than Tacquet, because he provides evidence of the continuing relevance of the ancients and derives detailed explanations from them."[85] Emphasizing that selected exercises from Archimedes' theorems was especially important at this stage, Tschirnhaus went on to explain that the singular quality of Tacquet's *Geometry* (also manifest in his *Opere*) is simple: "one understands more easily the ancient and Neotericorum Scripts cited by Euclid in the order that Tacquet puts them in, in such a way that the same understanding can not occur in the arrangements of Père Lamy."[86] While Tschirnhaus recommended Bernard Lamy's *Nouveaux Elemens de Geometrie,* as a useful source for additional training in mathematical theory, no one had yet matched Tacquet's organization of ancient knowledge—especially his juxtaposition of Euclid, Archimedes and Neotericians mechanics. Only after the instinct was awakened (in step one) and the intellect had engaged with the geometrical precepts as arranged by Father Tacquet (step two), was one prepared to undertake a study of physics. Tschirnhaus assured his reader, initially

[84] G.H.W. Vanpaemel, "Jesuit Science in the Spanish Netherlands" in Mordechai Feingold ed., *Jesuit Science and the Republic of Letters* (Cambridge, Mass: MIT Press, 2002): 410-412.
[85] E. W. von Tschirnhaus, *Gründliche Anleitung* (1708): 23.
[86] Ibid., 23. Bernard Lamy, *Nouveaux Elemens de Geometrie, ou de la Mesure du corps* (Paris, 1692).

Francke, that he could rest assured that this study "would eliminate the errors affecting us all that cannot be gotten rid of through rational processes."[87]

One final characteristic of Tacquet's writings that appealed to Tschirnhaus's interest in reconciling mathematics and physics was his emphasis on considering multiple points of view. Vanpaemel notes that a distinctive feature of Tacquet's texts was his "reluctance to discriminate between competing explanations;" for example, in the Jesuit's discussion of the scintillation of the stars:

> Tacquet explained this phenomenon first according to Aristotle, who ascribed it to the distance between the stars and the viewer. Then he proceeded to the explanation of Scheiner and Biancani, who sought the cause in the influence of the atmosphere. A third explanation was given by Bruno, Kepler und Riccioli, who presume a rotation of the stars…. He concluded his review by accepting the veracity of all explanations. No explanation was to be absolutely discarded, all explanations were useful and complemented each other.[88]

While Tacquet does not mention his adherence to a particular brand of philosophical reasoning or method, the parallels between this tendency and the conciliatory eclecticism of Johann Christoph Sturm (discussed in the following chapter) is quite remarkable. "This reluctance to discriminate between competing explanations" also became a hallmark of Francke's pedagogy, which frequently presented pupils with competing explanatory models in the interest of training them to derive their own conclusions. If their instincts had been properly trained, the conviction was that they would each derive the same truths from the exhibited phenomenon, despite visible contradictions.

Conclusion

[87] Ibid., 13.
[88] Vanpaemel in Feingold ed. (2002): 413

Tschirnhaus's method for reconciling mathematics and physics through instinct has enormous implications for our understanding of Pietism and vice versa. For Tschirnhaus and ultimately for Francke, using geometry to hone the intellect and rules for experiments to regulate sensation while assimilating what was produced by these activities instinctually—or using the soul—lay the key to reconciliation and the perfection of mankind. Because he actively sought out Tschirnhaus's advice and by all appearances applied it, Francke's pedagogical program must be understood alongside Tschirnhaus's program in order to be most fully appreciated. Francke's interest in implementing Tschirnhaus's method indicates his acceptance of several powerful assumptions: namely that mathematics and physics actually could be merged productively, that experimentation was more about perfecting sensation than understanding natural processes, that geometrical exercise was central to improving cognition and that the *phantasias* of our instinct held the key to the entire conciliatory project.

Cultivating the instinct or drive was an exceedingly important task that created opportunities for individuals like Spener and Francke to step in and teach others (including Tschirnhaus) what they knew about how the cultivation of instinct worked through illumination, meditation and exegesis. Francke carved out a program that implemented Tschirnhaus's method for reconciling mathematics and physics because he recognized that he, and Spenerian reform more generally, had a powerful place in it. I think he knew that championing the conciliatory potential of instinct and the middling mathematical (or practical) sciences was quite a bit like championing a practical faith—one that taught individuals how to assimilate essences handed down from the divine in

the Bible with their own subjective experiences of that same divine. They, too, were to do this instinctually—in their hearts. Each of these figures believed in the potential of perfecting both experience and cognition so as to affect changes in the world that would manifest themselves as *phantasias*, to be read or registered in heightened (illuminated) conciliatory drives. They were not the only ones. A father and son from Altdorf recognized the possibility of perfection in a conciliatory program as well, influencing its orientation and quite possibly inspiring the specifics of Tschirnhaus's method in the first place.

Chapter Two: Sturmian Eclecticism and the Technologies of Discernment

> *…Neither the reception of the species into the eye nor the material perception of those images in the brain can render the sense of seeing perfectly compleat as it is generally and ordinarily exercised in rational creatures: But there is required again, 3rdly, a mental perception with true, internal knowledge and consciousness of the impression which usually produceth some Judgment consequential thereupon.*
>
> -Johann Christoph Sturm[1]

Putting into practice the instructions contained in Tschirnhaus' *Basic Guide to the Useful Sciences* was inextricably linked to the construction of an institutional landscape oriented around the idea of reconciliation more generally. A conciliatory method for teaching mathematics and physics needed to be situated within a specially designated space—a neutral or middling space, like judgment or the heart, where the union of the two could take place through various forms of exercise in the "middling" mathematical sciences. The need for this separate or extended site becomes especially clear after considering Francke's interest in eclecticism, including his own connections to a pair of father and son mathematicians from Altdorf (just outside of Nürnberg), Johann Christoph (1635-1703) and Leonard Christoph Sturm (1669-1713). Until now, the influence of this duo on the curricula and construction of the Pietist Orphanage have been almost entirely overlooked. Also unrecognized have been Tschirnhaus's repeated references to Johann Christoph Sturm both in the *Medicina* and in the *Gründliche Anleitung*. His brief remarks to Francke at the end of the *Anleitung* about the similarities between his own method and Sturm's *Philosophia Eclectica* will receive some much needed attention here.

[1] Johann Christoph Sturm, in *Mathesis juvenilis: or a course of mathematicks for young students, Made English from the Latin of Jo. Christopher Sturmius,* by George Vaux, M.D. 3 vols. (London, 1708-09).

This chapter is concerned with making the relevance of eclecticism and the Sturms' interest in the mathematical sciences clear for the formulation and expression of Francke's science of perfection. Here I engage recent scholarship that has rediscovered J.C. Sturm and his formulation of an "eclectic method" of philosophical inquiry. I do this in conjunction with a brief introduction to the debates around irenicism that were occurring among theologians precisely at the time that Sturm began to popularize eclecticism. I especially consider the contributions of Georg Calixt (1586-1656), whose work on developing concrete strategies for the unification of all confessions wielded a powerful influence upon most German theological faculties and territorial rulers of the seventeenth century, his most vocal opponent in what are now referred to as the "syncreticist controversies," Abraham Calov (1612-1686), and the famous Reformed irenicist, David Pareus (1548-1622), with whom Johann Amos Comenius interacted while studying Heidelberg in 1614.[2] Finally, I use correspondence between Francke and Leonard Christoph Sturm, in tandem with L.C. Sturm's interest in architecture, to consider how the Orphanage building was able to function as a kind of conciliatory space—a symbol of the method it housed. The parallels between J.C. Sturm's eclectic method (extended and refined by his son), Boyle's experimental method (including his interest in "reconciling reason and religion") and Tschirnhaus's *Medicine for the Mind* are striking. A fuller treatment of the Sturms' contributions will make these parallels much clearer and demonstrate their relevance for Francke's pedagogical community.

[2] I rely on Johannes Wallmann's treatment of Calixt and Calov in his essay: "Union, Reunion, Toleranz: Georg Calixts Einigungsbestrebungen und ihre Rezeption in der Katholischen und Protestantischen Theologie des 17.Jahrhunderts," in Heinz Duchhardt und Gerhard May eds. *Union-Konversion-Toleranz: Dimension der Annaerhung zwischen den christlichen Konfessionen im 17. und 18.Jahrhundert* (Mainz: Verlag Philipp von Zabern, 2000): 21-38. My brief treatment of Pareus is drawn from Howard Hotson's "Irenicism and Dogmatics in the Confessional Age: Pareus and Comenius in Heidelberg, 1614," in *Journal of Ecclesiastical History* 45: 3 (July 1995): 432-453.

While going down this path, I show that there was much more to Sturmian eclecticism than integrating mechanical philosophy into an Aristotelian metaphysics. Treatments of J.C. Sturm to date have tended to portray his method as "fundamentally based on the system of Aristotle," or as kind of "eclectic Aristotelianism" that borrowed readily from several philosophical schools; however, in stressing Aristotelianism as the starting point or site into which Neo-Platonism and all other schools were to flow, scholars working on the subject have slightly misinterpreted how the method was supposed to work.[3] Christia Mercer and R.C. Sleigh Jr. explain in their introduction to Leibniz's early metaphysics that for German eclectics like Sturm, "the proper way to find what is 'most true' is to rid oneself of the dogma of any particular philosophical sect and to acquire knowledge of all the significant intellectual traditions," yet they conclude that what this ultimately amounted to was a system "fundamentally based in the philosophy of Aristotle."[4] I am certainly not denying that Aristotle was very important to Sturm, but I do not think the entire system was based "in" Aristotle. It was based in the soul and its ability to judge. The end goal may have been "the Truth, as Aristotle taught it," but the key was not to start with Aristotle or with Plato for that matter. The key was to start with oneself, in the middle, and to weave together all the insights of the various schools into a coherent tapestry in separate, third site—in one's heart. Doing this successfully required God; it required a great deal of prayer, supplication and contemplation. We miss something very critical to understanding the orientation of the Pietist Orphanage when we start "in" Aristotle. One started "in" the Orphanage. One started in a space both

[3] See Christia Mercer and R.C. Sleigh Jr., "Metaphysics: the early period to the Discourse on Metaphysics," in Nicholas Jolley, *The Cambridge Companion to Leibniz* (Cambridge: Cambridge University Press, 1995): esp. 68-71.
[4] Ibid.

physically and figuratively suspended from the norms of the outside world. This is why a more accurate understanding of J.C. Sturm's eclecticism is so critical to understanding what both Leibniz (see Chapter Three) and Francke were up to.

If we start "in" the Pietist Orphanage and examine the diversity of J.C. Sturm's work in mathematics (including his special interest in Archimedes' geometry) and his work in experimental physics in conjunction with his spirituality, we acquire a much fuller understanding of the power of the eclectic method that Francke eventually brought to bear on his own pedagogies. J.C. Sturm's eclecticism is also inextricably linked to the mathematical sciences and especially the mediatory capacity of certain optical instruments like the camera obscura that could be used to produce agreement between real and projected images. Like Tschirnhaus, J.C. Sturm was very interested in geometrical optics, and the potential of the camera obscura to also serve as a critical, third and neutral mediator (like the Halle Orphanage) between experience and cognition. Leonhard Christoph's work conveys a similar preoccupation with the mathematical sciences, especially architecture and mechanics. References to both father and son appear often enough in the curricula of Francke's schools, Tschirnhaus's *Gründliche Anleitung* and Francke's correspondence to warrant an investigation of their roles in the Pietist Orphanage's epistemological landscape—and an appeal for their singular contributions to a conciliatory science of perfection.

Johann Christoph Sturm

While perhaps not as famous E.W. von Tschirnhaus, J.C. Sturm was known internationally and admired by several of the leading intellectuals of his day. Both Tschirnhaus and Gottfried Wilhelm Leibniz made frequent references in their own

writings to the Altdorf professor and kept track of his various endeavors. "Like Leibniz," notes C.A. van Peursen, "Tschirnhaus frequently praises the works of Johann Christ(oph) Sturm, whose *Collegium Experimentale sive Curiosum* offered him many examples on how to cultivate the human mind through easy scientific experiments."[5] According to Stefan Kratochwil, Leibniz first alluded to J.C. Sturm's work in his dissertation on the *Art of Combination* (1666) and carefully followed several of the experiments Sturm was conducting in his Physics *collegium* in Altdorf; he was especially interested in those involving the observation of microorganisms with a microscope.[6] Leibniz, Tschirnhaus and J.C. Sturm also all studied under the same charismatic Professor of Mathematics in Jena, Erhard Weigel (1622-1699), who was quite highly regarded for his attempts to make mathematics more useful and founded a school in his home for the teaching of mathematical sciences.[7] Weigel transferred his interest in applied mathematics to these

[5] C.A. Van Peursen, "E.W. von Tschirnhaus and the Ars Inveniendi," *Journal of the History of Ideas* 54:3 (July 1993): 399-400. Johann Christoph Sturm, *Collegium experimentale sive curiosum* (Nürnberg, 1674): programma invitatorium. E.W. von Tschirnhaus, *Gründliche Anleitung* (1708): 18, 51-52, 132-51.

[6] Stephan Kratochwil, "Johann Christoph Sturm und Gottfried Wilhelm Leibniz," in Hans Gaab, Pierre Leich und Günther Löffladt eds., *Acta Historica Astronomiae: Johann Christoph Sturm* (Frankfurt: Verlag Harri Deutsch, 2004): 107, 109. Leibniz and J.C. Sturm had one public dispute, documented in the *Acta Eruditorum*, in 1694-95. Leibniz defended the idea of the world, God's creation, as a perfect machine that functioned according to internal laws; God did not have to intervene in the daily affairs of mankind. Sturm argued (following Boyle) against this idea and for the possibility that God intervened regularly in the world; he said the effects of divine interference could be felt physically. In Kratochwil, 114-15.

[7] See Günther Mühlpfordt "Gelehrtenrepublik Leipzig. Wegweiser und Mittlerolle der Leipziger Aufklärung in der Wissenschaft" in *Zentren der Aufklärung III Leipzig: Aufklärung und Bürgerlichkeit.* Ed. by Wolfgang Martens (Heidelberg: Verlag Lamber Schneider, 1990); Reinhard Schlelicke, Klaus-Dieter Herbst und Stefan Kratochwil, *Erhard Weigel: Barocker Erzvater der deutsche Auflklärung* (Harri Deutsch, Frankfurt, 1999); Christa Schaper, *Aus dem Kreis der Weigel-Schüler im Franken*. Archiv für Geschichte von Oberfranken 39 (1959): 141-155; Hildegard Schlee, *Erhard Weigel und sein süddeutscher Schülerkreis. Eine pädagogische Bewegung im 17.Jahrhundert* (Heidelberg: Quelle & Meyer, 1968). The best expression of Weigel's mathematics is his *Philosophia mathematica,theologia naturalis solida* (1693), which contained a discussion of Archimedes entitled *Archimetria*; U.G. Leinsle discusses the influence of Weigel on J.C.Sturm, but does not explore how he endeavored to link mathematics to his interest in physics. See U.G. Leinsle, "Universal Mathematik und Metaphysik bei Johann Christoph Sturm" in Hans Gaab, Pierre Leich und Günter Löffladt eds., *Acta Historia Astronomiae: Johann Christoph Sturm* Vol.22 (Verlag Harri Deutsch, 2004): 158-59.

figures; he played a powerful formative role in directing the interests of all three of his former students in the mathematical sciences.

In several sections of the *Gründliche Anleitung*, Tschirnhaus made his own affinity for the elder Sturm very clear. He described J.C. Sturm's method as a set of practices that used "sensual experience" as a means of exciting or producing wonder in order to awaken the "natural inclination of all people toward the truth."[8] Only a few books showed one how to use experience in this way, he explained to Francke, and J.C. Sturm's was one of them. His *Collegium Curiosum* was to be read alongside Daniel Schwenter's *Delicaie Physico-Mathematicae* and Ozenan's *Recreations Mathematiques & Physiques* to maximize the potential resident in a child's first exposure to the mathematical sciences.[9] In another instance, after underlining the importance of using "many examples" to teach children new mathematical concepts, Tschirnhaus points to Sturm's *Mathesi Enucleata* as an illustration of what he is talking about.[10] Finally, in the *Gründliche Anleitung*'*s* concluding section on the study of physics, Tschirnhaus emphasizes the importance of teaching youth how to derive meaning from "useful experiences;" he explained that "Herr Sturm does this very well in the second portion of his *Collegii Experimentalis* because he shows how with the simple extrication of the air a new philosophy in physics has emerged that tosses the old, tenacious opinions into a waste pile before our eyes."[11]

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[8] Tschirnhaus, *Gründliche Anleitung* (1708): 14. "…eine Verwunderung excitiren um die natürliche Begierde so bey allen Menschen ist zu der Wahrheit."
[9] Ibid, 14-15. Daniel Schwenter, *Delicae Physico-Mathematicae* (Nürnberg, 1636); Jacques Ozanam, *Recreations Mathematiques et physiques* (Paris, 1694, 2 vols.). For the varied uses of "wonder" in a variety of contemporary contexts see Lorraine Daston and Katherine Park, *Wonders and the Order of Nature 1150-1750* (New York: Zone Books, 1988).
[10] Sturm, *Mathesi Enucleata* (Nünberg, 1689).
[11] Tschirnhaus, *Gründliche Anleitung* (1708): 33.

A closer look at the lesson plans of Francke's schools also reveals several references to the work of J.C. Sturm. In 1707, Krüger writes, a tract entitled the "True News about the condition of the Orphanage and related institutions up to now" reported that "in the elementary mathematics classes (classe prima) the art of Gnomonicam (sun dials) from Sturm's *Mathesis Juvenilis* is being taught."[12] In one *Stiftungen* text, Tschirnhaus, Tacquet's *Geometry* and Sturm are mentioned in the same context. Joachim Lange reported in his "Improvement of the Art of Schooling" that in the *Stiftung*'s *Pädagogium*:

> Geometry and Trigonometry are taught according to Sturm's *Mathesis Juvenilis*, from which the scholars are taken for a specific period of time to the fields and are taught how to measure the length, width, height and density of physical bodies. For those who can prove their proficiency in the above exercises, a few things from Civil Architecture, Statics and Mechanics are taken up; and yes, if a few are found who acquire a taste for these things and can demonstrate a special desire and proclivity to the study of mathematics, then they can lead demonstrations themselves, according to explanations of selected theories from Archimedes found in A. Tacquet's *Elements of Geometry*. Sturm's lesson book has been introduced so that one can avoid having to purchase all of the many costly books recommended by Tschirnhaus.[13]

This passage provides a particularly powerful example of how interwoven the contributions of Tschirnhaus, Sturm, Tacquet (and Archimedes) were in the *Franckesche Stiftungen* and why a careful investigation of their points of convergence is so necessary.

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[12] Krüger, 54. Johann Christoph Sturm, *Mathesis Juveniles Teil 1: Accessit Consilium De Mathesi in Scholarum Triialium & Gymnasiorum Classes omnes, etiam puerorum legere discentium infimas, Ingenti Juventutis commodo postlimonio introducenda (Norimbergae : Hoffmannus, 1699)* and *Mathesis Juveniles Teil 2: Opticam cum Catoptrica & Dioprica, Astronomiam cum Usu globorum ... Complexus (*Nürnberg, 1701*).*

[13] Ibid., 55. Andreas Tacquet, *Elementa Geometriæ Planæ Ac Solidæ: Quibus accedunt selecta Ex Archimede Theoremata* (Anvers, 1654; Amsterdam, 1701); Lange, von *Verbesserung des Schulwesens* (1707), 41: "die Geometrie und Trigonometrie werden nach Sturms Mathesis Juvenilis gelehrt, wobei die 'Scholaren auch zu gewissen Zeiten aufs Feld geführet und zur Ausmessung mancherlei Länge, Breite und Höhe körperlichen Raums und Dichte angewiesen werden. Mit denen welche in gedachten Übungen sich vor andern fleissig bewiesen, hat man etwas aus der architectura civili, statica und mechanica vorgenommen, ja, wenn sich einige finden, die von allen diesen Dingen einen Vorschmack erlangt und zu dem studio Matheseos eine sonderbare Lust und Geschicklichkeit bewiesen haben, so können sie zu den demonstrationibus selbst angeführt werden, wie denn um deswillen des A. Tacquet Elementa Geometriae und dessen Theoremata selecta aus dem Archimede vormals erklärt worden sind.' – Sturms Lehrbuch hatte man eingeführt 'um die Anschaffung so vieler kostbarer Bücher' wie Tschirnhaus als fordere zu vermeiden."

While the use of Tacquet's *Geometry* indicates that Tschirnhaus's recommendations were taken seriously, Sturm's book apparently helped bridge the gap between what Francke wanted to teach in his schools and what kind of curricula he could actually afford.[14] It offered enough of what was needed for introducing pupils to the proper study of both mathematics and physics.

A few pieces of information about J.C. Sturm and his significance also emerge in the handwritten lesson plans that will become the primary focus of Part II. In a section containing detailed descriptions of the models of the universe (*Himmelsphären*) on view in certain European cities, the author mentions that the city of Altdorf was famous for its *Himmelsphären* based on the system of Copernicus; he then provides the following summary of J.C. Sturm's significance:

> The famous Johann Christoph Sturm, who is a professor of Physics and Mathematics in Altorff described the Sphaera Altorffina in 1695.
> He taught there himself for 34 years and achieved great renown.
> Wrote *Archimedem Germanicum, Physicae conciliatricis, Conamina, Collegium curiosum*.
> He introduced there the Eclectic Philosophy in opposition to the Philosophy Secatrice.
> He had to send his portrait to the Society of Science in England, which was shown to the foreigners (this was not without some hesitation—he did not want to let himself be painted…but then a painter was offered to him gratis).[15]

In only a few short sentences, this anonymous text captures a few critical pieces of information about J.C. Sturm that also help to explain why he was important to Francke and Tschirnhaus. He was quite well known in his day as a professor of both mathematics and physics and his publications were widely circulated. He valued Archimedes and tried to make his ideas more accessible in the vernacular. He had acquired fame both at home and abroad for his introduction of an "eclectic philosophy"—a method that had apparently attracted the attention of the British Royal Society.

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[14] The list of books Tschirnhaus recommended was indeed quite long. See Appendix 1.
[15] AFSt/H E 61 *Semler Lehrplan*, 818.

Like most intellectuals of his day, including several members of the Royal Society, J.C. Sturm was preoccupied with the idea of confessional (including political) and epistemological cohesiveness. I think he was entirely conscious of a perceived "impasse" between Platonists and Aristotelians or between those who preferred an experimental philosophy (especially its practices) over mathematical method that historians of science have repeatedly insisted was so characteristic of his time.[16] But he was just as convinced, I propose, that the impasse was resolvable—and that it stemmed from people not knowing how to most effectively integrate mathematics and experimental physics without choosing a side. In refining and popularizing an eclectic method for philosophy, then, J.C. Sturm was making a singular contribution to this problem. And it was in this method that he found the ideal solution: neutrality, tolerance, coexistence—precisely the solutions that theologians throughout the Holy Roman Empire were insisting held the keys to unifying all confessions at precisely the same time. Like his colleagues in the theology faculties, J.C. Sturm was convinced that a properly construed conciliatory methodology, an eclectic method, began and ended with individuals, or more specifically with the training of their souls.

This was something that Georg Calixt, a Lutheran theologian who held a chair (*Lehrstuhl*) in Controversial-Theology (*Kontroverstheologie*) in Helmstadt from 1614 until 1656, also believed. Living and writing before, during and after the Thirty Years War, he grew increasingly convinced that a mandate of *Toleranz* held the key to the eventual unification of all confessions. Calixt railed against the famous *cuius regio, eius religio* (whose region, his religion) principle of the Peace of Augsburg (1555), for

[16] Kuhn, "The Essential Tension" et al. See my discussion in the introduction, page 6.

example, which was reaffirmed again in the Peace of Westphalia (1648).[17] The entire concept needed to be done away with, he argued, because it placed limits on the promise of tolerance. While Westphalia at least allowed those who practiced a faith that was different than that of their region's established church to do so publicly during certain hours and in private, the principle itself still upheld a fundamental confessional hierarchy. It allowed a set of practices associated with one community to dominate or take precedence over others and this, in and of itself, was dangerous. In opinions he espoused and distributed broadly, Calixt insisted that the principle should no longer be upheld, *Toleranz* and coexistence should be enforced, and then vigorous inter-faith discussions should take place oriented around devising a *consensus antiquitatis* based entirely on careful exegetical readings of the fundamental tenets of apostolic Christianity. Once everyone was made to agree on the common truths animating all of their various expressions of faith, longstanding differences and resulting conflicts would fade away.[18]

Calixt's opponents, especially Abraham Calov, branded him a syncretist, or saw him as someone who would ultimately do away with (if given the chance) the unique characteristics of each confession.[19] Calov and others' criticisms led to a series of very heated disputes that pitted the theology faculties of the Empire against one another.[20] Calov's main concern was that by reverting entirely to a common or neutral source, syncretic methods undermined the integrity of varying confessional practices—or the aesthetic of the spiritual exercises that were the unique signature of each group. But the

[17] Wallmann, "Union, Reunion, Toleranz," 27.
[18] For discussion of Calixt's theological ethics see Inge Mager, *Georg Calixts theologische Ethik und ihre Nachwirkungen* (Göttingen: Vandenhoeck & Ruprecht, 1969).
[19] For Calov see Volker Jung's *Das Ganze der Heiligen Schrift: Hermeneutik und Schriftauslegung bei Abraham Calov* (Stuttgart: Calver Verlag, 1999).
[20] Ibid., esp. 35-37.

return to primitive or apostolic Christianity, which also became one of the defining characteristics of Spenerian Pietism, was viewed in Calixtean circles as a serious and necessary step to the elimination of strife and the restoration of what Calixt called a *Pax ecclesiae Germanicae*. Evangelical revivalism—or a return to a catholic or universal Christianity—was posited as a viable political solution to a complex set of geopolitical problems, explaining the enormous influence that theology faculties wielded in Central Europe more generally in this period. Of course, implementing Calixt's solution had to involve more than exegesis. It involved forcing all contemporaries, regardless of their social status, to directly confront the message of Christ and his apostles and to bring this message to bear on their souls. Each individual needed to be taught to how to exercise and monitor their spirituality so as to acquire "the true faith" and the message of love that is at the heart of the New Testament. It is not a coincidence that devotional literature as a genre proliferated in Germany at this time as contemporaries got caught up in this cause. Spiritual exercise was imagined as the only way to arrive at neutrality and then, ultimately, consensus and a universal faith. One had to return to the Bible (more specifically the figure of Christ), the third site, and in doing so one had to become fixated on one's soul.

Both Calixt and Calov were considered irenicists because both believed in the need for a union of Christian confessional systems and advocated policies of toleration, pacifism and neutrality. They were participating in what is sometimes referred to as "the syncreticist controversies," a multigenerational series of disputes oriented around the fundamental problem of how to affirm the integrity of diversity without gradually eliminating it by allowing one community or only certain ways of knowing dominate.

David Pareus, a reformed theologian active a generation before Calixt and Calov at the University of Heidelberg (then a centre of Calvinist learning) had defined the preoccupations of an "irenicist movement" with the publication of his *Irenicum sive de unione et synodo evangelicorum concilianda liber votives* in 1614. Scholars have noted that Pareus and the priorities of irenicists must have influenced Johann Amos Comenius' program of pansophic regeneration, which I discuss in greater detail in the following chapter. Comenius studied in Heidelberg from 1613 until 1614, precisely at the moment Pareus published his *Irenicum*. Pareus also influenced the Calvinist theologian John Bergius (1587-1658), who became the primary religious advisor to the first three Electors of Brandenburg-Prussia and also befriended Calixt in 1645.[21] Bergius had met Pareus while attending the University in Heidelberg and also come into contact with the famous Huguenot irenicist Pierre du Moulin (while living in France in 1610); as Bodo Nischan has shown, these contacts influenced his own passion for irenicism, which he was able to bring to bear on the forging of an official policy of religious toleration in Brandenburg-Prussia during the period of the Thirty Years War.[22]

This was the context into which J.C. Sturm introduced his own conciliatory methodology to the world after arriving at his post at the University of Altdof in 1669. Given the important role that the irenicist controversies had played in the confessional politics of this period, it is not at all surprising that Sturm would see himself as having something new to offer their cause. Scholars who have studied eclecticism, especially Christia Mercer and Donald Kelley, have rightly pointed out that Sturm drew readily

[21] Bodo Nischan, "John Bergius: Irenicism and the Beginning of Official Religious Toleration in Brandenburg-Prussia," *Church History* 51:4 (1982): 390, 403.
[22] Ibid., 390-92.

from the spiritual exercises of the Stoics.[23] They point especially to the influence of the humanist scholar Justus Lipsius, who had insisted on a method of choice or election in philosophy so as to reconcile the widely varying practices of the schools.[24] By the time Sturm was in Altdorf, the influences of Galileo, Descartes and Gassendi were so resounding that some saw potential in Lipsius' methodology as a means of getting mechanical philosophy and Aristotelian metaphysics to cohere. Jean-Baptiste du Hamel (1624-1706) of Paris, Johannes de Raey (1622-1707) of Leiden and Johann Clauberg (1622-65) of Duisburg are examples of figures who took this project very seriously, Mercer notes.[25] Sturm studied with de Raey in Leiden from 1660 to 1661.[26] The method he brought home to Altdorf then, in Mercer's view, "perfectly represents what happens to the conciliatory methodology of the Stoics (as espoused by Lipsius) when it is charged with the task of assimilating the new mechanical philosophy."[27] But as the preoccupation of Sturm's contemporaries with irenicism illustrates quite clearly, neo-Stoics were not the only ones championing a conciliatory methodology. Sturm's construction of an eclectic method can be read as a response to the syncreticist controversies of the world he lived in—offering a set of technologies and/or practices for producing the *consilia* that all irenicists wanted, without forcing them (or anyone else for that matter) to choose a side.

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[23] Christia Mercer "Platonism and Philosophical Humanism on the Continent" in *A Companion to Early Modern Philosophy* ed. Steven Nadler (Oxford: Blackwell Publishers, 2002): 26. Donald Kelley, "Eclecticism and the History of Ideas," *Journal of the History of Ideas* (2001): 580.

[24] The *Manductio ad stoicam philosophiam* of Justus Lipsius (1604) argued "that the method of critical choosing or election should have guided philosophers all along and helped them avoid sectarian disputes or dogmatic errors." Ibid. Matthew Jones points out that Lipsius offered a form of "spiritual exercise" that "focused on moralities grounded in knowledge of nature" in *The Good Life in the Scientific Revolution* (2006): 6.

[25] Mercer, "Platonism and Philosophical Humanism on the Continent" in Nadler ed. (2002): 33.

[26] According to Michael Albrecht, J.C. Sturm completed a "mathematisch-metaphysische Abhandlung" under de Raey and then headed to Jena, before taking up a professorship in mathematics and physics in Altdorff in 1669. See Albrecht's *Eklektik. Eine Begriffsgeschichte mit Hinweisen auf die Philosophie- und Wissenschaftsgeschichte* (Stuttgart-Bad Cannstatt: Friedrich Fommann Verlag, 1994): 309-310

[27] Mercer, "Platonism and Philosophical Humanism on the Continent" in Nadler ed. (2002): 33.

The key lay in emphasizing the importance of a neutral space where reconciliation could more easily occur.

Sturm called his method a *Philosophia Eclectica,* thereby permanently associating his name with the cause.[28] In the (1686) introduction, he wrote that he wanted to show his readers "how to break through the fortress of concealed truth" so as to discover the "secret workings of Nature" by becoming a collector of ideas. One's status as an able idea-collector was, in turn, defined by his or her ability to be discriminating while gathering these ideas up. Discrimination required one to be, first and foremost, neutral. Sturm urged practitioners of his methods to use their eyes correctly, to "avoid blindness," to "seek a variety of opinions," and to be willing to use "any method" to extend their minds "to the whole of Nature and Reason" so as "to recognize the truth and to distinguish it from the untruth."[29] Practicing eclecticism involved being a discriminating idea gatherer; someone who stepped outside his affiliations, obligations and assumptions and resided in a space of intrinsic neutrality, above the fray. One devised a coherent strategy for assimilating variety—for making it meaningful and productive—and this strategy revolved entirely around the faculty responsible for producing judgments, the soul. But instead of subsuming or boiling down the diversity of these varied stances to a single core (like Calixtean syncretism), Sturm's method promised that each stance, each

[28] He published a dissertation entitled *De Philosophia sectarian et elective* in 1679, and would come out with the first volume of his *Philosophia Eclectica* in 1686; the second volume appeared in 1698, during the intense period of collaboration between Tschirnhaus and Francke. He played with the words election and eclectic in ways that indicate he saw them as virtually interchangeable; he distinguished between an eclectic/elective philosophy and an elective physics as well. Texts oriented specifically around an eclectic or conciliatory physics include *Physicae conciliatrix* (Nürnberg, 1684) and *Physica Eclectiva sive Hypothetica. Tomus Primus Partem Physicae Generalem complexus* (Nürnberg 1697). See Michael Albrecht, *Eklektik* (1994): 318-319 and his "Hypothesen und Phänomene. Zu Sturms Theorie der wissenschaftliche Methode" in Hans Gaab, Pierre Leich und Günther Löffladt eds. *Acta Historica Astronomiae Vol.22: Johann Christoph Sturm, 1635-1703* (Frankfurt: Verlag Harri Deutsch, 2004): 121.
[29] Sturm quotes from Mercer, "Platonism and Philosophical Humanism on the Continent" in Nadler ed. (2002): 33-35.

rival epistemology would be upheld, vindicated and accepted as true at the same time as they were reconciled and/or assimilated with one another.

Michael Albrecht has noted that the signature of Sturm's physics was his insistence that the practitioner needed his senses to observe an experiment and his reason to explain the meaning of that same experiment.[30] But in order to produce new knowledge about natural phenomena, including causes, Sturm also emphasized that one had to rely on the judgments of one's soul.[31] Instead of integrating the new mechanical philosophy into a predominantly Aristotelian framework, or arguing that the stark differences between the two systems would disappear when their common links were discovered, Sturm's method stressed new ways of linking together mathematics and physics while taking all of their axioms as true, while accepting and celebrating their differences. Like Descartes, Sturm also distinguished between the mechanics of seeing and the soul's ability to make judgments about what was seen, only he did not adopt a skeptical stance towards the possibility of forcing resemblance between objects and their images.[32] Instead, he drew some inspiration from the example of Archimedes, whom he described as a figure who had stood in the middle, in neutral territory, and drew readily from mathematics and physics to create useful machines; the insights from his work had not been fully appreciated (or understood) in Sturm's view. As Archimedes had done, Sturm insisted that individuals should cultivate their ability to make judgments that could

[30] Albrecht, *Eklektik* (1994): 337.
[31] Albrecht briefly engages the role of the "mathematical" in Sturm's *Physica elective*. He notes that while Sturms Physik "ist nicht nach mathematischer Methode abgefasst," in 1689 Sturm came out with a mathematical method as an *Anhang* to his Physik that he called *Theosophiae h.e. Cognitionis de Deo naturalis Specimen Methodo Mathematica conceptum* (Altdorf 1689). Albrecht sees this as proof that Sturm valued mathematical method but thought of it as something entirely different from the new methodology he was developing for the study of physics. I tend to question this interpretation and read Sturm's juxtaposition here as more evidence of his interest in applying mathematical method to the study of natural phenomena. See Albrecht, *Eklektik* (1994): 347-48.
[32] See Stuart Clark's discussion of Descartes' skepticism in *Vanities of the Eye* (2007): esp. 339-342.

mediate what Sturm called the "innate geometry inside all people" (even the blind) and the perceptions of their senses.[33]

Even a cursory overview of J.C. Sturm's extensive writings on mathematics reveals his commitment to recovering the insights of Archimedes and to championing the assimilatory powers of the soul as a neutral, self-regulating, judgment- (and virtue-) producing faculty—a key element of Stoicism. Sturm published a study of Aristotle's Mathematics in 1660 and a text he called the *Universal Euclid* in 1661.[34] His *Incomparable Archimedis Sand Arithmetic*, subtitled *Or Deeply Meaningful Discovery of an especially easy-to-say number, which he [Archimedes] unquestionably proves to be larger than the number of all of the grains of sand that could fill the entire World,* appeared in 1667.[35] Only three years later, in 1670, Sturm came out with what came to be known as the *German Archimedes* or *Opera Archimedes* (the first German translation of Archimedes' *Opera)*, which he titled "The incomparable Archimedes Books of Art, or the writings of his that can be found today, translated into high-German with important commentaries throughout."[36] Finally, in 1687, he published the *Mathesis Enucleata*, in which he tried to determine the length of curves derived from Archimedes' spirals.[37]

The soul, or more specifically its ability to discern, comprised the middle ground between the Altdorf's mathematics and physics faculties; aptly, Sturm held a chair in

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[33] See Sturm's discussion of the "ways of knowing and estimating distances" in the Vaux ed. *Mathesis Juveniles* (1708-09): 290-91.
[34] *Aristoteles Mathematicus* (Jena 1660); *Universalia Eucliden* (den Haag, 1661).
[35] Johann Christoph Sturm, *Des Unvergleichlichen Archimedis Sand Rechnung oder Tiefsinnige Erfindung einer mit verderlicher Leichtigkeit aussprechlichen Zahl welche er unfehlbar beweiset grosser zu seyn als die Anzahl aller Sandkörlein mit welchen die Höhle der ganzen Welt biss an den äussersten Fir- oder Haft Sternen Himmel könnte ausgefüllet werden*. (Nürnberg, 1667).
[36] Johann Christoph Sturm, *Des unvergleichlicher Archimedes Kunst-Bücher, oder Heutigs Tags befindliche Schriften, aus dem Griechischen in das Hoch-Deutsch übersetzt und mit notwendigen Anmerkungen durch und durch erläutert* (Nürnberg, 1670); it also appeared as *Opera Archimedes quae extant graeco germanice versa & notis* (Nürnberg, 1670).
[37] Johann Christoph Sturm, *Mathesis Enucleata* (Nürnberg, 1689).

each one. In the two-volume text he wrote specifically for use in schools (including Francke's), *Mathematics for Juveniles,* Sturm emphasized the special role that the eye and the soul had to play in the cultivation of discernment.[38] Book One of the *Mathesis* introduced children, first, to the study of Universal Mathematics and second, to the study of Optics, especially the study of "rational Vision applied through exercises with the Camera Obscura."[39] Here he described a series of exercises one could engage in, using the camera obscura, in order to "cultivate diligent eyes" (*diligentem oculi*). Vaux's rendering of Sturm's *Juveniles* into English notes that there were especially two things required for seeing: "reception of the Species into the Eye and the material Perception of those Images in the Brain."[40] But perfecting vision required something more, a third space, entity or a "mental perception with true internal knowledge and consciousness of the impression which usually produceth some Judgement consequential thereupon."[41] Perfecting vision through the cultivation of this peculiar "mental perception with true internal knowledge," the ability to make sound judgments, was bound up with the laborious interrogation and exercise of one's soul that Calixt and practitioners of Spenerean Pietism insisted was necessary for the production of neutrality, consensus and, eventually, universal truth.

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[38] Johann Christoph Sturm, *Mathesis Juveniles I* (Nürnberg, 1699); *Mathesis Juveniles* 2: *Opticam cum Catoptrica & Dioprica, Astronomiam cum Usu globorum ... Complexus* (Nürnberg, 1701).
[39] Ibid (Book I): *Matheseos ad Visionis rationem ex Obscura Camera declarandam applicatae, sive Scientiae Opticae Praefamen*
[40] J.C. Sturm, *Mathesis Juveniles* (Vaux ed., 1708-09): 273-74. The term *species* denotes an image or something detected by the senses here. For a discussion of the Aristotelian concept of species see Stuart Clark, *Vanities of the Eye* (2007): 9-38.
[41] Ibid., 274. For more discussions of this "internal sense" or "mental perception with true internal knowledge" in the late medieval/early Renaissance context in which perspective first appeared see Michael Camille, "Before the Gaze: the Internal Senses and Late Medieval Practices of Seeing" in Robert Nelson ed. *Visuality before and beyond the Renaissance: seeing as others saw* (Cambridge: Cambridge University Press, 2000) and David Summers, *Judgment of Sense: Renaissance Naturalism and the Rise of Aesthetics* (Cambridge: Cambridge University Press, 1987).

The chapters of Sturm's *Mathesis Juveniles* (especially Book Two) are mostly concerned with explaining the mechanics and means of seeing, including the similarities between the "causes of Pictures in the Camera Obscura and those generated in the Imagination," (Chapter One) and the differences between daylight, direct, figural, situated, distant, broad, big, numeral, active and quiet vision." [42] They mostly offered up a series of strategies or tools for assessing the space or object in question so pupils knew how to determine which kind of visual modality was operating in any given context. The attempt seems reminiscent of Newton's own efforts to merge the "evident-ness" of sensory experience (like the experience of a color) with mathematics. As he explained in the introduction to his *Optical Lectures* (1670-72):

> the generation of colors includes so much geometry and the understanding of colors is supported by so much evidence that for their sake I can thus attempt to extend the bounds of mathematics somewhat, just as astronomy, geography, navigation, optics and mechanics are truly considered mathematical sciences even if they deal with physical things: the heavens, earth, seas, light and local motion. Thus although colors may belong to physics, the science of them must nevertheless be considered mathematical, insofar as they are treated by mathematical reasoning.[43]

Newton's message was not lost on J.C. Sturm, a mathematician and physicist, whose attempts to make the mathematical sciences accessible involved treating "physical things" with "mathematical reasoning." He was extremely optimistic about the camera obscura's ability to further mediate, and thereby extend and refine, this relationship. It could serve as the third, neutral space, which—like the eye or the soul—played an

[42] J. C. Sturm, *Mathesis Juveniles I:* 1. de Causis pictarum in utroque camerae obscurae genere imanginum; 4. de Oculi praerogativis, arti in parandis cameras obscuras inimitabilibus; 5. Visione ac Simplici videndi modo; 6. de Visione Lucis, Colorum, Umbrae &c tanquam visibilibus propriis proprieque sic dictis; 7. de Visionis directae requisites ac praecipuis conditionibus; 8. de Visione Figurae 9. de Visione Situs ac Distantiae; 10. De Visione Magnitudinis; 11. De Visione Numeri; 12. De Visione Motus & quietis

[43] Isaac Newton, *Optical Lectures* (1670-72) in Alan Shapiro ed. *The Optical Papers of Isaac Newton* Vol. 1 (Cambridge: Cambridge University Press, 1984).

absolutely pivotal role in the production of judgments that were not only sound, but moral.

J.C. Sturm and his contemporaries were fond of pointing to the camera obscura as the perfect model of the eye's machinery. They understood the value of the instrument as somehow contingent on its status as a mediator, which, like the eye, brought together the species that it received (via rays of light) from the outside and the perception of its meaning in the brain. Some saw the camera obscura apparatus as a kind of soul that could mediate divine and human forms of knowledge—as Solomon had been able to do from his Temple in Jerusalem. Samuel Rehyer, a mathematician/philosopher at the University of Kiel while Sturm was in Altdorf, wondered if Solomon's Temple should not also be thought of as a kind of holy camera obscura, "where the hole was not placed on the sides like today's optical window cameras, but instead had a small, round hole on the top through which the glow of heaven could come in and illuminate the throne of mercy." Reyher also wondered:

> how the camera obscura could be used to help explain the secrets of the incarnation. Because just like the camera obscura takes in the highest heavenly bodies and projects the lowest and strangest things above, in the same way the incarnation [of Christ] has taken godly nature itself and elevated man's nature—as Christ said, the biggest people are to become children and the smallest of these shall be raised up the highest in heaven. When the hole is placed above, nothing false can shine through it, instead only the heavens are allowed to shine through and overshadow the lowest of the chamber.[44]

The camera obscura served in this culture as a kind of metaphor for the holiest of Christian shrines; it mimicked a process that the wisest and divinely inspired king

[44] Samuel Reyher, *Kurzter Auszug aus D.Samuelis Reyheri Vornehmen Profess. Publ. Mathesi Mosaica* (Lünberg, 1656): 4. Samuel Reyher was the oldest son of Andreas Reyher (1601-1673), who directed the Gymnasium in Gotha where Duke Ernst the Pious introduced his new *Schulmethode* in the 1640s. Andreas Reyher authored a school book in 1657 called "Short Lessons on Natural Things" (*Kurzer Unterricht von Natürlichen Dingen*) which first introduced the concept of object lessons (*Realienunterricht)* into German schools. Francke attended this Gymnasium while Andreas Reyher was the director and knew his son. See Chapter Three.

Solomon understood as necessary for filtering out falsehoods in order to read the will of God. The instrument could be invested with a kind of spiritual significance appealing to those interested in new ways of mediating several competing versions of truth. Francke's careful records of the instruments and machines he purchased "for training in the mechanical disciplines" indicate he had acquired a camera obscura (possibly more than one) by 1706.[45]

Contemporary histories of vision and visuality have tended to point to the camera obscura's capacity to serve as metaphor for early modern ways of seeing more generally. Art historian Jonathan Crary in particular has argued that before 1820, early modern theories of vision were rooted in Johannes Kepler's location of the act of seeing in the retina and the idea that seeing should be understood as an unembodied, mechanical process that worked basically like a machine, or camera obscura.[46] He points to John Locke's use of the camera obscura as a metaphor for how the senses make impressions on the "screen" of the mind in his *Essays Concerning Human Understanding* and Leibniz's willingness to accept the validity of the metaphor in his response to Locke.[47] But this entire configuration rests on an assumption of the dominance of this model, which Crary calls a "classical episteme," for early modern theories of perception. For

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[45] AFST/W Rep.2 Fach 245 Nr.5 *Specification der Einahmen und Ausgaben wegen der Mechanischen Disciplinen 1704 bis 1723*.

[46] Jonathan Crary, *Techniques of the Observer: On Vision and Modernity in the Nineteenth Century* (Cambridge, MA: MIT Press, 1990) and idem. *Suspensions of Perception: Attention, Spectacle, and Modern Culture* (Cambridge, MA: MIT Press, 1999). See also Stephen Straker, "The Eye Made 'Other': Dürer, Kepler and the Mechanisation of Light and Vision," in L. A. Knafla, M. S. Staum and T. H. E. Travers et al. *Science, Technology and Culture in Historical Perspective*, University of Calgary Studies in History 1 (Calgary: University of Calgary Press, 1976): 7-25 and *idem*., "Kepler, Tycho and the 'Optical Part of Astronomy': the Genesis of Kepler's Theory of Pinhole Images," *Archive for the History of Exact Sciences* 24 (1981): 267-293.

[47] John Locke, *An Essay Concerning Human Understanding;* Gottfried Wilhelm Leibniz, *Essays on Human Understanding,* trans. and ed. Peter Remnant and Jonathan Bennett Vol. 2 (Cambridge: Cambridge University Press, 1996): xi, 17.

J.C. Sturm and other practitioners of eclecticism, designating the operation of seeing as akin to the operation of a camera obscura did not eliminate the problem of how to understand where the moment of recognizing the meaning of what was seen actually occurred. On the contrary, the problem itself presented a prime opportunity to reach for a conciliatory methodology because the act of seeing can be understood as a physical process involving the eye's mediation of material light rays *and* as a rational process, involving acts of interior grasping or cognition. The camera obscura offered hope (as a neutral site) to those convinced that competing epistemological strategies for understanding the world (not to mention competing confessions) could be compatible somehow.

David Summers has offered a compelling critique of Crary's argument for the dominance of mechanical theories of vision in the early modern period, stating that it greatly oversimplifies the variety of discourses readily acknowledging seeing as an embodied act.[48] He points out that despite his reputation as a "mechanist," Descartes maintained that the actual act of seeing did not happen in the eye but in a "pineal gland" in the brain. The problem of how to reconcile the mechanics of seeing with cognition was important to Descartes, as it was also to Locke and Leibniz. Even in antiquity, optics (specifically geometrical optics) seemed to offer some sort of solution. Summers writes that "optics was what came to be called a ‚middle science' which argued about real physical phenomena in terms of unreal geometric lines."[49] It served as a kind of epistemological bridge between real and abstract and animated the preoccupation with perspective in the Renaissance. Leon Battista Alberti and Leonardo daVinci understood,

[48] See David Summers, "Suspension of Perception (Book Review)," *Art Bulletin* 83:1 (March 2001): 157–161.
[49] Ibid., 161.

Summers continues, that "one point perspective construction precisely locates a viewer; however, the nature of the 'point' affecting this actual location is crucially important. If the point is geometric, then the viewer is by implication an abstract entity in an abstract world; if the point is physical, an actual area or surface, then the viewer is by implication corporeal, connected to a physical world, and light, rather than geometry, is finally physical energy that behaves within a mathematically describable consistency."[50] Like Tschirnhaus, J.C. Sturm recognized the power of geometrical optics to act as a conciliatory "middle science" that both necessitated and refined the abilities of individuals to perfect their vision, and their abilities to judge.[51]

The *Mathesis Juvenilis* was not the only text in which J.C. Sturm's preoccupation with the conciliatory potential of optics and the mathematical sciences emerges. This pairing is also evident in the *Philosophia Eclectica* as built into the strategies Sturm proposed for assimilating a variety of opinions. Sturm made the conditioning of vision central to the project of conciliation, or his eclectic methodology. Implementing the method involved exercises that merged analysis of the esoteric qualities of Archimedes's curves with physical experiments.[52] All of the exercises contained in the *Philosophia*

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[50] Ibid., 161.

[51] J.C. Sturm's *Collegium experimentale sive, Curiosum* (1674) contained the first reference to a portable reflex camera. This per John Ward's "Camera Obscura" entry in Robert Bud, Deborah Jean Warner eds. *Instruments of Science. An Historical Encyclopedia* (New York & London: Taylor & Francis Group, 1998): 90-91.

[52] In 1704, as a supplement to his famous *Optiks,* Newton published a treatise on cubic curves in which he linked his interest in identifying the physical properties of light and color with studying curves projectively or by means of observing their projection onto a plane. He had been studying cubic curves intensively since the 1660s —during the period when Tschirnhaus visited him and while Sturm was developing his eclectic methodology. I think there is a great deal of overlap between Newton's early endeavors (as a student of Isaac Barrow) and the projects of both Tschirnhaus and J.C. Sturm. For a brief discussion of the impact of Newton's studies of projective curves on Patrick Murdoch, a priest, and others see Kirsti Anderson (2007): 592-93. See also Isaac Newton, "Genesis curvarum per umbras" section 29 in *Enumeratio linearum tertii ordinis* [Optiks] (London, 1704). Reprinted in D. T. Whiteside, *the Mathematical Papers of Isaac Newton* (Cambridge: Cambridge University Press, 1976). Murdoch, a fellow of the Royal Society, published a treatise called *Neutoni genesis curvarum per umbras seu*

Eclectica deal with the intersection of cognition and experience in the act of seeing.[53] Sturm emphasized in this text too that he was captivated by the camera obscura's potential to contribute productively to an eclectic philosophy; it could also serve as a corrective and help to perfect sight. He explained that "Seeing can actually be taught by the camera obscura, which, when ingeniously positioned can be used for the perfection of all mankind: in every case it exposes clear and evident vision."[54] For Sturm, the camera obscura's potential as an assimilatory medium was beyond obvious. It could help perfect individuals' abilities to form judgments—a process that involved their souls and at least invited speculation about the very real possibility that the power of the passions could be harnessed to ensure that all judgments (and the actions that followed them) were always virtuous.

Perhaps the best known of Sturm's texts, and the one that seems to especially invite comparison with Robert Boyle's experimental method, was his *Collegium Experimentale sive Curiosum.* While the text itself offers clear evidence of their mutual interest and influence upon each other, the respective methods for the reconciliation of viewpoints that Boyle and Sturm offered differ from each other in ways worth considering briefly here. It is also important to remember that Sturm's *Collegium Experimentale* was the same text that Tschirnhaus recommended in the *Gründliche Anleitung* for getting children excited about the study of *mathematics*.[55] As we have

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perspectivae universalis elementa (*Newton's generation of curves by shadows or elements of general perspective*) in 1746.

[53] J.C. Sturm, *Philosophia Eclectica*, Part I (1686): 425.

[54] J.C. Sturm, *Philosophia Eclectica*, Part II (1698): 439. "Oculum revera Cameram obscuram esse docet sed perfectiorem multo quam ulla unquam hominis manu aut ingenio parari: modum adeo visionis evidentem & clarissimum exponit."

[55] Thomas Ahnert has speculated that in the *Collegium Experimentale* we begin to see the dawning of an experimental program (linked directly to Boyle and the Royal Society) in the Holy Roman Empire. He points to Sturm's defense of Boyle's *Tractatus de Ipsa Natura* in the *Leipzig Acta Eruditorum* as evidence

seen, in Tschirnhaus's method, Sturm's *Collegium Experimentale* was to be used only at the very beginning of the training program in order to produce wonder.[56] Once the child was hooked, the focus of training was not to remain on the physical experiments described in Sturm's text (as one might expect) but instead was to start with a selective introduction to the study of mathematics using especially the *Geometry* of Andreas Tacquet first. Underlying Sturm's lessons was his belief in the perfectibility of the reader's judgment; physical experiments would inspire a course in conciliatory seeing rooted in geometry that would eventually allow one to reconcile the wondrous experiments shown at the beginning with their intrinsic geometry using this third sense, or judgment. Boyle's method, on the other hand, stressed the fallibility of human judgment and demanded replicable evidence to verify speculative statements.[57] Boyle's method involved producing meaning through gentlemanly or "civil" dialogues. Sturm's method relied on the special conciliatory powers of practical optics, stereometry and the soul's ability to make increasingly better judgments the more one experienced *and* studied mathematics.[58]

Boyle came out openly against mathematical methods for acquiring knowledge precisely because such methods were not accessible to most people and did not rely on

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for Sturm's support of Boyle's program but does not consider Sturm's lingering belief in the validity of mathematical methods. See Thomas Ahnert, *The Culture of Experimentalism in the Holy Roman Empire: Johann Christoph Sturm (1635-1703) and the Collegium Experimentale* (unpublished paper, 2002).

[56] Daston and Park (1998).

[57] Shapin and Schaffer (1985).

[58] Steven Shapin and Mario Biagioli have written extensively on the importance of civility and good manners in these discussions. See Shapin's "The House of Experiment in Seventeenth-Century England," Isis 79 (1988): 373-404 and Biagioli's *Galileo, Courtier: the Practice of Science in the Culture of Absolutism* (Chicago: University of Chicago Press, 1993).

communally verifiable technologies of experimentation, replication and witnessing.[59] While the experimental philosopher maneuvered in the visible realm, the mathematician participated in a highly "abstract and esoteric" form of culture; the two modes of acquiring knowledge about the natural world—two distinct cultural forms—seemed to Boyle to be fundamentally incompatible or irreconcilable. Only it was precisely the reconciliation of these cultural forms, or ways of knowing, that concerned J.C. Sturm and Tschirnhaus. Like Boyle they sought consensus. But they were trying to make the convergence of interior and exterior knowledge-making processes communally verifiable by introducing a method for perfecting the act of seeing itself—so that the consensus-driven conversations of the Royal Society (oriented as they were around producing meaning) would no longer be necessary. If everyone saw correctly, then there really would be no need to participate in the contrived, civil dialogues Boyle and his associates were advocating. There would be no need for these dialogues if the souls of individuals were already perfect. Conciliatory eclecticism offered an especially appealing alternative for individuals who appreciated the value of experimentation and who, in keeping with the method's mantra, wanted to take experimental philosophy as true but who, at the same time, were not willing to discard mathematical methods. Many of J.C. Sturm's surviving texts make clear that he deeply admired Boyle; however, he also deeply valued the insights and perfecting abilities of mathematicians.

There is no question that Boyle's and the Royal Society's influence was felt by Pietist intellectuals in Halle by the end of the seventeenth century. Francke appears to have especially cherished Boyle's treatises on reconciling reason with religion, in

[59] See especially Steven Shapin, "Robert Boyle and Mathematics: Reality, Representation and Experimental Practice" in *Science in Context* 2:1 (1988): 23-58; and idem, *A Social History of Truth* (Chicago & London: the University of Chicago Press, 1994): esp. 310-354.

addition to his ruminations on the meaning of "seraphatic" love. In 1708 and 1709, two compilations of Robert Boyle's writings were published by the Halle Orphanage press, "because of their worthiness" (*wegen ihre Würdigkeit*), as the preface notes. These included: (1.) *Gedancken vom Stilo und Schreib-Art der heil. Schrift*; (2.) *Von der Vortrefflichkeit der Theologie in Vergleichung mit der Philosophie*; (3.) *Von der Veneration und Verehrung so der menschl. Verstand Gott schuldig ist*; and (4.) *Von der Seraphischen Liebe*.[60] The community also translated into German one of Boyle's most famous texts, his *Considerations About The Reconcileableness Of Reason And Religion* (1675), and was literally one of the only places in the Empire to acquire a vernacular copy of these texts.[61] Their interest in doing this speaks to Francke's engagement with the same sets of questions that animated Boyle's lifelong quest to study natural phenomena empirically without disrupting a worldview that accepted the mysterious capabilities of divine providence and authority. They also confirm in some ways the extent to which Francke and his circle may have seen themselves as distant members of the extended community Boyle was endeavoring to create— members who appreciated

[60] Robert Boyle, 1) *An Essay Upon the Style of the Holy Scriptures* (London, 1663); 2) *Excellence of Theology Compared with Natural Philosophy* (London, 1664); 3) Of the high veneration man's intellect owes to God, peculiarly for his wisdom and power (London, 1685); 4) *Seraphic Love* (London, 1648/1660). Idem, *Amor Seraphicus. Die Seraphische Liebe, Oder Einige Anreitzungen zur Liebe gegen Gott ... In einem Sende-Schreiben an einen Freund geschrieben von Roberto Boyle. ... Aus der lat. Version* (Halle, Waysenhaus 1708); *Des Edlen Roberti Boyle, Weyland Mitglieds der Königl. Societæt der Wissenschaften in England Auserlesene Theologische Schrifften: Als erstl. Dessen Gedancken vom Stilo und Schreib-Art der heil. Schrift; (2.) Von der Vortrefflichkeit der Theologie in Vergleichung mit der Philosophie; (3.) Von der Veneration und Verehrung so der menschl. Verstand Gott schuldig ist; (4.) Von der Seraphischen Liebe; Nunmehro Wegen ihrer Würdigkeit zum gemeinen Nutzen ins Teutsche übersetzet und mit gehörigem Register versehen* (Halle, Waysenhaus 1709). I discuss Boyle's *Seraphic Love* in conjunction with how Francke and Leibniz understood the meaning of philanthropy in Chapter Three.

[61] AFSt/H B 50:00; the translated title reads: *Einige Betrachtungen von der möglichen Vereinbahrung der Vernünft und Religion, vorgeleget von Boyle*. It was never printed.

the same rhetorical tropes or strategies (*energeia*) one employed to produce clear and distinct visual images that could also be used to "call forth God's real presence."[62]

Apart from a kind of nascent fascination with Boyle and the experimental method in general, J.C. Sturm's eclecticism as a mode of philosophical inquiry was much more in fashion in Halle around the time Francke started to build his Foundation. Two of its most prominent practitioners, Johann Franz Buddeus and Christian Thomasius, were Francke's colleagues at the newly opened University (founded in 1694) and certainly understood the method's purpose and orientation. Kelley notes that Thomasius' understanding of eclecticism was taken directly from Sturm, as his definition of it in his *Introductio ad philosophiam aulicam* of 1688, reveals.[63] "I call eclectic philosophy not what depends on the teaching of an individual or on the acceptance of the words of a master," he wrote, "but whatever can be known from the teaching and writing of any persons on the basis not of authority but of convincing arguments;" even Denis Diderot accorded Thomasius a place "among the reformers of philosophy and the founders of a revived eclecticism."[64] Although Thomasius was sometimes openly critical of Francke's project, Thomas Ahnert has recently shown just how closely linked Thomasius' ideas were with certain tenets of Pietist theology.[65]

Thomasius was soon joined by Buddeus, who, even after leaving Halle for a post in Jena's theological faculty, also strongly championed the merits of a conciliatory or

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[62] Wintroub, "The Looking Glass of Facts" (1997): 189-211, esp. 210.
[63] Kelley, "Eclecticism," 587.
[64] Ibid., 584.
[65] Thomas Ahnert, *Religion and the Origins of the German Enlightenment: Faith and the Reform of Learning in the Thought of Christian Thomasius*. (Rochester: University of Rochester Press, 2006): 33.

eclectic philosophy.[66] Buddeus's most influential contribution was probably his *Elements of Instrumental Philosophy* (1717) or *Elementa philosophiae instrumentalis, seu institutionum philosophiae eclecticae, tomus primus*, which teachers in Francke's *Paedagogium* were asked to read before taking on their teaching duties.[67] The Francke Foundation press eventually published its own version of this text in 1725; yet the name of the Halle Orphanage appeared in conjunction with so many Buddeus texts that his influence is worthy of more discussion than I have been able to provide in this project.[68] The Francke's Orphanage press printed Buddeus' *History of the Philosophy of the Hebrews* (1702), his preface to Johann Amos Comenius' *History of the Bohemian Brethren* (1702), his *Elementa philosophiae instrumentalis seu institutionum philosophiae eclecticae* (1703); his introduction to the letters of Martin Luther (1703); his *History* (written with P.J. Spener's son, Jacob Carl) *of Mankind's Middle Way* (1704); *Selected Exercises in the History of Philosophy* (1706); his introduction to Georg Michael Laurenti's *Explanation of Paul's letters to the Corinthians* (1711); his commentary on *De Concordia Religionis Christianae Statvsqve Civilis* (1712); and various ecclesiastical histories (1715-1721). Francke and Buddeus were in close contact

[66] Kelley, "Eclecticism," 584. See also Albrecht, *Eklektik* (1994).

[67] Hieronymous Freyer, *Verbesserte Methode der Pädagogium Regium*, *Glaucha* (Halle: Waysenhaus, 1721): 118. See also Martin Mulsow, "Idolatry and Science: Against Nature Worship from Boyle to Rüdiger, 1680-1720" *Journal of the History of Ideas* 67:4 (October, 2006): 697-711.

[68] Buddeus, in turn, was joined by J.G. Heineccius (also an associate of Francke's), who gave further methodological shape to eclecticism, concluding that "one should not seek truth by oneself, nor accept or reject everything written by ancients and moderns" and that "no other method of philosophizing is more reasonable than the Eclectic method." In Kelley, 584. Martin Mulsow has argued that Buddeus borrowed extensively from the philosophies of John Tolund and Henry More in his work; see Mulsow's "Idolatry and Science: Against Nature Worship from Boyle to Rüdiger, 1680-1720" *Journal of the History of Ideas* 67 (October 2006): 697-711. The Francke Foundation library contains two Toland texts (London, 1699 and 1702) and four More texts (London 1653, 1653, 1662, 1708).

for the majority of their adult lives and even a cursory glance at the character of their correspondence indicates an amicable relationship.[69]

Yet it is in the handwritten lesson plans that formed the backbone of the mathematical sciences curricula in Francke's schools where we find perhaps the best evidence of how eclecticism adapted as pedagogy here actually worked. The plans indicate that Pietist teachers were using heavenly spheres (*Himmelsphären*) like Sturm's own Sphaera Altdorfina in their lessons on a regular basis. Samuel Lange would later confirm this in his biography of Georg Frierich Meier, noting that unlike in Altdorf (and in most cities), where only one *Himmelsphära* was on display, Francke's Orphanage offered two large spheres to viewers.[70] He explained that the spheres on display in the Orphanage "present the systems of Tycho Brahe and Copernicus. Both are ordered in such a way that the precise movement of the whole universe and individual pieces, including the moons of the planets, can be guided with a single twist so that they agree with real time, eclipses and all other movements."[71] Lesson plans now resident in Francke's archive (see Part II) note that not only the most current heliocentric theory of the universe was shown to pupils but also a geocentric theory. In a section entitled, *Astronomia mechanica or actual models of the universe after the systems of Copernicus and Tycho Brahe*, the author indicated that the following statements should be made to pupils:

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[69] Stab/F 7/14: 38-41, 43-44 (February 16 & 20, 1719; March 3 & 5, 1719; February 2 & 12, 1720). A series of letters from February 1719 to 1720 include long digressions by Buddeus about how much he enjoyed hosting and mentoring Francke's son Gotthilf while the latter was studying at the University of Jena, for example.

[70] In Samuel Gotthold Lange, *Leben Georg Friedrich Meiers* (Halle, 1778): 20-21.

[71] Ibid.

> Regarding the structure, order and arrangement of the entire universe, we find especially two hypotheses and opinions. The one according to Tycho Brahe's guidelines puts the earth at the middle of the world; the one according to Copernicus' opinion, however, puts the sun in the center of the Universe.
> ….
> This *himmelsphaera* presents the *Systema Tychonicum*, where the Earth is at the center of the world and the entire firmament of the heavens, including the stars, turn and move around it from morning til night
> ….
> This *himmelsphaera*, however, presents the system of Copernicus. According to the same system, the sun sits in the middle, in the center; the planets go around it and the firmament of the heavens stays still.
> ….
> That one has here both systems side by side in such an unusually large size and with more movements represented than in other models is a *singulare*, neither to be found in Paris, nor in London or St. Petersburg.[72]

The detailed descriptions of both systems that appear in this section offer proof of the eclectic method at work in the pedagogical landscape of the *Franckesche Stiftungen*. The author's claim to be doing something different by "showing both systems side by side" speaks to how practitioners of an eclectic method imagined themselves as engaged in a very special project, a *singulare*. It speaks to the ability of the Pietist Orphanage to become a symbol of this *singulare* by housing it. Presenting both models to viewers who witnessed the models inside the Orphanage seems to indicate Francke's interest in exposing the pupils of his schools and all those who viewed the two spheres in his Orphanage to competing points of view; following Sturm, he did this in the interest of mediating these different positions by getting individuals to understand and accept the merits of *both* systems. Only then could they reconcile them.

Perhaps the defining feature of Francke's schools was their ability to appropriate Sturm's eclectic methodology to not only show pupils several "points of view" or competing theories but to introduce all children, regardless of class or status, to as many forms of knowledge as possible. This meant exploiting the mediatory potential of the

[72] AFST/H E 61, *Semler Lehrplan*, 739, 741, 763 and 829.

mathematical sciences and their ability to assimilate higher mathematics, experimental physics and what Pamela Smith has called "vernacular science."[73] Especially the printed descriptions of Pietist curricula consistently cite this juxtaposition as the most unique feature of their schools. In the elite *Pädagogium*, boys who were destined to inherit their titles and (following tradition) would never have to work with their hands were visiting artisans in their workshops and learning how to use wood lathes. As Hieronymous Freyer explained:

> Informatores actually go with their assigned scholars to the houses of artists and handworkers… who show and tell the scholars what belongs to their profession; the scholars can ask content related questions—if the profession was handed down to them or not, how long one needs to learn it, where they get their materials from, where they get their wares from and how, etc. They also visit large offices, factories and institutions where there is something useful to observe, because these things will help them in many ways lead a virtuous life.[74]

Boys destined to a life of the mind—perhaps training to become theologians or clergymen like their fathers and, therefore, learning Latin, Greek and Hebrew—were building optical and astronomical instruments with their hands and were encouraged to do this because it would make them more loving.

The famous Professor of medicine at the University of Halle, Friedrich Hoffmann, remarked that Francke's Orphanage schools "provided youth with opportunities to practice being better people, including learning to grasp the mathematical and physical sciences through many experiments. *No one is denied* enough advice pertaining to the costly instruments and *all* are encouraged to research the nature and strength of the elements, such as air, water and fire, as well as other natural things to the extent they see

[73] Pamela Smith, *The Body of the Artisan: Art and Experience in the Scientific Revolution* (Chicago: Chicago University Press, 2004).
[74] Freyer, *Verbesserte Methode* (1721): 116.

fit."[75] In a handwritten register entitled *Specification der Einnahmen und Ausgaben der Mechanische Disciplinen*, August Hermann Francke kept detailed records of the materials and machines he purchased and received as donations for these lessons.[76] Spending thousands of thalers, Francke purchased globes, a laterna magicum and pneumatic airpump from Holland, a camera obscura, measuring instruments (*Masstäbe*), various astronomical instruments such as quadrants, a Herbarium viuum, barometers and thermometers, a microscope and skeletons for lessons in anatomy. He also kept careful records of the individuals he paid to offer specific lessons in the use of these instruments and to repair or recalibrate them when necessary. Tschirnhaus's name appears more than once as someone to whom Francke directed payment for the optical instruments the "experimenting youth" of his instruments were using to help them assimilate by honing their visual (and thereby moral) acuity.

Leonard Christoph Sturm

It is likely that J.C. Sturm's son, Leonhard Christoph, also had much to do with making his father's eclectic method central for Francke—although the elder Sturm's reputation was certainly large enough as to allow relatively easy and independent access to his insights. Between 1683 and 1688 L.C. Sturm studied mathematics and theology in Altdorf before moving to Leipzig in 1689 to study with Thomasius. In 1694 he took a position at a *Ritterschule* in Wolffenbüttel as a professor of mathematics before accepting

[75] Friedrich Hoffmann in Johann Heckers *Einleitung in die Botanie* ... (Halle: Waysenhaus, 1734**).**
[76] AFST/W Rep.2 Fach 245 Nr.5 *Specification der Einahmen und Ausgaben wegen der Mechanischen Disciplinen* 1704 bis 1723.

a professorship in Frankfurt an der Oder in 1702.[77] He became a member of the Berlin Academy of Science this same year.[78] During this period he published several tracts on the mathematical sciences that seem to owe much from the work of his father; yet his architectural treatises are derived almost entirely from translations of a little known architectural theorist from Leiden named Nicholas Goldmann.[79] In 1711 he moved to the court of Duke Friedrich Wilhelm of Mecklenburg in Schwerin (1675-1713) to serve as the head architect there and, after eight years, he took a similar position back in Wolffenbüttel. In his autobiography, L.C. Sturm cites his engagement with Pietist circles in Leipzig as central to his spiritual development; however, Bernet notes that L.C. Sturm's millenarianist leanings (he was obsessed with mathematically predicting the arrival of the apocalypse) won him few friends.[80] These sensibilities are often cited as the reason he ultimately distanced himself from Pietist circles (or they from him) and converted to Calvinism.

Despite their differences, Francke and L.C. Sturm were still engaged with each other in ways that suggest a high degree of mutual respect and influence. Sturm donated money specifically to further Francke's mission plans (discussed in conjunction with Leibniz in chapter three), and he corresponded with Francke regarding the plans he had for the education of his own son, Samuel Christoph. Apparently Francke had sent L.C

[77] For Sturm's biographical details see Claus Bernet, "Leonhard Christoph Sturm," *Biographisch-Bibliographisches Kirch-Lexicon* Vol. 19 (2001): 1349-1369.
[78] He became an abwesentes Mitglied on July 21, 1702. See Werner Hartkopf's *Die Berliner Akademie der Wissenschaften. Ihre Mitglieder und Preisträger 1700-1990* (Berlin: Akademie Verlag, 1992): 355.
[79] Leonard Christoph Sturm, *Kurzer Begriff der Gesamten Mathesis. Nicht nur den Lehrenden und Lernenden zum Nutzen aufgesetzet, sondern auch vor die Geübten hin und wieder mit neuen Anmerckungen kurtz und zu weiterem Nachsinnen untermenget*. (Frankfurt an der Oder 1707); *Nikolaus Goldmann Vollständige Anweisung zu der Civil Bau-Kunst* herausgegeben von L.C. Sturm (Wolfenbüttel, 1696).
[80] In Ibid. Two tracts in particular convey a sincere interest in millenarian numerology: *Mathematischer Beweis des heiligen Abendmahls* (Frankfurt, 1714) und *Von der apocalyptischen Zahl 666* (Rostock, 1716) or *Mathematical Proof of the Holy Supper* and *About the Apocalyptical Number 666*.

Sturm a young man from his *Stiftungen* schools to serve as Samuel Christoph's private tutor; the placement did not go smoothly, and when L.C. Sturm complained to Francke that the young tutor (*informator*) was incompetent, Francke offered to take Samuel Christoph into his *Pädagogium* to be educated.[81] At least in theory, seats in the *Pädagogium* were reserved for the children of gentry who were in a position to pay for the education they received; Francke's willingness to take Samuel Christoph into his most elite school in this instance suggests that his relationship with Samuel's father merited special treatment in this case.[82] But possibly the best evidence of Sturm and Francke's mutual interest in each other comes to us in one of Sturm's earliest letters to Francke, from June of 1701. L.C. Sturm answered what seems to have been a pointed request from Francke for help with the design of the *Stiftungen* buildings, stating clearly that he looked forward to being able to offer Francke his services in all questions relating to their construction.[83] In the same letter, he asks for Francke's opinion on whether he might potentially be considered for the Mathematics professorship currently vacant at the University (the one Christian Wolff would eventually fill).[84]

Francke's archive also contains a mysterious handwritten text entitled *Collegium Sturmihnum Pantomathematicum* (dated August 11, 1697) that seems to have been almost entirely derived from a treatise on *The nature and constitution of mathematics*…

[81] For L.C. Sturm's detailed request of Francke and description of the kind of education he imagined for his son: AFST/H C 817:25 [April 30, 1714]; he describes ten-year old Samuel Christoph as having a "very good disposition (*Gemüth*) but a very weak body." He hoped that if young Samuel was surrounded by other "well-bred" children, his physical health would improve. As proof of his son's potential and character, he relays the story of how, after reading Francke's *Fusstapfen*, Samuel sent 6 Thalers to help orphaned children his own age in Francke's *Waisenhaus*. For other letters in which L.C. Sturm conveys his frustration with the tutor Francke sent him: Stab/F 20, 2/13:8-10 (30.5.1713 and 9.10.1713). The tutor (Domke) is described as suffering from "Malo Hypochondriaco."
[82] It is not clear if L.C. Sturm was expected to pay for his son's education or not.
[83] Unfortunately Francke's original letter to Sturm is lost. (13.6.1701) Stab/F 20, 2/13, 1-61: 1.
[84] In another letter from June 3, 1702, L.C. Sturm asks Francke to send him medicine and to please not be secretive about the exact recipe.

for the studying youths of the Collegium Pantomathematicum, that he published in 1706.[85] It does not figure prominently in the printed descriptions of Francke's schools, nor has it received any attention in the secondary literature on Pietism. But its residence in Halle and contents are worth considering—even comparing to the *Mathesis Juveniles* of J.C. Sturm and the specific prescriptions of Tschirnhaus's *Gründliche Anleitung*. Introductory statements from the printed version note L.C. Sturm's reliance on the contributions of Erhard Weigel's *Analysin Aristotelico, Euclideam*; Malebranche's *de Inquirenda veritate* and a certain "illustrious Tschirnhaus's" *Medicinam Mentis*.[86] Citing his reliance on Jesuit contributions to the mathematical sciences, namely Gaspar Schott's *Cursum Mathamaticum*, Miliet de Chales' *Mundus Mathematicus* and Athanasius Kircher, he divided mathematics into two already widely observed categories: abstract and applied.[87] He conveyed his preference for applied mathematics, especially geometry, making a point of citing the same figures Tschirnhaus cites in the *Medicina Mentis*; he pointed to the singular importance of Bernard Lamy's *Elementa Mathesis* (1692) and *Nova Geometria Elementa* (1692), J.C. Sturm's *Opera Archimedes* (1670), Isaac Barrow's *Euclidis Elementorum* (1675), Andreas Tacquet's *Elementa Geometriae plane & solide quibus accessere selecta ex Archimede Theormeata* (1683), Samuel Reyher's

[85] AFSt/H 31: 1 *Collegium Sturmihnum Pantomathamaticum*, [August 11, 1697] Hoc MS continentur Arithmetica cum Algebra et Analysi speciosa, Geometria, Optica et Astronomia. Leonard Christoph Sturm, *Tractatus de Natura & Constitutione Matheseos* (Frankfurt, 1706).
[86] As quoted in Ibid., 8-9. "Atque utinam omnes, qui Academias ingrediuntur, Erh: Weigelii Analysin Aristotelico Euclideam, Malebranchii de Inquirenda veritate, Illustrisque Dn. De Tschirnhausen Medicinam Mentis legere possent atque vellent." As I mentioned in Chapter One, Malebranche's *Recherche de la vérité* (1675) contended that without conditioning the senses, one could never arrive at truth. L.C. Sturm also specifically mentions Tschirnhaus in lesson 86 of the printed *Pantomathematicum* in a discussion of a concave speculum.
[87] Gaspar Schott, *Cursus mathematicus* (Frankfurt, 1652); Claude Francois Milliet de Dechales. Amantus Varcin eds. *Cursus seu mundus mathematicus* (Lyon, 1674).

Euclidis libb. VI priores Kilon (1699), William Whiston's *Taqueti Element* (1701) and the works of John Wallis.

A "panto" or "everything" mathematics, L.C. Sturm explained, could be used to glorify God through its ability to help man assimilate a wide variety of objects.[88] The *Pantomathematicum* marked his contribution to this project, to the forging of a mathematics that would prove its inherent utility to the world precisely because of the assimilatory technologies it drew upon.[89] This was a form of mathematics that relied on the conciliatory power of the eye, the soul and projective geometry. "Our souls," he wrote in his *Short Conception of all of Mathematics* (*Kurtzer Begriff der Gesamten Mathesis*) "see objects in the places where they are," thereby eliminating the distance between projections of these objects and the objects themselves. He continued:

> If you were to look at a picture that is projected onto a plane from behind in a camera obscura … you would see it standing upright behind the screen and would receive in your eyes what in truth actually stands there. The human soul sees this thing more exactly and discerns from the picture rays (*bild-strahlen*) of the object, not only the picture into the eye but rather to the end of the origins of the object itself, like one of the many who goes around with the camera obscura and in the same way becomes accustomed to the true object through the picture—or has a much better sense of it than someone who only looks at the object for the first time.[90]

A panto-mathematics was useful precisely because of its engagement with, rather than its disassociation from, the *realia* of the world. And not only was it concerned with the "truth" of objects, it offered the practitioner a set of tools for reconciling this truth with its representation. The soul's ability to discern was at the heart of pantomathematics. L.C. Sturm's father, Tschirnhaus, Leibniz, even Wolff—all of the major figures Francke

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[88] Leonard Christoph Sturm, *Tractatus de Natura & Constitutione Matheseos* (1706): 8-9.
[89] Knoblauch notes that Sturm's conception of panto-mathematics was heavily influenced by Descartes, especially his treatment of *mathesis unviersalis* in the fourth rule of his *Rules for Direction of the Mind.* See Knobloch, 87-88.
[90] Leonhard Christoph Sturm, *Kurtze Begriff der Gesamten Mathesis* (Frankfurt a.d.O, 1707): 92.

drew readily from in order to define the pedagogical orientation of his *Schulstadt*—were engaging in and endeavoring to extend it.

L.C. Sturm's own interest in improving and extending panto-mathematics is especially apparent in his work on developing a "mathematical" geography and architecture. In 1705, he came out with a short text called *Geographia Mathematica*, in which, he announced he was endeavoring to provide a much needed "mathematical footing (or *Grund*)" to the study of geography. "Without mathematical knowledge, globes and maps cannot be properly used," he insisted. In fact, "so much from geometry and astronomy affects geography," he continued, that the study of it deserved to be renamed Mathematical Geography, and discipline divested of its connections to the study of history entirely. He promised to "show the youth" in this text, using some of his father's correspondence "with famous mathematicians," the proper method for finding the *lineam Meridianam* by teaching them how to perform various experiments using the *Declinationem Magnetis*. His book provided instruction in methods for constructing globes, using a panto-meter to solve the problem of measuring longitude and constructing topographical maps.[91]

So important was furthering the study of architecture as a form of practical mathematics for L.C. Sturm, that he treated it in several treatises. The most important one was a multivolume synthesis (with some original commentary) of Nicholas Goldmann's writings on architecture called *Vollständige Anweisung zu der Civil Bau-*

[91] Leonard Christoph Sturm, *Geographia mathematica oder kurtze u. gründliche Vorbereitung zu rechtschaffener Erlernung der Geographia: worinnen von der Construction ... der Erdkugeln und aller Sorten von Land-Carten gehandelt und mit nöthigen Figuren und Tabellen erläutert wird (*Frankfurt a.d.O., 1705). Athanasius Kircher's "pantometer"—or tool for measuring everything—was also especially popular and often copied; see Chapter Three.

Kunst (*Thorough Instructions in the Art of Architecture*).[92] According to Johann Doppelmeyr's account, L.C. Sturm's father met Goldmann while he was studying mathematics in Leiden; Goldmann was not a professor but apparently instructed J.C. Sturm privately in architecture.[93] Goldmann's architectural manuscripts were never published in his lifetime but found their way into the Sturm household and, by all indications, were highly prized by both father and son—who were determined to make them available to the public. The single most important reason Goldmann's work needed to be published, wrote L.C. Sturm in the preface, was that "all of Goldmann's architecture presents an accurate mathematics and a judicusen Eclecticum."[94] He would eventually apply the principles of eclecticism in his own architectural treatise—a text he called *Miliatris Hypothetica & Eclectica*.[95]

In the *Vollständige Anweisung*, Goldmann commented extensively on Vitruvius, Leon Battista Alberti, Sebastiano Serlio, Andrea Palladio und Vincenzo Scamozzi's application of linear perspective to the design of buildings.[96] He wanted the reader to understand architecture as a form of projective geometry. He also explicitly aligned civil architecture with a form of activity that was very important to many of Europe's intellectuals in this period: measuring Solomon's Temple. Juan Villalpando, Samuel

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[92] Nicholas Goldmann, *Vollständige Anweisung zu der Civil Bau-Kunst* (Wolfenbüttel, 1696). It was a multivolume work republished in 1720 by category; for example: *Allerhand Öffentliche Zucht- und Liebes-Gebäude, Als hohe und niedrige Schulen, Ritter-Academien, Waysen-Häuser, Spitäle vor Alte und Krancke und endlich besonders also genannte Zucht-Häuser und Gefängnisse wohl* (Augsburg, 1720).
[93] Johann Gabriel Doppelmayr, *Historische Nachricht von den Nürnbergischen Mathematicis und Künstlern* [Nürnberg, 1730] (Reprint. Hildesheim, New York: Georg Olms, 1972). Doppelmayer was also a member of Leibniz's Academy of Science.
[94] Leonard Christoph Sturm, "Vorrede," *Vollständige Anweisung* (1696); also mentioned by Hans Gaab, "Sturms Studienzeit an der Universität Leiden und sein Lehrer," in Hans Gaab et al. *Acta Historica Astronomiae Vol.22: Johann Christoph Sturm* (Frankfurt: Verlag Harri Deutsch, 2004): 57.
[95] Leonard Christoph Sturm, *Architectura Miliatris Hypothetica & Eclectica* (Nürnberg, 1702).
[96] Vitruvius's manuscript *On Architecture* (*De architectura*) is from the first century BCE, trans. Frank Granger, 2 Vols. (London, 1955). Leon Battista Alberti's *On Painting* (or *De pictura*) marked the first formal codification of perspective; see Chapter 6.

Reyher, William Whiston, Isaac Newton and countless other members of the Royal Society and the Berlin Academy, including L. C. Sturm himself, were extremely interested in the Temple of Jerusalem's proportionality.[97] Another of Goldmann's texts conveys this interest more directly: his *Heilige Bau-Kunst oder des Vilalpandi, Beschreibung des Tempels Salomonis* provides a running commentary on Villalpando's measurements. L.C. Sturm also made his own contribution to ongoing discussions; he called it: The *Unbreakable Rules of Symmetry… How they can be applied using the beautiful example of the godly temple of Solomon*."[98] For L.C. Sturm and others preoccupied with measuring Solomon's Temple during this time, making the temple's measurements relevant to the world held an enormous amount of potential. Proportional measurements handed down by God himself could be used to inform the construction of every sort of civic building imaginable. People would look at buildings and see nothing but perfect yet substantial forms. These perfect buildings would communicate divine will—serving as mediators between God and man.

But first, in order for the Temple's measurements to be useful and universally applicable, they had to be calibrated. And calibration took time; it also required

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[97] Juan Bautista Villalpando (1552-1608) was a Jesuit who studied geometry and architecture with Juan de Herrera, the royal architect of Philip II of Spain; he applied Euclid's propositions to architecture and developed a scale model of Solomon's Temple that was frequently cited by Newton and Whiston [known as *Ezechielis Explicatio* (1596-1604)]. William Whiston's comments on the temple appeared in *A Short View of the Chronology of the Old Testament, and of the Harmony of the four Evangelists* (Cambridge, 1702) and a text that was translated and printed into Germany by Siegmund Jacob Baumgarten as *Herrn Wilhelm Whistons Beschreibung der Stiftshütte und des Tempels* (Halle, 1747). Isaac Newton wrote about the features of the Temple in his *Observations upon the Prophecies of Daniel and the Apocalypse of St. John* (London, 1732) and in his *Chronology of Ancient Kingdoms Amended* (London, 1728). See S. Snobelen, " 'The Mystery of this Restitution of All Things': Isaac Newton and the Return of the Jews," in J.E. Force and R.H. Popkin eds., *Millenarianism and Messianism in Early Modern European Culture: the Millenarian Turn* (Amsterdam: Kluwer Academic Publishers, 2001): 95-118.

[98] Leonard Christoph Sturm, *Die unentbährliche Regel Der Symmetrie Oder: Des Ebenmaasses: Wie sie zuförderst an dem herrlichsten Exempel des Göttlichen Tempels von Salomone erbauet, wahrzunehmen; ... von uns hingegen heut zu Tage in Ausübung zu bringen; Alles auf das deutlichste angewiesen und durch behörige Kupffer erkläret* (Augsburg, 1720).

exchanging notes, opinions, and demanded extensive deliberation—even dispute. Leibniz and Jablonski's Academy, modeled as it was on the Royal Society, provided the perfect venue for participating in these calibration exercises. My investigation of how they worked is at this point only preliminary; however, the *Berlin-Brandenburgische Akademie der Wissenschaft*'s archive in Berlin contains several documents that provide some useful traces. They especially demonstrate just how closely linked "holy architecture" was to proficiency in several other forms of practical mathematics, especially mechanics. When he built scale models of machines powered by water, which he did as well, Leonard Christoph Sturm imagined his fountains and watering devices as components of the perfectly proportional scale model of Solomon's Temple he was building at the same time.[99] In his report (*Gutachtung*) "regarding the attachment sent by L.C. Sturm of the fountain (*Springbrunnen*) that King Solomon had built for Jerusalem's Temple" (1705), fellow Academy member J. L. Frisch first made what he called "mathematical comments" and discussed the fountain's place within the "order of the entire work," before he took issue with Sturm's interpretation of the "meaning of the Hebrew words" and the style of handle (*Handgriff*) he had chosen to depict.[100] Those who witnessed L.C. Sturm's presentation of the Temple would be moved, Frisch noted, and would intuit the perfect Temple's holy mandate in conjunction with the technologies Solomon had employed to direct water from the large lakes to Jerusalem and the Temple itself.

L.C. Sturm's treatises on what he called an "eclectic" architecture—one capable of bringing several forms of practical mathematics and holy *Baukunst* to bear on the

[99] See my discussion of three-dimensional models in Chapter Five.
[100] BBAW/A: I-V, 5a: Gutachtung von J.L.Frisch zu der von L.Ch. Sturm eingesand Abhandlung über den von König Salomo im Jerusalemer Tempel gebauten Springbrunnen um 1705, 10-11.

design and construction of buildings—marked his contribution to a set of much broader discussions about *Eurythmie* (*Wohlgereimheit*) or *Symmetrie* occurring in this period. Several years before Sturm's treatise, Christian Wolff had defined *Eurythmie* as "the similitude of the sides in relation to a dissimilar middle" in his *Beginners Guide to Mathematics*. "The French call it Symmetrie," he continued, "and the external shape of our bodies is one example of it."[101] The beautiful or graceful appearance of buildings was contingent on the "quality" of the proportional relationships (or the soundness of the mathematical principles) they employed in their assimilation of a building's physical components. "The ancients took these relationships from the human body," Wolff noted and several individuals had provided a solid foundation for understanding them—especially Perrault, whose commentary on Vitruvius both Sturm and Wolff heartily recommended. Regarding the soul Wolff wrote: "Why Eurythmie stirs up such a special pleasure in us, we will not investigate here because in architecture it is enough that we know that it does this. I will remind you only of this," Wolff continued, "that the soul is helped when it can clearly grasp the figure of a building without much effort and that essential perfection (*wesentlichen Vollkommenheit*) is realized in works of art and nature, as well as in buildings."[102]

That Francke's Orphanage building—and those gradually added to his rectangular complex of buildings—made powerful impressions on those that witnessed it is undisputed. Perhaps the most famous record of a person's reaction upon first seeing the *Stiftungen* buildings is a report detailing the Prussian crown prince's surprise visit to Francke's Orphanage in August of 1713. Upon seeing the building for the first time, the

[101] Christian Wolff, *Anfangsgründe aller Mathematischen Wissenschaften* [First edition 1710] (Halle, 1757): 314. Reprinted in *Gesammelte Werke*, Part One: Vol. 12 (Hildesheim, Georg Olms, 1965ff).
[102] Ibid.

prince supposedly exclaimed in an exuberant tone, "Is that not a building!" (Ist das nicht ein Bauen!") and ordered his driver to circle it a few times before he went inside.[103] At the time it was constructed, there was really no other building quite like Francke's orphanage in all of Brandenburg-Prussia. While we cannot know for certain if L.C. Sturm's plans were applied to its construction, the younger Sturm's 1701 letter is a clear response to Francke's plea specifically for architectural advice.[104] The model of Solomon's Temple housed in the Orphanage was widely regarded for its perfect proportionality and ability to speak to people's souls (see Chapter Five). And Francke also openly referred to his Universal-*Anstalt* as a kind of prophet school, like the schools housed in the Temple (see Chapter Seven). Interestingly, in L.C. Sturm's *Kurzter Begriff der Gesamten Mathesis*, which is also occasionally referenced in descriptions of *Stiftungen* curricula, there is a building prototype that corresponds almost exactly to what Francke's flagship building would eventually look like.[105] It is highly likely that the first Pietist Orphanage was designed with the proportions of Solomon's temple in mind.

Conclusion

[103] "Bericht von 1713" in Gustav Kramer, *Neue Beiträge zur Geschichte August Hermann Francke's* (Halle: Waysenhaus, 1875): 129. This is also mentioned by Carl Hinrichs, *Preußentum und Pietismus: Der Pietismus in Brandenburg-Preußen als religiös-soziale Reformbewegung* (Göttingen: Vandenhoeck and Ruprecht, 1971): 94.

[104] The secondary literature around the design of Francke's orphanage building has suggested that Francke derived the plans for its design from Dutch orphanages; he even sent his close associate, Georg Friedrich Neubauer, to the Netherlands on a kind of a scouting trip. This does not detract my claim in any way, especially when one considers that Nicholas Goldmann was from Holland and L.C. Sturm derived many of his ideas, sketches for buildings etc. from him. See Joke Spaans, "Early modern orphanages between civic pride and social discipline. Francke's use of Dutch models," Udo Sträter ed. *Waisenhäuser der Frühen Neuzeit*. Tübingen: Nieymer Verlag, 2003): 183-196.

[105] Leonard Christoph Sturm, *Kurzter Begrif der Gesamten Mathesis.* (Frankfurt a.d.O., 1707): appendix. L.C. Sturm also designed a mission church in Madras, India called "New Jerusalem" (built in 1711) that Francke's organization was also involved in maintaining. Burnet notes that Dresden's Annenkirche, Hamburg's St. Michaeliskirche and Münster's Lotharinger Kirche were likely built according his plans.

Johann Christoph and Leonard Christoph Sturm are two figures rarely associated with Halle Pietism, the orientation of Francke's pedagogical program or his orphanage. Yet they were central to Francke's project in its formative stages. J.C. Sturm's interest in reconciling physics and mathematics, including the exercises he developed in order to accomplish this, had certainly attracted the attention of Tschirnhaus by 1698, who specifically mentioned the elder Sturm's efforts to Francke. In the final pages of his *Gründliche Anleitung* he recommended Sturm's *Philosophia Eclectica* as a kind of figurative icing that would perfectly accent the synthesis of the *Medicina Mentis* he had just presented. J.C. Sturm's *Juveniles Mathesis* was used as a substitute for all the books Tschirnhaus had recommended thereby associating the *Stiftungen* schools with an eclectic methodology. In honing and popularizing this method, J.C. Sturm was offering a set of technologies for helping individuals learn how to discern, how to make judgments by choosing to reside in a state of constant and affective neutrality. He was offering his contemporaries a coherent methodology for producing the *consilia* generations of irenicists had been seeking. His method claimed to be able to help individuals avoid collapsing distinctions between various points of view. One took all ways of knowing as true at the same time as one used one's soul to mediate the tensions and problems these differences caused. J. C. Sturm's method especially privileged the conciliatory potential of the camera obscura and the "middling" mathematical sciences. This mandate was taken up and extended by his son, Leonhard Christoph, who aimed to improve these sciences by promoting the conciliatory potential of architecture, geography and mechanics. Especially L.C. Sturm will appear again in the narrative that follows; he was,

after all, Francke's colleague in the Berlin Academy and a supporter of Francke's cause. He, like Leibniz, was a proponent of Pietist philanthropy.

Chapter Three: Illuminated Missions of Conciliatory Love. Leibniz, Francke and the Berlin Academy of Mathematics and Physics

> *God always acts Geometrically*
> *How great a Geometrician art thou, O Lord! For while this Science has no Bound; while there is for ever room for the Discovery of New Theorems, even by Human Faculties, Thou art acquainted with them* ***all at one View****, without any train of Consequences, without any wearisome Application of Demonstrations. In other Arts and Sciences our Understanding is able to do almost nothing; and, like the Imagination of Brutes, seems only to dream of some uncertain Propositions: whence it is that in so many Men are almost so many Minds.* ***But in these Geometrical Theorems all Men are agreed****: In these the Human Faculties appear to have some real Abilities, and those Great, Wonderful and Amazing*
> *….*
> *[I] pant after that Day, with the Earnest Breathings of my Soul, when thou shalt be pleased, out of thy Bounty, out of thy Immense and Sacred Benignity, to* ***grant me the favour to perceive****, and that with a pure Mind, and clear Vision, not only these Truths, but those also which are more numerous, and more important; and all this without that continual and painful Application of the Imagination…*
>
> -Isaac Barrow[1]

In 1700, Gottfried Wilhelm Leibniz—court philosopher, polymath, savant—and his associate Daniel Ernst Jablonski founded the *Kurfürstlich-Brandenburgische Societät der Wissenschaften*, in Berlin. Modeled after the Royal Society in England and the Académie Royale des Sciences in Paris, both organizations to which Leibniz belonged, the Academy was renamed the *Königlich Preußische Sozietät der Wissenschaften* after the crowing of King Frederick I in 1701 and was especially oriented around furthering the dissemination of "practical" forms of knowledge.[2] It was very often simply referred to as the Berlin Academy in this period, which is the designation I will also employ here. As Michael Duchesneau has noted, from the very beginning Leibniz articulated a clear

[1] Isaac Barrow, *Apollonii conica: methodo nova illustrate*, quoted in William Whiston, *The Elements of Euclid with Select Theorems out of Archimedes. By the Learned Andrew Tacquet. To which are added, practical corollaries, shewing the uses of many of the Propositions.* The Whole abridg'd and this Fourth Edition Publish'd in English, by William Whiston, M.A. Mr. Lucas's Professor of the Mathematicks in the University of Cambridge (London, 1719).
[2] This is confirmed by Lorraine Daston in her essay: "Die Akademien und die Einheit der Wissenschaften: Die Disziplinierung der Disziplinen," in Jürgen Kocka eds. *Die Königlich Preussische Akademie der Wissenschaften zu Berlin im Kaiserreich* (Berlin: Akademie Verlag, 1999): 69.

agenda for this Academy that involved a "conciliation of observations." He readily acknowledged that his main goal was "to unite in a happy wedding theoreticians and observers so as to improve on incomplete and particular elements of knowledge."[3] As we have seen, for E.W. von Tschirnhaus and J.C. and L.C. Sturm, uniting theoreticians and observers through the deliberate mixing of geometrical and experimental method was the key to producing knowledge that was useful in its capacity to generate the reconciliation required for improvement. Finding new ways to make geometrical projections of images agree with their physical location was a poignant expression of this goal, as were attempts to apply the proportionality of Solomon's Temple to civil architecture. It will come as no surprise that calibrating measurements of Solomon's Temple was a major preoccupation of several of the earliest members of Leibniz's Academy, one of whom was August Hermann Francke.[4]

Underemphasized in histories of this new, conciliatory Academy is that Leibniz himself conceived of it as a mission organization that would send Protestant missionaries to China to counterbalance the influence of Jesuit missionaries there.[5] He made no secret

[3] Michael Duchesneau, "Leibniz's Model for Analyzing Organic Phenomena," in *Perspectives on Science* 11:4 (2004): 379. Duchesneau uses Leibniz's conciliatory vision for his academy to explain his "combinatorial approach" to the study of medicine and disease; this involved replacing the theory of temperaments at the heart of Galenic medicine with "a more complex one, based on the indications and counter-indications of various temperaments—as re-conceptualized in the form of a combinatorial representation of chemical processes analyzed into the smallest and ultimate subdivisions." Leibniz articulated several plans for his Academy between 1667 and 1676.

[4] Francke was formally accepted into the Academy on October 12, 1701. His entry in the first "Table of Academy Members" reads: "the high worthy, hugely noted and highly learned Herr Magister August Hermann Francke, Greek and Oriental Language Professor Ordinarius at King Frederick's University in Halle and pastor in Glaucha, because of his special talents, understanding and learnedness—especially in the languages of the far East (*Morgenland*), as well as his efforts to plant the message of the Evangelists. Also in these places his sermons have been sent." In BBAW/A I-III-47 Table of Academy Members. Francke was designated an *abwesendes Mitglied*, or a member in absentia. See Werner Hartkopfs, *Die Berliner Akademie der Wissenschaften: Ihre Mitglieder und Preisträger, 1700-1990* (Berlin: Akademie Verlag, 1992): 110.

[5] For example, Leibniz's mission plans are only briefly treated in an often cited Academy Press publication about its earliest history: Hans-Stephan Brather ed., *Leibniz und seine Akademie. Ausgewählte Quellen zur*

of his interest in introducing new methods of reconciliation abroad and was especially supportive of his co-founder Daniel Ernst Jablonski's detailed plans to unify German, Swiss and English Protestants in pursuit of this goal.[6] The figure of Jablonski is also a critical and mostly overlooked part of this story; he corresponded extensively with both Francke and Leibniz, serving as a kind of go-between. At the time he participated in the founding of the Berlin Academy, Jablonski was the Prussian Elector's Reformed court chaplain and was a bishop of the Bohemian Brethren. He was also Johann Amos Comenius's grandson. In 1725, he took over the inspection of the new Pietist "Military-Orphanage" that Francke was helping get off the ground in Potsdam.[7] Before becoming involved in all of this, Jablonski had spent two years at Oxford in the 1680s, where he became drawn to the Church of England. Back in Germany, he tried to unite the Lutheran and Reformed churches around the Anglican liturgy, translated the English Book of Common Prayer and corresponded with several Anglican clergymen.

In 1697, Leibniz published his *Novissima Sinica* (*The Newest from China*) and sent copies of it to his own contacts in England, namely John Wallis, Gilbert Burnet and Thomas Burnet.[8] Relying on their updates, he followed the plans of two newly

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Geschichte der Berliner Sozietät der Wissenschaften, 1697-1716 (Berlin: Akademie Verlag, 1993): 152-168.

[6] Scholars have mostly emphasized how and why D. E. Jablonski's efforts failed rather than exploring the links between his interest in church union and the conciliatory eclecticism of G.W. Leibniz or J.C. Sturm. For example, N. Sykes, *Daniel Ernst Jablonski and the Church of England* (London, 1950); B. Levis, "The Failure of the Anglican-Prussian Ecumenical Effort of 1710-1714," *Church History* 47 (1978): 381-99. For an introduction to Jablonski and his relationship with the SPCK see Daniel L. Brunner, *Halle Pietists in England: Anthony William Böhm and the Society for Promoting Christian Knowledge* (Göttingen: Vandenhoeck & Ruprecht, 1993): 47-48.

[7] Stab/F 17,1/4: 10-11 [1725] Johann Porst to A.H. Francke re: Jablonski and Potsdam Waisenhaus; see Carola Wolf and Steffi Wunderlich, *Ziel, Inhalte, Organisationsformen und Methoden der Bildung und Erziehung im "Großen Potsdamer Militärwaisenhaus" von 1724 - 1870* (Potsdam, 1985); Hermann Dalton, *Daniel Ernst Jablonski, eine preußische Hofpredigergestalt in Berlin vor zweihundert Jahren* (Berlin: Warneck, 1903).

[8] The *Novissima Sinica* contained letters and updates from Jesuit missionaries about the Chinese "Tolerance Edict" (1692), the Russian-Chinese Peace of Nerčinsk (1689) and the Chinese Emperor's

established voluntary societies in England who shared with him and Jablonski the goal of sending Protestant missionaries to China: *the Society for the Promotion of Christian Knowledge* (SPCK), founded in 1698, and the *Society for the Propagation of the Gospel in Foreign Parts*, founded in 1701. Leibniz, Jablonski and Francke each corresponded with members of these societies and they imagined themselves as working together towards similar ends. This added dimension of the Berlin Academy's activities helps explain a great deal about its earliest membership and orientation. Leibniz and Jablonski saw it as a conciliatory body concerned with assembling various bits of knowledge to affect universally applicable changes that were inseparable from the form of spirituality both he and Francke championed. Spiritual regeneration and improvement of the entire world would result if *realia* could be reconciled, via the heart, with their universal—geometrical, proportional, perfectible—forms.

This chapter takes on two specific tasks that are extremely important for understanding the Pietist Orphanage's status as a material manifestation of divine will (both rational and benevolent) orientated around the implementation of Tschirnhaus's method and the furthering of the Berlin Academy's goals. First, it offers a reinterpretation of Leibniz and Francke's interest in each other, querying specifically what each considered the value and meaning of spiritual practice for their respective, but closely related, causes. The correspondence between Leibniz and Francke has certainly not gone unnoticed by contemporary scholars, but their relationship is generally

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interest in Astronomy. See Brather, "Projekte der ersten Jahre," *Leibniz und seine Akademie*, 159-160 n.198 and Franz Rudolf Merkel, *G.W. von Leibniz and die China-Mission* (Leipzig, 1920): 190-201. Wallis shared with Leibniz an interest in geometrical mechanics; Gilbert Burnet (1643-1715) was a theologian, bishop and member of the Royal Society; Thomas Burnet (1635-1715) wrote the *Telluris Theoria Sacra, or Sacred Theory of the Earth* (1692).

portrayed as fleeting and forged out of necessity, not choice.[9] But when one considers Leibniz and Spener's early contact and engagement with the ideals of pansophy, Leibniz's own "thoughts" about how to reform schools, Francke's interest in the contents of Leibniz's *Theodicée,* and how both men understood the meaning of philanthropy and *philotheia*, some new ways of thinking about the meaning of Pietism emerge. Both Francke and Leibniz used two main metaphors, light and love, to express a vision of reconciliation each one of them recognized in the other.

Second, this chapter also reassesses the relationship between Francke's organization and Leibniz's Academy of Science. Not only did Francke serve as one the very first members of Leibniz's Academy, he also personally corresponded with at least 35 of its original members (see Appendix 4)—a few of whom I will introduce here.[10] He and Daniel Ernst Jablonski exchanged literally hundreds of letters and much of Jablonski's Academy-related correspondence (over 500 letters he composed and 150

[9] Several foundational studies of Pietism and Leibniz's mission plans discuss the correspondence briefly in these terms and contain some of the first published copies of these letters. See: Kramer, *August Hermann Francke* (1880); Merkel, *G.W. von Leibniz und die China-Mission* (1920); Edward Winter, *Halle als Ausgangspunkt der deutschen Russlandkunde im 18.Jahrhundert* (Berlin: Deutsche Akadmie der Wissenschaft, 1953). Some letters have been republished in *Gottfried Wilhelm Leibniz*, *Sämtliche Schriften und Briefe.* First Series: *Allgemeiner politischer und historischer Briefwechsel*. Vol. 14: May – December, 1697 (Berlin, 1993). Gerda Utermöhlen offers a highly necessary (albeit brief) synthesis of this scholarship but also reaffirms many of its assumptions; see "Die Russlandthematik im Briefwechsel zwischen August Hermann Francke und Gottfried Wilhelm Leibniz" in Johannes Wallmann und Udo Sträter eds. *Hallesche Forschung 1: Halle und Osteuropa zur europäische Ausstrahlung des hallischen Pietismus* (Tübingen: Max Niemyer Verlag, 1998). Her article contains the only published copies of three letters the pair exchanged in 1714. Carl Hinrichs and Erich Beyreuther discuss Francke and Leibniz's relationship in broader terms that have informed my discussion below. See Beyreuther's *August Hermann Francke und die Anfänge der ökumenischen Bewegung* (Hamburg: Herbert Reich Evangelischer Verlag 1957).

[10] Some of the studies cited above have noted Francke's membership in the Berlin Academy of Science but downplay its significance. Hinrichs briefly notes the similarities between Francke's "universal goals" and Leibniz's goals but he sees their mutual interest in Russia and Protestant mission as *unabhängig voneinander* or not closely intertwined with one other; see Hinrichs, 41. This chapter challenges Hinrichs' assessment, which has continued to dominate the way in which Francke and Leibniz's relationship is understood.

addressed to him) at one time resided in the archive of the *Franckesche Stiftungen*.[11] In light of this evidence, I argue that Francke's orphanage was serving as the institutional arm of Leibniz's Academy—as a kind of educational outpost. From the very beginning it was a living expression of Leibniz's "plans" for the reform of education and the development of missionary training institutes modeled after Jesuit colleges. This in no way detracts from my case in the previous chapters for Tschirnhaus's and the Sturms' influence on Francke; on the contrary, all of these men also corresponded individually with Leibniz, articulated conciliatory positions and should be seen as close allies of his. To be clear, I am arguing that Francke's *Schulstadt* was also a manifestation of Leibniz's "thoughts;" both figures embraced Tschirnhaus's "method" and attached similar meanings to the terms Pietism and philanthropy. I acknowledge that this upsets longstanding, historiographical distinctions between Pietism and Leibniz/Wolffianism, but this is precisely what the sources suggest must be done.[12]

Pansophy and the Children of Light

As with Tschirnhaus and Francke's introduction to each other, Philipp Jakob Spener is an important part of the Leibniz-Francke story. We have evidence of a fairly sustained correspondence between Spener and Leibniz dating back to the 1670s. Several of their letters indicate that the two were exchanging information about a series of

[11]The majority of these materials are now in the *Staatsbibliothek (Preußischer Kulturbesitz*) *Francke Nachlass* [Berlin].

[12] I am not saying that Leibniz was a Pietist, but I am historicizing his and Francke's use of the term in their correspondence. Both figures readily acknowledged it was "only a name"; Leibniz lamented all of the "dissonance" the term had caused in Germany in his *Theodicée,* which he first published in France in 1710. I rely on the following translation from 1760: *Essais de Theodicée, oder Betrachtung der Gütigkeit Gottes, der Freyheit des Menschen u. des Ursprungs des Bösen ..welcher vorgefügt ein Discours von der Übereinstimmung des Glaubens mit der Vernunft sammt angehängten Anmerkungen über Mr. Hobbes alles in französischer Sprache geschrieben von Leibnitz, anitzo aber ... in die Deutsche Sprache gebracht* (Amsterdam: Boudenstein, 1760): 22.

controversies involving Jean de Labadie (1610-1674), the Jansenist theologian Antoine Arnauld (1612-1694) and Hugo Grotius (1583-1645); in one of these, Spener asked Leibniz where Labadie stood in relation to Descartes.[13] After Leibniz left for Paris in 1672, Spener told another correspondent that Leibniz had written him to say he had arrived and that he would stay as long as he needed to ensure the success of his efforts; in the same passage Spener mentioned that Leibniz was undertaking a study of both mathematics and mechanics.[14] To another correspondent, Spener also reported having shown Comenius's collection of millenarian prophecies, *Lux en tenebris* (*Light in Darkness*), to Leibniz.[15] Recent scholarship has suggested that both Spener and Leibniz had been influenced by Jan Amos Komeský (1592-1670), or Comenius, whose vision of a pansophic movement of spiritual regeneration—included the founding of a *Schola ludus* (school of light)—has also been closely linked with the utopian visions of Tommoso Campanella and Johann Valentin Andreae (1586-1654).[16]

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[13] Johannes Wallmann, Udo Sträter und Markus Matthias eds., *Philipp Jakob Spener*, *Briefe aus der Frankfurter Zeit 1666-1686* Vol. One: 1666-74 (Tübingen: J.C.B Mohr, 1992). The volume contains at least six letters from Spener to Leibniz about these and other figures. Labadie was a Jesuit who became a Calvinist and attracted followers (notably Anna Maria von Schurmann) throughout the Netherlands who established separatist utopian communities; according to Wallmann, Spener visited Labadie in Geneva in 1660/61; see idem, 327, n.19. T. J. Saxby, *The Quest for the New Jerusalem. Jean de Labadie and the Labadists*, *1610-1744* (Dordrecht, 1987). Arnauld was involved in several conversations with Blaise Pascal and Pierre Nicole about how to improve mathematics and the human mind around this time; see Jones, 124-27. Tschirnhaus recommended Arnauld's New *Elements of Geometry* in the *Gründliche Anleitung*; Antoine Arnauld, *Nouveaux éléments de géometrie, contenant des moyens de faire voir quelles lignes sont incommensurables* (Paris, 1667).

[14] Wallmann et al. *Spener Briefe aus der Frankfurter Zeit*, Vol. One.

[15] This reported by Maria Rosa Antognazza and Howard Hotson, *Alsted and Leibniz: on God, the Magistrate and the Millennium Wolfenbütteler Arbeiten zur Barockforschung* (Wiesbaden: Harrassowitz Verlag, 1999): 199; they note that Leibniz wrote an epitaph for Comenius shortly after the latter's death in 1671. See also Wallmann et al. *Spener Briefe aus der Frankfurter Zeit*, Vol. One, 437; Josef Brambora, 'Comenius und Leibniz,' *Akten des [I.] Internationalen Leibniz-Kongressees, Hannover, 14-19. November 1966 Studia Leibnitiana*, Supplementa, 5 Vols. (Wiesbaden 1968-71): V, 55-71. Johann Amos Comenius, *Lux en tenebris* (Amsterdam, 1657).

[16] Carl Hinrichs provides a useful discussion of pansophy and Pietism in *Preußentum und Pietismus* to which I am deeply indebted. However, he is less willing than I am to see a pansophic worldview as more than an idealistic backdrop for Francke's project. More recent studies of Pietism have continued to foster false distinctions between Francke's "plans" and what he "actually" did; even Udo Sträter's recent attempt

The many important parallels between Comenius, Spener and Francke's preoccupation with divine illumination, moral improvement and perfection are worth considering. Comenius was originally from Bohemia but in his early twenties spent a year in Heidelberg (1613-14), where he came into contact with Johann Valentin Andreae and certain Rosicrucian groups that were active in this area of Germany at the time.[17] He became a bishop of the Czech Unity of Brethren, was exiled from Bohemia during the Thirty Years War and landed in Poland, where he became rector of a Gymnasium and began to develop his "Christian philosophy" or pansophy. Jim Bennett and Scott Mandelbrote have emphasized just how influential Comenius's attempt to "harmonize the senses, reason and scripture" was, including his attempts to develop a pansophic language that would serve as a universal carrier of Light."[18] At the invitation of Samuel Hartlib, he went to England and made the acquaintance of Francis Bacon and other members of the "Hartlib circle"—a nebulous group of individuals mostly oriented around Harlib's personality who were concerned with devising "practical" schemes for moral improvement and education. Their schemes almost always linked natural philosophy and

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to situate Halle Pietism "somewhere between utopia and reality," downplays the significance of the similarities between Leibniz and Francke's visions he mentions. See Udo Sträter, "Der hallische Pietismus zwischen Utopie und Weltgestaltung" in Udo Sträter, Hartmut Lehmann, Thomas Müller-Bahlke und Johannes Wallmann eds. *Interdisziplinäre Pietismusforschungen. Beiträge zum Ersten Internationalen Kongress für Pietismusforschung* 2001. 2 Vols. (Tübingen, 2005): 19-36. There is an extensive literature around both Campanella and Andreae; for an introduction see John M. Headley, *Tommoso Campanella and the Transformation of the World* (Princeton: Princeton University Press, 1997) and Donald R. Dickson *The tessera of Antilia: utopian brotherhoods and secret societies in the early seventeenth century* (Leiden: Brill, 1998).

[17] While the origins and meaning of Rosicrucianism have been subject to a great deal of fanciful speculation over the years, historians mostly concede that it was a movement founded between 1606 and 1616 by German Protestants, who published three widely circulated texts: *Fama Fraternitatis Rosae Crucis, Confessio Fraternitatis* and the *Chymical Wedding of Christian Rosenkreutz*. Johann Valetin Andreae would later claim authorship of the *Fama Fraternitatis*. See the (now classic) Francis Yates, *The Rosicrucian Enlightenment* (London & Boston: Routledge & Kegan Paul, 1972).

[18] Jim Bennett and Scott Mandelbrote, *The Garden, the Ark, the Tower, the Temple. Biblical Metaphors of Knowledge in Early Modern Europe* (Oxford: Museum of the History of Science, 1998): 107-108.

the mechanical sciences with a configuration of the divine that affirmed the possibility of human perfection.

Comenius made pansophy the centerpiece of his *School of Light* and several of his schemes for the reformation of education that Hartlib and countless others embraced in his wake. His plans would play an especially important role in the milieu in which Francke himself was educated. Perhaps the most popular expression of his Comenius's vision for the reform of education appeared in his *Janua linguarum reserata* or *Gate of Language Unlocked* (1631).[19] In the introduction of this text, he admitted that he had been deeply influenced by a similarly titled Latin-teaching guide circulated by the Jesuit College in Salamanca. Comenius eventually wrote the *Orbis sensualium Pictus* in the 1650s as an introduction to the *Janua linguarum reserata*. Erwin Schadel reports that he was not only influenced by the lesson plans of Jesuit colleges, but by Descartes, whom he met in person in Endegeest in 1642. By the time Francke began attending school in Gotha, where his father was a political advisor to Duke Ernst the Pious, it was in his Gymnasium that the Duke and his advisor Andreas Reyher first introduced a new *Schulmethode* (*Kurzer Unterricht von Natürlichen Dingen)* that was derived from Comenius's philosophy.[20] Francke himself noted in his *Organization and Teaching Art of the Orphanage Schools* (1702) that that he was using a small *Büchlein* here that had been produced for Duke Ernst of Saxony in Gotha; the text, he said, summarized the most

[19] Johann Amos Comenius, *Janua linguarum reserata: The Gate of Language Unlocked* (Lissa, 1631). See Erwin Schadel, *Sehendes Herz (cor oculatum)-zu einem Emblem des späten Comenius. Prämodernes Seinsverständnis als Impuls für integral konzipierte Postmoderne* (Frankfurt.a.M: Peter Lang, 2003): 23-24.
[20] Before becoming Rector of the Gotha Gymnasium in 1640, Reyher directed a Gymnasium for thirty years in Schleusing, where he corresponded with another pedagogue, Sigismund Evenius. Albrecht-Birkner reports that the contents of their letters revolve extensively around the pedagogical ideas of Comenius. See Veronika Albrecht-Birkner, *Reformation des Lebens. Die reformen Herzog Ernst des Frommen von Sachsen-Gotha und ihre Auswirkungen auf Frömmigkeit, Schule und Alltag im ländlichen Raum (1640-1675)* (Leipzig: Evangelische Verlagsanstalt, 2002): 439, n.45

important principles from the useful sciences for the children's benefit.[21] Duke Ernst's method was also influenced by Wolfgang Ratke (1571-1635), whose pedagogical imperatives have been directly linked to both Francis Bacon and Comenius.[22]

Francke acquired several of Comenius's texts for his *Anstalt*, including some original manuscripts, and his press reprinted at least two of these texts, *De Rerum Humanarum Emendatione Consultatio Catholica* and *Historia Fratrum Bohemorum*, in 1702.[23] The conciliatory aims of the Berlin Academy that Jablonski and Leibniz founded and Francke participated in as a member can be read as an expression of Comenius's irenic vision. Just as Comenius endeavored to link together observation (*Anschauung*) with application (*Anwendung*), so too did Leibniz and Jablonski's Academy stress the importance of linking together immaterial ideas with real objects (*realia*).[24]

Comenius's writings are also replete with visual metaphors. Comenius believed that God had spread pieces of his light throughout the world that needed to be collected and reassembled in a single point, "not through an encyclopedic systemization," as

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[21] August Hermann Francke, *Ordnung und Lehrart... Waysenhaus gehörigen Schulen*... (Halle, 1702): "Es ist das Fürnehmen gewesen des hoch seel. Herzog Ernsten zu Sachsen Gotha, welcher nicht allein für diejenigen Knaben welche nicht studiren sondern zu Handwerckern, Künstlern und Kauffleuten gethan werden sollen, eine besonder Teutsche Schule geordnet, sondern auch zu solchem Zweck ein besonder Büchlein in teutscher Sprache, darinnen die Principia der vornehmsten und nützlichsten Wissenschaften kurtz verfasset sind, heraus geben lassen, welches Büchlein denn auch bishero bey den Waysenkindern dazu gebrauchte worden."

[22] For Ratke's pedagogy and connections to Comenius and Gotha see Gerhard Michael, *Die Welt als Schule. Ratke, Comenius und die didaktische Bewegung* (Berlin, 1978); Detlef Ignasiak, *Magister Andreas Reyher (1601-1673). Handschriften und Drucke*. Bestandsverzeichnis bearbeitet von Annett Gerlach, Cornelia Hopf, Susannee Werner (Forschungs und Landesbibliothek Gotha, 1992).

[23] For many years, several manuscripts in Comenius's hand resided in Francke's archive until they were given to the *Staatsbibliothek* in Prague (in the early years of the GDR). Francke's press printed: Jo. Amos Comenii, *De Rerum Humanarvm Emendatione Consultatio Catholica, Ad Genus Humanvm Ante alios vero Ad Eruditos, Religiosos, Potentes Evropae* (Halae, Typis & impensis Orphanotrophii, 1702) and *Historia Fratrum Bohemorum, Eorum Ordo Et Disciplina Ecclisiatica, Ad Ecclesiae Recte Constituendae Exemplar* (Halae, Typis & impensis Orphanotrophii, 1702). Francke and Jablonski discussed the publication of *De rerum humanorum emandatione* in several letters from 1703; see Erhard Peschke, "Die Reformideen des Comenius und ihr Verhältnis zu A.H.Francke's Plan einer realen Verbesserung in der ganzen Welt" in Heinrich Bornkamm, Friedrich Heyer, Alfred Schindler eds. *Die Pietismus in Gestalten und Wirkungen* (Bielefeld: Luther Verlag, 1975).

[24] Johannes Kühnel, *Comenius und der Anschauungsunterricht* (Leipzig: Klinkhardt, 1911): 47.

Hinrichs observed, but through their holistic unification with each other expressed in a single form of recognition.[25] The source of everything that was wrong in the world, he explained in his *Unum Necessarium*, was that people did not know how to recognize divine essences; they could not see in such as way as to allow them to discern true and necessary knowledge.[26] Their training needed to involve the inculcation of strategies for reading the scriptures *and* for recognizing, seeing the light of the divine in the natural world. Comenius emphasized the need for new practices to help reel in and derive meaning from this light—accumulating its rays around a single focal point. In a tract he called *Oculus fidei* (*Auge des Glaubens* or *Eye of Belief*), he explained that he was engaged in a project that linked the discovery of a "catholic" or universal truth to the sun, which shone for all people, regardless of creed or nation.[27] Spener, as we have seen, frequently used light as a way of talking about divine energy, or the essence of love. Johannes Wallmann has suggested that Comenius's emphasis on cultivating certain forms of recognition, or seeing the divine, in the *Una Necessarium* inspired the method Spener embraced for the "College of Piety" he started in Frankfurt in 1670.[28]

Especially Francke's sermons are full of visual metaphors that emphasize man's need to embrace the divine light as the source of all knowledge and to apply that light first to himself and then to the world. In a move signaling his alliance with Comenius, he gave a sermon in 1716 called *Das Auge des Glaubens* (*the Eye of Belief*), in which he told his listeners to direct their eyes to the "higher principles" of the holy scriptures *and*

[25] Hinrichs, 37.
[26] Johann Amos Comenius, *Unum Necessarium* (Amsterdam, 1668).
[27] He wrote the *Oculi fidei* (1661) as a shorthand version of Raymund von Sabunde's (Professor of theology in Toulouse in the 1420s and 30s) *Liber creaturarum*. See Schadel, 23-24.
[28] See his *Philipp Jakob Spener und die Anfänge des Pietismus* (Tubingen; J.C.B. Mohr, 1986): 283-84.

to the example of Christ.[29] In another sermon titled the *Intelligence of Children of the Light* (*Die Klugheit der Kinder des Lichts*), Francke explained that when one "turned from the darkness to the light," one became a child of that light, but needed to learn how to express the forms of knowledge it had to offer:

> Even if there is only a small ray of the divine light in a person's soul, he will very easily recognize how all the things that belong to an earthly life are small in comparison to the heavenly and spiritual things offered to us through Jesus Christ. Yes, wherever, through the grace of God, there is even only the beginning of a living recognition of the light in someone, soon that person receives so much light in his soul that he does many higher and larger works of Christ…throughout the entire world using everything that is inside of him….[30]

The entire sermon revolved around providing the listener with instructions for "exercising the true intelligence of the light." Francke also offered his followers practical *Instructions for Illumination (Erleuchtung),* in a sermon of the same name.[31] He explained how one became illuminated through a combination of self-knowledge (obtained by directing the eyes to certain (not uncertain) things, rigorous study of the Bible and prayer. This allowed one's abilities to recognize, one's faculties of perception, to become increasingly perfect so that one was better able to see things others could not and affect noticeable, useful, changes in the world.

Like Comenius and Spener, Francke encouraged his followers to use their possession of divine light to introduce radical material change.[32] One used the intellect to

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[29] August Hermann Francke, *Das Auge des Glaubens* (Halle: Waysenhaus, 1716)
[30] August Hermann Francke, *Die Klugheit der Kinder des Lichts* [Luke 16:1-9] (Halle: Waysenhaus, 1714): 23; he preached the sermon for the first time on August 13, 1713. Reprinted in *August Hermann Francke Predigten und Tractätlein,* Vol.. 3 (Halle: Waysenhaus, 1723) and *August Hermann Francke Sonn und Fest-Tags Predigten* (Halle: Waysenhaus, 1724).
[31] August Hermann Francke, "Die Lehre von der Erleuchtung (6.März 1698)" in Erhard Peschke, *August Hermann Francke Predigten* I (Berlin: Walter De Gruyter, 1987): 380-99.
[32] Antognazza and Hotson argue that Spener's aims were not overtly materialist, or that he "believed that the millennium would be an exclusively spiritual phenomenon…without prominent material blessings except insofar as they stem very directly from these spiritual ones." They place Spener's millenarianism in direct contrast to that of the "Baconian universal reformers such as Comenius… Henry More, Thomas Burnet, John Evelyn, Isaac Newton and William Whiston," who "associated the millennium with a reform

direct the material substance of light—which contained its own infinite measure of intelligence—towards charitable acts that would become manifest as symbols of divine love. And this involved consistently seeing the figures (*Gestalten*) of the world for what they really were—appearances or mirages that did not contain within themselves the essence or energy of the divine:

> Our holy master says clearly that people will never be trusted with the truth and Christ will have reservations about entering their souls… until they discover that the error-ridden and the foreign, the silhouettes (*Schatten Werken*) and the most insignificant of things, are not true.[33]

Silhouettes, shadows or the figures produced by an absence of light were empty, strange and caused errors because they were often mistaken for truths. Francke was concerned with helping his followers recognize the essence of light and to avoid errors of perception. "Teach us how to properly understand and practice the true intelligence of the children of light through yourself and your *recognition*," he pleaded in the closing prayer of the *Klugheit* sermon. Francke's prayer corresponds directly to the sentiments expressed in the prayer from Isaac Barrow's *Apollonius* that opened this chapter. Both Barrow and Francke believed in the power of the divine to bestow a gift of recognition that would allow one to grasp his will.[34]

Francke and Spener's use of visual metaphors is also a mark of their engagement with the "culture of perspective" that surrounded them. Leibniz too was preoccupied with perspective, with "mutations of appearances" (or anamorphosis), optical tricks,

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of philosophy, science, education, agriculture, medicine, law and politics." My reading challenges this distinction. I see Spener as a "materialist millenarian," profoundly influenced by Baconian empiricism. The authors are in some ways mimicking Charles Webster's stance in the *Great Instauration*, which introduces a false distinction between Pietist and Baconian reformers. See Antognazza and Hotson, 207; Charles Webster, *The Great Instauration: Science, Medicine and Reform, 1626 – 1660* (New York: Holmes & Meier, 1975).

[33] August Hermann Francke, *Die Klugheit der Kinder des Lichts* (Halle: Waysenhaus, 1714): 29.

[34] Isaac Barrow, *Appolonius*, quoted in William Whiston, *Elements of Euclid* [by Andreas Tacquet] Fourth Edition (London, 1719).

machines, illusions and strategies for helping people see many things all at once, and see them clearly and distinctly. But this interest, apparent also in his development of the quadrature (which divided a circle into triangles from only a single point), can be read as his unique response to the mandate of pansophy—or what was a multigenerational attempt to discern and reassemble pieces of a divine light around a single point. Leibniz, Francke and Spener's interest in the metaphor of the city—including its use by the earliest proponents of pansophy as an expression of a lived utopian ideal—must also be understood in this context. In a culture of perspective, cities in miniature could be constructed so that their material components provided a clear and distinct visual impression of the rational principles behind their organization. The city could become a metaphor for reconciliation and the power of a mathematical architecture to produce perfectly proportional structures.

Leibniz frequently talked about the beauty of Tomasso Campanella's *Civitate Solis* (City of the Sun), Johann Valentin Andreae's *Christianopolis*, the *Utopia* of Thomas More and Francis Bacon's *Atlantide* as akin to the kind of *consilia* among men he longed to create.[35] Even before his Paris years, Jones notes, the cityscape figured prominently in Leibniz's thinking. In a portion of 1669 letter to Jacob Thomasius, for example, he plays with the relationship between the city, perception and the body:

> Just so, the same city presents one aspect if you look down upon it from a tower placed in its midst; this is as if you intuit the essence itself. The city appears otherwise if you approach it from without, which is as if you perceive the qualities of the body. And just

[35] "Solche Glückseeligkeit Menschliches Geschlechtes wäre möglich wenn eine allgemeine conspiration und Verständnüss nicht inter chimaeras zu rechnen, und zur Utopia Mori, und Civitate Solis Campanellae und Atlantide Baconi zu setzen und gemeiniglich der allergrössten Herrn Consilia von allgemeineter wohlfart zu weit entfernet werden." G.W. Leibniz, "Grundriss eines Bedenkens von Aufrichtung einer Societät," in Gottfried Wilhelm Leibniz, *Sämtliche Schriften und Briefe.* Fourth Series: *Politische Schriften* Volume One (Berlin, 1983): 536.

> as the external aspect of a city varies as you approach it differently, …the qualities of the body vary with the variety of the sense organs.[36]

The tower in this instance offers a "superior perspective" or "privileged epistemic access to essence," in Jones' words, which certain relationships are understood in such a way that one entering a city on foot and viewing it from a horizontal perspective could simply not appreciate.[37] To counteract the tendency of human beings to confine themselves to only one point of view, which only inhibited their understanding of universal harmony, new kinds of training institutes needed to be devised to help people climb up to the top of the tower—to teach them how to appreciate and reproduce a variety of perspectives. This involved extensive training in the technologies of representation: using mirrors, new optical machines and lenses and creating ichnographies.[38]

The metaphor of the city, or specifically the kind of city detailed by Andreae, was important to both Francke and Spener as well. They discussed Andreae's *Christianopolis* in their correspondence—specifically their interest in disseminating a new version of it.[39] Martin Brecht, who has become the most outspoken advocate of defining Pietism broadly, has emphasized the numerous points of convergence resonant in both Andreae and Spener's plans.[40] And Wallmann has confirmed that Andreae's influence on Spener is especially apparent in his *Pia Desideria.* Francke mentions Andreae explicitly in his *Grösser Aufsatz*, a detailed summary of his vision for his *Schulstadt*. He wrote that

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[36] Quoted in Jones, 211-212.
[37] Ibid.
[38] Ibid., 208.
[39] Spener wrote that he often thought of offering a new version of Andreae's *Christianopolis*. In a letter from Leipzig (November 12, 1689), Francke told Spener he had just completed the preface to a new Latin-German version of *Christianopolis* being printed by a local press. Noted in Udo Sträter, "Der hallische Pietismus zwischen Utopie und Weltgestaltung" (Halle, Tübingen: Max Niemyer Verlag, 2005): 23, n. 18. See also Johannes Wallmann, *Philipp Jakob Spener und die Anfänge des Pietismus* (Tübingen, 1986).
[40] Brecht has placed selected writings from Spener, Andreae, Johann Albrecht Bengel and Philipp Mattias Hahn together in a single volume to demonstrate the enormous degrees of similarity between them. See Martin Brecht, *Ausgewählte Aufsätze* Vol. 2*: Pietismus* (Stuttgart: Calwer Verlag, 1997).

several upstanding individuals had already detailed the ruined condition of all three estates, which was living proof of God's frustration with the current state of society, and he specifically pointed to the concerns and regenerative schemes of Spener and Andreae to confirm the legitimacy of his own efforts.[41]

The cityscape's capacity to "bring things into perspective" also served Francke well as an all-purpose metaphor. He repeatedly pointed to the capacity of his *Anstalt* or *Schulstadt* to serve as a "Universal Seminar" that would "bring into order" a myriad of relationships around a single point. "My purpose," he wrote in a letter to a Pastor Ring from Grünebartau (October 29, 1712), "is to develop a universal institution, useful for bringing into a good and holy order everything that is important for the Christianity of all orders of society—that all in someway relates to the healing power of the soul."[42] His orphanage or *Seminar Universali*, he insisted, should be understood as an "orderly medium" for communicating God's intentions for the organization of society—just as God's plan for the Israelites could "be seen," in all of its variety, in the single Temple of Jerusalem or the *Stiftshütte* of Moses; these physical structures, Francke wrote, taught their viewers how to love and to perform good works.[43] Like the "prophet schools" started by the prophet Samuel "when the people of Israel stood in a state of great decay," Francke explained that he was endeavoring to create a useful *Seminarum rei publicae*

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[41] *August Hermann Franckes Schrift über eine Reform des Erziehungs- und Bildungswesens als Ausgangspunkt einer geistlichen und sozialen Neuordnung der Evangelischen Kirche des 18.Jahrhunderts.* Otto Podczeck ed. *Der Grosse Aufsatz* (Berlin: Akademie Verlag, 1962): 72. Francke also mentioned Veit Ludwig von Seckendorff's *Christen Staat* (Leipzig: Gleitsch, 1685). He continually added to his *Grosser Aufsatz* over the years but never published it; I am quoting from the earliest version, from 1704.

[42] *August Hermann Francke's Project zu einem Seminario Universali oder Anlegung eines Pflanz-Gartens in welchem man eine reale Verbesserung in allen Ständen in und ausserhalb Deutschlands, ja in Eruopa udn allen ueberigen Theilen der Welt zu gewarten*. Gratulationsschrift zum fünfzigjährigen Lehrer-Jubiläum St. Aug. Eckstein's (Halle: Verlag der Buchhandlung des Waysenhauses, 1881): 21. This is a printed version of a manuscript in Francke's hand with no date; the editor, Dr. Otto Frick argues that Francke wrote it shortly before Easter, 1701; see page 18.

[43] Ibid., 16

vere Christianae oriented around a single purpose—discovering and applying God's *allerbeste Intention* or a divine will always pointing one toward what was best:

> The purpose is to present the simple essence of the thing itself, whose foundation was partially laid by God and can partially be found in the *Gemüth*; and to present it before the eyes of those people who are deemed worthy by God and who can see correctly the cause of common depravity, who long for improvement and are ready to cooperate.[44]

In this universal seminar, or what he also called a Seminar of Nations, "children sent from many different, far away lands" would travel to a single point to be raised and educated. In addition to learning several languages so that they would be "prepared to go to unbelieving lands," they too would become able to instinctively able to reconcile competing points of view. They would become material expressions of light—or mustard seeds, as Francke liked to call them—who would leave the "garden" of his seminar and spread themselves throughout the world. Even university students (*studiosi*) could be introduced to the sciences that have "a real use" and shown how their studies could be "applied to a much larger perfection" or be made to serve a greater good.[45]

Conciliatory Visions & Missions

As we saw in Chapter One, Tschirnhaus too was drawn to the teachings of Philipp Jakob Spener and employed the same kinds of conciliatory and vision-oriented metaphors so central to pansophy. As in the case of Lebniz, his early exposure to the conciliatory thinking of J.C. Sturm, Weigel and Spener compelled him to carve out of a new method or scheme for improvement.[46] Both he and Leibniz recognized in the geometrical

[44] Francke, *Project zu einem Seminario Universali* (1701): 16.
[45] Ibid., 14
[46] Throughout his life he insisted "on a moral, as well as epistemological, need to consider and to weigh carefully the view of others;" and in a manner reminiscent of J.C. Sturm, "called for technical means to recognize what aspects of truth were to be found in these views." In Jones, 246-247. See also Christia Mercer, *Leibniz's Metaphysics: Its Origins and Development* (Cambridge, 2001): 49-59.

methods of Descartes and Spinoza the kind of gesture towards moral improvement that they themselves sought, only both would ultimately contend that neither figure had gotten the recipe for improvement quite right. Tschirnhaus eventually printed the summary of the *Medicina Mentis* he had written for Francke, the *Gründliche Anleitung*, and upon its completion sent a copy of it to Leibniz.[47] That Spener had also tried to ensure a copy of it landed in Leibniz's hands is evidenced by Leibniz's letter to him, dated June 8, 1700 from Berlin (see Appendix 5):

> I am sending back Herr von Tschirnhaus's beautiful thoughts expressed in the *Gründliche Anleitung zu nützlichen Wissenschaften* with my indebted gratitude; I would have wished that they were more extensive and that he, so as with others before him, would be more oriented towards the specifics (ad Specilia). But there are certainly already many good and useful things in here. In the meantime, I have also received a letter from him and see that he has also sent me an Exemplar of the text. [48]

Leibniz then wrote a fairly detailed review of the 32-page text; he later sent a copy of the review to Tschirnhaus as an attachment to one of his letters.

In the review Leibniz also made no secret of his affinity for the *Gründliche Anleitung*, again describing it as "beautiful" and offering his summary of its most useful insights:

> Nowhere is the truth more apparent than in mathematics, which also can be usefully applied to water and land in war and peace, but even more because mathematics transmits before the eyes key proofs of the pure truth and shows the way to correctly recognize this truth… the mathematical method allows itself to be applied in physics, politics and ethics, just like the Neoterici let themselves be served by it. And Plato has already shown in his speeches that it is also needed for the common good, as the translation [of these speeches] into French shows. Two ways to Mathesi are followed: one way uses many instruments, praxis and books but does not bring one closer to the truth. The other way is through the theory of Euclid, Archimedes, Apollonius and Analysin, which seem at first to slow up things because of the emphasis on major findings from the past, but only this way provides the grounds for one to find oneself—something that others search for with many costs. Indeed, because of what the youth want, *one must take the middle path* and teach the beginners only the most important practices from the discipline of

[47]C.I. Gerhardt ed., *Der Briefwechsel von Gottfried Wilhelm Leibniz mit Mathematikern. Tschirnhaus, Huygens, Newton* 2nd Edition (Berlin: 1899) [Reprinted in Hildesheim: Olms, 1987].
[48] From Gottfried Wilhelm Leibniz, *Sämtliche Schriften und Briefen*. First Series: *Allgemeiner, Politscher und Historischer Briefwechsel*, Volume 18: January – August 1700 (Berlin, 2004): 703-704.

> mathematics in order *to awaken a passion and a light within them*, after which they can be shown causes and led through theory.[49]

Here Leibniz managed to boil down the essence of Tschirnhaus's *Medicina Mentis* to a few key sentences. His review made clear that both he and Tschirnhaus saw the nobleman's method as a "middle path" between mathematical and experimental method. It deliberately mentioned Tschirnhaus's repeated references to the Neoterici's willingness to "let themselves be served" by applied mathematics. It also reiterated Tschirnhaus's emphasis on awakening the passions of youth, or "a light within them." In the final portion of the review, Leibniz echoed Tschirnhaus's sentiment that "if one were to teach these things in the schools, learning would become *recht Ludus*," or real fun.[50]

In another letter to Leibniz from this period, Tschirnhaus referred to Leibniz's new Academy as "eine Academia ad Mathesin et Physicam"—one that (like his method) endeavored to link the study of mathesis and physica in new ways. On the eve of the Academy's founding, he wrote, "By the way, do not let go of this moment to stabilize the plans for an Academy of Mathematics and Physics in Berlin; maybe something will come of them that cannot yet be discerned externally."[51] Several of Leibniz's letters from this period indicate his interest in Tschirnhaus's *inventa optica*, which, in one instance, he described as having provided the Academy "with a huge light and help."[52] In a related passage, Tschirnhaus referred Leibniz explicitly to his description in the *Medicina Mentis* of creating curves through rays of light that "requires only a small reflexion." The kind

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[49] Gottfried Wilhelm Leibniz, *Sämtliche Schriften und Briefe*. First Series: *Allgemeiner, Politischer und Historischer Briefwechsel*. Vol. 19: September 1700 – May 1701 (Berlin, 2005). The attachment (*Beilage*) was appended to a letter Leibniz sent to Tschirnhaus from Hannover, dated April 17, 1701. It was printed in a journal called *Monthly Excerpts from New Books*.

[50] Gerhardt ed., *Briefwechsel*, 515. "Solte man die Sachen in Schulen lehren, würde Schola recht Ludus werden." *School as Fun (or Play)* is also the title of one of Comenius's best known treatises, the *Schola Ludus* d. i. *Die Schule als Spiel.* Trans. Wilhelm Bötticher (Langensalza: Beyer, 1907).

[51] Gerhardt ed., *Briefwechsel*, 510. October 16, 1700: Tschirnhaus to Leibniz (from Leipzig).

[52] Ibid., 511. April 17, 1701: Leibniz to Tschirnhaus (from Hannover)

of geometrical optics Tschirnhaus was engaged in merged higher and lower forms of geometry through the material medium of light—the central metaphor of pansophy. His *inventa optica* provided a set of technological strategies for bringing about the reconciliation and improvement both Leibniz and Francke desired.

Leibniz devised countless "schemes" for the improvement of society over the course of his lifetime—so many that they are rarely taken very seriously. But several of his plans correspond so closely to the kind of project Francke developed that one wonders if Francke—through Spener or Tschirnhaus—had read some of them. In a manner reminiscent of Francke's interest in teaching children forms of knowledge that had "real use," Leibniz sketched out new ways to introduce youth to the applied sciences. For example, in a short piece he entitled *Grundriss eines Bedenkens von Auffrichtung einer Societät* (1671), Leibniz described his interest in founding a society that would work together:

> to improve the schools, to exercise the youth in languages and the reality of the sciences… to develop a kind of gentry school (*Ritterschule)* institution that teaches handcrafts with new instruments…that is able to allow pupils to try everything in chymicis and mechanicis—including glass making, the study of perspective, machines, water-arts (fountains etc.), clock-making, turning wood, painting, printing books, dying wool, weaving, ironworking…also to develop funds of curious things, a "Theatrum naturae" and art, rare and anatomy chambers, for the easy learning of all things… to collect relations, experimenta, correspondez letters, to have everything in order and "indicibus", to give poor students room and board and at the same time create an institution that can use their work (where they can be useful)….[53]

Francke's *Pädagogium* could easily be described as a kind of *Ritterschule* that was oriented around the teaching of languages, especially Latin, Greek, Hebrew, Arabic and Russian. His organization became known for its large *Wunderkammer*, or its extensive

[53] Leibniz's "Grundriss eines Bedenkens von Aufrichtung einer Societät" from 1671(?) presents this and many other sketches or ideas regarding what such a society should look like. In Gottfried Wilhelm Leibniz, *Sämtliche Schriften und Briefe*. Fourth Series: *Politische Schriften*. Vol. One (Berlin, 1983): 537.

collection of curious objects that were used in lessons.[54] He gave hundreds of university students room and board in exchange for their labor, as instructors, in his schools. From the very beginning his organization had an archive; he and his staff kept meticulous records and kept most, if not all, of the correspondence they received. In other words, it could be described as a material expression of the sketch of Leibniz's thought portrayed above.

Francke was also able to create opportunities for his pupils to "try everything in chymicis and mechanicis"—in a way that mirrored precisely what Leibniz had expressed in his 1671 sketch. In the following excerpt from a Foundation text called *Description of the Pädagogium*, Francke's associate, Heinrich Neubauer, described a form of learning that was *ludus*:

> It is very good to observe when the scholars have their divertissement. Here sits one for an hour on the turning wheel (lathe bank) and turns under the direction of an agreeable master; there another polishes pieces of glass. Others grind the glass into lenses for telescopes, microscopes and the kinds of lenses called for in sieges…
> Others prepare the tubes of telescopes out of cardboard. Others practice on the air pump and are called upon to show how the air compresses all things and how one could increase and decrease most observations through artistic machines, an understanding of which can lead an educated mind to many new discoveries.
> The divertissement of others involves taking mice, frogs and other animals, including fish in water, and extracting air from them with the airpump to see how they react—also afterwards when the air is put back into them again…
> On the roof is a balcony where those with finished lenses observe stars and also eclipses of the sun and moon.[55]

The pupils of Francke's elite school were able to "exercise themselves" in the "reality of the sciences," in manner strikingly similar to what Leibniz had envisioned thirty years earlier. But Francke also frequently referred to his entire organization—including the *Ritterschule*—as "an Orphanage," thereby exploiting its potential as an easily

[54] See Thomas Müller-Bahlke, "Der Realienunterricht in den Schulen August Hermann Francke" in *Schulen Machen Geschichte: 300 Jahre Erziehung in den Franckeschen Stiftungen zu Halle* (Halle: Verlag der Franckeschen Stiftungen, 1997): 43-65.
[55] AFST/H A129b:21 *Beschreibung des Paedagogii*.

recognizable cultural symbol that would allow him to directly link his project to a philanthropic ideal. Leibniz had already played with the term Orphanage in a similar manner. After describing a "sort of *Ritterschule* institution" in his "Sketch of a Thought' he reworked a portion of his scheme, stating that what someone should create was "an institution that takes the seeds out books and turns them into a profitable local commune…". He wanted this commune:

> To take over the education and administration of gifted pupils who have achieved some recognition so that they are not raised poorly and debauched by friends and tutors.
> …
> Yes, this would be a kind of *unrestricted Orphanage* [my emphasis] where all poor orphans and foundlings could be fed, put to work and either raised to study or to participate in mechanics or commerce.[56]

This is precisely what Francke's commune or Orphanage offered those it housed and educated. "Gifted" children, including foundlings, were trained to go on to the University; those that Francke's staff deemed unsuitable for advanced studies were taught the rudiments of the mechanical sciences and entered trades. It is little wonder, then, that Leibniz was so receptive to Francke's *Historische Nachricht* when it was first brought to him in 1697. For him Francke's plans marked the material implementation of a carefully calculated, rational thought—in this case Leibniz's own.

Francke and Leibniz exchanged at least eight letters with each other between 1697 and 1699. In the earliest stages of his project, Francke sent Heinrich Neubauer to the Netherlands on a kind of scouting trip with a set of very specific questions about the structure of relief organizations there that he wanted answered.[57] On his way to Holland,

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[56] Leibniz, "Grundriss eines Bedenkens" (1671) in Gottfried Wilhelm Leibniz, *Sämtliche Schriften und Briefe.* Fourth Series: *Politische Schriften,* Vol. One (Berlin, 1983): Nr. 43, 539.
[57] Georg Heinrich Neubauer, *Was bey Erbauung unseres Waysen-Hauses zu wissen nöthig sey: der Fragenkatalog Georg Heinrich Neubauers für die Hollandreise 1697. Kleine Texte der Franckeschen Stiftungen Nr. 9* (Halle: Verlag der Frankeschen Stiftungen, 2003); Stab/F 28/1: 2 [1697] Ergänzende

Neubauer stopped in Hannover and personally gave Leibniz a copy of the *Historische Nachricht*, one of Francke's many formal expressions of his project's vision.[58] Neubauer also relayed Francke's approval of Leibniz's *Novissima Sinica*, in which Leibniz had presented a detailed plan for a Protestant missionary enterprise to China, via Russia. In voicing his approval, Francke also clearly stated that "through God's grace, the field in Russia had already been opened," and that his project in Halle was strategically necessary for accomplishing the objectives Leibniz had articulated.[59] Leibniz responded in turn with a long letter to Francke in which he made clear that he fully appreciated the powerful points of convergence between their plans. He said that he saw in Francke's project the culmination of several attempts by others, especially Erhard Weigel, to teach useful sciences and expressed his hope that several large cities would adopt the model Francke was introducing in Halle.[60]

In this same letter, Leibniz recommended that Neubauer be sent to Hamburg to meet with Leibniz's correspondent there, Vincent Placcius, so that the two could discuss other issues related to reforming Germany's schools; there, he suggested, a propaganda campaign should be launched promoting the founding of new schools after the "Halle model."[61] He also indicated that he immediately recognized in Francke's plans a set of

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Fragen Georg Heinrich Neubauers zum Studium der Waisenhäuser in Holland; Stab/F 28/1: 3-4 [1697] Aufzeichnungen von Georg Heinrich Neubauer.

[58] Hinrichs reports that Neubauer gave Leibniz a copy of Francke's *Historische Nachricht von Verpflegung der Armen und Erziehung der Jugend in gedachtem Glaucha* in *Preußentum und Pietismus*, 40-41. It was printed as an attachment to Philip Jakob Spener's *Christliche Verpflegung der Armen, als aus Churfürstl.gnädigester Verordnung das Gassen Bettlen in den Churfl. Residenz Städten abgeschaft...* (Berlin, 1697).

[59] Letters reprinted in Leibniz, *Sämtliche Schriften und Briefe*. First Series: *Allgemeiner, Politischer und Historischer Briefwechsel* Vol. 14 (Berlin, 1993): 123. Francke's "begeisterte Zustimmung" is letter n. 203. For a brief summary of these events see Utermöhlen, 110-111.

[60] In Merkel, *Anhang I Briefwechsel* (August 7, 1697): 215-216. See also Utermöhlen, 112.

[61] A letter from Vincent Placcius (1642-1699) dated March 7, 1678 resides in Francke's archive, indicating that possibly Spener had made contact with him earlier. AFST/H A 140: 27.

educational objectives already resident in similar projects underway throughout the continent—projects often expressly modeled after Jesuit colleges, he explained:

> Now in Paris and elsewhere—all over the place—there are training academies that are privately organized by skilled men and pensioners who are called upon to do so by the state and who emulate the example of the Jesuits.[62]

Leibniz situated Francke's project in the pan-European context he knew well, but he also made a point of indicating how Francke's plans were different from those academies "in Paris and elsewhere." Leibniz was especially pleased, he wrote, that Francke would be reaching "young men before the age of thirty" with "the new method" (*Novae Methodi*) because wherever this method was applied, he wrote, "cognitions are turned into expressions that cannot be called into doubt."[63]

In the preface of the *Novissima Sinica*, Leibniz famously explained that both China and Europe could improve themselves if they became open to what they each had to teach one another. He expressed his interest in a *kulturelle Vereinigungswerk*, a project of cultural reconciliation that made Russia, specifically the person of Tsar Peter the Great, the critical bridge, or centre point.[64] Often unacknowledged is that in the *Novissima*, Leibniz also made extensive use of Plato's link between virtue and geometry (in the Meno mainly), where, as Patrick Riley explains, "knowledge of geometry (as something 'amounting' to a faith) is crucial."[65] In the *Novissima*, we have the essence of Leibniz's theory of universal justice or philanthropy, where, following Riley, "all good

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[62] In Merkel, *Anhang I: Briefwechsel* (August 7, 1697): 216. "Nam et Lutetiae Parisiorum et alibi passim Academiae exercitiorum a privates habentur et Van den Enden Belga, homo doctus (sed cuius quod Rohanaei Equitis conspiritioni miscuisset, exitus infelix fuit) pensionarios quos vocant in eadem urbe Regia habebat exemplo et aemulatione Jesuitarum."

[63] Ibid. "Nescio an videris quae juvenis ante 30 annos edidi titulo Novae Methodi docendae discendaeque jurisprudentiae, juvenilia quidem, sed quae nunc quoque viris quibusdam egregiis magis quam mihi ipsi placent. Ibi cogitations quaedam meae sunt expressae quibus ne nuc quidem renuntiavi."

[64] Hinrichs, 41.

[65] Patrick Riley, "Leibniz's Political and Moral Philosophy in the *Novissima Sinica*, 1699-1999" in *Journal of the History of Ideas* 60 (1999): 228.

things—truth, wisdom, Platonic geometry, charity, justice, virtue, popular happiness—are strongly related to one another, if not fully equated."[66] Leibniz insisted that the Chinese people had been better able to "realize" wisdom in their daily lives. They "behave to each other so lovingly… almost in emulation of the teachings of Christ," and are "averse to war," he wrote.[67] In voicing his "approval" of this text to Leibniz, I think Francke was doing much more than simply expressing his mutual interest in a Protestant mission to China. He was conveying his alignment with Leibniz's brand of Christian Platonism. Riley describes Leibniz's Christian Platonism as able to merge a geometrical configuration of eternal virtue or truth with the Apostle Paul's insistence that charity, a material expression of love, is the most important of these virtues.[68] This was a configuration resoundingly similar to Spener and Francke's juxtaposition of reason (or the training of cognition) and praxis.

Several of Francke's activities during this period of time, including his interest in describing his project as a "Seminar of Nations," suggest that he saw himself as Leibniz's ally in the extension of a global vision of conciliation. His remaining correspondence with Leibniz from 1697 to 1699 is about how to strategically maneuver to make contact with the individuals closest to Tsar Peter I.[69] 1697 had been the year of the young Tsar's famous tour of Europe and both Leibniz and Francke's saw the visit as their chance to secure the Tsar's personal support of their mission plans. They attempted to convince Peter I to come to Halle so that he could see Francke's training institutes for himself; by

[66] Ibid., 229.
[67] Ibid., 230.
[68] Ibid., 219
[69] They touch on all the rudiments of whom to talk to and when and how. Upon finding out that the children of Tsar Peter's general Golav had been placed at a school in Berlin while their father was touring, Leibniz specifically asked Francke to recommend to Spener that he look in on them occasionally. Spener was serving as the Prussian court preacher at the time so he would have been in a position to extend them special privileges. Utermöhlen, 112-113.

placing the buildings before his eyes, they expected that he would be moved, literally, to set up similar institutes throughout Russia.[70] Although the Tsar never came, someone who had lived in Russia from 1693 to 1695 and had become close to Peter did arrive in Halle to observe the new method in action and to advise Leibniz and Francke on how to proceed: Heinrich Wilhelm Ludolf (1655-1712) stayed with Francke from the end of 1697 to April of 1698. He corresponded extensively with Leibniz during this time and served as the kind of critical middleman Francke and Leibniz needed to get the Tsar on board with their plans.[71]

In a letter to Johann Fabricius (also a Berlin Academy member) from May of 1698, Francke gave a rundown of the events that had transpired since his first exchange with Leibniz.[72] He told Fabricius how pleased he was that Leibniz was so interested in the Halle *Schulformen* he had constructed and hoped that his institutes could eventually be used to build a "commercium litterarum" with China. He also told Fabricius that the Tsar's emissaries in Europe were now fully aware of his schools and plans and that the Russian nobleman Postnikov had come to visit. Francke saw this as his chance to prove

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[70] Ibid.

[71] Heinrich Wilhelm Ludolf is a pivotal figure in this discussion, deserving of much more attention then I can give him here. He had familial connections to the Danish crown and spent several years (1677 to 1689/90) in London before leaving for Russia on a kind of diplomatic mission (in the service of king Georg of Denmark). The Francke Foundation archive contains a great deal of his correspondence. In one letter to his brother, he explained that he was "undertaking a trip to Moscow until the European relationships were further developed;" see AFSt/H C 144a 41. For a recent attempt to synthesize and extend our understanding of Ludolf's relationship with Francke, see Renate Wilson, "Heinrich Wilhelm Ludolf, August Hermann Francke und der Eingang nach Russland," in Johannes Wallmann und Udo Sträter ed. *Hallesche Forschung 1: Halle und Osteuropa zur europäischen Ausstrahlung des hallischen Pietismus* (Halle: Franckesche Stiftungen Verlag, 1998). By all indications, he became part of Peter I's inner circle. Leibniz corresponded with him and with his uncle, Hiob Ludolf, who resided in Halle from November 1696 to March 1698 and became one of the first members of the Berlin Academy.

[72] Johann Fabricius was a theology professor from Helmstedt, who would join Leibniz's Academy on March 11, 1701. Utermöhlen summarizes the most important points from Francke's letter to Fabricius, 115. It is reprinted in Gottfried Wilhelm Leibniz*, Sämtliche Schriften und Briefe.* First Series: *Allgemeiner, Politischer und Historischer Briefwechsel* Volume 19 (Berlin, 2006): n. 498. Leibniz wrote to Fabricius around the same time saying he had some thoughts to share with Francke; idem, n. 371.

to Tsar Peter's closest associates that he took the teaching of the Russian language very seriously. He discussed with Postnikov the problems still present in the Russian dictionary H. W. Ludolf had written and gave him his *Short Introduction to Christianity* (*Kurze Anleitung zum Christentum*) and Johann Arndt's *Four Books of True Christianity* (*Vier Bücher vom wahren Christentum*). A few months later, Francke would tell Leibniz that he was hopeful that the Russians' interest in the "Halle method" would grow; he said he agreed with Leibniz that the first priority was to support the Russians in their attempts to reform their educational system. Then the ultimate goal of Christianization and a mission to China would logically follow.[73] Leibniz had expressed this same sentiment to Ludolf in January of 1698—the dissemination of "true Christianity" would follow naturally by simply helping the Russians with their attempts to "build up their culture" (their *kulturelle Aufbauarbeiten*). The introduction of a certain kind of education—or method—was to be the first priority.

Elaborating on the components of the Halle method was certainly a big part of Francke's direct correspondence with Tsar Peter about establishing likenesses of his *Schulstadt* throughout Russia. While virtually no examples of the nature of these exchanges remains, we do have a *Gutachtung*, or some formal comments, that Francke sent to Peter the Great about an orphanage founded in Russia in 1719. Here Francke emphasized the importance of introducing the study of geometry in the new institution:

> For a good upbringing it is necessary to make them learn well about Christ's teachings, sin, conversion, how to live a blessed life pleasing to God… how to read, write, a little bit from Geography and History (at least enough so that they can recognize the most important countries and cities from maps and the most important stories about the beginning of the world from the Bible), and finally introduce them to Geometry, the first

[73] In Utermöhlen.

> of all sciences, in which certain boys who are naturally adept can be further trained quite easily. Of these, some boys can be selected to learn other languages deemed useful.[74]

Francke's emphasis on teaching geometry—the "first of all sciences"—in conjunction with geography and language learning is an expression of the conciliatory method's critical coupling. Combining the study of geography, languages and geometry placed mathematical exercise alongside activities that conditioned the senses—i.e., to recognize inscriptions on a map or to derive meaning from the new configuration of symbols and sounds of a foreign tongue. Proficiency in map reading and languages were the most important practical skills a missionary could hope for in order to successfully maneuver about new lands.

It is not a coincidence that this juxtaposition of handling real objects with geometry became the hallmark of the "Halle method" *and* served as the central rallying point for members of the Berlin Academy. Geometry was a form of mathematics that lent itself to the calibration of material objects. It required the *consilia* of higher forms of cognition and experience and, therefore, seemed the perfect tool to use in order to further a *consilia* of Protestants—and eventually all believers. Geometry signified the materiality of divine reason, and it could be used to disseminate divine love. Francke and Leibniz's correspondence provides perhaps the best evidence of how the two men linked the study of geometry with mission and a universal project of cultural reconciliation. In his first letter to Francke, Leibniz made a clear link between Francke's institutes and Jesuit colleges, which also served as training institutes for missionaries; Francke indicated in the same set of exchanges that he saw his schools as critically important for the realization of a Protestant mission. A correspondent that they each held in common,

[74] AFST/H C 491 [1719] Gutachtung Franckes über die Errichtung von Waisenhaus in Russland für Peter I; quoted in Eduard Winter, *Russland als Ausgangspunkt*, appendix.

Conrad Mel, would also formally link the new Berlin Academy with a mission-oriented agenda that required the very kind of training institutes Francke had developed in Halle.

Mel's *Point of Observation (Schauburg)*

Conrad Mel was a preacher from Hersfeld who served most of his life in Königsberg. He became a member of Leibniz's Academy in January of 1701, the second official member after Gottfried Kirch, and, shortly afterward, produced a key text that endeavored to explicitly pair mission with science as equally valid expressions of the Academy's mandate.[75] He called it his *Point of Observation of the Evangelical Legation* (*Schauburg der Evangelischen Gesandtschaft)* (1701) and explained in the introduction that the purpose of the newly founded Brandenburg Society:

> not only includes the practicing of sciences in the service of the free arts, the study of nature, and the description of the earth, but also sacred missions…I plan to offer the Society here a few words of advice about how best to send the barbarous folk in China the light of Christendom and the pure Evangelii…[76]

[75] As the first member of Leibniz and Jablonski's Academy, Gottfried Kirch (1639-1710) provided expert advice on making calendars (for which Leibniz had obtained a license allowing the Academy to produce and sell calendars to fund their projects) and on building an Observatory, also a central activity of early members. His correspondence has been published recently: Klaus-Dieter Herbst unter Mitw. von Eberhard Knobloch eds. *Die Korrespondenz des Astronomen und Kalendermachers Gottfried Kirch* (1639-1710) Three Vols. (Jena: Garamond, 2006).

[76] For many years, authorship of the Latin version of this text was attributed to Francke because it resided in his archive: *Pharus missionis Evangelicae se Consilum de propaganda fide per conversions ethnicorium maxime Sinensium, prodromus fusioris opeis ad potentissimum regem Prussiae Fridericum, in quo veritatis demonstration, causae moventes, conversionis praeparatoria, tentamen legationis evangelicae, subsidia necessaria, obstacula, ut et modus conversionis et conversorum conservation primis fundamentis delineantur et censurae societatis Brandenburgicae scientarium, ut et eruditorum omnium et piorum seriae deliberationi subjiciuntur* (1701); the full title of the German version is: *Die Schauburg der Evangelischen Gesandtschaft oder ohnmassgebliche Vorschläge wegen Fortpflanzung des allerhieligsten Glaubens durch Bekehrung der Heiden sonderlich in China*, worin zu sehen: 1) dass eine allgemeine Bekehrung der Heiden zu hoffen; 2) was vor ursachen uns bewegen, dieselbe zu befördern; 3) wie man Anstalt machen musste, solche ins werck zu richten; 4) wie ein Versuch zu thun durch eine gesandschaft; 5) woher die Holfsmittel und unkosten zu nehmen; 6) was vor Hindernisse möchten vorfallen auch wie dieselben zu heben; 7) wie die Bekehrung anzugreifen; 8) wie endlich die Bekehrten zu erhalten seien: Alles kürzlich entworfen, auch von Ihro Majestät dem Grossmächtigen König in Preussen Friderico genehm gehalten—von der Brandenburgischen Societät der Wissenschaften approbirt und allen frommen Christen und Eyfferern vor Gottes Ehre zu weiterer heiligen überlegung und beförderung vorgestellt von Conrad Mel, Konig. Hofprediger in Preussen (1701). The *Schauburg* was reprinted by Merkel, 225; the *Pharus missionis Evangelicae* appears in Kramer, *August Hermann Francke* (1880): 285-303.

Mel then offered up a detailed plan for preparing an "evangelical mission" that included the intensive teaching of mathematics in Academy-organized, missionary training institutes. In his rationale, he directly attributed the success of Jesuit missions abroad to the order's ability to provide their missionaries with rigorous mathematical training:

> The mathematical sciences deserve to be paid attention to above all else because the kind of progress the Roman Catholics have had through teaching them is well known. It is to be advised that one should look for the best mathematicians from all the Universities, who can present their thorough understanding of these arts so that they can (unlike before) at least challenge the Roman Catholics' superiority.
>
> Above all things, it should be ensured that all ground-rules and teaching clauses should be taught by introducing trustworthy test cases from Physics, mathematics and *Oeconomie* for practice; such figures that can help a common essence grow out of a basic knowledge of the sciences should be presented before the eyes.[77]

The Jesuits' success in using mathematical knowledge to the benefit of their missionary ventures was apparent to all; in his assessment of their activities, Mel mentioned the study of physics and the need to produce common essences out of shapes and figures that could be visibly "presented." Following this section, he emphasized the importance of experiencing the mechanical arts and made some very direct remarks about how, despite their success, Jesuits used their mathematical knowledge improperly:

> The mechanical arts must be experienced so that those being sent abroad can profit from them. Experience has consistently shown what the Jesuits have been able to accomplish through their mathematical arts. Through their knowledge of the arts of observing the stars they were able to put their foot in the middle of the Chinese kingdom; …but in discovering new knowledge of the entire earth, they have furthered a divided Christian Israel among the heathen Caananites. It is not difficult to see how if we also bring art and sensible masters in painting, clock-making and glassworks… our main goals can also be furthered.[78]

Mel's polemic in this passage is clear; while emulating the Jesuits' training programs the proponents of evangelical mission would seize control over and reapply the Jesuits'

[77] Conrad Mel, *Schauburg*, reprinted in Merkel, 231.
[78] Ibid., 238-39.

monopoly over certain forms of mathematical knowledge to the proper ends. Jesuits were perpetuating divisiveness, Mel argued, not reconciliation.

In his plan, Mel also emphasized that the missionary training institutes should provide training in languages and theology in addition to "worldly knowledge":

> The practice of languages is especially recommended, not only the three most popular—Latin, Greek and Hebrew—a knowledge of which we will expect of our candidates, but also those languages useful in the areas where trips will be directed, especially Russian/Moscovite, Chinese, Arabic and others…
> The practice of God's teachings should be taught intensively so that the destined to be theologians have more than written teachings of godly truths to offer… but instead embody these truths themselves…
> The practice in worldly knowledge must be emphasized, especially *Naturkunde* and Ethics (*Sittenlehre*).[79]

In addition to offering several languages in his *Pädagogium*, in 1702 Francke founded his *Collegii orientalis theologici*, whose purpose was to offer rigorous instruction in the "Chaldaeic, Syrian, Arabian, Rabbinic, Talmudic and Ethiopian languages," as well as ancient Greek, Hebrew, Latin, and, whenever it was possible, Armenian, Persian, Chinese, Turkish, New-Greek, Polish, Slavonic and Russian.[80] He also offered several *collegia* in theology and published *Manuductio Ad Lectionem Scripturae Sacrae* (1693), *Einleitung zur Lesung der H.Schrift* (1694) and *Definitio Studii Theologici* (1708) as general guides for students of theology.[81] His institutes were known for their emphasis on the study of ethics and several forms of "worldly knowledge."

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[79] Ibid.
[80] Francke, *Project des Collegii orientalis theologici*, reprinted in Kramer (1880): 282.
[81] Anton Böhm reportedly told Francke that he had published the *Definitio* in England (London, 1708) so that theology students at Oxford would become familiar with it. "Um selbigen unter denen Oxfurtischen Studenten bekand zu machen." AFST/H C 229:68 [July 9, 1708] Anton Wilhelm Böhm to August Hermann Francke; quoted in Brunner, 137. Francke's *Introduction to Reading the Holy Scriptures* or *Einleitung zur Lesung der Heilige Schrift, insonderheit des neuen Testaments* (Halle, 1694) was reprinted in 1698, 1699, 1705, 1710, 1719 and 1729.

Mel insisted that the training institutes should be organized *at the discretion of the Berlin Academy*; the missionary training institutes would rely exclusively on the expert guidance and "protection" of Academy members:

> Preparation of an evangelical mission involves founding an Academy or School where the persons destined to become missionaries can be trained.
> I. The persons who will direct this large work are:
> 1. Our king…
> 2. The Brandenbug Society because the members are sought after in all sciences for their learning and have a basic knowledge of things abroad...
> The teachers of this Academy will be
> 1. Exceptional professors from different locations, faculties and sciences.
> 2. … exceptional Students from Academies and from all kinds of faculties and sciences, who are recommended by the Professors, examined and approved by the Society,… and who have a noticeable fear of God … [82]

In other words, overseeing missionary training institutes oriented around the teaching of the mathematical sciences was to become one of the Academy's main tasks. It is not too great a leap to suggest that Francke's institutes and the ones Mel describes here were actually one and the same. Francke's method, which Leibniz had affirmed was an expression of "the new method," offered the same kind of approach to knowledge-making that those members of the Berlin Academy preferred, a method that merged mathematics and experience by privileging the middling, mathematical sciences (like geometry). Francke, as an early member of Leibniz's Academy, was part of a cohort that had a stake in his own institutions' success—and helped further them. These were institutions entirely oriented around the precisely the "practice and studies" described above.

Members of the Academy situated Francke's institutes, the mathematical sciences and the idea of a Protestant mission in the very same discursive context, including discussions of various technologies and ongoing projects. Leibniz often set the tone of

[82] Ibid., 233-34.

these discussions, noting in his *Bedenken* (1701) that the success of the mission was contingent on education and the society's ability to develop the technological means of reaching distant lands; he specifically mentioned Tsar Peter I's interest in the longitude problem, for example, and the need to devise a solution to impress him.[83] Francke's orphanage press published a solution to the longitude problem in 1723.[84] Mel also heeded the call; while working on his own detailed model of Solomon's Temple, he developed a *Pantometrum Nauticum*, a device for taking all kinds of measurements (including longitude) at sea, which he sent to the society for comment.[85] In 1710, he sent the Academy an illustrated report about a watering device (*Bewässerungsanlage)* for the Temple with some news and a request that involved Halle:

> I am also sending herein an exemplar of my mission wishes… and am hoping to gain the trust of a highworthy member of the English Society for the Propagation of Truth… My current occupation is to finish up my *Preacher Solomon* text and then to bring my weighing machine into better state of perfection. The mathematicians in Rome have gotten me excited about this but through a very costly exchange;
> …
> My oldest son has gone through all the classes of his current Gymnasium, which have laid a foundation in languages, mathematics and philosophy. I would like to send him to

[83] Leibniz, *Bedenken* (1701) in Brather, 166. "Es ist nehmlich bekand dass der Tzar die Schiffarts-sachen ueberauss liebet und der Compass gleichsam vor die Seele der Seefahrt zu achten, selbiger aber von Norden etwas abweichet und zwar an unterschiedenen orthen unterschiedlich. Worinn ein noch nich ausgelösetes Änigma naturae stecket, welches aber wenn es vollende entdecket, ein Succedanum der Logitudinum und eine uberauss grosse hulffe vor die piloten dargeben würde."

[84] Francke published his friend and colleague Christoph Semler's solution to the problem, which I discuss at greater length in chapter four; Christoph Semler, *Supremo Magnae Birtanniae Senaturi Illustrissimo Parlamento Consecrata Humillimeque Submissa Methodus Inveniendae Longitudinis Maritimaee per Acus Verticales Magneticas, Evidentissimis Superstructa Experimentis Terra Marique Factis* (Halae Magdeburgicae: Orphanotropheum, 1723).

[85] Leonard Christoph Sturm offered an assessment (a *Gutachtung*) of Mel's *Pantometer* for the Academy in 1708; see BBAW/A I-V, 5a [1708] *Gutachten von L.Ch. Sturm über das Pantometrum Nauticum des K. Mel*. Christian Wolff offered his comments in the *Acta Eruditorum* in 1709: in *Dr. Conrad Mel: Ein Lebensbild* (1864). Conrad Mel worked many years on his model of Solomon's Temple and published a description of it under the following title: *Salems Tempel; Oder Beschreibung des herrlichen Tempels Salomons, wie auch ...; und dessen Structur, Eintheilung u. Vorhöfe, samt dem heiligen Geräht u. dessen geheimniß-vellen Bedeutung; mit behörigen Abrissen u. Kupffern* ausgefertigt von Konrad Mell (Frankfurt; Leipzig, 1726). He also wrote a treatise on Solomon as a Preacher, *Der Prediger Salomo Oder Die Eitele Welt: durch Predigten erkl. u. zueeign* (Leipzig, 1711).

> Halle if it could be hoped that the Herr Majesty, the King, would make the price lower or that I could receive some kind of a subsidy for him.[86]

Mel did not direct this request to Francke personally, despite their direct correspondence with each other. Instead it came in the middle of his descriptions of the swirl of activities he was engaged in—activities deemed relevant to the collective's main program. After vouching for his son's solid preparation in "languages, mathematics and philosophy," which were central to Francke's schools, he made a pointed request to the Academy members for help in sending his son to Halle.

Mel's correspondence with Francke is even more telling. He wrote to Francke in March of 1706, for example, to explain that he had been called back to Hersfeld to become the inspector of the churches and rector of the Gymnasium there. In Hersfeld, he lamented, the teaching of "true Christianity" had gone into steady decline which had prevented the teaching of "good sciences" (*guter Wissenschaften*) in the churches and schools.[87] Mel told Francke of his plans to "imitate" the "praiseworthy institutes of Halle" and their "famous method" (*beruhmte Methode*). He then asked Francke if he would please send him a student with a "good and solid education in Latin, Greek, Hebrew and Mathematics" to help him begin the process of reforming the curriculum of Hersfeld's Gymnasium.[88] On February 19, 1709, he wrote to congratulate Francke on the good success of the mission to Coromondel, told him of his plans to start a *Seminarium Missionarium* in Hersfeld and to send Francke several texts he had sent other

[86] The "mission wishes" he refers to here are contained in text he was circulating around the same time that he sent this report; it was printed the following year: Conrad Mel, *Missionarius Evangelicus: seu consilia de conversione Ethnicorum, maxime Sinensium* (Hersfeld, 1711). He called his weighing machine a *Pantometrum Carolinum*.
[87] Stab/F 15, 1/5 [March 7, 1706] Conrad Mel to August Hermann Francke
[88] Ibid.

members of Leibniz's Academy, including L.C. Sturm, for comment.[89] "I am sending herein some of my thoughts about a Universal Character; if only such a thing were to be used it could further the propagation of truth," he wrote. "I have set next to this my thoughts about the *inveniende Longibundine Locorium in Mari*, which was born out of my school work in mathematics…"[90] He closed the letter with a promise to send one of the students he was training to teach in Francke's orphanage.

That Mel sent Francke a copy of his "thoughts" about a Universal Character, also a major concern of Leibniz's, is evidenced by the residence of a text in Francke's archive entitled "Conrad Mel's opinion about the project initiated by the royal Prussian Society of Science (because of a sensible author) and their master, the king of Prussia, to develop a universal character…to speak with all people of the world" (see Appendix 6)[91] This "sensible author" was likely Leibniz, whose preoccupation with developing a universal character that was ideographic or could be used to convey a complex set of rational sequences in a single, visible and instantly recognizable symbol, has been well documented.[92] Leibniz shared his interested in developing a universal character with other practitioners of a conciliatory pansophy, including Comenius, whose preoccupation with developing a pansophic language of light stood at the heart of his own mandate of

[89] Ibid. February 19, 1709. By this time Francke's organization had successfully sent two missionaries to the southeast coast of India, known by contemporaries as the Coast of Coromondel.
[90] Ibid.
[91] AFST/W XI/-/3 D *MELL(eng) JUDCIVM und Entdeckte Meynung um sie Erlangte Königliche Preussische Societät der Wissenschaften wegen des von einem sinnreichen Author; ihrer königlichen Maiester von Preussen übergebenen projects vom einem Charactere Universali ob und weit derselbe practicabel durch 50 Characteren und deren Determinitiones ohne erlernung fremder sprachen mit allerley Volckern der Welt zu reden*
[92] Leibniz's *Projekt der characteristica universalis* (1675) is an early expression of his interest in this project; see his *Von Ideen* (1704) as well. There is an extensive secondary literature; for example, Jaap Maat's *Philosophical Languages in the Seventeenth Century: Dalgarno, Wilkins, Leibniz* (Dordrecht: Kluwer Academic Publishers, 2004) or Paulo Rossi, *Logic and the Art of Memory: the Quest for a Universal Language* (Chicago: Chicago University Press, 2000).

universal reform. Responding to Leibniz's call, Mel sent Francke a text specifically written for the members of Leibniz's Academy. By all indications, Mel saw Francke as someone who would be interested in receiving such a text—someone aligned with a conciliatory project embraced by himself and by Leibniz.

Pietism and Philanthropy

After 1699, we only know of three more letters exchanged between Leibniz and Francke, all in 1714. While it difficult to know for certain, they indicate that many more conversations between the two men took place[93], and in some ways provide the perfect means of bringing the discussion back to pansophy—and the meaning of philanthropy. Read with the evidence of the important parallels and partnership between their organizations in mind, these last remaining letters also speak powerfully to the pressing question of what the word Pietism may have meant to both Francke and Leibniz. We literally see them here querying its meaning and defining the boundaries of their alliance with each other. Francke, writing from Halle on January 10, 1714, started this exchange with a bold request for Leibniz's help in salvaging the name Pietist, which, he notes, had been tarnished unjustly:

> Now, your Excellency knows for himself, so that a demonstration will not be required, how 'Pietism' is nothing other than a name for men who are obliged to respond to morally unsound men through the study of the literal word and truth of piety, thereby restoring and increasing credulity…. Of course since this name first came into being in Leipzig and the Leipzig theologians could give their own certain information about it, I have attached one of their notices (*Informat*); there around 1700 a Commission was established to investigate the entire thing…something was published… that attested to the purity of our theological readings but Pietism was still publicly declared a pur lautere

[93] According to Gerda Utermöhlen, Leibniz supposedly spent time in Halle in 1707, 1711 and 1712; she implies that more evidence of meetings and correspondence between the two figures may exist but has not yet been unearthed. In 1700, Leibniz reported to Jablonski that he stopped in Halle "incognito" to pay H.D. Hoffmann a short visit, taking care to remark that he found "his experiments very beautiful." In Utermöhlen, 117-188 n. 34.

> calumnie… Your Excellency will not only be familiar with the holy D. Spener's *Theologische Bedenken* and his edited history of pietism, but also the famous tract by H. von Seckendorf… both of which place the entire affair in a clearer light.[94]

Drawing on Leibniz's affinity for Spener's writings and the philosopher's interest in him and in Halle, his specific request of Leibniz followed:

> Now that your Excellency has been here in person and given me the honor of viewing my institutions for taking care of the poor and raising the youth, and has also spoken with me about them many, many times, and from this has undertaken a fundamental investigation of what people like to call Pietism, I would like to ask you to please, for the love of truth, to provide the king and his ministers with the proper picture of the entire saga…[95]

Francke's request was specifically linked to his discovery that two of his former students were being denied employment in the kingdom of Hungary (Siebenbürgen or Transylvania) because of their reputation as Pietists. Leibniz was in Vienna at the time at the court of Karl VI and, as Utermöhlen and others have pointed out, Francke saw this as a great opportunity to lean on the Emperor to intervene. But the problem, as he and Leibniz both knew, was a much more complex one about the meaning of "what people like to call Pietism."

Leibniz had taken it upon himself, Francke noted, to undertake his own investigation of Pietism. In Leibniz's response—a clear statement of support for Francke indicating that he had, indeed, asked the Austrian Emperor to intervene—he defined Pietism as a set of practices with no underlying dogma:

> … It appears that people see your innocence but are seized by dilatoria effugia… Because the Kaiser is interested in the circumstances in Siebenbürgen, I hope he will be able to right the wrong and that restitution will follow.
>
> Thanks for sending me the Leipzig Response against Pietists. How could one think that they are members of a new sect when they have no dogmata improbata but instead focus on getting to know symbols & words (libris symbolicis) and on practicing Christianity (praxin christianam)?

[94] Ibid. appendix
[95] Ibid.

Leibniz then made a very pointed statement about juxtaposing spiritual training with training in the sciences so that individuals would recognize "outward manifestations of godly works" and participate in the regenerative cycle of conciliatory love. Just as Pietists juxtaposed the study of holy words with pious practices, "furthering the sciences" had to be joined with spiritual training:

> In my estimation, the most important thing is that one strives to make the education of the youth better. And to do this it is to be hoped that the furthering of the sciences will be combined with promoting the fear of God and that this will shed more light on the way to a natural recognition of God; through this the manifest Religion will be furthered, strengthened and transmitted as the outward manifestations of godly works awaken the inner grace of godly love more and more—just like I prove in my Theodicaea with great approval to prominent people in different religious parties….[96]

He closed by mentioning that the Austrian Emperor was "well disposed towards funding a society of science" and was seeking his advice in this regard.

In the letter that marks the end of this exchange, Francke conveyed his feelings about a text Leibniz had just published in France and that he described in the excerpt cited above as a conciliatory piece, directed at "different religious parties"—his *Theodicée*. Francke also echoed Leibniz's sentiments linking the "furthering the fear of God" with "furthering the sciences":

> …I am of the opinion that furthering the fear of God and furthering the sciences are two tasks that want to be joined, indeed must be joined, and my few institutions, in which now 1700 children and scholars and 120 teachers can be found, show how this can be done. God bless your good advice, and that of the Emporer's, for the funding of a society to honor his holy name and to bring about a unified church. As for the badge of truth that you have laid forth in your *Theodicéée*, we rejoiced heartily to receive it.[97]

In aligning himself with Leibniz's goals and the sentiments expressed in the *Theodicée* so overtly, Francke was making a very important statement about the nature of his circle and self-identity. The above cited excerpts clearly show how Francke's vision for his

[96] Ibid. Leibniz also explicitly mentions the term Pietism in his *Theodicée*. See below.
[97] Ibid.

institutions, his understanding of himself as a Pietist ("nothing other than a name") and his appreciation of Leibniz's *Theodicée* as "badge of truth" were not mutually exclusive. They involved a common set of convictions about how to merge operations of the intellect with material expressions of faith.

While this is certainly not the place to undertake a thorough analysis of the *Theodicée*, the most obvious similarity between the metaphysical stance Leibniz takes in this text and Spener's stance (extended by Francke) in his *Theologisches Bedenken* is worth restating here. In a manner reminiscent of Leibniz's earlier emphasis in the *Novissima Sinica* on the Chinese people's ability to "practice" their wisdom—which amounted to an authentic expression of Christian piety—Spener had also emphasized the "proper use of reason, meditation and erudition" for belief, i.e. for conditioning practical expressions of piety. He championed the need to partner interior and exterior manifestations of the divine and saw the formation of charitable institutions as the best material expression of a rational, pious impulse. Leibniz extended this discussion in the *Theodicée*. As material manifestations of a divine or Supreme Reason, he insisted, humans have a natural inclination to obey or follow this reason, which means that every time one physically implemented a fully comprehended rational act, one carried out the will of God. And, in carrying out the will of God, one was acting charitably or for the common good. While some forms of reason were handed down through the mysteries of faith and others required effort or exercise; all reason was the essence of perfection, of love. And when it dictated an act or expression (the construction of an orphanage building, a new universal language) the act itself was the physical expression of divine

love, or philanthropy, showing the way to improvement.[98] The Greek word philanthrōpos, he had explained many years earlier (1693) in the *Codex Iuris Gentium*, is affection regulated by divine wisdom. It is a "universal benevolence," and benevolence is "the habit of loving or of willing the good."[99]

Leibniz's description of the essence of philanthropy as love regulated by divine wisdom very closely resembles Francke's description of that same love and Robert Boyle's expression of a "seraphic love" in two key texts: the *Philanthropia Dei* (1705) and *Philotheia* (*the Love of God*) (1706).[100] "God's love is the weight of the soul," Francke explained in the *Philotheia*, and the degree to which one imbibed this love determined the forms of knowledge the divine master allowed one to see and to express. The spirit of God illuminated man's capacity to grasp or understand things, Francke continued, as the sun illuminated the earth with an unexplainable *Liebeskraft*, or love force. In the *Philanthropie Dei*, Francke also emphasized the power of this force, this love, which gave humans the power of recognition, of *Erkenntnis*; only through this love force did man have the ability to recognize virtue, beauty and the fact that he was a being whose senses were oriented towards the spirit, not the flesh—in short, that the spirit, through the cultivation of the love force and the power of recognition it provided, could help one manage, control the physical (body and world).[101] Everything associated with

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[98] He also writes in the *Theodicée* about the art of doing geometry "empirically' as linked to the preceding juxtaposition of interior and exterior manifestations of piety (1760): ccxiv.

[99] Leibniz, *Codex Iuris Gentium* in Patrick Riley ed. and transl., Leibniz: *Political Writings* (Cambridge: Cambridge University Press, 1988); in Riley, "Novissima," 217.

[100] He published a version of the *Philanthropia Dei* in French as well: *La Philanthropie ou L'Amour de Dieu envers les Hommes: Propose aus jeunes gens, qui êtudient dans les Ecoles dependantes de la Maison des Orfelins, à la fin d'un examen, pour le mediter soigneusement, & exciter à la pieté,* par Auguste Armand Francke, Professeur en Theologie à Halle, ... Traduit de l' Allemand (Halle: Waysenhaus, 1709).

[101] "Betrachte, dass diese Liebe allerley göttliche Kraft, was zum Leben und göttlichen Wandel dienet, dem Menschen schencket durch die Erkentniss des, det ihn berufen hat durch seine herrlichkeit und Tugend; welche Göttliche Kraft ihn von aller weltlichen Lust entfernet, und ihn der göttlichen Natur theilhafftig

one's self, Francke wrote—one's "actual senses (*gegenwärtigen Sinne*), perspectives and goals, undertakings, words and works, external and internal conditions"—were signifiers or expressions of the degree of one's engagement with the divine.[102] And the divine provided the wisdom so essential for directing manifold expressions of love; this is a configuration of philanthropy that closely followed Leibniz's own.

Only a year before Francke's organization translated and published his *Philanthropie Dei* into French, he published a translation of Robert Boyle's *Amor Seraphicus*, or *Seraphic Love*.[103] Here Boyle explicitly linked the love of God with an ability to recognize, to see the beauty of creation clearly. "The love of God comes from gazing upon (*anschauen*) God," he explained; but "in order to observe and to recognize God, one must have illuminated eyes." Although Francke believed, like Leibniz, in the mysteries of faith and the need to ask the divine—as Barrow did in his preface to *Apollonius*—for the ability to perceive, he also accepted Boyle's insistence here that one could also improve one's vision and propensity to love by gazing on "outwardly beautiful figures." Boyle wrote in *Amor Seraphicus* that

> the observation of an outwardly beautiful figure, when one looks at it often…moves us to love this figure—the Greeks had a saying for this: from the gaze comes love. In this way, we will be more inclined to love God when we observe his holy ways correctly and let these flow into us—the more beautiful and wonderful things we see, the more we see and discover.[104]

Boyle advocated a form of visual training that provided the individual with the opportunity to acquire divine love through experience; he explained that one could do

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machete, dass er nun nicht mehr fleischlich, sondern geistlich gesinnet ist..." Francke, *Philanthropie Dei*, 16-17.

[102] Ibid., 19.

[103] *Amor Seraphicus. Die Seraphische Liebe, oder einige Anreissungen zur Liebe gegen Gott. In einem Sende Schreiben an einen Freund geschrieben von Roberto Boyle*.. (Halle: Waysenhaus, 1708). According to Boyle, "Seraphim comes from Saraph, which means hot flame or burning fire."

[104] Ibid. 17-18.

more than hope that the divine would bestow the gift of recognition or wisdom upon oneself. One actually could take some initiative—by directing one's gaze to certain figures, to expressions of God himself—to acquire this wisdom for oneself.[105] This is fundamentally different from the expression of philanthropy Francke described above; yet it is precisely these two approaches to the acquisition and expression of knowledge that Tschirnhaus, Leibniz and Francke were interested in reconciling. In his *Medicina Mentis* Tschirnhaus had advocated training cognition and perception—in mixing mathematical and experimental methods. That Francke's press would print Boyle's "method" for acquiring divine love through observation only a year after he printed his own discussion of the mysterious love force that grants one the gift of recognition suggests his willingness to engage with (and potentially reconcile) both approaches to the problem of knowing and making manifest the divine.

Conclusion

Instead of assuming that Francke and Leibniz were engaged in fundamentally different projects that happened to involve a common interest in Protestant mission, I have endeavored to illustrate some powerful points of convergence between their ways of approaching the world. I see them as deeply engaged in a multigenerational conciliatory project that had finally arrived at pivotal moment. Leibniz and Tschirnhaus claimed to have finally found the right method or "middle way," Francke was applying that method in his schools, and several conciliatory organizations oriented around Protestant mission were forming. Several conciliatory visions were finally materializing in the form of the Berlin Academy and Francke's *Orphanotropheum*. According to Leibniz, Pietists

[105] Ibid. "No one likes a person who is not somehow striving after his improvement."

merged the study of divinely inspired symbols with activities that allowed them to express, physically, what these symbols meant (and how they could be usefully applied in the world). This is precisely what members of the Berlin Academy did as well; they studied divinely inspired, mathematical symbols (or traces of rational essences) and applied them to affect change in the physical world (or to better understand the physical) according to a pre-determined set of calculations. They strove to produce accord, agreement between material phenomena and intuition. Francke, a Pietist, was not ill-disposed to the conciliatory method of the Berlin Academy and Academy members—Mel, Jablonski, L.C. Sturm and Leibniz—were very fond of the way in which Pietists linked praxis with symbols and words in love. Another member of this Academy, Christian Wolff, would become part of this milieu and work to extend the conciliatory mandate that both he and Halle Pietists embraced.

Chapter Four: Measuring Virtue, Character and Faith: the Mathematical Sciences as *Paideia* for Francke and Wolff

> *The eyes of a properly fashioned Christian rest constantly upon the uncertain with a kind of illumination that makes all of his senses blind to this uncertainty. He sees what is omnipresent but even more he sees what lies ahead… His understanding is illuminated by divine rays and he has just as much love in his heart as words of conciliation on his tongue.*
>
> -Joseph Hall
>
> *The mathematical sciences suit young people well because they prepare the character (Gemüth) and free them from doubt so that they can become virtuous enough to understand the knowledge of the world*.
>
> -Christian Wolff quoting Plato[1]

When Christian Wolff became a member of Leibniz's conciliatory Academy in 1711, he was 32 years old and had been serving as a Professor of Mathematics in Halle for four years (since 1707). Many years later—in his autobiography—Wolff would reflect that he had taken up mathematics because at some point it became very clear to him that the mathematical sciences held the secret to resolving competing definitions of truth. The methods mathematicians used to derive universally applicable theorems, he was convinced, needed to be adapted for use in other disciplines, like theology. So, he applied himself to the rigorous study of the mathematical sciences and his special "talents" for them soon emerged. Leibniz would ultimately take a personal interest in the young Wolff and was responsible for securing him (through his friend Friedrich

[1] From Joseph Hall, *Characteres der Menschen: Oder die Entlarvete Welt, an ihrer innerlichen Eigenschafft, Handlung und Betrüglichkeit. Worinnen allen Ständen der Welt die … der Falschheit abgezogen an dero statt aber ihnen die Tugend, Thor und Schwachheiten in ihrer Natürlichen Blösse, als in einem Helleuchtenden Spiegel* (Amsterdam, 1701): 12*;* Christian Wolff, *Wie die Messkunst den menschlichen Verstand ausnehmend bessere* [October.1713] in Wolff's *Gesammlete kleine philosophische Schriften* (Halle, 1737): 424. Reprinted in Chrisian Wolff, *Gesammelte Werke*, Part One: Vol. 21-3.

Hoffmann) the coveted mathematics professorship in Halle.[2] Wolff would spend two extended periods living, writing and teaching in Francke's city: from 1707 until 1723, when he was forcibly expelled in a still legendary episode (see my introduction) and from 1740 until his death in 1754.[3]

The first period may have been the most conflict ridden, but it is also the least understood. It continues to be characterized by statements such as this one: "In Halle Wolff and the Pietists never really got along," which are generally made in passing and are based on little or no evidence.[4] According to Carl Hinrichs' assessment of the relationship between Wolff and "the Pietists," what really distinguished Wolff from Francke (and Thomasius) was that he "tried to determine and to unify the relationship between reason and faith, two areas that were absolutely separate for Thomasius and Francke, in a manner reminiscent of the Scholasticism of the high Middle Ages and the Lutheran Orthodoxy of the seventeenth century."[5] As I have emphasized in previous chapters, Spener and Francke's understanding of the relationship between reason and faith was also an integrative or conciliatory one; they were not two "absolutely separate"

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[2] This is confirmed in a recent biographical sketch of Wolff (the first published in English since 1911) by Wolfgang Drechsler, "Christian Wolff (1679-1754) A Biographical Essay" in *The European Journal of Law and Economics* 4 (1997): 111-128. Leibniz's role in securing Wolff the position is also mentioned by William Clark in "The Death of Metaphysics in Enlightenment Prussia" in William Clark, Jan Golinski and Simon Schaffer eds. *The Sciences in Enlightened Europe* (Chicago: University of Chicago Press: 1999): 425.

[3] Frederick the Great (Friedrich II) invited Wolff back to Halle when he came into power in 1740. Only after he was forced to leave Halle in 1723 did Wolff acquire a reputation (and international following) as a philosopher.

[4] I took this statement from William Clark's "Death of Metaphysics" article in *The Sciences in Enlightenment Europe*, 425. While Clark's assessment of the tension between Wolff and Joachim Lange over the problem of mechanization, dehumanization and fatalism is quite sound, it relies on the same false dichotomy between Wolff and the collective mentality of Halle Pietists (or "Lange and his Pietist pals" as he calls them) that continues to adversely affect our understanding of early eighteenth-century Halle.

[5] Carl Hinrichs, *Preußentum und Pietismus*, 388, 393. Hinrichs calls Wollf's expression of spirituality a "philosophical religion," which, as we will see, is not a far cry from Francke's understanding of "True Christianity." In support of his reading here, Hinrichs cites Max Wundt's *Die deutsche Schulphilosphie im Zeitalter der Aufklärung* (Tübingen, 1945): 124. Wundt places Halle Pietists "in stark opposition to the antecedent age and its school philosophy," which is simply a false assessment; quoted by Clark, 425.

areas for them either. Reason was to be employed in the service of faith and vice versa. Wolff's *Metaphysics*, published in 1719 as *Reasonable Thoughts about God, the World and the Soul of a Person*, must be situated within a broader reassessment of Halle's intellectual culture leading up to its debut—one in which the "Lutheran Jesuits" of Francke's institutes had long been endeavoring (through visual training and other forms of spiritual exercise) to determine or fix the relationship between reason and faith that so greatly preoccupied Wolff.[6] Both Wolff and Francke had been profoundly impacted by the conciliatory mandate of Tschirnhaus, Sturm, Leibniz and so many others and the traces of this influence are apparent in the orientation of Wolff's writings during his first tenure in Halle and the pedagogical orientation of Francke's schools.

This chapter is concerned with the pre-1723 Wolff—the young mathematics professor who arrived in Halle precisely at a moment when some were growing skeptical of eclectic philosophy's capacity to actually foster a reconciliation of multiple views. A resurgence of Pyronnic skepticism was sweeping the city as an increasingly appealing alternative to eclecticism.[7] Because it posed such a formidable challenge to the eclectic

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[6] Christian Wolff, *Der Vernünfftigen Gedancken von Gott, der Welt und der Seele des Menschen, auch allen Dingen überhaupt* [1st ed. 1719] (Frankfurt, 1724, 1740). The phrase "Lutheran Jesuits" was used to describe Francke's community in his own lifetime. For a recent use of the phrase see Ben Marschke, "Lutheran Jesuits" in *Covenant Quarterly* 65:4 (November 2006): 19-38; Hans Ahrbeck mentions Christian Thomasius' insinuation that Francke's *Pädagogium* offered a "Jesuit education" [in Max Fleischmann, *Christian Thomasius* (1931): 431] as does Sebastian Edzardi in *Der Labadismus die Quelle des Pietismi* (1734) when he refers to Francke's community as a "Generalem Jesuitarum." In Hans Ahrbeck, "Über die Erziehungs- und Unterrichtsreform A.H. Franckes und ihre Grundlagen," in *450 Jahre Martin-Luther-Universität Halle-Wittenberg Band II* (Halle: Selbst Verlag der Martin-Luther-Universität, 196?): 77-78. Hinrichs relays evidence of Jesuit interest in Wolffian Metaphysics without acknowledging the clearly discernable (and deliberate) links between the orientation of Pietist and Jesuit training institutes. "In der Tat urteilten die Jesuiten von Wolffs Metaphysik," relays Hinrichs, "es sei dieses Buch zum Verstande der Theologie sehr nützlich, aber nur zu bedauern, dass es in der deutsche Sprache geschrieben worden," 389.

[7] Martin Mulsow has made a case for the increasing importance of Pyrrhonic Skepticism in Halle by the first decade of the eighteenth century perhaps due to a mounting sense that eclecticism had failed as an autonomous method of philosophical inquiry—that it had simply produced yet another philosophical sect. See his "Eclecticism or Skepticism? A Problem of the Early Enlightenment" *Journal of the History of Ideas* 58:3 (July 1997): 465-77. However, in making his case, Mulsow embraces the longstanding historiographical tendency to view all Pietists as skeptical of over-valuing human reason and generally

ethos that had come to characterize Halle's intellectual culture—especially manifest in the scholarship of Christian Thomasius and Johann Franz Buddeus—in some ways the mounting tensions among Wolff's colleagues around his presence and lectures at the University may only begin to become legible with this in mind.[8] Michael Albrecht has suggested that the increasingly conflict-ridden institutional culture Wolff encountered in Halle when he first arrived led him to conduct a critical appraisal of eclecticism and its aims. He began to publicly lament the dangers of eclectic posturing—or inauthentic conciliatory stances tainted by prejudice. And considering that he was experiencing these prejudices first hand, especially from his colleague in the theology faculty Joachim Lange, it makes sense that he would "appear" as an opponent of eclecticism. However, part of what I aim to show here is that despite his caution and criticism, Wolff remained fundamentally committed to authentic expressions of eclecticism, especially conciliatory ways of knowing. He believed that the rigorous practice of mixed mathematics "freed one from the dominance of the Imagination," which he also saw as the singular cause of the errors of perception that led to prejudice and misconception.[9] Practical mathematics or mathematical sciences provided the best expression of a form of reconciliation that earlier practitioners of eclecticism had also heartily embraced. Following in the footsteps

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prone to thinking alike. In a related text, he writes: "Pietisten waren in hohem Masse skeptisch gegenüber allen Errungenschaften blosser Vernunft, und das Projekt einer Geschichte des Nicht-Wissens musste ihnen unmittelbar einleuchten." In Martin Mulsow ed. *Skepsis, Providenz, Polyhistorie: Jakob Friedrich Reimmann (1668-1743)* (Tübingen: Niemeyer, 1998): 26.

[8] Thomasius associated himself with eclecticism in his *Introductio ad philosophiam aulicam* of 1688; see Chapter Two and Kelley, "Eclecticism," 584.

[9] See the introduction to his *Anfangs-Gründe aller mathematischen Wissenschaften (Beginners Guide to the Mathematical Sciences)*[1st ed. 1710] (Halle, 1757). Reprinted in Christian Wolff, *Gesammelte Werke*, Part One: Vol. 12. "There is no other way to recognize the power of a person's understanding than seriously practicing the mathematical sciences, and because one cannot reach an end without steady practice, this is the most certain means of using reason—in discoveries of things still unknown and to advance/spread things already known—and of freeing oneself from the dominance of the Imagination, thereby eliminating errors and prejudices."

of Tschirnhaus, Leibniz and Isaac Barrow, Christian Wolff saw a *mathesis universalis* as the key to a form of reconciliation that was simultaneously real (material) and true (rational).[10]

Wolff often wrote about the necessity of applying mathematical reasoning to the physical sciences in order to acquire *Erkenntnis*—or the form of recognition necessary for grasping meanings that were universally resident in nature. "Neither nature's laws of motion, nor the power of its forces can be recognized (*erkannt*) without the art of Geometry and Arithmetic," he wrote in his *Beginner's Guide to Mechanics or the Art of Movement*; "without mathematics, one can do as little philosophizing as someone who has no feet, or is at the very least lame, can run spryly or walk."[11] Mathematics was for Wolff a rational or philosophical language that had to be applied to the experimental study of natural phenomena in order to make this language legible and relevant. It had to be strategically combined with knowledge acquired through experience—the two forms of acquiring knowledge were entirely dependent upon each other.

As a key excerpt from Francke's *Short and Simple Lessons* (*Kurz und Einfältiger Unterricht*) signals quite clearly, Wolff was joined in this conviction by the very person who appears in the story of Wolff's banishment as his ideological opposite. Despite his (still disputed) role in Wolff's expulsion from Halle, Francke's position concerning the relationship between intuition and experience is markedly similar to Wolff's. Francke

[10] To signal this commitment, he wrote his *Elementa matheseos universae* (1713-15), an exhaustive synthesis of all mathematical forms of knowledge; he first produced the shorter, vernacular version of the *Elementa* (i.e. the *Anfangsgründe)*. *Elementa matheseos universae* reprinted in Christian Wolff, *Gesammelte Werke*, Part Two: Vol. 7.

[11] Christian Wolff, *Anfangs-Gründe der Mechanick oder Bewegungskusnt* in *Anfangsgründe aller Mathematischen Wissenschaften, Anderer Theil, welcher die Artillerie, Fortification, Mechanick, Hydrostatick, Aerometrie und Hydraulick in sich enthält, und zu mehrerem Aufnehmen der Mathematik so wohl auf hohen, als niedrigen Schulen aufgesetzt worden* (Halle, 1757): 748. Reprinted in Christian Wolff, *Gesammelte Werke*, Part One: Vol. 13.

also understood *Erkenntnis* to be the heart of all *Wissenschaft*. It comprised the first pillar of wisdom, he wrote; experience (*Erfahrung*) comprised the other:

> All wisdom (*Klugheit*), whether true or false, rests upon two main pillars, namely knowledge (*Wissenschaft*) or cognition (*Erkenntnis*) *and* experience (*Erfahrung*); either pillar can be misused on its own but together they can both be used correctly. And the true wisdom is nothing other than the eye in people, through which one sees what serves the best and protects oneself from damage.[12]

The key to the proper application of cognition and experience was using them both, simultaneously, through the eye (equivalent to the heart in Comenius). Taking the fundamental importance both Francke and Wolff attached to the two pillars of recognition and experience as my starting point, I argue that the mathematical sciences (and eclecticism more generally) hold the key to bridging the gap that continues to exist between these two figures and their legacies. The two separate historiographical traditions that have been built up around Francke and Wolff have overlooked both men's prolonged engagement with a conciliatory project that sought to refine and extend new, concrete strategies for merging cognition and experience through visual training.

The first section of this chapter is concerned with the two significant ways in which Wolff endeavored to contribute to this project: (1) by formalizing proofs for a projective geometry and (2) by championing the art of measurement. In his *Elementa matheseos universae*, Wolff included a section on the *Elements of Perspective* (*Elementa perspectivae)* derived almost entirely from Andreas Tacquet—whom we met in chapter one.[13] He also included a discussion of perspective in his *Beginner's Guide to all of the*

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[12] August Hermann Francke, *Kurzer und Einfältiger Unterricht: wie die Kinder zur wahren Gottseligkeit und christlichen Klugheit anzuführen sind* (Halle: Waysenhaus, 1702).

[13] Christian Wolff, *Elementa matheseos unviersae* (1713-15) in *Gesammelte Werke* Part Two: Vol. 7; idem. *Mathematisches Lexicon* (Leipzig, 1716). Reprinted in *Gesammelte Werke*, Part One: Vol. 11. According to Kirsti Anderson, Wolff was the first person in Germany to publish a formal proof of a mathematical theory of perspective; see *the Geometry of an Art: the History of the Mathematical Theory of Perspective*

Mathematical Sciences (Anfangs-Gründe aller Mathematischen Wissenschaften), one of the most important German mathematics textbooks of the eighteenth-century—a text used in Francke's schools. His systematic treatment of perspective (or projective geometry) was one of its first formal presentations in a vernacular German; only the Jesuit mathematician Gaspar Schott (in *Cursus Mathematicus*, 1677) and Johann Christoph Sturm (*Mathesis Juveniles*, 1699/1701) had touched on "practical optics" in a German language textbook before him. In addition to formalizing the study of perspective, Wolff also became an advocate of the "art of measurement" (*Meßkunst*) more generally. Of course, the application of precise mathematical proportions to physical bodies, including the air (*Aerometrie*), was an inherently conciliatory practice. When one measured something, one performed a conciliatory gesture involving the senses and the intellect. The gesture itself was supposed to bring about understanding and virtue by fostering congruence—namely the reconciliation or calibration of multiple views.

In the second section of this chapter, I consider specifically how Francke linked visual training to the measurement and training of character, a process he specifically referred to as *Gemüthspflege* or *cultura animi*. Francke also saw the mathematical sciences as an expression of the reconciliation he sought for the individual—who longed for reunification (*Versöhnung*) with the divine—and as a tool for conditioning virtue. Just as Wolff recognized the soul's power of recognition (*Erkenntnis*), Francke also believed that recognition, like faith, could be cultivated through observation and meditation—through gazing upon beautiful or perfect forms (in a way reminiscent of

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from Alberti to Monge [Sources and Studies in the History of Mathematics and Physical Sciences] (New York: Springer, 2007): 620-21.

Boyle's assertion in *Seraphatic Love*) and taking care of the *Gemüth*.[14] Likely through his sustained periods of reflection upon ancient texts, Francke knew that the ancient Greeks and the first Christians had made no distinction between their faith and philosophy; they saw spiritual exercise, or *askesis*, as central to their expression of a Christian way of life—or way of being. In Pierre Hadot's formulation, "exercise" connotes *askesis* or *melete* in the ancient Greek context, designating "inner activities of the thought and the will" and was received into Christianity in the second century by a group of writers commonly referred to as the Apologists. "They believed," Hadot writes, "that that which had been scattered and dispersed throughout Greek philosophy had been synthesized and systematized in Christian philosophy. Each Greek philosopher had possessed only a portion of the *Logos*, whereas the Christians were in possession of the *Logos* itself, incarnated in Jesus Christ." He emphasizes that Christianity, despite its "incomparable originality," still successfully assimilated the "style of life, spiritual attitude and tonality" of philosophy precisely because philosophy was already "above all else, a way of being and a style of life."[15] For Francke too, caring for the self, or for the soul, required rigorous spiritual exercises that involved the practice of mathematics—the most basic of these exercises. I aim to lay the groundwork for this assertion in what follows. The lesson plans from Francke's schools that I analyze in Part II will help me demonstrate the same assertion even more conclusively.

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[14] Christian Wolff most famously discussed the power of the soul to "recognize" in his *Vernünftige Gedanken von den Kräften des menschlichen Verstandes und ihrem richtigen Gebrauch in der Erkenntnis der Wahrheit* ('Rational Thoughts on the Powers of the Human Understanding and their Correct Employment in the Cognition of the Truth') [*German Logic*] (Halle: 1712). Reprinted in *Gesammelte Werke*, Part One: Vol. One.

[15] See Pierre Hadot, *Philosophy as a Way of Life: Spiritual Exercises from Socrates to Foucault* [Arnold I. Davidson ed., trans. Michael Chase] (Oxford, UK and Cambridge, MA: Blackwell Publishing, 1995): 129-130.

Congruence through perspective and measurement

In the final volume of his *Beginner's Guide to the Mathematical Sciences*, Christian Wolff provided a "Short Lesson on Arithmetical Writings" in which he made several observations about the most important developments in mathematics since antiquity. He carefully wove the contributions of Archimedes, Andreas Tacquet, Isaac Barrow and Johann Christoph Sturm into the following narrative:

> Whatever is missing in Euclid about circle, sphere and cylinder calculations, Archimedes resolved with his two books, *On Spheres* & *On Cylinders* and the smaller book, the dimensions of circles, from which Tacquet provides the most useful lessons in his *Elementis Geometriae*—called *Selected Exercises in Archimedes' Theorems*. This same Archimedes left us behind a few writings in higher Geometry, namely a book *On Spirals*, another *On Cones and Sphaeroids* and one on the Parabolic Quadratur. All of his works, next to the first four books *Sphaericorum Theodisii*, Isaac Barrow published with a few of his own demonstrations. Beyond the geometrical writings, Barrow still planned to work on [Archimedes'] books *De aequiponderanibus* & *infidentibus humido*, but he left aside the grain of sand calculations….These works of Archimedes, up through the books *De insidentibus humido*, Johann Christoph Sturm translated into German and published in Nürnberg (1670).[16]

In this single excerpt, Wolff linked the geometry of Archimedes up with the contributions of Andreas Tacquet, Isaac Barrow and Johann Christoph Sturm in a manner reminiscent of Tschirnhaus's juxtaposition of these same personalities in the *Basic Guide to the Useful Sciences*. Tacquet's *Geometry*, a text that was used in Francke's schools and championed by Tschirnhaus, contained "useful" lessons about how to apply the advanced principles of spheres, cylinders and the dimensions of circles to the real world, Wolff explained. Tacquet (following Archimedes) made mathematics useful and entirely necessary for the study of mechanical phenomena. Barrow had extended almost all of Archimedes' works and published them "with a few of his own demonstrations."[17] J.C.

[16] Christian Wolff, *Kurtzer Unterricht von den arithmetischen Schriften* in *Anfangs-Gründe aller mathematischen Wissenschaften.* Reprinted in *Gesammelte Werke,* Part One: Vol. 16.
[17] In a recent dissertation entitled, Kant on the Reality of Mathematical Definitions (UCLA, 2005), Katherine Dunlop discusses the significance of Isaac Barrow's emphasis on "sensible representation" for

Sturm also contributed a translation of the "grain of sand calculations." Throughout this text, Wolff consistently pointed to Archimedes, Barrow, Sturm, Tacquet and Tschirnhaus as contributing to the superior or ideal expression of the mathematical sciences as they should be understood by others.

In an early passage from his autobiography, Wolff recounted the various currents and texts that determined his own intellectual trajectory. Not surprisingly, Barrow, Sturm, Tacquet and Tschirnhaus figure prominently in the narrative he offered. First he provided the reader with an explanation as to how he became interested in mechanisms for determining truth mathematically from a variety of competing viewpoints:

> Because I lived under the Catholics [in Breslau] and, already in my earliest childhood, understood there to be animosity between Catholics and Lutherans, I noticed that each one always claimed that they were right; I wondered if it might be possible to show the truth in theology so clearly that it would allowed no contradiction. When I heard that mathematicians proved their things so certainly that everyone had to recognize them as true, I was motivated to learn the mathematical method and to work hard to bring theology to an incontrovertible state of knowing.[18]

Reflecting, admittedly very late in life, on what inspired him to take up the study of mathematics, Wolff pointed to animosity grounded in competing definitions of truth. If it were possible to apply the methods mathematicians used to illustrate a single, universal truth in theology, animosities and disputes could be mediated. It was then, Wolff explained, that he set out to learn which of these methods was superior. He began to study Tacquet's *Elemente Euclidis*, "because Herr von Tschirnhaus recommended it in his lessons in Mathematics and Physics (the *Gründliche Anleitung*);" he also "took the

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Wolff's mathematical method, which would subsequently impact Immanuel Kant. Barrow argued that the knowledge of axioms or definitions in geometry fundamentally relied on the senses. He claimed that "Euclid's postulates asserted the possibility of certain motions, which can only be known through the senses," and raised the issue of the "affections of magnitude obvious to any sense"—in other words, the issue of congruence, or how magnitudes can be compared; Dunlop (unpublished dissertation), 40.

[18] Christian Wolff, *Eigene Lebensbeschreibung,* 120-121. Reprinted in *Gesammelte Werke,* Part One: Vol. 10.

opportunity to demonstrate certain propositions from Herr Sturm's corollaries." From Tacquet and Sturm, Wolff wrote, he received "the first light of the method of demonstrating truth."[19]

Wolff remembered while he was in Jena that he slowly began to understand Tschirnhaus's *Medicina Mentis* better than he had initially, when he "knew nothing of Mathesis" and still had not learned how "to study Physics correctly."[20] But what started to bother him about Tschirnhaus's text, he explained, was that the nobleman had not provided a clear enough idea of "*das concipere*," nor did he show clearly enough how "real definitions" were supposed to be discovered. Wolff explained that at the time:

> I was not only familiar with the definition of *reales* that Sturm gives in his *Mathesi Enucleata*, but I also knew the one that Barrow had given in his *Lectionibus Mathematicus*, and I was also accustomed to how one abstracts rules like this in mathematics. It did not take much to appreciate that the rules that Tschirnhaus gave for the discovery of the *reales definitiones* almost allow themselves to be abstracted from the definition of a *circuli genetica*. I found it especially difficult to show how the elements of the definitions that Tschirnhaus provided could be found. But after thinking about it, I developed my own way of finding the *definitiones reales*—partly a priori and partly posteriori—which I have described in my *Logick*…..[21]

In one of his best known texts, often referred to simply as the *German Logic (Deutsche Logick),* Wolff presented what he called his own method for determining real definitions.[22] Here Wolff offered what must be understood as a corrective to Tschirnhaus's plan to reconcile the study of *physica* and *mathesis* in the *Medicina Mentis*.

Just as a mathematical proof starts with definitions, upon which theorems or rules can be based, Tschirnhaus and Wolff were endeavoring to provide definitions for *Reales* that would duly allow for rules governing natural phenomena to be generated—rules that were incapable of being disputed. As we saw in Chapter One, Tschirnhaus had defined

[19] Ibid., 123.
[20] Ibid.
[21] Ibid., 334.
[22] Christian Wolff, *Deutsche Logick* (Halle: 1712). Reprinted in *Gesammelte Werke*, Part One: Vol. One.

Reales as "essences, which, unlike *Rationales*, can be grasped in multiple ways rather than in singular and unchangeable ways…. For example, all that we grasp as material, unclean or non-transparent."[23] But in Wolff's opinion, Tschirnhaus had not taken his study of *Reales* far enough. Pressed by Wolff on this issue, Tschirnhaus conceded that the *Medicina* had been much more oriented around *Rationales* and *Phantasias*—the other two essences Tschirnhaus identified; he said he had planned another volume to address this problem, but it was never forthcoming.[24] Wolff claimed to be offering, then, a way of showing how the definitions *Reales* themselves could be found. For example, in his *Logick*, Wolff explained that definitions are either nominal (involving the enumeration of some properties) or real (involving the manner in which a thing is possible). Actually pointing out the internal structure of a clock constitutes a real definition, whereas simply saying a clock is "a machine which shows the hours," is nominal. In the same way, Wolff wrote, "If I say that Reason is the faculty of perceiving the connection of general truths, I give a nominal definition of Reason; but if I show how such Perception is possible by the powers of the soul, the definition becomes real."[25] More than simply observing the relationship between the soul and sensation for certain signs (in order to know when the Holy Spirit was materially present), Wolff wanted to show *how* the powers of the soul make perception possible.

Part of reconciling intuition with sensation, or *mathesis* with *physica*, involved acknowledging that real *and* nominal definitions of an object (such as a clock) or a

[23] Tschirnhaus, *Medicina Mentis* (1963): 115.
[24] As we saw in Chatpter One, Tschirnhaus frequently pointed to his interest in promoting the understanding of complex phenomena in individuals, who did not necessarily need to be provided with real definitions—like the way we use our hands without understanding the intricacies of their inner structure or composition.
[25] Christian Wolff, *Logic, or rational thoughts on the powers of the human understanding: with their use and application in the knowledge and search of truth* (London, 1770). Reprinted in *Gesammelte Werke*, Part Three: Vol. 77: 41-42.

concept (like reason) are both equally valid and necessary expression of that same single object or concept. In effect, the act of providing real and nominal definitions for all objects and concepts can be considered a fundamentally conciliatory or eclectic practice. In the *German Metaphysics* (1719), Wolff explained that he was trying to offer—in the face of a dangerous brand of sectarianism that some were endeavoring to disguise as eclecticism—the "right method for a *Philosophia Eclectici*." He wrote:

> One can see again that I do not advocate anything sectarian (*dass ich nichts Sectirisches verlange*)…but rather that I am searching for ways to hold onto all that is good, and I will find it wherever it is… This, I think, is the right method for an Eclectic Philosophy, or a way of knowing the world (*Welt-Weisen*) that does not belong to any flag but rather tests everything and retains the things that can be joined together with reason, or that let themselves be brought together in a system of harmony.[26]

Wolff's brand of eclecticism sought to generate real and nominal definitions by "testing everything" and, ultimately, the joining up of certain things (material objects) with intuited ones.[27] It was about creating new strategies for demonstrating *how* the process of reconciliation worked via the material medium of the soul, which somehow contained the power to make natural objects legible. Two strategies in particular Wolff saw as particularly promising in this regard: projective geometry (especially the formalization of proofs for the science of perspective) and measurement.

In another excerpt from his short lesson on famous arithmetical writings, Wolff explained that several others, especially Johannes Kepler, had recognized measurement

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[26] Christian Wolff, *Der Vernünfftigen Gedancken von Gott, der Welt und der Seele des Menschen, auch allen Dingen überhaupt* [1st ed. 1719]: 377. Reprinted in *Gesammelte Werke*, Part One: Vol. 2.

[27] In his ambitious attempt to write the history of eclecticism from antiquity to the present, Michael Albrecht argues that it was not important for Wolff. He titles one of his chapters "Wolff hat Eklektik nicht nötig," and insists that Wolff both never openly identified himself as a practitioner and came out against it in his response to J. F. Buddeus's *Bedencken über die Wolffianische Philosophie*. Wolff's statement (in the *Bedenken*) that eclectics tended to choose poorly despite all their talk of the power of choice should not be construed as evidence that eclecticism was not important for Wolff. He was deeply concerned with its ability (like all methodologies) to become corroded or misused. See Michael Albrecht, *Eklektik* (1994): 526-538; Johann Franz Buddeus, *Bedencken über die Wolffianische Philosophie* [Frankfurt, 1724] (Hildesheim: Olms, 1980): 95.

as the logical (and perfectible) extension of Archimedes' contributions to the mathematical sciences:

> In his new *Stereometria Doliorum Vinariorum* (Linz, 1615), Johannes Kepler made a start at extending and improving Archimedes teachings... He published his work in German... the title of the book is *Extracts from Archimedes' Ancient Art of Measurement*… But because he didn't discern more ways of measuring bodies than could be useful to the art of seeing (Visirkunst), Bonaventura Cavalerius, of the Jesuit order of S. Hironymi, was encouraged to still go further and to investigate the contents of more bodies than Archimedes and Kepler had done; he made this known in the preface of his *Geometria indivisibilus continuorum noua ratione promata Bononiae* (1653)[28]

While Kepler may not have fully realized the implications of his derivative art of measurement for the art of seeing (in Wolff's opinion), others had. Wolff goes on to list the work of the Jesuit Stephen Angli, Evangelista Torricelli of Florence, who "also took it upon himself to elaborate and extend the discoveries of Archimedes" and the Jesuit Paulus Guldinus—whose work "Des Chales presents very clearly in his *Mundus Mathematicus*."[29] He also mentioned Isaac Barrow as someone who understood the power of Archimedes' *Ancient Art of Measurement* and merged the fundamental principles from his *Lessons in Optics* (London 1674) with his *Lessons in Geometry*. Now that Leibniz has discovered his differential-calculus, "everything can be shown much more easily," Wolff explained.[30] Leibniz's differential calculus, the esoteric properties of curves, Archimedes' art of measuring physical bodies and the art of seeing were woven together by Wolff in such a way as to constitute an improved method for conditioning conciliatory ways of seeing.

Kirsten Dunlop has explained that in Barrow's estimation, "congruence is superior to other affections in two ways: it is more easily grasped by the intellect and

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[28] Christian Wolff, "Kurtzer Unterricht von den arithmetischen Schriften" in *Anfangs-Gründe aller mathematischen Wissenschaften,* 28. Reprinted in *Gesammelte Schriften,* Part One: Vol. 16.
[29] Ibid., 30-31. Tschirnhaus also recommended Des Chales' *Mundus Mathematicus* to Francke in the *Gründliche Anleitung*.
[30] Ibid.

more evident to the senses." The best way to determine the congruence of two magnitudes, he insisted, was to "compare conceptions of their locations in space."[31] While making this comparison, the senses "grasped" the materiality of congruence at the same time as the mind made judgments about its quality. Barrow also emphasized, like J.C. Sturm, the importance of judgment—a province of the mind affected by the lower faculties of the soul—to perform congruence, noting that "geometricians do not perform their Congruity by the Hand but by the Thought, not by the Sense of the Eye but by the Judgment of the Mind. They suppose an accurate and perfect Congruence… and from the Supposition, draw just and logical Consequences."[32] Barrow stressed that "every sort of Magnitude" is "involved in some Sort of Matter" and that, therefore, every magnitude could be made "visible or palpable; so that what the Mind demands to be understood, the Hand can execute in Part, and the Praxis can in some measure emulate the theory."[33]

In his own *Mathematical Lexicon*, Wolff emphasized that the science of magnitude, or *Stereometrie*, was a "part of practical geometry, which teaches how one should calculate the contents of material bodies."[34] He cited the *Géométrie pratique* of Mallet and his own *Elementis Geometriae* as examples of texts that presented and extended the findings of Euclid and Archimedes—especially his books *de Sphaera* and *Cylindro*.[35] In his lessons on famous arithmetical writings, he also cited specifically the advancements in the science of "field measuring" or surveying that had been described

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[31] Dunlop, 41-43.
[32] Ibid.
[33] In Isaac Barrow, *Optical Lectures* (Lectiones XVIII). H.C. Fay transl., A.G. Bennett and D.F. Edgar eds. (London, 1987): 187-88
[34] Christian Wolff, *Mathematisches Lexicon* (Leipzig, 1716): 1325. Reprinted in *Gesammelte Werke*, Part One: Vol. 11.
[35] Alain Manesson Mallet was a French cartographer and military engineer who wrote a number of treatises on fortification and surveying. His *Géométrie Pratique* was published in 1702. Wolff's *Elementis Geometriae* is contained within his *Elementa matheseos universae* (1713-15).

specifically by de la Hire and Ozenam (in Paris) and Henry Wilson (in London).[36] Yet the combination of theory and praxis manifest throughout Wolff's work in this period must also be understood in the sense that Barrow describes it here. Producing congruence through visually (or materially) palpable magnitudes was a moral imperative, rooted as it was in solid or sound judgments of quality. I also think Wolff's interest in measurement (and also Tschirnhaus and Francke's own interest in teaching young children how to measure fields) must be linked to Barrow's contention that "congruence is more easily grasped by the intellect and more evident to the senses."[37] From this contention could easily follow the idea that children could be taught how to measure or to recognize congruence at an early age. By conditioning a child's abilities to recognize congruence and to apply this skill to other areas of their lives, competing viewpoints could be more easily reconciled with one another. Congruent magnitudes, including universal truths, could actually be generated. Measuring fields was the perfect expression of conciliatory visual exercise. It required the intellect and the senses to work collaboratively to form judgments.

Long before Wolff and Francke began advocating that children should be taught to measure fields and physical bodies, Plato added "an entirely new kind of mathematical science" to the mathematical lessons of his Academy, which had been mainly oriented around arithmetic, geometry, astronomy and music (or the *quadrivium)*.[38] In Plato's Academy, the science of measurement became an integrated into a set of

[36] Christian Wolff, "Kurtzer Unterricht von den arithmetischen Schriften" in *Anfangs-Gründe aller mathematischen Wissenschaften.* Reprinted in *Gesammelte Werke*, Part One: Vol. 15*;* de la Hire, *l'Ecole des Arpenteurs oder die Feldmesser Schule 8 vols.* (Paris, 1689) and Jacques Ozanam *Edirte methode facile pour arpenteur, ou mesurer toutes fortes de superficies & pour toiser exactement* (Paris, 1699).
[37] See Chapter One for evidence of Francke's *Pädagogium* pupils measuring fields.
[38] Werner Jäger, *Paideia: die Formung des Griechischen Menschen*. Vol. 3 (Berlin: Walter de Gruyter & Co., 1947): 29.

mathematical practices that were, in effect, spiritual exercises intended to improve the self. In the *Republic*, Socrates argues that even though geometers were concerned with "doing things," their actions always involved acquiring new knowledge of magnitudes; practical geometry, then, could help orient the soul towards truth and produce philosophical thought.[39] Measurement, a form of practical geometry, came to be seen as one of the many technologies of *paideia*—or the formation of self. Jäger's still authoritative study of the subject explains that the term *paideia* connotes a life-long process of spiritual exercise in which the individual is empowered to realize his essential qualities and destiny. The individual is invited to participate in the formulation of himself, which involves careful reflection on the inherent gifts, predilections and tendencies of his "interior culture."[40] Measurement, as a mathematical way of knowing, was seen as a way of purifying the mind of sensible impressions—in pursuit of a higher ethical obligation or aim.[41] It helped one cultivate the soul, which was (for Plato) "more important than ten thousand eyes."[42]

And yet measurement relied on the eyes. While it certainly depended upon the axioms of Euclid and Archimedes, considered universally sustainable and true, it simultaneously depended upon some kind of normalization of sensation. The science of

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[39] Ibid.
[40] For the relationship between *paideia* and individuation in Jungian psychology see Luigi Zoja, "Individuation and Paideia" in the *Journal of Analytical Psychology* 42 (1997): 481-505. Scholars interested in the origins of the discipline of psychology have also cited Wolff's interest in the cultivation of the soul as fundamental. By the end of the 1730s (beyond the parameters of my study), Wolff was distinguishing between a "rational psychology" (or the "science of what was possible by the human soul") and an "empirical psychology" (or the "science that identified psychological principles with the help of experiences regarding what actually happened in the human soul"): in Thomas Teo, "Local Institutionalization, Discontinuity, and German Textbooks of Psychology, 1816-1854," in the *Journal of the History of the Behavioral Sciences* 43:2 (Spring 2007): 139. Christian Wolff, *Psychologia empirica* [1738], Reprinted in *Gesammelte Werke*, Part Two: Vol. 5 and idem, *Psychologia rationalis* [1740] in *Gesammelte Werke,* Part Two: Vol. 6.
[41] Hadot, *What is Ancient Philosophy?* 61.
[42] Jäger, Vol. 3, 29.

perspective held a great deal of potential in that, as a form of measurement, it could calibrate or normalize sensory impressions alongside those forms of recognition contained in the soul; however, in Wolff's estimation, perspective had been neglected—its potential unrealized. He indicated in his *Short Lesson on Optical Writings* (contained within the *Arithmetical Writings* text) that Andreas Tacquet's *Optica*, which was to be found in his *Opera Mathematica*, was "the only text" currently available that actually led one through the rules of Perspective.[43] Several other individuals, including Johannes Zahn and Athanasius Kircher, had dealt with practical optics, he explained, but they had not offered sufficient proofs for the study of perspective.[44] This field, Wolff explained, was best treated by Andreae Alberti, Girard Desargues and Abraham Bosse, the Jesuit Johann Christoph Rembold, Bernard Lamy and Jean-François Nicéron.[45] He was also especially interested an *Essay on Perspective* by Wilhelm Jakob Gravesand, a professor of mathematics from Leiden, because 's Gravesand, like Tacquet, "demonstrated everything," he said.[46] This was the only way to establish "rules" that the science of perspective needed.

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[43] Christian Wolff, "Kurtzer Unterricht von den arithmetischen Schriften" in *Anfangs-Gründe aller mathematischen Wissenschaften,* 120. Reprinted in *Gesammelte Werke*, Part One: Vol. 15. "Andreas Tacquet hat in seiner Optica, welche unter seinen Operibus Mathematicis zufinden ist, dasjenige gegeben, woraus sich die Regeln der Perspectiv herleiten lassen, welche er zugleich mit durchnimt: in seiner Catoptrica aber die Egenschaften der platen, hohlen und erhabenen Spiegel erwiesen."

[44] Johannes Zahn, *Oculo artificiali Teledioptrico* (Nürnberg, 1702); "Dieses Buch ist denen zu recommendiren, welche sich auf Praxin legen," Wolff noted in Ibid. Athanasius Kircher, *Ars magna lucis & umbrae* (Rome, 1646).

[45] Christian Wolff, "Kurtzer Unterricht von den arithmetischen Schriften" in *Anfangs-Gründe aller mathematischen Wissenschaften,* 120. Reprinted in *Gesammelte Werke*, Part One: Vol. 15. "Andreae Alberti *zwey Bücher von der Perspectiv* (Nürnberg, 1670) sind allen Leibhabern dieser Kunst sehr zuloben, und nicht weniger des Desargues' *Maniere Universelle pour pratiquer la Perspective*, welche anfangs von Abraham Bosse heraus gegeben... welches letztere für das Hauptbuch in der Perspectiv von Verständigen gehalten wird" (Amsterdam, 1686). Johann Christoph Rembold, *Perspective Practique* (Paris, 1642). He also recommended Bernard Lamy, *Perspective* (Paris, 1701), Jean-François Nicéron, *Thaumaturgum Opticum* (Paris, 1646) and idem, *Perspective curieuse* (Paris, 1652).

[46] W. J. s'Gravesande (1688-1742) also eventually came out with an *Elementa matheseos universalis* (Leiden, 1727); *Esaai de perspective* (Haag, 1711).

In a recent study, Stuart Clark discusses seventeenth-century attempts to remedy the inadequacy of the "resemblance model" of seeing inherited from medieval perspectivists. He explains that René Descartes recognized a "lack of correspondence with things" in the science of perspective, not a "rational presentation" of them—which had been the original goal. The Renaissance innovation of perspective, Clark argues, was based on the principle of resemblance, or the idea "of the world being essentially what it appeared to be in human consciousness."[47] Over time, the model became incapable of dealing with "the vastly multiplied instances of visual experiences where appearance and reality bore little or no resemblance to each other;" nor, in Clark's estimation, could it survive "the rebirth of a skeptical philosophy…that denied the possibility of establishing cognitive resemblance altogether."[48] Despite the capacity of perspective to stabilize the relationship between objects and their images, there were still so many mismatches that the science itself seemed to hold little promise. For Descartes, the science of anamorphosis was more appealing because it had the capacity to exaggerate and expose the deceptions of perspective; Clark writes that anamorphosis reinforced Descartes' view that "there was no place for the principle of resemblance in visual cognition."[49] In other words, at the time Wolff set out to create proofs for the science of perspective in the first decade of the eighteenth century, it had long been the object of derision and skepticism.

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[47] Stuart Clark, *Vanities of the Eye*, 331. Following closely the work of Martin Kemp, Clark explains that "the geometry that informed perspectival representation was thought to be inherent both in the objective world being depicted and also in the natural processes of human vision. To look this way at the world was therefore to capture ('reflect') in true reality and 'mirroring' was indeed the ubiquitous metaphor applied to it." See also Martin Kemp, *The Science of Art: Optical Themes in Western Art from Brunelleschi to Seurat* (New Haven, 1990): 78 and idem. "Perspective and Meaning: Illusion, Allusion and Collusion," in A. Harrison ed., *Philosophy and the Visual Arts: Seeing and Abstracting* (Dordrecht, 1987): 255-268.
[48] Stuart Clark, *Vanities of the Eye*, 331.
[49] Ibid. 335.

In my view, Wolff wanted to breathe new life into the science of perspective because of his confidence in geometry—especially the conviction held by late medieval perspectivists like Alberti that universal geometrical laws were resident in *both* the material world and its representation. All natural objects were magnitudes and, as John Wallis and Isaac Barrow had argued, contained within themselves geometrical principles of motion that could be extrapolated, studied and measured to determine or affect congruence.[50] "Perspective is the science of drawing the figure or likeness of some (material) thing as it appears in a certain length and height in the eye on a transparent board, which is placed perpendicular to the horizontal space between the eye and the object," Wolff explained. His expression of the science of perspective amounted to a standardization of the principle of resemblance, or agreement between object and image, and marked simply another way of thinking about the reconciliation of cognition and sensation that he was interested in promoting. Wolff's discussion of geometry in his *Mathematical Lexicon* also emphasized its capacity, as a science of measuring "the space taken up by corporeal things," to "sharpen the understanding, … to condition humans to see things more deeply" and to "consider things more deliberately." He added that "in the time of Plato and the other philosophers no one was allowed to study who had not learned geometry. And if one would follow this praiseworthy example today, geometry would acquire a much higher status in all sciences."[51]

[50] I have not done justice to Wolff's interest in the geometrical physics or mechanics of John Wallis, which is closely related to Barrow's project. Wallis, who had also written a *Mathesis universalis* (Oxford, 1657), is cited throughout Wolff's *Mathematische Lexicon* and *Anfangs-Gründe aller mathematischen Wissenschaften.*

[51] Christian Wolff, *Mathematisches Lexicon* (Leipzig, 1716): 665. Reprinted in *Gesammelte Werke*, Part One: Vol. 11.

According to Kristi Andersen, most of the proofs Wolff offered in his *Introduction to Perspective* were derived directly from Tacquet; yet the synthesis he offered was only preceded by Gaspar Schott and Sturm's *Mathesis Juveniles* (used in Francke's schools, see Chapter Two) in a vernacular German textbook. For Wolff, as for J. C. Sturm, the key to the proper assimilation of expressions of particular things and their signifiers lay in the soul's ability to recognize these things through feelings or sensations *and* rationally intuited signs.[52] A person's soul was where divine "likenesses" were developed in which God revealed his will—facilitating understanding and, in the soul's higher faculties, the cultivation of reason. *Seele* or soul was often used in combination with the word *Gemüth* in the German context, a term connoting the character or the inner essence of a person that presented itself to the eye through certain traits or behaviors. One's essence or character was determined by the soul and vice versa, meaning that improving the soul's ability to understand, to judge or to recognize magnitudes was inextricably linked to improving one's self. Wolff insisted that the art of measurement helped the essence of an individual become fully realized because it taught the *Gemüth* how to apply the knowledge of the world (*Weltweisheit*). In an essay he called *How the Art of Measurement can dramatically improve human understanding,* he wrote that measurement gave the *Gemüth* an unexpected yet helpful tool (*unverhoffte hilfsmittel*) for promoting learnedness *and* for applying this learnedness to the improvement of the world.[53] Wolff advised that those who doubted him should read Philipp Melanchthon's

[52] See Christian Wolff's *Vom dem Nutzen und der Lehrart, in der erfahrenden Lehre von der Seele (or Seelenwissenschaft)* (Marburg, 1734) in *Gesammelte kleine philosophische Schriften* (Halle, 1737): 222-256. Reprinted in *Gesammelte Werke*, Part One: Vol. 21-3.
[53] Christian Wolff, *Wie die Messkunst den menschlichen Verstand ausnehmend bessere* [October.1713] in *Gesammelte kleine philosophische Schriften* (Halle, 1737), 362. Reprinted in *Gesammelte Werke*, Part One: Vol. 21-3.

foreword to Johann Vogelius's *Introduction to Geometry*. Wolff understood that the legendary Protestant reformer Melanchthon was known for his religious doctrine of moderation and universal brotherhood; he too saw potential in the conciliatory exercises that practical geometry offered mankind.[54]

When one measured something, one was forced to rely, at the same time, on "expressions of particular things" that are recognized through feelings (Wolff's definition of experience), explanations that express "the manner in which something is made possible" (*reales definitiones*) and signs "from which something can be recognized" (*nominal definitiones*). The experience oriented applications of mathematics he offered in the *Beginner's Guide* relied explicitly on Wolff's interest in not only creating rational explanations (*Erklärungen)* comprised of both rational and nominal definitions, but in creating a more systematic method for stabilizing the relationship between these explanations (real and nominal) and experience (*Erfahrung*).[55] Like Francke, he believed in the power of joining together the pillars of wisdom. Forms of knowledge, including physics, which rested upon the foundation of measurement were intrinsically more sound, in Wolff's view, because they reconciled rational explanation with experience. "I am not surprised at all," he wrote, "by Robert Boyle's acknowledgement that his mechanical pursuits have shown him the enormous utility of the art of measurement in deciphering nature's laws."[56] Boyle stated that he wished he had spent more time and energy

[54] Ibid. He called Melanchthon "a man who is known for his fine mathematical knowledge, but also for his beautiful philosophical and theological knowledge and who deserves to be called the communal teacher of all of Germany." R. J. W. Evans describes Melanchthon as a conciliatory figure and "creator of a natural philosophy which has much in common with the great medieval syntheses." See R.J.W. Evans, *Rudolf II and his World: A Study in Intellectual History 1576-1612* (Oxford: At the Clarendon Press, 1973): 93.
[55] Christian Wolff, *Der Anfangs-Gründe aller Mathematischen Wissenschaften* (1710): preface.
[56] Christian Wolff, *Wie die Messkunst...* (October, 1713) in *Gesammelte kleine philosophische Schriften* (Halle, 1737): 376.

learning geometry and the arts of calculation.[57] And while Wolff claimed not to fault Boyle for admitting that measurement was essential for the experimental studies of natural phenomena he and the members of the Royal Society had undertaken, he used it as more evidence in support of his central claim in the text that "one can only approach the science of nature more certainly and accurately, thereby achieving mastery over creation, if one uses *Messkunst* in the *Naturlehre*."[58] Measurement offered a kind of "certainty and accuracy" to ways of knowing that began in the soul or in the world, thereby perfecting cognition and perception simultaneously. Wolff was convinced that if people could be introduced to the art of measurement before any of the other mathematical sciences, they would be able to advance more quickly, easily and properly through these exercises for perfecting, or realizing, themselves.[59] Measuring fields was a way of sharpening children's intuitive and perceptive abilities to recognize congruence; it would also prepare them to better grasp the demonstrations so central to his expression of the mathematical sciences.

"To demonstrate everything" is exactly what Wolff set out to accomplish in his *Beginners Guide to the Mathematical Sciences*, which, as I have mentioned, was a text used in Francke's *Pädagogium*. He divided his guide into four key volumes, which would lead the practitioner down the path to the proper assimilation of knowledge derived from mathematical exercise. Newcomers to the study of mathematics needed to have it presented to them in such a way that they would "glimpse, without noticing it, a picture of the right order of mathematics in their understanding and acquire a taste for it,"

[57] This famous lament of Boyle's is discussed by Steven Shapin, "Robert Boyle and Mathematics: Reality, Representation, and Experimental Practice," *Science in Context* 2, 1 (1988): 23-58.
[58] Christian Wolff, *Wie die Messkunst...* (October, 1713) in *Gesammelte kleine philosophische Schriften* (Halle, 1737): 379. Reprinted in *Gesammelte Werke*, Part One: Vol. 21-3.
[59] Ibid., 369.

he explained in the preface; his *Beginner's Guide*, like Tschirnhaus's (only much more systematic) placed things in their proper order so as to awaken interest.[60] Part One provided a basic introduction to the art of calculating and the rudiments of geometry and trigonometry, but ended with a section on architecture—including a series of exercises for applying the theoretical principles discussed in the previous sections. Part Two was devoted to discussions of the art of fortification, mechanics, hydrostatics, aerometrie and hydraulics—all "physical" sciences. Part Three he devoted to the science of optics, catoptrics, dioptrics, perspective, spherical trigonometry, astronomy, chronology, geography and gnomonics (the art of sundials). And part IV reverted back to a purely theoretical discussion of Algebra or Differential calculus derived from Leibniz (to "further Barrow's project"—as we have seen). Throughout the *Beginner's Guide,* Wolff offered a series of very carefully constructed demonstrations that were essentially exercises for training both the feelings of "expressions of particular things" alongside the rational soul's capacity to recognize the truths resident in the explanations he provided.

Cultura animi, Paideia and Francke's pedagogy

When historians talk about the prevailing pedagogical strategies applied in precisely the period in which Francke and Wolff were teaching in Halle, they often use the term "habituation" to describe the process of implanting habits in children as a means of overcoming the unpredictability of the passions. John Locke's *Thoughts Concerning Education* famously (and influentially) characterized the child as a *tabula rasa* who needed to be instilled ("by little and almost insensible impressions") with good habits so

[60] Christian Wolff, *Der Anfangs-Gründe aller Mathematischen Wissenschaften* [1st ed. 1710] (Halle, 1757): preface. Reprinted in *Gesammelte Werke*, Part One: Vol. 12.

it could become better able to overcome dangerous desires.[61] In his astute examination of the physiology of reading in seventeenth-century England, Adrian Johns argues that the very act of reading was contingent upon "a habituated passion," which was universally regarded as "the best hope an individual had of countering immoral, unhealthy, excessive or erroneous passions."[62] Generations of men and women—in the British context here—were told again and again that if the habituation process was initiated early enough, it would be possible to initiate an internal "civility of the mind." Hundreds of manuals spelling out precisely how this process worked and should be initiated were circulated, including parenting manuals and guides promising to teach readers how to read correctly, or virtuously.

Like his contemporaries in England, Francke was very interested in how reading and other visual exercises could be conditioned so as to produce desired responses in people. As professor of Greek and Oriental languages and, later, a professor Theology, he was an expert in exegesis—the science of offering nuanced readings or commentaries on texts. He was known among his contemporaries for his attempts to breathe new life into the art of exegesis in the *Collegio Paraenetico* he established for students of theology at the University of Halle. [63] One of his most widely read and circulated tracts

[61] Several translations of Locke's treatises found their way into library of Francke's Foundation and seem to suggest Francke was familiar with them. These include *Herrn Johann Locks Unterricht von Erziehung der Kinder: aus dem Englischen; Nebst Herrn von Fenelon Ertz-Bischoffs von Cammerich Gedancken von Erziehung der Töchter aus dem Frantzösischen übersetzet* (Leipzig, 1708) and a French version of Locke's most famous *Thoughts Concerning Education* entitled: *De L´Education Des Enfans, Traduit de l´Anglois De Mr. Locke* (Amsterdam, 1727).

[62] Adrian Johns, *The Nature of the Book: Print and Knowledge in the Making* (Chicago: University of Chicago Press, 1998): 402-08.

[63] See his *Lectiones Paraeneticae oder Öffentliche Ansprachen an die Stuidosos Theologiae auf der Universität zu Halle in dem so genannten Collegio Parenetico, in welchen dieselben zur gründlichen Hertzens-Bekehrung und zum Christlichen und exemplarischen Wandel, auch zu einer ordentlichen und weislichen Art zu studieren angewiesen, erwecket, ermahnet und aufgemuntert sind* (Halle: Waysenhaus, 1726-1729).

was about how to read the Bible in order to experience real or true edification.[64] But instead of only encouraging his readers to habituate their passions so as to fully comprehend the teachings of the Bible, thereby becoming better Christians, he also wanted them to see the act of reading itself as an opportunity to stir the passions productively—to fully utilize and draw sustenance from the emotions of the soul. Reading was, in Francke's view, a spiritual exercise that required intense concentration and an opening of the self to the didactic or self-forming potential of the text at hand. Francke explained that before one even opened the physical book, one was to spend a considerable amount of time and energy praying or "in rapt contemplation" that God would send his holy spirit "to open [his] eyes to see the wonder in God's law."[65] The reader allowed him or herself to become fully overcome with "prayers and sighs" directed toward praising and thanking God, and then, when it was over, let things "settle." Francke liked to remind his theology students that the art of prayer was something that required constant practice and needed to be done in conjunction with reading. He urged them not to spend the whole day studying but to "take a couple of hours every day and to use them to come into a closer communion with God by turning to prayer and trying to restore the poor heart to its proper strength….It well often takes more than a half hour," he explained, "before one can collect his *Gemüth* properly."[66]

Francke understood his techniques to be fundamentally different from those employed by enthusiasts. *Schwärmer*, as they were called in German, may have relied upon the stirring up of passions in a manner that appeared, on the surface, very similar to

[64] August Hermann Francke, *Einfältiger Unterricht, Wie man die H. Schrifft zu seiner wahren Erbauung lesen solle: Für diejenigen, welche begierig sind, ihr gantzes Christenthum auff das theure Wort Gottes zu gründen, entworffen* (Halle, 1694).
[65] August Hermann Francke, *Lectiones Paraeneticae* (1726-1729): 130-131.
[66] Ibid.

what Francke urged members of his own community to engage in; but enthusiasts did not properly manage their passions so as to allow them to see properly. According to Henry More and Meric Casaubon, those affected by "enthusiasm" suffered from an excess of "ecstatical passion" which reinforced "illusions of the imagination." Thus, their claims of divination posed dangerous and unpredictable threats to the social order. Although Francke's critics may have been quick to label the members of his community *Schwärmer*, he certainly never saw himself as one. His reading and teaching methods must be understood as a corrective to the dangers of enthusiasm[67]

After the emotions of the soul had been stirred, the heart was to be held very still so that a moment of enlightenment could occur. "As the sun is to be seen in still water and strongly warms everything that cannot be seen in the water around it," Francke explained, "you will become illuminated;" you will "see God's grace and wonder so that your heart will become enflamed, enlightened, rapt and happy."[68] The very act of reading the Bible, for Francke, required one to inflame the passions so as to properly see and experience the grace of God. Then one was in a position to comprehend and assimilate his teachings for a general improvement of himself and, subsequently, the world. A critical part of this moment of comprehension involved acquiring a picture or vision upon which to focus the attention. Francke told the readers of this widely circulated text to stir up their emotions, to manipulate or to rationally appropriate enthusiasm in order to push themselves into a higher level of consciousness. "Go there," he pleaded, "Go to that place where you can be still, and grasp the picture deep in your

[67] For More and Casaubon's definitions of enthusiasm see Johns, 409.
[68] August Hermann Francke, *Einfältiger Unterricht, Wie man die H. Schrifft zu seiner wahren Erbauung lesen solle* (Halle, 1694): 2-3.

heart."[69] It was only by initiating a process of ideographic mediation that the powerful messages of the Word of God could be discerned.

Like Wolff, Francke was interested in *how* the powers of the soul make perception possible; this involved appealing consistently to Christ to bestow the gift of recognition (*Erkenntnis*) on the soul. The only way this was possible, Francke explained in a sermon he called *A Short Guide to Jesus Christ's True and Noticeable Recognition*, is through reconciliation with this same Christ—the kind of reconciliation Paul described in 2 Corinthians 5:

> Whoever has read the texts of the New Testament, especially Paul's epistles, has certainly discovered that the apostle uses the word "reconciliation" again and again, although the expression is not always used in the same way. Many have heard or read an explanation of the term reconciliation but one seldom meets someone who has a proper understanding of it, meaning their heart has been fundamentally moved because of the understanding they have acquired—as though they have been awakened from a deep sleep.[70]

God only opened the "teachings of the Word" up to those who had been properly unified with him. Union with Christ was the first step toward acquiring the recognition so essential to understanding the relationship between the soul or the *Gemüth* and sight. Those who had been properly reconciled to Christ would receive "the real ability to grasp in the soul." They would also be able to recognize a divine presence in the world because Christ would intervene and "adjust [their] ability to perceive."[71] The most important task

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[69] Ibid., 3. This represented a very different stance than those taken by several of Francke's contemporaries in England; for example, Edward Reynolds argued that expulsion from Eden had destroyed the harmony that had once existed between the senses and Reason "throwing distortive passions between the human soul and the rest of Creation." See Johns, 401. In other words, for him the passions stood in the way of reconciliation with Christ whereas for Francke, a reasoned manipulation of the passions held the key to becoming unified with him—thereby restoring harmony between sensation and intuition. See Edward Reynolds, *A treatise of the Passions and faculties of the Soul of man. With the several dignities and corruptions thereunto belonging* (London, 1678).

[70] August Hermann Francke, *Kurtze Anweisung zur wahren, lautern und apostolischen Erkentniss Jesu Christi; da in zehn Puncten, wie dieselbe nach dem Sinn und Lehrart der Apostel richtig und nachdrücklich zum wahren heyl der Seelen zu fassen sey, gezeiget wird* (Halle: Waysenhaus, 1714).

[71] Ibid., 14.

of the teacher, Francke continued in this text, is to introduce their pupils to the process of *Bekehrung*, or conversion, necessary for reconciliation to occur.[72]

Francke's pedagogy, with its emphasis on the cultivation of character through conversion and the mathematical sciences, must be understood with all this in mind. It is actually quite different from the Lockean model of education that has dominated historians' attempts to understand the pedagogical innovations and orientation of the early Enlightenment. Francke's own use of the phrase *cultura animi* is a clear signal of his interest in self-formation, or *paideia*, as it was practiced by the "heathen" philosophers of ancient Greece and, ultimately, adapted by the first Christians. In 1702, one year after he had provided a thorough description of his project plans in the *Grosse Aufsatz* (or large Essay), Francke produced a summary of his pedagogical techniques that cited the "cultivation of character" (*Gemüthspflege*) as the "only tool" (*einzige Mitte*) capable of awakening a fear of God in youth so that they will become obedient and diligent. Characters that were "fresh" and properly "cleaned up" (*aufgeräumt*) through *Gemüthspflege*, Francke wrote, were more open to the lessons their teachers had to offer them. He also used the phrase when describing his method for teaching theology, stating explicitly that "the study of theology is *cultura animi*."[73] When individuals embarked on this course of study, what they were really engaged in was the cultivation, that is, perfection of their souls.

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[72] Ibid., 17.

[73] "Cultura animi oder die Gemüthspflege ist das einzige Mitte wodurch dieser Hauptzweck in Anweisung der Jugend erhalten wird." In August Hermann Francke, *Kurzer und Einfältiger Unterricht: wie die Kinder zur wahren Gottseligkeit und christlichen Klugheit anzuführen sind*. (Halle: Waysenhaus, 1702): 23. Nowhere in the text does he employ the word *Bildung*—a term that has been used to describe the emphasis on self cultivation resident in German pedagogical strategies from the late eighteenth- into the nineteenth-centuries. See for example W.H. Bruford, *The German Tradition of Self-Cultivation: Bildung from Humboldt to Thomas Mann* (Cambridge: Cambridge University Press, 1975). For Francke's statement that the "Studium Theologicum est cultura animi," see Erhard Peschke, *Studien zur Theologie August Hermann Franckes*, Vol. 2 (Berlin: Evangelische Verlagsanstalt, 1964-66): 130.

In Plato's formulation, the highest goal of any state should be to sponsor the "inner transformation and purification of the soul" of all its citizens. In effect, true education or "cultivation of character" was about being given license (by a *Herrscher*, or overseer of the process) to participate in a purely educational space within which individuals acquired the autonomy and sustenance they needed to push their souls down the path toward illumination.[74] *Cultura animi* connoted a process whereby the soul was continually filled with new knowledge and experienced feelings similar to what someone who had been blind for many years might feel upon being granted the power to see. Following Plato's description of the process in *The Republic*, Jäger wrote:

> True education (*Erziehung*) is the awakening of abilities resident in the soul. It initiates the organ with which one learns and grasps things… It involves the right orientation of the soul towards the source of the light, or recognition.
> ...
> The essence of philosophical education (philosophy as a way of life) is, in effect, "conversion"—in the most original, solid meaning of this word. It involves the complete metamorphosis or transformation of the entire soul toward the light of the idea of the good, the source of everything.[75]

This is not a (Lockean) form of education that endeavors to inculcate values and ideas found to be lacking in the animus; rather, it presents itself as a way of life that is about cultivating awareness of the gifts of recognition, goodness and virtue that are already manifest in all people. Hadot likens it to the art of sculpting, which involves a gradual chipping away—not the laying on of additional materials. He notes that Plato derived his understanding of it from Socrates, who explained (in the *Theaetetus* for example) that true education should not be about filling up empty vessels or writing on blank slates; instead it is about opening the eyes of each individual so that they see that while they are already full of potential, they actually know nothing and must work to realize what has

[74] Jäger, Vol. 3, 18.
[75] Ibid.

already been given to them.[76] It involves regular participation in a set of practices, which, as we have seen in previous chapters, were central to the articulation of faith for virtually all of the texts considered central to the expression of Pietist spirituality (Arndt, Arnold, Spener etc.).[77]

For the ancient philosophers, recognizing that knowledge resides in the soul and not in the world was the secret to the production of virtuous citizens. It was the end goal of an educational process that endeavored to move its participants towards conversion (*Bekehrung*)—a process that bears a remarkable resemblance to the kind of conversion Francke insisted was necessary for full membership in his community—and the cultivation of their innate abilities to discern the truth. This was not a form of conversion that happened in a single instance and then affected an instant change in the way in which one sees the world and relates to other people; for Francke and the "heathen" philosophers who influenced his interest in *Gemüthspflege*, conversion was a lifelong educational process aided by edification, the reading of God's word and the channeling of the mysterious gift of recognition, granted by the holy spirit, towards virtuous acts.[78] Wolff evoked similar metaphors of illumination and self realization as resulting from

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[76] Pierre Hadot, *What is Ancient Philosophy?* 27.

[77] In addition to his *Wahre Christentum* (*True Christianity*), Johann Arndt's *Paradiesgärtlein* [c.1708] would be translated into English in 1716 and given a title indicating the contents' preoccupation with spiritual exercise; it was called, *The garden of Paradise: or, holy prayers and exercises; whereby the Christian graces and virtues may be planted and improved in man, the divine image renew'd true Christianity promoted, the Kingdom of god established, and heavenly life raised up in the spirit. Pursuing the design of the famous treatise of True Christianity* (London, 1716). Francke printed his own version of Arndt's *True Christianity* in 1704: *Vier Bücher vom Wahren Christenthum, Das ist: Von heilsamer Buße ... Versehen mit vielen Schrifft-Allegaten, neuen Numern der Paragraphen und nützlichen Registern* (Halle: Waysenhaus, 1704).

[78] This is confirmed by Markus Matthias, who explains that "in contrast to Luther and Lutheran Orthodoxy, Francke asserted an effectively new determination of Christian existence and placed this exegetically in his interpretation of Romans 7, where the apostle would describe the condition of the Christian person, who is not yet reborn but is being found in the process of conversion;" see his piece on "August Hermann Francke" in Carter Lindberg ed., *The Pietist Theologians* (Oxford: Blackwell Press, 2005). Matthias draws this insight from a manuscript version of Francke's "Von der Verpflichtung auf die Bekenntnisschriften" in Adolf Sellschopp, *Neue Quellen zur Geschichte August Hermann Franckes* (Halle: Niemeyer, 1913): 142.

process of conversion in his own Guide to 1 Corinthians 4:7.[79] He explained that "through conversion, through illumination, a person acquires a new power or ability to understand… especially the truths that are not as easy to see in natural ways;" individuals acquire a "certain new strength or power, which is not given to the human soul by nature."[80] There was also a huge difference, Wolff believed, in the ethical disposition or (*habitus moralibus*) of those *Gemüths* who had been converted and thereby illuminated by God and those who had not.[81] In his *Metaphysics*, he advised those who were illuminated to continually strive to "do whatever makes you and your condition more perfect and to leave behind whatever makes you and your condition less perfect."[82]

As I showed in the first part of this chapter, Wolff was interested in the science of measurement's reliance on the soul's power of recognition, but he also believed in the power of measurement and other practices to cultivate this same power. Similarly, Francke's pedagogical writings reveal his own conviction that sponsoring an awakening of abilities resident in the soul involved more than teaching people how to prepare themselves to receive the Holy Spirit so as to acquire the *Erkenntnis* so essential to the acquisition of knowledge. This was only one pillar of wisdom. The other pillar, of course, involved the management of experience and included the inculcation of certain values through sensation, especially gazing upon beautiful forms and allowing those forms of knowledge to affect the orientation of the soul. Without question, Francke

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[79] Christian Wolff, "Dass ein Mensch nichts von sich selbst habe, nach Anleitung 1 Corinthians" in Christian Wolff, *Gesammelte kleine philosophische Schriften* (Halle, 1737): 500-518. Reprinted in *Gesammelte Werke*, Part One: Vol. 21-2.
[80] Ibid. This sentiment is remarkably similar to those expressed by Francke in his *Philanthropie* (1709) and Barrow's prayer, quoted at the beginning of Chapter Three, asking the divine for the ability to perceive.
[81] Ibid.
[82] Quoted in Hinrichs, 393. From Christian Wolff's *Metaphysik* (1719). Reprinted in *Gesammelte Werke,* Part One: Vol. 2.

understood the value of *Tugendlehre*, or the extensive literature around cultivating virtue as an antidote to the passions that was proliferating throughout his lifetime.

In a manner reminiscent of Boyle's sentiments in *Seraphic Love* regarding the capacity of the individual to affect his ability to perceive by gazing upon beautiful or perfect forms, Francke explained in the ninth chapter of his *Short and Simple Lessons* that "the virtues and vices should be painted in living colors before children in order to strengthen the good that has been initiated in them."[83] *Vormalen*, or vividly depicting vice and virtue "has been determined by the reasonable heathens as a good way of awakening virtue and getting people to turn away from vice," he explained. Aristotle's pupil, Theophrastos (372-285 BC), had produced a text called *The Characters* that provided the perfect example of how to do this. Also, several Christian authors, such as Joseph Hall (1574-1656) and Johann Heinrich Boecler (1611-1672), he wrote, had provided a summary of signs (*Kennzeichen*) of virtuous characters derived from Theophrastos' typology from which lessons inspiring the mimicking of these signs could be derived. Boecler was a professor of history in Strasbourg who created a typology of virtuous Roman emperors based on the work of the Roman historian, Vellejus Paterculus.[84] Hall, an Anglican bishop, read Theophrastos's *Characters* as a work of moral philosophy, which he said inspired him to publish a two volume collection of character sketches in 1608. The collection became so popular that it would eventually

[83] August Hermann Francke, *Kurtzer und Einfältiger Unterricht* (1702): 24.
[84] Johann Heinrich Boecler, *Characteres Politici In Velleio Paterculo expositione quadam demonstrati* (Strasbourg, 1672).

spark an entirely new yet derivative literary genre. Francke likely had access to a German edition of Hall's *Characters* published in Amsterdam in 1701.[85]

Circulated with commentary by Isaac Causabon in 1688 under the title of *Theophrastu Ethikoi charakteres* or *Theophrasti notationes morum*, the *Characteres of Theophrastos* presented its readers with a collection of signifiers for rendering character visually accessible.[86] Despite promising in the introduction to present examples of both virtue and vice, Theophrastos's characters were all archetypes of vice, whose conduct and other observable signifiers provided unencumbered access into the state of their souls.[87] Those "Christian authors" who endeavored to follow in Theophrastos's footsteps were concerned with creating signifiers of virtuous archetypes as well, in the interest of inviting emulation. Joseph Hall described the signs (*Kennzeichen*) of one who is wise as someone who is "eager to learn or to recognize everything but especially to know his strengths and his weaknesses."[88] His eyes "never stay together, instead one stays at home and gazes upon himself and the other is directed towards the world…and whatever new things there are to see in it;" he is a good student, master and lawgiver; he is articulate.[89] The eyes of a properly fashioned Christian are also one of his most clearly recognizable signs. They are "illuminated" and rest upon the uncertain in a way that directly affects

[85] Joseph Hall, *Characteres der Menschen* (Amsterdam, 1701). See Jacques Bos's discussion of the influence of Hall's *Characters* in his "Individuality and Inwardness in the Literary Character Sketches of the Seventeenth Century," *Journal of the Warburg and Courtauld Institutes*, 61 (1998): 151. Bos explains that well over twenty English character-books had been published by the end of the seventeenth century, including Sir Thomas Overby's *Characters* and John Earle's *Microcosmography*—both especially popular.
[86] Isaac Casaubon (1559-1614) was a classical scholar considered by his contemporaries to be the most learned man in Europe; his *Theophrasti notationes morum* was published in 1688 in a collection edited by Thomas Hale called *Opuscula Mythologica Physica Et Ethica: Græce Et Latine; Seriem eorum sistit pagina Praefationem proxime sequens* (Amsterdam, 1688).
[87] This has also been observed by Jacques Bos, who discusses the uncertainty around this text (comprised of 30 character sketches) and its intended purpose; it is the only ancient Greek description of characters ever found. The introduction explains that "the study of good and bad types of human behavior is a very useful introduction to ethics." See Bos, "Individuality and Inwardness," 143.
[88] Hall, *Characteres des Menschen* (1701): 4.
[89] Ibid.

his senses. "He speaks with God in prayer" and, "when he comes near to God puts on a purple robe."[90]

While Francke makes specific mention of Hall's text and Isaac Casaubon's role in disseminating Theophrastro's *Characters*, Jean de la Bruyère, a preceptor of Louis XIV's cousin, Duke Louis of Bourbon, had also published and circulated a version of it that was well known.[91] Bruyère was part of a circle of pedagogues, called the Petit Concil, who became famous for their numerous discussions and treatises about how best to cultivate virtuous rulers; the circle included Bishop Bossuet, Claude Fleury and François Fénelon. Throughout the *Short and Simple Lessons*, Francke cited the importance of the French church historian and educator Claude Fleury's *Traité du choix et de la méthode des études* (1686) for the formulation of his pedagogy, and gave the instructors of his schools license to create character typologies using famous Biblical personalities.[92] Wherever possible they should strive to use "living and exemplary" presentations of archetypes, such as Joseph, to "awaken a love of virtue in children so that they wish nothing more than to be similar in every way to these figures."[93] This, of course, is precisely what Fleury had suggested in both his tractat and in his *Mœurs des Israelites* (*Manners of the Israelites)*.[94]

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[90] Ibid., 10.
[91] See his *Les caractères de Théophraste traduits du grec Avec Les Caractères Ou Les Moeurs De Ce Siècle Par Mr. de La Bruyère de l'academie Françoise Et La Clef, En marge & Par Ordre Alphabetique* (Paris, 1697); for a discussion of it see Mark A. Cohen, "La Bruyère and the "Usage" of Childhood: the idea of Pedagogy in the Caractères" *French Forum* 26:2 (Spring 2001): 23-42.
[92] Claude Fleury had achieved international fame for his role as a tutor of the Dukes of Anjou, Burgundy and Berry; he was also part of the Petit Concil, headed by Francois Fenelon. A German version of his *Traité du choix et de la méthode des études* appeared in 1726: *Des Herrn Claudii Fleury Klugheit zu studiren: Oder Gründliche Nachricht Wie ein junger Mensch bey den gelehrten Wissenschaften eine kluge Wahl beobachten und selbige vermöge Einer geschickten Lehr-Art begreiffen soll* (Budißin, 1726).
[93] August Hermann Francke, *Kurtzer und Einfältiger Unterricht* (1702): 24.
[94] His *Mœurs des Israelites* appeared in French in 1681; a German translation came out in 1709 entitled: *Die Sitten der Israeliten, oder Muster einer schlecht und rechten Politischen Unterweisung, den Staat zu regieren und die Sitetn zu verbessern durch M. Fleury* (Hannover, 1709).

The picture accompanying the title page depicts two men gazing at two Israelites, from whom they are separated by a slight distance (see Appendix 7). One is writing, or creating an inscription of what he sees in front of him, while the other is holding a large drawing pad in such a way that it is obvious he is painting a likeness, or producing a representation (*vormalen*) of the two figures. It was the cultivation of precisely this technique, of capturing likenesses of virtuous essences, which Francke endeavored to include in the pedagogical practices of his schools. And it seems that in Fleury, Francke recognized the traces of the conciliatory methodology he sought—one that integrated *paideia* (or sculpting, realizing the *Gemüth*) with the habituation of sensation. He described Fleury as someone whose "fine method…reminds one very well that there are especially two things that one should consider above all if one hopes to make the raising up of children truly fruitful: namely, the Attention or Awareness (*Aufmerksamkeit*) and Experience." Francke continued: "These two pieces one cannot simply expect to come from individuals of a young age; instead the teacher must awaken these things in them…."[95]

Francke also frequently wrote about the capacity of images to serve as examples that either give one an ideal to emulate or to force reflection or a confrontation with oneself—like a mirror. He wanted the members of his community to be especially attuned to the didactic undertones of *phantasias* in general and knew that acute visual experiences could be manipulated to uphold or to undermine certain values. In his *Admonitory Lectures* (*Lectiones Paraenetica*), for example, he explained that the Holy Scriptures provided people with examples to follow in our lives and served as a mirror

[95] August Hermann Francke, *Kurtzer und Einfältiger Unterricht* (1702): 51.

that could force us "to confront our ugly appearance."[96] They had the power to inspire reflection and action. Instructors of his schools were also told to look for ways they could "clearly and distinctly show [children] good examples that they can then follow."[97] They were to embody the example they wanted their pupils to emulate, or be living *Vorbilder*. In the 1707 tract about how to improve the art of schooling penned by Francke's colleague Joachim Lange, the importance of teaching children how to use words so that they will have a "lifelike effect… and direct real actions" is emphasized several times.[98] If the "lifelike effect" was not there, then it would be impossible to acquire a "living recognition" of something because the "affected and rendered action" did not appear before the eyes. But there was more to producing a lifelike effect before someone's eyes than simply employing the proper syntax, arguments and words. In a move that suggests the power of a conciliatory ideal for Francke and the larger intellectual community of which he was a part, Lange proclaimed that the eloquent or evocative speech depended entirely on wisdom or reason (*sapientia*).[99] Just as an experiment or mechanical exercise needed to be guided by the intellect, ideally mathematical truths, in order for the meaning to be properly discerned, so "oratorical exercise" needed to be joined with the solid knowledge of things in order for the meaning of the words to come alive.[100] Lange promised that his method would ensure that what

[96] Peter Menck's now classic study of Francke's pedagogy contains an insightful, if brief, discussion of the importance of the example in Francke's schools. See idem, *Die Erziehung der Jugend zur Ehre Gottes und zum Nutzen des Nächsten: Die Pädagogik August Hermann Franckes* (Halle, Tübingen: Verlag der Franckesche Stiftungen, Max Niemeyer Verlag): 44-47. August Hermann Francke, *Lectione Paraeneticae* (1726-1729).
[97] Quoted in Menck, 46; from Karl Richter ed., *August Hermann Franckes Schrift über Erziehung und Unterricht* (Berlin, 1871).
[98] *Joachim Langens Verbesserte und Erleichterte Lateinische Grammatica ... Mit einer Vorrede von Verbesserung des Schulwesens* (Berlin, Halle: Waysenhaus, 1707): 31.
[99] Ibid., 31.
[100] Ibid., 31.

rhetorical exercises visually evoked would be more oriented toward virtuous and godly ways of being (*Wesen*). The art of language was taught in Francke's schools not as a signifier of authentic learning, he wrote, but as a "tool for the further planting and exploration of the truth."[101]

Michael Wintroub has shown how rhetoric, which he defines as "complex web of social, epistemological, and spiritual practices by which the putative distance between words and things could be effaced," was central to Boyle's attempts to create an experimental community.[102] Rhetorical strategies were easily accessible to the "civil" members of his circle, all of whom had been schooled in the art of speaking well; rhetoric was also one of the signatures of a humanist education and a subject taught in Francke's advanced schools.[103] Speaking well involved acquiring proficiency in the art of evocative image making. The more evocative the images the better witnesses or observers would understand the message of a speech. Geometrical exercise also involved becoming proficient in the art of producing evocative images, which could lead to higher forms of understanding.[104] Just as the study of rhetoric could ever increasingly bring the gap between "words and things," so could geometry. Like the soul and its abilities to make judgments, rhetoric and geometry also stood in the middle offering assimilatory techniques for mediating objects and forms. Each stressed the conciliatory power of the visual example to do precisely this.

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[101] Ibid., 41
[102] See Wintroub, 210.
[103] For an overview of this education as it was imagined and impacted by Erasmus, see Manfred Hoffmann, *Rhetoric and Theology: the Hermeneutic of Erasmus* (Toronto: University of Toronto Press, 1994): esp. "Humanism and Rhetorical Theology" and Part IV: Speech and Interpretation, 18-27, 135-162.
[104] The training in rhetoric Descartes received in a Jesuit school was central to his formulation of a geometrical practice also intended to help one visualize certain images and grasp certain truths. See Jones, 56-57.

Inside the pedagogical space that Francke directed children were led through what must be understood as a series of exercises akin to those practiced in the schools of ancient Greece. And in this space, mathematical exercise was held in high esteem because of its capacity to awaken the soul. For Plato, man is not human without mathematics; therefore, the *Herrscher*, or director, of an academy needed to ensure that those he educated were introduced to the beauty and utility of arithmetic. He did this not in the interest of creating a skilled class of workers, but rather, he introduced a study of mathematics so as to make the process of conversion, the orientation of the soul towards the realization of one's essence, easier. The study of mathematics for the Greek philosopher was about sharpening the understanding. Francke himself explained that in order to promote a meditative stillness in the *Gemüth* and a recuperation of natural strength, instructors should follow the example of "the heathens:"

> Who offer a beautiful example in that they led their children to *Mathesis* at an early age, which is advised by certain mathematicians today as well. Of course, one should not forget that *Mathesis* is too difficult for children. But if one leaves the most difficult things pertaining to demonstrations and calculations for riper years, one will still find enough in mathematics to inspire children with lust and pleasure—without overwhelming them. [105]

He advised his instructors to pay special attention to the children, "who always seem to be taking it upon themselves to create something or to work on their own." These were telltale signs of an especially promising *Gemüth*, which could "more easily be led by an instructor towards something useful."[106] Especially young children could be easily led to appreciate Astronomy, Francke continued, which provided the perfect opportunity to teach them to recognize the size, quantity and order of heavenly bodies. He also suggested that "in their periods of rest" (*Ruhestunden*), geographical maps (*Mappae*

[105] August Hermann Francke, *Kurtzer und Einfältiger Unterricht* (1702): 32.
[106] Ibid.

Geographicae) should be used. "It would be very pleasing to them," he continued, "if a short introduction is given in which they can ask each other questions if they want about how the world is divided and into what lands and kingdoms the world is divided into."[107]

Division, size, quantity, order—in effect, a discourse of quantification, of proportionality, of measurement was at the very heart of a set of pedagogical strategies that simultaneously endeavored to regulate or condition experience *and* to provide children with opportunities to exercise their *Gemüther*. As a practitioner and proponent of a dialectical faith, Francke recognized a familiar relationship between the cultivation of an individual's inner qualities and the manifestation of those qualities in traits, behaviors and other material expressions. There had to be a way to keep track of a child's inner progress through the careful monitoring of his or her *reales* or material attributes. Practicing or carrying out Francke's pedagogical strategies involved extensive note-taking, observation and assessment in order to accomplish precisely this task—to determine, while presenting beautiful examples *at the same time*, the quality of the individual being educated and their potential. Implementing Francke's method meant engaging in an extensive array of surveillance practices that saw the varied outward expressions of each pupil—especially behaviors and physical appearance—as a measure of their interior culture, including their faith. Perhaps the best evidence we have of the measurement of character at work in Francke's schools is found in the hundreds of pages of detailed lists recording pupils' "behavior and qualities" in various Orphanage registers.[108]

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[107] Ibid., 33.

[108] For example AFST/S A I 197 [1705-1754] Verhalten der Schüler und Beschäftigung ehemaliger Scholaren. See also Juliane Jacobi, "Man hatte von ihm gute Hoffnung ...": *Das Waisenalbum der*

In a sermon he called the *The Measure of Faith,* Francke explained that while Christ was happy with any amount of a faith that was real and true, he was especially attuned to its manifold sizes and strengths. In the parables of the gospels Christ consistently sized up the quantity and quality of the faith of those he encountered—often measuring it against the faith of the Israelites as the ultimate muster. To the Canaanite woman at the well he said openly, your faith is large. Also, using the story of the centurion from Capernaum (found in Matthew 8: 1-13), he explained that there were three distinct signifiers that made it possible for Christ to determine if this man's faith was larger and stronger than others: namely his abasement (or willingness to prostrate himself before Christ), his immediate recognition of the beauty of Christ, and his conviction that Christ could help him by uttering only a single word.[109] With these signifiers in mind, Francke asked his audience to examine or "test" themselves to determine the quality and quantity of the gifts Christ had bestowed upon them. He invited his listeners to participate in an exercise that required the application of a universal standard or *gradus* (through the observation of both one's internal comportment and external signifiers) to the mysteries of a faith that they could experience or feel. In short, he offered his followers (and pupils) a methodology that would allow them to use certain material expressions of faith, or signifiers, to represent the level of self-realization they had acquired through union with the divine. His solution, like Wolff's, saw measurement as a way of extending and deriving benefits from the perceptive capabilities of the soul.

Franckeschen Stiftungen 1695 - 1749 (Halle, Tübingen: Verl. der Franckeschen Stiftungen & Niemeyer-Verl., 1998).

[109] August Hermann Francke, *Die Unterschiedene Maass des Glaubens* (*The Measure of Faith) aus dem Evangelischen Text Matth. 8: 1-13* (Halle: Waysenhaus, 1716): 8.

Just as the mathematical sciences were embraced as tools for conditioning certain higher faculties of the soul by "heathen philosophers," so Francke would employ them in his schools. They were a starting point—important, but for a very specific set of reasons connected with *cultura animi* above all else. From a very early age, Francke believed, children needed to be raised to be wise, meaning they needed to be taught how not to let themselves be led astray by the "false teachings of the eyes."[110] The teaching and practice of the mathematical sciences in his institutes, and his interest in reconciling the language of mathematics with experimental method, was about cultivating individuals who recognized their ethical obligation to perfect themselves in order to improve the world. Those who had perfected their ability to recognize, or see correctly, would experience pleasure, peace and "contentment of mind" akin to the kind described by the famous Huguenot irenicist, Pierre de Moulin (1600-1684), in his treatise of the same name—also frequently cited by Francke.[111] As practitioners of a "Christian philosophy," they would become carriers of light, love and philanthropy, which they would extend to the rest of the world.

Careful consideration of Francke's pedagogical writings reveals his own preoccupation with visual training as a concomitant practice of *paideia*, inextricably linked to the cultivation and measurement of faith. Like Wolff, Francke championed the soul's power of recognition, its ability to receive wisdom intuitively through the exercises in *consilia* or congruence that the mathematical sciences offered. At the same time, he accepted the validity of praxis or experiential ways of knowing when used to produce accord, in keeping with the mandate of the "middle way." Both figures, despite their

[110] August Hermann Francke, *Kurtzer und Einfältiger Unterricht* (1702): 44.
[111] Pierre de Moulin, *Von dem Seelenfrieden und der Gemüthsvergnügung* (Leipzig, 1719).

differences, saw spiritual exercise or *askesis* as key to producing increasingly perfect individuals, whose senses had been habituated *and* whose characters were fully realized. They believed they were offering the world a refined set of methodologies or exercises for better accomplishing this. My analysis in the following section of the way in which the mathematical sciences were taught in Francke's schools using models, natural objects, instruments and other media, will help further illustrate how these practices worked, including how they were understood as the most ideal expression of the mandate of philanthropy, universal benevolence and the salvation of mankind.

Part II: Applying the Method

Unity of faith must flow out of wisdom,
And **wisdom** (*Weissheit*) is building a house of **unity**, listen up;
Those who would like to know something about the large structure:
The wise and wonderful God, who alone commands praise,
Directs me constantly towards true wisdom,
And is building, as has long been planned,
A huge house of virtue (*Tugendhaus*) **and schools of true wisdom**:
In this same work, many boys allow themselves to be taught wisdom
Through the arts and sciences,
To God's praise and honor and their parents' reputation and happiness,
Although not every son, without difference, can study there.
Only the best ones are sent,
So that they will immediately begin to blossom and begin to love,
Until the spirit of wisdom begins to peek out of his soul,
And raw utility becomes corporally actualized.
In this school of wisdom one only takes in boys
Who, by their natures, are oriented towards knowledge,
The parents can even be Jews and Turks
Really, Protestants attend there alongside Papists.
The children do not hear about even the slightest hint of confessional strife,
But instead learn virtues and the arts from all sides,
So that they grow in years and in wisdom,
And this means they have to work, themselves, on hundreds of things.
The same kind of project is to be seen nowhere else
And one will find much more there than what one can speak of here
The Orphanage in Halle is truly good and fine,
There is really nothing that can be counted against it.

-Johann Ernst Bessler, aka Orffyreus (1723)

Chapter Five: Orientation through *Anschauung:* Three-Dimensional Models as Tools of Philanthropy

Im perspectiv liegt das Modell
Vor Augen deutlich klar und hell,
Wie das im Waysenhaus zu Hall
Nach allen Stücken überall
Schrifft-mässig aufgerichtet.

In perspective lies the model
Before the eyes-clear, distinct and bright,
Just like the one in Halle's Orphanage
Where all the parts are overall
Erected according to the Scriptures.

-Johann Jacob Scheuchzer

All knowledge is the display of understanding, for which the same conditions must be met as for displays of the eye.

-Johann Amos Comenius [1]

In their introduction to *Models: the Third Dimension of Science*, Nick Hopwood and Soraya de Chadarevian insist that "three-dimensional models have always embodied and displayed knowledge, but how this was done varied enormously and altered over time."[2] Until relatively recently, however, historians of science have tended to neglect three-dimensional models in favor of two-dimensional forms of representation; they have preferred to see the model as invested with a purely pedagogical function (involving the rendering of certain truths popular or understandable) somehow separated from the construction of these same truths. "This is a mistake," continue de Chadarevian and Hopwood, "for not only was teaching the centrally important means of ratifying and conveying knowledge, and addressing wider audiences crucial to establishing scientific authority, the movements of models also exemplify the impossibility of separating these

[1] Johann Jacob Scheuchzer, *Kupfer-Bibel, In welcher Die Physica Sacra, Oder Geheiligte Natur-Wissenschafft Derer In Heil. Schrifft vorkommenden Natürlichen Sachen* (Ulm, 1731): 137, 125; Johann Amos Comenius, "Die Methode für die Wissenschaften im besonderen" in *Grosse Didaktik* [Hans Ahrbeck ed.] (Berlin: Volk und Wissen Volkseigener Verlag, 1957): 194. "Die Wissenschaft ist die Schau des Verstandes, die sich unter den gleichen Erfordernissen vollzieht wie die Schau des Auges."
[2] Soraya de Chadarevian and Nick Hopwood eds. *Models: The Third Dimension of Science* (Stanford: Stanford University Press, 2004): 3.

activities from research."[3] Their assertion, with its emphasis on the capacity of teaching to ratify and convey knowledge while participating in its formulation, gets to the very heart of this chapter's aims and assumptions.

Three-dimensional models were fixtures of A. H. Francke's community in Halle, where they were invested with a special pedagogical, epistemological and spiritual significance. Using a variety of evidence of their presence in his orphanage, as well as the hand-written lesson plans that were given to him in 1718 by his colleague, Christoph Semler, I look at the strategies through which the mathematical sciences were being taught in Halle, and by all accounts in Francke's schools—strategies that would both convey and generate new, conciliatory ways of knowing. I am interested in showing how the three-dimensional model served as the ideal medium for lessons in conciliatory seeing by examining the meanings practitioners of an eclectic method in early eighteenth-century Halle ascribed to them as focal points, or sites, where the joining together of intuition and perception could be materially represented.[4] Surely, most scholars would readily concede that in some ways all models, regardless of the era, are conciliatory artifacts constructed according to rational principles and, at the same time, experienced through the senses—especially the eyes and the hands. But in the *Franckesche Stiftungen*'s culture of reconciliation these models were integrated into the habitus of *paideia* (see Chapter Four); they were points of orientation for the conciliatory exercises of self cultivation being conducted there. In Francke's Halle, models and instruments

[3] Ibid. See Willem Hackmann's treatment of models as "didactic instruments" in his "Scientific instruments: models of brass and aids to discovery," David Gooding, Trevor Pinch and Simon Schaffer eds. *The Uses of Experiment* (Cambridge: Cambridge University Press, 1989): 31-65.
[4] See my discussion of eclecticism in Chapter Two and Donald Kelley, "Eclecticism and the History of Ideas," esp. 580-82. My focus here is mainly on scale models of buildings, cities and the universe, as well as mathematical and optical instruments; in Chapter Seven I discuss Semler's models of machines.

were tools of philanthropy that could condition and trigger impulses of love and reconciliation in individuals. Simply by viewing the three-dimensional structures, the inspired observer would be forced to calibrate their intellect's ability to recognize with their imagination's ability to perceive.

The *Franckesche Stiftungen's* status as a "universal seminar" was rooted solidly in a pansophic worldview that drew readily from a pedagogical tradition, linked to Johann Amos Comenius, known as *Anschauungsunterricht*. The word *Anschauung,* or observation, connotes an entire process of visualization—from the senses to the intellect via the sensitive (or lower) faculties of the soul. The German word *Anschauung* better captures the dialectical relationship at the heart of Comenius's didactical strategies because of its capacity to mean (or imply) *both* perception (*Vorstellung*) and intuition (*Erkenntnis*), as well as contemplation (*Betrachtung*) and conception (*Auffassung*). I have deliberately translated *Anschauung* as "observation" because of this word's ability to dually signify the cultivation of attention (a form of *Erkenntnis*) and various forms of experience one needed to embrace in order to properly observe something. *Anschauung*'s active form is *anschauen*, which connotes the act of observation but specifically as the culmination of a process that has already involving external seeing and inward contemplation.[5]

In the *Didactica Magna,* Comenius distinguished between "outward" and "inward" *Anschauungen*. Just like the mechanics of seeing, or *das äußerliche Schauen*, resulted from a combination of the eyes, objects and light, so did internal seeing, or *das*

[5] See discussion of "Anschauung" and "Anschauung Gottes" in Joachim Ritter ed. *Das historische Wörterbuch der Philosophie* Vol. 1 (Stuttgart: Schwabe & Co., 1968): 340-353 and Lorraine Daston's treatment of attention in "Attention and Values of Nature in the Enlightenment," Lorraine Daston and Fernando Vidal eds., *The Moral Authority of Nature* (Chicago: University of Chicago Press, 2004): 100-126.

innerliche Schauen. "The eye of inner observation," Comenius explained, "is the spirit (*Geist*) or understanding (*Verstand*);" it was the part capable of responding to "rational demonstrations" (*vernünftige Demonstrationen*).[6] The objects of *innerliche Schauen*, he continued, "are all things lying outside of or within the *intellectus*," including the "inward senses" (*innerliche Sinne*), or the lower faculties of the soul, which could be awakened by *sinnliche Demonstrationen.* Just as with seeing externally, internal observing was aided by light—or the cultivation of a "diligent attention" (*die gebührende Aufmerksamkeit*).[7] Since they were part of the soul, the inner senses were capable of imprinting upon the *sensus communis* of the body, and were believed to be connected in some way to the soul's rational faculties; no one knew exactly *how* the higher and lower faculties of the soul were linked together, although some claimed to know.[8] The real question was about how the process of awakening the "inward senses" worked—namely how to reach them via "outward perceptions" (*aussere Empfindungen*), objects and their likenesses. Comenius argued that the procedure for "external" observing was fundamentally

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[6] Johann Amos Comenius, "Die Methode für die Wissenschaften" in Hans Ahrbeck ed. *Grosse Didaktik* (Berlin: Volk und Wissen Volkseigener Verlag, 1957): 194: "Die Wissenschaft oder die Kenntnis der Dinge vollzieht sich, insofern sie das innerliche Schauen der Dinge ist, unter ebensoviel Erfordernissen als das äusserliche Schauen oder Sehen; diese sind Auge, Gegenstand und Licht. Wenn diese vorhanden sind, so ergibt sich daraus das Sehen. Das Auge des inneren Sehens ist der Verstand (mens) oder die geistige Anlage (ingenium), der Gegenstand sind alle Dinge, die ausserhalb und innerhalb des Verstandes (intellectus) liegen; das Licht ist die gebührende Aufmerksamkeit. Aber wie bei dem äusseren Sehen eine bestimmte Art und Weise notwendig ist, wenn man eine Sache sehen soll, so wie sie sit, so bedarf man hier einer bestimmten Methode, nach der die Dinge dem Geist so dargeboten werden, dass er sie sicher und rasch erfasst und druchdringt." Also quoted in Johannes Kühnel, *Comenius und der Anschauungsunterricht* (Leipzig: Klinkhardt, 1911): 22.

[7] Ibid. For a recent look at the relationship between "the eye" and "the heart" in Comenius see Erwin Schadel, *Sehendes Herz (cor oculatum)—zu einem Emblem des späten Comenius* (Frankfurt am Main: Peter Lang, 2003).

[8] For a succinct and insightful discussion of the *sensus communis* as it was understood by early modern contemporaries see Adrian Johns' discussion in the *Nature of the Book*, esp. 387-97. Following Oxford Professor of Natural Philosophy Thomas Willis' descriptions, Johns describes the common sense as "a space of open exchange, where the animal spirits mingled freely," and a "dynamic system in which vision and imagination participated."

deductive whereas the procedure for "internal" conceiving was inductive.[9] However, since both procedures relied on the eyes, objects and light, *Anschauung*—including the medium of the *Schauplatz*, or site of observation—could become the critical, extended or "third site" for linking perception and cognition together. Vision, or visual training, held the key to the reconciliation of fundamentally opposing strategies for coming to terms with the world.

That the founder of Pietism, Philip Jakob Spener, was hugely influenced by the precepts of *Anschauung* is evidenced in several of his writings, but perhaps most readily in his *Pia Desideria*—or *Pious Desires*. Of course, Spener was not the first person to employ this title in a devotional book. In his own *Pia Desideria* of 1624, the Jesuit Hermann Hugo (1558-1629) had popularized what were already widely embraced as the three basic steps of meditation: seeing (*sehen*), reflective/inward viewing (*betrachten*) and, ultimately, observing (*anschauen*).[10] P. J. Spener's decision to employ the same title in his foreword to a short *Postille* by Johann Arndt is a clear indication of his interest in aligning his movement with a similar process of meditation—one oriented around visualization.[11] In doing this he made a direct link to the emphasis on *Anschauung* so

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[9] Discussed in Kühnel, 22-23.

[10] The following version of Hugo's *Pia Desideria* was published in Gotha in 1707: *Hermanni Hugonis Pia Desideria, elegantissimo carmine descripta : una cum Barlæi, aliorumque præstantiorum nostræ & superioris ætatis poëtarum sacris carminibus selectioribus, & brevi singulorum vitæ historia (*Gotha, 1707). The tract was first published as *Pia Desideria, Tribus Libris Comprehensa. 1. Gemitus animae poenitentis; 2. Vota animae Sanctae; 3. Suspiria animae amantis* (Antwerp, 1624); it was translated into in Spanish in 1626, German, French and English in 1627, Dutch in 1629 and Italian in 1633. At least 42 individual Latin editions of Hugo's *Pia Desideria* were printed, each divided into three parts: "1. Stossseufzer der reuigen Seele; 2. Gelöbnisse der frommen Seele; 3. Verlangen der liebenden Seele," and including 15 copperplate engravings. In Ernst Thomas Reimbold, *Pia Desideria Gottselige Begierden* (Olten und Freiburg im Breisgau: Walter-Verlag, 1980): 8-9. Augustine famously explained in his *Confessions* that having eyes (*Augen-haben*) and viewing (*betrachten*) is not the same thing, just as there is a difference between viewing (*betrachten*) and observing (*anschauen*). Therefore the soul must have three qualities: it must have eyes, it must view (reflectively) and it must observe." Quoted in Reimbold, 19-20.

[11] Comenius also considered himself a student of Arndt, whose *True Christianity* (or *Bücher vom wahren Christentum*) was, in Spener's estimation, the most popular (and frequently printed) devotional book of all

prevalent in expressions of Jesuit spirituality, such as Ignatius Loyola's *Spiritual Exercises*, and an indirect link to Jakob Böhme, who conspicuously employed the term. Böhme, whose life and writings were linked to the identities of autonomous Pietist communities in the seventeenth century, had included a section entitled "How the Soul can be made to come to the *Anschauung* and Obedience of God" in his nine-volume *Way to Christ*, published in 1682.[12] Loyola had stressed the importance of the showplace (*Schauplatz*) as the "visual site of Meditation (*composito locis*)," where the eyes could initiate the internal modes of reflection necessary to observe properly.[13]

When A.H. Francke eventually arrived in Halle in 1692 and founded his *Stiftungen*, one of the means through which municipal authorities articulated what was different about his approach to spiritual training was by emphasizing what they recognized as his tendency, as Spener's protégé, to put the eye before the Word. In a report to the Prussian King Friedrich I regarding the "differences that have developed between the evangelical-Lutheran leaders of the University and the city ministry of Halle," several members of the ministry stated that "regarding A.H. Francke's teachings, both sides are united; rather it is the manner of carrying out these teachings in an

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time; the 1679 "Riga edition" (edited by Johann Fischer) was full of copperplate engravings and prayers at the end of each chapter to read aloud. See Johannes Wallmann, "Johann Arndt (1555-1621)" in Carter Lindberg ed. *The Pietist Theologians*, 21. Several recent studies have emphasized the preoccupation with meditation by Lutheran reformers like Böhme, Arndt and Spener in the seventeenth century; however, they have not (in my view) sufficiently emphasized the visual metaphors these reformers employed in their writings or their interest in *Anschauung* as a form of spiritual exercise. See Udo Sträter, *Meditation und Kirchenreform in der lutherischen Kirche des 17.Jahrhunderts* (Tübingen: Mohr Siebeck, 1995) und idem. „Wie bringen wir den Kopff in den Herz?" in Gerhard Kurz ed. *Meditation und Erinnerung in der Frühen Neuzeit* (Göttingen: Vandenhoeck & Ruprecht, 2000): 11-35.

[12] Jakob Böhme, *Das Sechste Büchlein: Vom Ubersinnlichen Leben, Nebst ein Gespräche eines Meisters und Jüngers: Wie die Seele möge zu Göttlicher Anschauung und Gehör kommen: Und was ihre Kindheit in dem natürlichen und übernatürlichen Leben sey ...* In *Der Weg zu Christo : Verfasset in neun Büchlein. Das 1. Von wahrer Busse. 2. Vom heiligen Gebeth. 3. Ein Schlüssel Göttlicher Geheimnüsse. 4. Von wahrer Gelassenheit. 5. Von der Wiedergebuhrt. 6. Vom übersinnlichen Leben. 7. Von Göttlicher Beschauligkeit. 8. Von der erleuchteten und unerleuchteten Seele. 9. Von den vier Complexionen* (Amsterdam, 1682).

[13] Reimbold, 45.

edificatory manner that differences have developed."[14] The general consensus, continued the report, was that "new teachings were being implemented that neglected the ecclesiastical word and Lutheran symbols and involved much more emphasis on visual representation (*Augenschein*)."[15] Despite Francke's extensive commentaries on the "certainty of the biblical word," many of his orthodox Lutheran contemporaries were concerned that his interest in *Augenschein* detracted from the intensive reading of the Holy Scriptures.[16] Following P. J. Spener and the legacy of those (Augustine, Arndt, Böhme, Loyola, Hugo, Comenius) who had placed visuality at the heart of spiritual exercises, Francke was emphasizing the need to see and reflect upon the Holy Scriptures, so as to properly observe them.

As we saw in Part I, all of the points of convergence between Francke and several of the most prominent intellectual figures of his day revolved around the development of a universal method that could reconcile (and stabilize) the relationship between perception and cognition via visual training. Tschirnhaus and Leibniz had advocated exposing children to *sensualia* first, to inspire or awaken them, and then continuing with training in "rein Analysin" so as to make learning "ludus"—an idea derived directly from Comenius's *Scholae Ludus*, or school of play. This kind of schooling embraced

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[14] *Bericht dessen was wegen der zwischen den Evangelisch-Lutherischen Geistlichen von der Universität und Stadt Ministerio in Halle, eine zeithero geschwebten Differentien, durch von seiner Churf. Durchl. zu Brandenburg Gnädigst verordnete Commission abgehandelt und zu dero Beruhigung in Göttlichem Segen ausgerichte worden* (Colln an der Spree, 1701): "In welchen befindlich dass die zwischen dem Prof. Theol. August Hermann Francke und dem Stadt Ministerio erhobene Action, nicht die Lehre selbst, darin sei beyderseits einig, sondern die Art wie dieselbe erabaulich vorzutragen, ferner die Ubung der Kirchen Disciplin, Fleiss und Sorgfalt der Lehrer in ihrem Amte, endlich das Leben und Wandel etlicher Prediger betreffe: wegen dergleichen Christlichen dem Göttlichen Worte gemässen Erinnerungen aber niemand der Unterchtigkeit in der Lehre beschuldiget werden können."

[15] Ibid. "...als würden zu Halle neue Lehren getrieben, und die Liebri Ecclesia Lutheranae Symbolici negligiret; da sie denn sich auf den Augen schein beziehen... ".

[16] Pietist privileging of the visual has not been emphasized in ongoing discussions (among theologians and historians) about the reasons their orthodox critics were often disdainful of their practices; in highlighting the preoccupation with visual training in Francke's orphanage, my project is gesturing towards a way of distinguishing Pietists from their detractors via contemporary critiques and concerns.

empiricism in its emphasis on experiencing objects (or their likenesses) first—"exercising the senses" as Comenius called it—juxtaposed with the exercise of the intellect via training in "immaterial ideas."[17] Instead of integrating or situating experimental philosophy into mathematical framework, the hallmark of Halle's conciliatory method was its attempt to allow *both* "pillars of wisdom" (to use Francke's phrase) to stand together as equally valid places to begin any investigation.[18] The goal was to arrive at the same destination in the end—i.e. to meet in the middle—and to exploit the creative potential of both "approaches" in order to discern what was common to both. Practitioners of both experimental and mathematical methods privileged the visual, meaning they considered certain kinds of images and models to be "better" carriers of information.[19] Thus, it was primarily in seeing, or in championing the heart as the "eye in people," that cognition and sensation could be made to work together.

To be sure, the transnational goals of Francke's organization required a great deal of linguistic and technological proficiency, thereby generating a heightened interest in visual pedagogies that could more effectively introduce pupils to the latest (and most useful) forms of innovation. But the need for proficiency, influenced as it was (to an extent that is still being debated) by the designs of the cameralist state, only partially

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[17] Kühnel, 39.

[18] In Francke's words: "All wisdom (*Klugheit*), whether true or false, rests upon two main pillars, namely knowledge (*Wissenschaft*) or cognition (*Erkenntnis*) and experience (*Erfahrung*); either pillar can be misused on its own but together they can both be used correctly….." In *Kurzer und Einfältiger Unterricht* (Halle, Waysenhaus, 1702).

[19] See Brian S. Baigrie, Descartes's Scientific Illustrations and 'la grande méchanique de la nature,' in Baigrie ed. *Picturing Knowledge: Historical and Philosophical Problems Concerning the Use of Art in Science* (Toronto: University of Toronto Press, 1996): 86-134. Visual strategies had long been valued by practitioners of "practical" mathematics, especially optics and astronomy; see Sven Dupré, "Visualization in Renaissance Optics: the Function of Geometrical Diagrams and Pictures in the Transmission of Practical Knowledge" in Sachiko Kusukawa and Ian Maclean eds. *Transmitting Knowledge; Words, Images and Instruments in Early Modern Europe* (Oxford: Oxford University Press, 2006) and Martin Kemp, "Temples of the Body and Temples of the Cosmos: Vision and Visualization in the Vesalian and Copernican Revolutions" in Brian S. Baigrie ed., *Picturing Knowledge*, 40-85.

explains why *Francke's Stiftungen* was full of three-dimensional models, instruments and machines. Here the idea of proficiency was entirely bound up with a pansophic idea of improvement invested with ethical meanings.[20] While the use of three-dimensional models may have been about distilling or bringing together disparate forms of knowledge into a single and accessible point of reference, using models in lessons was also about acquiring better, sounder ways of seeing, understanding and being. Viewing models in Francke's orphanage was an intrinsically moral and meditative exercise bound up with the spiritual and social prerogatives of those doing the showing or "demonstrating"—teachers in an institution entirely oriented around producing knowing, yet habile and virtuous, subjects. In early eighteenth-century Halle, demonstrations were spiritual exercises that endeavored to make models the focus of the *Schauplatz*, or sites for both reflecting upon the one's own improvement and for constructing individuals who approached the world demonstratively. This means that one appreciated the links between demonstrations and geometry at the same time as one reveled in the demonstration's ability to exercise and inspire the senses—thereby awakening the lower faculties of the soul. The demonstration, as it was performed with models, machines and *naturalia* in Francke's Stiftungen (and like the models themselves) was also a site for the expression and refinement of conciliatory gestures.[21]

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[20] On the idea of improvement and its role in the knowledge making projects of Empire see Richard Drayton, *Nature's Government: science, imperial Britain, and the 'improvement' of the World* (New Haven, Conn.: Yale University Press, 2000).

[21] Simon Schaffer has explained that in Georgian England demonstrations "were both performances in front of audiences and also collaborative productions by interested practitioners," referring "either to geometrical synthesis—the extraction of proof from undeniable axioms—or else to theatrical showmanship—the display of dramatic phenomena." Early eighteenth-century Pietists in Halle certainly appreciated the theatrical element of the demonstrations they performed with models and artifacts; however, the unique social contours of the community they created meant that the demonstration (and the objects around which it revolved) itself was an expression of philanthropy. See Simon Schaffer, "Machine Philosophy: Demonstration Devices in Georgian Mechanics," *Osiris*, 2nd Series Vol.9 Instruments (1994): 157.

The Semler plans also indicate that teachers were "demonstrating" models of buildings, machines, *naturalia* and instruments in very similar ways. A lesson oriented around a model of a house, for example, was simultaneously about the house's proportionality and the natural materials and instruments needed to construct it. Whenever possible, these were demonstrated as well. Instruments were featured in lessons as models, corresponding entirely to Ephraim Chambers' definition of a model as "an Original, or pattern proposed for anyone to copy or imitate" in his *Cyclopedia* of 1727.[22] And since Francke's institutes were oriented around the cultivation of virtuous subjects via the imitation of beautiful and virtuous archetypes and the cultivation of higher forms of recognition, it follows that three-dimensional models and instruments would be highly valued as "originals" capable of inspiring imitation—namely the imitation of mediums that were intrinsically conciliatory. Both models and instruments (as originals) could make one more proficient, but first one needed "to see" how they worked—and more importantly, *why* the imitation of their form and animating principles was needed. One also needed to understand what made the three-dimensional model a superior conciliatory artifact and how its power might possibly be accentuated with the help of two-dimensional geometrical projection, especially the *Grundriss* or *Modul* privileged in Christian Wolff's writings.

Outsiders to Francke's community would probably have recognized the model of Jerusalem, the transporteur, compasses, quadrants and celestial spheres that were presented to pupils of Francke's schools. However, the meanings that members of Halle's community attached to these "mobile" instruments or "originals" were never

[22] Quoted in Malcolm Baker, "Representing Invention, Viewing Models," in de Chadarevian and Nick Hopwood, 23-24. From Terrence M. Russell, *The Encyclopaedic Dictionary in the Eighteenth Century: Architecture, Arts and Crafts vol.2: Ephraim Chambers Cyclopedia* (Aldershot: Ashgate, 1997).

entirely "immutable."[23] While the hope was that especially the moral applicability of these devices would become universally transferable, in the long run, only for those affiliated with Francke's movement could a magnetic compass become embedded with the conciliatory significance of love and philanthropy. The longitudinal device Semler developed, presented ocularly to his pupils and described in a tract printed by the Halle Orphanage press in 1723, was laden with ethical meanings—but in England, when it eventually arrived there, it was yet another instrument endeavoring (unsuccessfully in the end) to solve a problem of orientation that had been divested of any connection to the related issue of being oriented, meaningfully or morally, in the world.

Christoph Semler and architectural models in Francke's Waisenhaus

Before exploring the conciliatory use of models Francke's orphanage, I must elaborate on the context of their imagined uses and construction in Halle via a prominent local minister and magister, Christoph Semler. In 1707, the same year Christian Wolff arrived in Halle, a text was published by the University entitled *Useful Suggestions for the Founding of a Mathematical Handworkers-School*. It was a description of and justification for a *Realschule* that Semler had attempted to start in Halle the same year—a school that has long been considered the first *Realschule* to have ever been started in Germany.[24] But in justifying the need for such a school, Semler did not stress the

[23] See Bruno Latour's discussion of the "immutable" and "mobile" qualities of certain objects in "Drawing things together," in M.Lynch and S.Woolgar, *Representation in Scientific Practice* (Cambridge, Mass.: MIT Press, 1990): 19-68.

[24] In the nineteenth century, *Realschule* connoted a school oriented entirely around vocational or industrial training and this understanding of it continues to affect the way in which the Semler *Realschule* is understood today, as a the first incarnation of the modern *Realschule*. While I acknowledge that Semler initially intended his school for the sons of artisans, who would comprise the ranks of an emergent working class by the nineteenth century, he also emphasized that "the work is organized in such a way that boys who want to go on to study and those who are destined for the mechanical arts can both derive use from it,"

importance of training more technologically savvy workers. Instead, he explained that his "first and most important intention" was to foster a "better recognition" of the enormous strength and knowledge of God. Those youths who attended his school would "learn how to lift up (*erheben*) their *Gemüther*" in pursuit of this goal; and, as an added bonus, they would receive a "useful preparation" in the latest forms of mechanical knowledge.[25] Regarding the method to be employed by the teachers of his school, Semler advised, for example, that "all of the varieties of materials that the handworker needs to be familiar with in order to do his work (wood, leather, wool, glass etc.) should be demonstrated ocularly (*occulariter demonstriret*) *and,* wherever possible, presented before the eyes *in natura*." Teachers would endeavor to "awaken these youths" by laying "master-pieces" before their eyes because "these master-pieces contain within themselves the quintessence and highest powers of wisdom and understanding… because they must concentrate all of their reason-oriented rules together in one piece at the same time."[26]

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in Christoph Semler, *Neueröffenete Mathematische und Mechanische Realschule* (Halle, 1709): 30. Part of my aim here is to demonstrate the way in which Semler attached mainly conciliatory (not class based) meanings to his venture, making it central to the project of philanthropy. Examples of studies that have situated Semler's school within a much wider narrative of progress and modernization include: Wolfgang Rudowicz, *Die Entwicklung der realen Bildung in Deutschland vom Beginn der Neuzeit bis zum Ende des II. Weltkrieges* (Essen : Verl. Die Blaue Eule, 1992); Heinz Semel, *Die Realienlehrprogramme im 17. und 18.Jahrhundert* (Hamburg, 1964); Horst Wollenweber, *Die Realschule in Geschichte und Gegenwart* (Köln [u.a.] : Böhlau, 1997); Nikolaus Maassen, *Geschichte der Mittel- und Realschulpädagogik I Band: Von den Anfängen bis Ende des 19.Jahrhunderts* (Berlin: Hermann Schrödel Verlag, 1960).

[25] Christoph Semler, *Nützliche Vorschläge von Auffrichtung einer Mathematischen Handwercks-Schule bey der Stadt Halle* (Halle, 1708): 5.

[26] Like Leibniz (and Tschirnhaus) Semler had also studied briefly in Jena with the famous mathematics professor Erhard Weigel, who was fond of emphasizing the need for privately funded "Schools of Pleasurable Arts and Virtues" in which children would learn by building models and figures out of cardboard, measuring and being shown all manner of machines and instruments. See Erhard Weigel, "Kurtzer Entwurff der freudigen Kunst- und Tugend-Lehr, vor Trivial und Kinder Schulen" in Hermann Schüling, *Gesammelte pädagogische Schriften (*Giessen, 1970): 64-72; discussed in Wilfried Schlagenhauf, "Ansätze einer technikbezogenen Bildung in Schulkonzepten um 1700" in Lars Bluma, Karl Pichol, Wolfhard Weber eds. *Technikvermittlung und Technikpopularisierung. Historische und didaktische Perspektiven* (Waxmann, 2004): 202-204.

Presenting objects before the eyes *in natura* and arranging ocular demonstrations contingent on the "real presence" of the objects themselves became the two central components of the method Semler sought to apply in his school. He argued that certain kinds of demonstrations were necessary in which a refined sensibility to various "gradations of recognition" could be cultivated.[27] In doing this, he was adapting a widely accepted set of assumptions about the power of observing objects *in natura*; Comenius had also written that "the eye is the most delighted by representations (*Darstellungen*) of certain things that are true to life," namely depictions that endeavored to remain faithful to the intrinsic qualities of the object being depicted.[28] Like Comenius, Semler organized a hierarchy of representation—a universal schema for assessing the degree (*Grad*) or quality of the recognition that could be achieved with certain mediums:

> In the recognition of visible things, one finds different gradations. For example, for an Indian fruit-tree I can acquire recognition from
>
> 1. a description with words in a book. But this recognition is like death; it is like when one sees something at night. Now if something is described through
>
> 2. word of mouth by someone who has seen it himself, then my recognition will become much more lifelike because I can ask this person more questions if I do not quite understand enough; this cannot happen with a book. Now if a foreign fruit tree is presented
>
> 3. in a copperplate engraving, or
>
> 4. in a painting with living colors, or
>
> 5. in a model from wax or wood, then the recognition is so much brighter and more distinct, or

[27] "So vieles immer möglich ist soll alles was nur demonstriret wird in natura und in Gegenwart des objecti demonstriret werden." Semler, *Nützliche Vorschläge* (1708): 10.

[28] From Comenius, *Schola Ludus* d. i. *Die Schule als Spiel*. Translated by Wilhelm Bötticher (Langensalza: Beyer, 1907). "Das Auge wird am meisten ergötzt durch naturgetreue Darstellung sichtbarer Dinge." Quoted in Kühnel, 38. I discuss Halle Pietists' interest in affecting high quality forms of resemblance between objects and their images in Chapter Six; for a nuanced discussion of resemblance or the "representational model of vision based on *species*" see Stuart Clark, *Vanities of the Eye,* esp. 9-38 and Joel Snyder, "Picturing Vision," Critical Inquiry 6 (1980): 499-526, reprinted in W.J.T. Mitchell ed. *The Language of Images* (Chicago, 1980).

> 6. in nature itself and laid in the presence of the eyes. This is without question above all the previously listed grades, the highest degree of recognition and is what the *Gemüth* can derive the best ideas from.
>
> Now when these kinds of ocular demonstrations are applied to life-like, verbal lessons, then the recognition of the thing will sink itself more deeply into the *Gemüth*. And it is this highest grade of recognizing objects that is intended by this project, which endeavors to show everything either *in natura* or in a model.[29]

Living representations of objects—ones that were colorful, bright and lifelike—left the deepest impressions on an individual's character. They helped one reach a higher level of consciousness—to see, and more importantly to understand, better and more easily. Like Francke, who wanted his followers to test the relative quality or gradation of their faith relative to others (especially archetypal figures from the Gospels), Semler was offering a set of visual strategies for individuals to achieve higher forms of cognition by engaging with real objects and their likenesses.

In a later formulation of this recognition typology from 1739, Semler would emphasize that the art of schooling could be greatly improved if children were introduced "in their earliest years" to material expressions of ideas (*ideas rerum materialium)* through three-dimensional models first, and then immaterial expressions of these same ideas (*ideas rerum immaterialium*) through "short definitions and clear descriptions (*descriptiunculas*)." By presenting them with bits of *sensualia* first, "they will receive, *per autopsiam* and through the ocular representation (*Darstellung*) of each object, many

[29] Christoph Semler, *Nützliche Vorschläge* (1708): 10. Comenius had also emphasized that whatever one had seen with his own eyes, remained more firmly in the memory; in his estimation too, models and pictures were second only to actually seeing and experiencing the thing *in natura*. In his "Methode für die Wissenschaften" in Ahrbeck ed., *Grosse Didaktik*, 196-97. „Und weil der Sinn der treuste Haushofmeister des Gedächtnisses ist, wird jener sinnliche Nachweis aller Dinge zur Folge haben, dass ein jeder das, was er weiss, beständig weiss. In der Tat, wenn ich nur einmal Zucker gekostet, einmal ein Kamel gesehen, einmal die Nachtigall habe singen hören, einmal in Rom gewesen bin und die Stadt durchwandert habe (wenn dies nur mit Aufmerksamkeit geschehen ist), so haftet all das fest im Gedächtniss und kann mir nicht wieder entfallen.... Wenn aber die Dinge einmal fehlen, so kann man an ihrer Stelle Modelle oder Bilder nehmen, die man zu Lernzwecken angefertigt hat."

ideas 1) truly (*veras*), 2) clearly (*claras*), 3) distinctly (*distinctas*) and 4) completely (*completas*), so that they can clearly (*deutlich*) recognize—meaning they can also understand what people are saying when the object is talked about—thereby becoming knowledgeable and rational people."[30] Semler remarked that this integrative method was something he had been emphasizing and discussing with other members of Halle's community for over thirty years. His description of it is striking for its capacity to resemble sentiments for which prominent members of the Royal Society had linked to an experimental method *and* those championing preeminently mathematical ways of knowing. For example, Robert Hooke (1635-1703) had expressed in both the bestselling *Micrographia* (1665) and in his *True Method of Building a Solid Philosophy* that it was first through a combination of the hands and the eyes that knowledge was acquired and then traveled to the memory.[31] At the same time, Semler's reference to the Roman rhetorician Quintilian's characterization of evidence (truly, clearly, distinctly), which Stephen Gaukroger has demonstrated lay behind much of Descartes' call for the use of geometrical exercises to make manifest the relationships between ideas and the sensitive soul, clearly links him to practitioners of geometrical method.[32] The holistic method he was advocating, a form of *Anschauung*, was endeavoring to take both starting points as

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[30] Christoph Semler, "Von Königl. Preussl. Regierung des Hertzogthums Magdeburg und von der Berlinischen Königl. Societät derer Wissenschafften approbirte und wieder eröffnete mathematische, mechanische und öconomische real-Schule bey der Stadt Halle" in the *Wöchentliche Hallische Anzeigen* (Monday, February 9, 1739), 83-84.

[31] Robert Hooke, *Micrographia. Some Physiological Descriptions of Minute Bodies Made by Magnifying Glasses with Observations and Inquiries Thereupon* (London, 1665 [first edition]); Robert Hooke, "The Present State of Natural Philosophy" and "Of the True Method of Building a Solid Philosophy, or of a Philosophical Algebra" *Posthumous Works . . . containing his Cutlerian Lectures and other discourses* (London, 1705); see Steven Shapin, "Who was Robert Hooke?" in Michael Hunter and Simon Schaffer eds. *Robert Hooke: New Studies* (Woodbridge: Boydell, 1989): 253-285.

[32] Stephen Gaukroger, "Descartes' Early Doctrine of Clear and Distinct Ideas," *Journal of the History of Ideas* 53 (1992): 585-602; Jones, 64-65.

true by privileging each community's dependence on the eye—especially clearer, "better" vision.

In the three formal descriptions of the school curricula he published, Semler was careful to align his project with the Berlin Academy of Science, suggesting several ways in which the lesson plans and descriptions of his schools can be seen as an expression of this conciliatory body's mandate.[33] This alignment also placed him firmly within the same network of individuals with whom Francke corresponded. In both the 1709 and 1739 published descriptions, for example, he included an excerpt from the *Gutachtung* the society had produced and approved on December 15, 1706 regarding his plans. The assessment, possibly penned by Leibniz, included the following:

> It seems advisable and feasible to allow boys, who are mostly taught reading, writing and arithmetic in German schools, to be instructed in certain ideas, new developments and exercises in a certain mechanical school, so that th*eir Understanding and their Senses* will be opened up more and that they will learn about especially the most important materials and objects, including how to recognize their worth and price, as well as about the proportional circle, the lineal, weights and measures—including other scales of measurement—and, whenever possible, how to use the globular microscope for a more exact comprehension of the body, and other useful instruments… the recognition of which will lead to the better understanding, practice and construction of useful instruments. Among other things, it is hoped that the pupils of this school will acquire a good sense of proportion (*Augenmaaβ*), a steady hand, a sharpened ability to use the outwardly senses, and a solid advantage in all tasks that present nature and move the exercises forward….[34]

The *Gutachtung* specifically referenced the Semler school's capacity to "open up" or to expand the capacities of young boys' intellects *and* their senses—namely, their abilities to improve both their cognitive and perceptive abilities through exercises in

[33] The first school Semler started in 1707 had folded by 1710; his second attempt in 1739 came to abrupt end after his death in 1740. These were his only formal attempts although, by all accounts, he continued to tutor individual pupils in his home.
[34] Semler (February 1739), 86-87.

Anschauung.[35] Semler's school, like Francke's pedagogy, Tschirnhaus's "true method," Leibniz's Academy and Wolff's guide to the *Mathematical Sciences*, endeavored to improve and to reconcile children's abilities to perceive with their ability to understand.[36]

The approval of Semler's school by Berlin Academy members set off a flurry of activity that directly involved Francke's institutes and orphanage. Semler explained that shortly after he received the *Gutachtung*, he began formal instruction in his *Priester-Wohnung*—the apartment he had available to him for the carrying out of his ministerial duties.[37] He hired a "litterato," he wrote, "who was highly experienced in mathematics, mechanics and oeconomie," to direct the lessons, which continued for almost a year and presented over "63 *objecta singularis"* to pupils.[38] For reasons that have become lost to us, he was forced to close the school possibly as early as 1709 and would not be able to formally reinstate it until 1738. But in the period that elapsed between the closing of the first school and its reopening, Semler would continue to teach and build three-dimensional models. The philosopher Georg Frierich Meier (1718-1777) would later recount that Semler was deeply involved in giving private lessons in the mathematical and mechanical arts in Halle and many of his models found their way into Francke's Foundation. On May 5th, 1729, Meier remembered:

> I was brought to Halle. I lived with my stepbrother, Nicolaus Heinrich Spielberg, who was a student and went to school in the house of M. Christoph Semler. First I lived with

[35] Horst Bredekamp discusses Leibiniz's affinity for the visual metaphors of the Theater and *Schauplatz* when describing his ideal Akademie; see his "Leibniz' ideale Akademie" in Wilhelm Vosskamp ed. *Ideale Akademie: Vergangene Zukunft oder konkrete Utopie?* (Berlin: Akademie Verlag, 2002): 159-164.
[36] Semler became a member of the Berlin Academy himself on June 13, 1731. See Werner Hartkopf, *Die Berliner Akademie der Wissenschaften Ihre Mitglieder und Preistraeger, 1700-1990* (Berlin: Akademie Verlag, 1992): 335.
[37] Semler was an adjunct of St. Ulrich's Church in Halle from 1688 to 1692, and a deacon from 1692 to 1709, after which he remained as a minister. Francke was an adjunct of the same church from 1692 to 1709 and took over as Deacon after Semler in 1709 (until 1716). This according to Gotthilf August Francke in a letter to the new Prussian King, dated February 12, 1740.
[38] The literato's name was Christian Benit, a student at the University of Halle, about whom (unfortunately) very little else is known.

> my stepbrother and then on the 3rd of March, 1730, Master Semler took me fully into his own house. And there I remained until the year 1736. I owe a great deal to this properly fashioned man.
>
> He was a lover of mathematics. He built the two *Himmelsphären*, globes, presentations of the routes of the planets, the city of Jerusalem, the *Stifthütte* of Moses and the Temple of Solomon that are all in the Orphanage's cabinet of curiosity; every day, three *Informatores* were received from the *Waisenhaus*, who would each teach us for two hours a piece. In his house was also a mechanical fabrique. He worked on building earthly and celestial globes and we children helped him with this. He instilled in us, playfully, a love of mathematics this way.
>
> I am especially thankful for the following way in which he directed my studies:
> 1. He let us be instructed in pure mathematics (*Mathesi pura*) and so, very early on, I received a love of thinking in the scientific way (*zu der scientischen Art zu denken*) and in my 13th year, I could demonstrate all of the clauses in Wolff's *Excerpt from the Mathematical Sciences*, especially arithmetic, geometry and trigonometry.
>
> 2. He made me learn the Latin language through reading the authors and through speaking; he never let me be bothered with the rote-memorization of grammar.[39]

Meier's report confirms much of the lore around Semler and his relationship to Francke's organization. The globes and models he produced in his mechanical workshop found their way into Francke's orphanage, where they were displayed prominently. The Halle Orphanage was apparently also sending their own teachers to Semler, suggesting a great deal of convergence between the goals of the *Realschule* and the forms of instruction available in Francke's foundation. Meier also made an indirect reference to Semler's ability to make mathematics *ludus*, by this point a kind of trope connecting Semler's pedagogy to Comenius's *Scholae Ludus* and to Leibniz.

Samuel Lange, one of Joachim Lange's sons and co-author of George Meier's autobiography, would also note that he too had studied with Semler. He explained that

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[39] In Samuel Gotthold Lange, *Leben Georg Friedrich Meiers* (Halle, 1778): 20-21. Meier became a member of the Berlin Academy in 1751. Semler's entry in the Zedler *Universallexikon* indicates that Semler's models (especially his "astronomical machines" and models of the Temple) were "not only to be seen in Halle's Orphanage, but in many distant locations such as Petersburg, Riga, Copenhagen, Landau, Dresden, Berlin, Nürnberg, Erfurt, Helmstedt und Stettin, where they were sent out of love (*auf begehren*)." Johann Heinrich Zedler, *Grosses vollständiges Universal-Lexikon*, Vol. 40 (Leipzig/Halle, 1744): 1777. See my discussion of the extension and replication of the Halle method, via the circulation of models and other artifacts, in Chapter Eight.

his admiration of Semler was so strong that he was compelled to talk about him often with his friends. He also described Semler's interest in creating a *Realschule* as *pia desideria*—a clear indication of Semler's connections to Comenius, Spener, Francke and *Anschauung*; like Meier, who readily connected Semler's school to Francke's *Waisenhaus*, Lange linked Semler's methods up with the conciliatory visual training that had become a hallmark of Francke's community in Halle. Lange explained that

> Semler was a great mathematician. He was also one of the greatest mechanics of his time and, at the same time, a great astronomer. His knowledge of physics was exceptional. He was the first founder of a school that would become famous as a *Realschule* and published a small treatise about his suggestion for a mechanical school for all artists and artisans. At the time this was *pia desideria*. After it became realized, his name was not remembered. He said that models of all types of wartime and civil architecture, and the art of building ships, should be constructed. He said that models of wind and watermills should be made. The suggestions that were realized in the finished models that are now in the Halle *Waysenhaus*... all of these came from him.[40]

Lange insisted that it was Semler who had provided Meier with „an introduction to the art of observing the whole and all of the parts that fit within it." In S. Lange's estimation, "the spirit" of Meier, whose philosophy would become linked with Wolff's (especially in Wolff's second tenure at the University of Halle) was directly attributable to the education he received from Semler. Because of this education, Meier "could take all of the clear philosophical particulars and see them as wheels—well divided wheels that fit somehow into larger whole…. It was at the hands of this kind of man," Lange wrote, "that Meier learned to think, to test, to differentiate and to find."[41]

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[40] Ibid.

[41] Ibid. For the relationship between Meier's philosophy and Wolffianism see Richard Pozzo, "Prejudices and Horizons: G.F. Meier's *Vernunftlehre* and its Relation to Kant" *Journal of the History of Philosophy* 43:2 (2005): esp. 189 ff.

While very little is known about Francke and Semler's relationship, as early as 1692 both were listed as adjunct ministers of Halle's St. Ulrich church.[42] According to his own records, Francke purchased a large model of Solomon's Temple from Semler for 100 Taler in 1717.[43] He also paid Semler 1000 Taler for the two large models of the universe, or *Himmelsphären,* that Meier indicated were available for viewing in the orphanage's curiosity cabinet.[44] In 1718 Francke would report to his patron Carl Hildebrand von Canstein that Semler had given him all the models from his *Realschule* so that he could start his own mechanical school in the *Stiftungen*. Canstein responded that he was overjoyed to learn that Francke "had received the mechanical school." He said he hoped that "the entire *consilium* of Herr Magister Semler could at the very least be accomplished," indicating the way in which the plans and school were linked to the larger conciliatory ideal of the Berlin Academy and its members.[45] When the Prussian

[42] Both men were appointed members (alongside their colleague Freylinghausen) of a royal commission, formed in 1720, to investigate allegations of corrupt handling of the church's "widow's fund;" a letter to King Friedrich Wilhelm (dated February 5, 1721) contains a report from this commission that refers to the archdeacon Francke as Magister Semler's "good friend." GSPK, I HA Rep 52 Nr 159b (1721-1749). According to Wachtler, Semler was confessor to Francke's son-in-law and baptized three of Francke's grandchildren, although he cites no specific evidence of this. A. Wächtler, *August Hermann Francke als Pastor zu St. Ulrich 1715-1727: Festschrift der St. Ulrichsgemeinde in Halle zu der 200 jährigen Jubelfeier der Franckeschen Stiftungen* (Halle: Niemeyer, 1898). Nikolaus Maassen has portrayed Semler and Francke as enemies, arguing that Semler was not only in close contact with Christian Thomasius, who had openly criticized Francke's *Anstalt*, but had been one of the city authorities who had signed the letter to the king (cited above) voicing concerns about the manner in which Francke was putting his teachings into practice in Halle. While these two pieces of evidence clearly indicate that Francke and Semler's relationship must be approached with caution, there is certainly more evidence of a great deal of productive exchange between the two figures than dissonance. For Maassen's discussion see *Geschichte der Mittel- und Realschulpädagogik* Vol. 1*,* 41-43. We have only one original letter from Semler to Francke in which Semler specifically requested Francke, who was then in Berlin, to use his influence at the Prussian court to help an acquaintance (H. Wesener) maneuver out of some debt-related problems he was experiencing. AFST/H RS: 1 [March 19, 1725]

[43] AFST/W Rep.2 Fach 245 Nr.5 *[Specification der Einahmen und Ausgaben wegen der Mechanischen Disciplinen* 1704 bis 1723…]: 56.

[44] Thomas Müller-Bahlke, "Der Realienunterricht in den Schulen August Hermann Franckes," in: *Schulen Machen Geschichte: 300 Jahre Erziehung in den Franckeschen Stiftungen zu Halle* (Halle/Saale: Verlag der Franckeschen Stiftungen, 1997): 58.

[45] Canstein responded to Francke (July 9, 1718): „Es ist mir eine hertzliche Freude, dass Sie nun die Mechanische Schule bekommen haben. Meines Erinnerns bedarf es wohl nicht, dass noch dazu gethan werden, was etwa noch fehlet, als dann konte das gantze consilium des H.M.Semlers wenigstens

king visited Francke's Foundation on August 22, 1719, Callenberg reported that one of the first places Francke took him was "through the mechanical room," where several of Semler's models were on display.[46]

One year after he had purchased Semler's model of Solomon's Temple, Francke's press printed a guide, also penned by Semler, containing detailed instructions for demonstrating the temple to audiences (see Appendix 8). The guide contained the same typology for fostering the highest degree of recognition possible in potential viewers, meaning that while the manual contained copperplate engravings to look at when one could not view the "material presentation," it also contained instructions for how to view the "actual model" on display in the orphanage.[47] Like observing a model of the temple, reading about that same temple while observing it, as Lorraine Daston has noted, "means also to see. The eye is as engaged as the mind, as the scholar's spectacles bear rueful witness. The Latin verb *legere* means to read, to select, but also to survey or to observe."[48] Reading was a part of *Anschauung*. In order to understand the "many strange histories" contained in the Bible, "the foundation of our faith," Semler explained that all individuals needed to acquire some "knowledge of the topography" of the Holy Land—including, he wrote, some "cognition of Palestine, Jerusalem and the situation of

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grossentheils bewerckstelliget werden..." In Peter Schicketanz ed., *Der Briefwechsel Carl Hildebrand von Cansteins mit August Hermann Francke* (Berlin: Walter de Gruyter, 1972). Thomas Müller-Bahlke's "Realienunterricht" (1997) provides the best overview of this story, esp. 59.

[46] In Kramer, *August Hermann Francke* (1880): 329. I discuss Semler and Francke's understanding of mechanics and motion in Chapter Seven.

[47] Christoph Semler, *Der Tempel Salomonis: Nach allen seinen Vorhöfen, Mauren, Thoren, Hallen, Heiligen Gefässen, ... nebst allen und jeden in folgender Beschreibung und beygefügten Kupferstücken enthaltenen Theilen desselben, in einem eigentlichen Modell und materiellen Fürstellung* (Halle: Waysenhaus, 1718).

[48] Daston continues, "There are many examples from the sixteenth century onward of anatomists and naturalists conducting observations with books in hand, triangulating between word, image, and thing. In these cases, reading and observing are so tightly integrated as to form a single practice." In Lorraine Daston, "Taking Note(s)" *Isis* 95 (2004): 444; more discussion of this relationship in a much earlier context can be found in Michael Camille, "Seeing and Reading: Some Visual Implications of Medieval Literacy and Illiteracy," *Art History*, 1985, 8:26–49. See also Johns, 380-443.

the temple. This fosters a clearer recognition of the worship services of the Old Testament, including the ceremonies of the Levites." But while the authors' descriptions and the copperplate engravings contained in his text could provide some guide, nothing provided more "distinct and living ideas" than actually "seeing the entire temple in a material presentation and model standing before the eyes." By viewing a model of the temple, those who had "only a dark concept" would receive a "bright and clear" one. Hearing or reading about the history animating and surrounding the temple would "press (or imprint) upon the *Gemüth* more deeply" so that one would become more fully convinced of the truth.[49] The model's utility and power lay in stirring up the imagination but in such a way as to evoke a more intense and meaningful edification (*Erbauung*).

The text conveys Semler's interest in regulating the quality of edification one experienced; it also portrayed models as tools for generating high quality sensations in the soul's lower faculties so as to positively affect better forms of cognition. That Francke also appreciated three-dimensional models for the higher quality of recognition they could generate in a person's soul, thereby heightening a person's abilities of perception and remedying the problem of the imagination's intrinsic unreliability, is perhaps most evident in a letter he wrote to the crown prince in Berlin on August 21, 1720. The letter accompanied a model of Jerusalem, likely built by Semler, which Francke had promised to send a few months earlier, during his extended stay at the Prussian court. Francke wrote to the young prince that he hoped the model would serve as "a medium for the channeling of the spirit of God," that would awaken the prince "to

[49] In this text, Semler also relates the story of his collaboration with a Jewish rabbi, whom he says was moved to construct his own larger model of the temple after seeing Semler's—a model that apparently was also displayed in the orphanage. He indicates that the models garnered a great deal of attention from the local Jewish community, some of whom came to the orphanage several times to "hear the demonstrations" because they "wanted to see their temple." In Semler, *Der Tempel Salomonis* (1718): xvi.

desire and love the holy word." He said he hoped that his presentation of this "form of Jerusalem" would make the process of constituting the prince's *Gemüth* (*Gemüthsverfassung)* more pleasant (*angenehmer*)," since "the frequent observation of it and the comparison of it with the Holy Scriptures according to the printed guidelines I have sent along, can yield all kinds of benefits, so that the word of God is *approached with more and more desire* [my emphasis], especially with the help of historical and geographical commentary, through which ever more uses and edificatory applications can be derived."[50] Pupils of his *Pädagogium* were also directed to regularly view models of the temple during their periods of exercise because, as Francke's associate Hieronymous Freyer explained, "showing this while reading the old and new Testaments provides a huge light and makes many beautiful locations and sayings very clear that one would otherwise not understand very well."[51]

The significance Francke's community attached to the model as an edificatory and didactic medium, as well as a carrier of information, resembles the way in which several individuals, including Johann Jacob Scheuchzer (also a member of the Berlin Academy) would link the significance of Semler's Temple of Jerusalem to its capacity to serve as the highest quality architectural muster or example available to man—a masterpiece, worthy of emulation.[52] As we have seen, the construction of three-

[50] Quoted in Kramer, *August Hermann Francke*, 326-327.
[51] Hieronymous Freyer, *Verbesserte Methode*, n. 7: "Es ist von diesem Tempel im *Pädagogio* ein grosses und von Holz fabricirtes Modell, 5 Elen lang und breit, vorhanden und eigentlich zu dem Ende angeschaffet worden, dass die Structur und Beschaffenheit desselben den Anvertrauten recht bekant gemachet werden solte: weil solches bey Lesung der heiligen Schrift altes und neues Testaments ein grosses Licht gibt und manchen schönen Ort und Spruch sehr deutlich macht, den man sonst nicht so wohl verstehen kann." Freyer also noted that "aside from this model, there is to see a model of the city of Jerusalem and the Holy Land in the Orphanage, also constructed in the same way, which the scholars are also shown."
[52] "Der Tempel Salomnis wird von allen Schrifft und Bau verständigen als das Vollkommenste Muster und Meister Stück der Civil-Bau-Kunst angesehen." Scheuchzer, *Physica Sacra* (1731): 121. For some recent

dimensional models of the Temple (and the calibration of their measurements) was a major preoccupation of several members of Leibniz and Jablonski's Academy. L. C. Sturm and Conrad Mel (see Chapters Two and Three), both in direct contact with Francke, were especially active in this regard. Scheuchzer, who became a member of the Academy in 1706, would stress that it was very important, "above all things, to place a horizontal and a vertical, perspectival projection of the entire Temple under the eyes of the worthy and knowledge-seeking reader so that he can see it in its entirety and grasp the most important parts in his memory."[53] His *Physica Sacra* contained a copperplate engraving of Semler's model of the Temple that Scheuchzer described as being housed in Francke's orphanage and of exceptionally high quality.[54]

When Semler donated his *Realschule* lesson plans and models to Francke in 1718, Francke did not start a new mathematical and mechanical school in his *Anstalt* but rather integrated them into the curricula of his own schools. The content of the "Semler lesson plans," then, is exceedingly important because, perhaps more than anything else, it conveys the depth of both men's commitment to three-dimensional models as specially designated tools for conditioning conciliatory ways of seeing (and being) in their pupils. The plans help me to more conclusively link Semler's school and Francke's institutes with the conciliatory mandate of the Berlin Academy and its participants. They allow us a much fuller understanding of how and why three-dimensional models became implicated in the great systems building projects of the early eighteenth century—

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work on Scheuchzer see Robert Felfe, *Naturgeschichte als kunstvolle Synthese: Physikotheologie und Bildpraxis bei Johann Jakob Scheuchzer* (Berlin: Akad. Verlag, 2003) and Irmgard Müsch, *Geheiligte Naturwissenschaft: die Kupfer-Bibel des Johann Jakob Scheuchzer* (Göttingen : Vandenhoeck & Ruprecht, 2000).

[53] Scheuchzer, *Physica Sacra* (1731): 125. For Scheuchzer's membership in Leibniz's Academy see Hartkopf, 316.

[54] Scheuchzer, *Physica Sacra* (1731): 136-37.

including how they were relied upon to construct the individuals capable of sustaining and understanding these same projects. Francke and Semler were in the business of training conciliatory *Gemüther* and employed a series of technologies that they borrowed from several individuals (Plato, Comenius, Tschirnhaus, the Sturms) and several different disciplines in order to accomplish their goals. In particular the lesson plans reveal a special preoccupation with models of buildings, cities and the heavens, and using these models in conjunction with the demonstration of various instruments and two-dimensional geometrical projections (*Grundrissen*). The plans also provide some evidence of just how nebulous the relationship between three-dimensional model and horizontal projections was in practice in this moment. Wolff privileged the *Grundriss*, not the model, and in the plans we actually see the authors of certain lessons endeavoring (by relying heavily on Wolff) to integrate two-dimensional geometrical projection into a recognition typology that privileges three-dimensional forms.

Malcolm Baker's essay on "Representing Invention and Viewing Models" in Enlightenment England acknowledges the longstanding importance, since the fifteenth century, of the architectural model as "an explanatory device to help patrons to understand a proposed design as well as to persuade them to proceed with a scheme."[55] In one of his many commentaries and published editions of Nicholas Goldmann's architectural treatises (*Short Presentation of Civil Architecture)*, Leonard Christoph Sturm similarly explained that it was important for architects to produce a representation of an idea (*Vorbildung*) of a building to serve as a "medium through which the architect

[55] Malcolm Baker, "Representing Invention and Viewing Models" in de Chadarevian and Hopwood eds., *Models*, 27; He relies on John Wilton-Ely's work in his discussion, especially *The Architect's Vision: Historic and Modern Architectural Models* (Nottingham: University of Nottingham, 1965) and idem. "The architectural model." *Architectural Review* 142 (1967): 26-32.

can help others recognize how a designated building should or will be constructed." Another strategy (one which Semler had pointed out was a superior strategy) for representing buildings, L.C. Sturm wrote, was having an "*idea materialis*, Modello, Modelle, Model or Muster" as when "a building is built to appear in miniature according to a certain scale in such a way that the building itself appears like the large building does or will."[56] But in Baker's estimation, this way of thinking about the architectural model as an "explanatory device," or a "representation of an idea," did not give way to the use of these same kinds of models as educational aids until the end of the eighteenth century. My evidence suggests that not only was Halle awash in architectural models in the first decades of the eighteenth century, but that their status as didactic instruments was widely acknowledged. In Francke's institutes, the architectural model became a site for the practicing or acting out of philanthropic impulses which placed them at the heart of the pedagogical regimens of *paideia*. Models, as the second best means of generating high quality forms of recognition, had the capacity to duly represent a pansophic ideal—generating concurrence between the model of the orphanage and the model of the temple in Jerusalem (as though each one resembled the other)—and to participate in the inculcation of these same ideals by becoming the focal points of individual lessons, the site to which all *Gemüther* would focus their attention. Certainly, members of Francke's community and correspondents drew heavily on the legacy of the architectural model as an "explanatory device," but they also adapted it to their unique pedagogical needs and institutional aims.

[56] Leonard Christoph Sturm, *Kurtze Vorstellung der gantzen Civil Baukunst* (1718): 3-4, "Von der Vorstellung der Gebäude."

Several of the 55 individual lessons contained in the Semler plan are oriented around three-dimensional models of some sort of building or collection of buildings. There is a lesson based on a model of a house and the city of Halle (with its most prominent physical structures), a glass-making hut (*Glasshütte*), brewing and baking houses (*Brauhaus* und *Bachhaus*), a salt mill, a chemical laboratory and a fortress (*Festung*). Models of the orphanage building, the temple of Jerusalem and the *Stiftshütte* were also circulating in the *Schulstadt*; however, they are not directly implicated here. In most of these cases, the three-dimensional miniature building served as a signifier for a set of practices or technologies being employed inside of it—providing the perfect point of entry for explaining those same practices. For example, a revealing subtitle follows a lesson entitled "Model of a House"—namely "model of a house, and what the work of a carpenter involves." The lesson begins with a description of the materials needed to construct any house (wood, especially pine), then the instruments (an ax, a *Winkel-Eisen*, a *Bley-Wage*…) and then the effects. The first few sentences of the *effectus* section read: "This is a model of a house, or a *Meisterstück* that has been made according to a scale (*Maßstäbe*). It is ___ long, ___ wide and ___ high. The following pieces are contained within it…".[57] The three-dimensional model of the house becomes a conciliatory site in which to see how the various materials, instruments and skills of the carpenter come together.

In most (if not all) of the three-dimensional models of buildings displayed in lessons, the structure itself could be presented to viewers in "closed" or "opened" form. When the model of *Glashütte* building is closed, it appears to the viewer as a white house with hardly any other defining markers of its interior life or animating principle; only

[57] AFST/H E 61, *Semler Lehrplan*, 17.

once it is opened and the various materials, instruments and practices engaged in inside the walls are explained does the small white structure begin to stand in for the special combination of skill, craftsmanship, nature and technology contained inside of it. More important than the precise arrangement of the materials contained within the model, however, were the exercises (*Sinnliche Übungen)* that invested the object with meaning, especially the questions viewers were asked so as to gauge the quality of the experience they had obtained while viewing it. Here is where the "edificatory applications" of these mediums are most apparent. The exercises contained within the lessons (usually placed at the end) included exercises in *Arithmetica, Geometria, Mechanica, Statica, Historia et Chronologia* and *Theologia*, with the theology exercises being the most detailed. The "Model of a House" lesson started with a Bible verse (2 Corinthians:5) and then presented a series of questions:

> 1) How does God decree that houses should be oriented? Towards hope.
> 2) What is this house made of?
> 3) Who lets these things grow upon the earth?
> 4) Can a person be constructed out of wood?
> 5) What purpose do these houses serve?
> 6) Can one live in a small house as merrily as one can live in a beautiful palace?
> 7) Does God know what happens inside all houses?
> 8) Can God allow us to be expelled from our houses and hunted down?
> 9) What happens to houses during war?
> 10) What will be our house of residence be when we die?[58]

These "theological exercises" contained at the end of the "Model of a House" lesson are striking for their ability to link the model's status as a conciliatory signifier of practices, materials and rational principles with edification and the message of hope, or moral improvement via *Anschauung* so prominent in the community of Halle at the time these lessons were written. The model's capacity to evoke "brighter" forms of recognition via the sensitive faculties of the soul is drawn upon here to inspire higher forms of

[58] Ibid., 22.

edification, intuition and perception in young viewers. And this is constructed as simply another "form of exercise," presented in conjunction with exercises in arithmetic, geometry, mechanics, statics and history. Reflecting on the divine origin of trees is a form of exercise connected to viewing a model of the house—to be engaged in around the same moment as one practiced constructing an angle "like the carpenter" or used the carpenter's measuring tools in various exercises.[59]

Semler understood his method for conditioning a more perfect form of recognition as contingent upon a certain set of strategies for representing material forms to the eye. The presentation (*Darstellung*) of the three-dimensional models he constructed was to occur in a formal setting where individuals would be introduced to the 1) *concreta,* 2) *particularia,* and then 3) *sensualia* and *individualia;* when viewing models of the Holy Land and temple; he wrote, "in some cases the [viewer's] eyes would be directed to short Biblical phrases and sayings" placed in prominent positions above or next to the space "where the demonstrations happen, transpire and are explained."[60] Demonstration, in Semler's formulation here, involved the directing of the eyes, via the model, and the directing of the attention via explanation, or the inculcation of rational principles. Like *Anschauung*, demonstrating merged cognition and perception and was therefore the method of choice for the "eminent erudites, dignitaries and other experienced individuals," who had lent their names to Semler's cause. All of those Semler claimed to have spoken with about his ocular method were resoundingly supportive; especially, he said, the director of the University (Christian Thomasius), Christoph Cellarius (Philosophy and Antiquity), Friedrich Hoffmann (Medicine) and

[59] Ibid.
[60] *Hallische Anzeigen* (February 9, 1739): 85.

Christian Wolff (Mathematics), "animated me in my propositions and promised me every possible assistance."[61]

In his *Mathematical Lexicon* from 1716, Christian Wolff defined a demonstration as a "kind of proof that allows itself to be parsed into several formal conclusions in such a way that…no claim can be turned into a conclusion that has not been proven."[62] He explained that the best illustration of the art of demonstration he was championing could be found in his *Elements of Geometry*, which also conditioned individuals to observe "drawn and presented figures" upon which they were "to direct their thoughts." Like Semler and Francke, Wolff valued and promoted *Anschauung*. Directing one's attention to "the things that reach one through the senses" could condition more powerful or clear moments of cognition by bringing other useful pieces of information into one's memory. And more than simply calibrating the power of sensation with the cognitive capacities of the soul in isolated conciliatory gestures or performances, each of these figures was interested in the prospect of cultivating personas who did this constantly. They wanted to teach children to approach the world demonstratively and experientially—that is to link the experiences filtered through their senses to the rational propositions contained within their memories.

However, Wolff did not feature three-dimensional models prominently in his *Beginner's Guide*, nor did he offer a definition of the three-dimensional model in his *Mathematical Lexicon*. Instead he emphasized the two-dimensional *modul* as "a *Maas* that reconciled various heights, widths and depths with each other to establish a certain,

[61] Ibid.
[62] Christian Wolff, *Mathematisches Lexicon* (Leipzig, 1716): 502 ff. Reprinted in *Gesammelte Werke*, Part One: Volume 11.

ideally simple, proportional relationship."[63] The Maas linked cognition and perception via precision and proportionality, by forcing the two "pillars" to assimilate according to certain, geometrical axioms—thereby making the three-dimensional model, or third conciliatory site, less critical. In some ways, the relationship between three-dimensional models and two-dimensional drawings has always been varied and contested, as those working as architects in the seventeenth and eighteenth centuries also understood. But in some cases, the model was imagined as a superior medium for more accurately rendering all of a physical structure's proportional relationships. The seventeenth-century British architect Sir Roger Pratt, for example, in attempting to explain his preference for models over drawings said that "whereas all the other drafts do only superficially and disjointedly represent unto us the several parts of a building, a model does it jointly, and according to all its dimensions."[64] However, Baker emphasizes how important it is not to characterize the relationship between three-dimensional models and two-dimensional drawings in terms of a "straightforward development from 2-D to 3-D."[65] Here we have a very interesting example of how the two-dimensional *Grundriss* becomes imagined as a superior form of representation because of the kind of reconciliation it fostered.

Wolff defined architecture as "the science of properly specifying a building so that it corresponds completely with the main intentions of the master builder" in the first volume of his *Beginner's Guide* (1709). He explained that while most people still considered architecture a trade (*Handwerk*) and tended not to think of it as a mathematical science, in his opinion it ought to be taught in academies to youths

[63] Ibid., 905.
[64] Quoted by Baker, "Representing Invention" in de Chadarevian and Hopwood eds, *Models*, 30.
[65] Ibid.

planning to study at universities.[66] The Semler *Lehrplan* contains two lessons in architecture that begin with Wolff's definition of *Baukunst* and incorporate, sometimes word for word, his treatment of the discipline. They attest to the ways in which the three-dimensional model's status as a superior conciliatory site in the Semler typology was being imagined (and tested) relative to the technologies of geometrical projection that Wolff had introduced in Halle.

One lesson is called "About the Ground Plan or Horizontal Projection (*Grundriss*) of a Building" and promises that the Ground Plan and "what it causes to be remembered" will allow architecture to be "actually" or "materially" handled.[67] It involves the ocular technologies of *Anschauung* but it is one of the only lessons that does not revolve around a three-dimensional model.[68] It also mimics Wolff's emphasis on the graceful appearance of buildings and basic proportional relationships (1:1, 1:2) to stir the soul because "the soul desires that what it can easily grasp." Wolff had offered his readers three axioms (*Grundsätze)* and one theorem (*Lehrsatz)* at the outset of his *Beginner's Guide*: namely: "1) every building must be staged or situated solidly, 2) one can judge the durability of a building by how long it stands, 3) every building must be built comfortably." The first theorem included this statement: "a building must be built beautifully and gracefully." The next portion of the Semler lesson mimicked these axioms: "the building master must observe the following: 1) the strength or durability of building (Wolff's 1 and 2), 2) the comfort or coziness 3) the beauty and grace" of the

[66] Christian Wolff, *Anfangsgründe der Baukunst* [1st ed. 1709] (Halle, 1757), 305. Reprinted in *Gesammelte Werke*, Part One: Volume 12.
[67] AFST/H E 61, *Semler Lehrplan*, 557.
[68] There are just a couple changes to the word order of Wolff's definition in the Semler plan definition. Wolff: "Die Baukunst ist eine Wissenschaft, ein Gebäude recht anzugeben, dass es nemlich mit den Haupt-Absichten des Bau-Herrn in allem völlig überein kommt." *Lehrplan*: "Die Baukunst ist eine Wissenschaft ein Gebäude rechtanzugeben, dass es mit dem Haupt Absichten des Bauherrns übereinkämte in allen völlig."

building. The Semler lesson then boiled down Wolff's systematic discussion of *Eurythmie* to a few "points of observation" and discussed, in depth, the art of creating and applying geometrical projection techniques.[69]

The producer of this text was especially interested in helping his audience understand these techniques, including why different forms of architectural drawing were necessary:

> 1. The *Hauptriss* is made when the *Baumeister* wants to make his invention easier to stage; sketches of the rooms' layout in a given space are rendered with easy lines.
> 2. The *Grundriss* is made when one wants to depict not only the order and spacing of the rooms, like with the *Hauptriss*, but instead when one wants to draw up a likeness that shows the thickness of the walls, the width of the windows, the placement of the stoves, fireplace, oven etc. and their distance from arches as well.
> 3. The *Aufriss* shows the height and width of the outward walls, doors, windows, and other adornments.
> 4. The *Durchschnitt* or *Pensill*… presents the height of the rooms or the profile of the building, as if it has been cut down the middle…
> 5. The *perspectivische Riss* presents all sides of a building at once. Of these kinds of renderings, the *Grundriss* and *Aufriss* are the most important. We will stay with the *Grundriss* now, of which the following things should be noticed…[70]

The rest of the lesson demonstrated the detailed components of the *Grundriss* to the viewer. Revealingly, the lesson that immediately follows the lesson in architecture is oriented around the demonstration of a "model of a city with its houses, walls." Only the lesson giver is careful to note that "we have already had a horizontal projection of Halle."[71] It seems that this anonymous lesson writer had hit upon a new tool for conditioning conciliatory forms of recognition in young people. Faced with new synthesis of mathematical knowledge Wolff offered in the *Beginner's Guide*, the author was engaged in expanding the Semler recognition typology to include Wolff's emphasis on geometrical projection techniques. In this largely derivative lesson, the two-

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[69] Christian Wolff, *Anfangsgründe der Baukunst* [1st ed. 1709] (Halle, 1757), 314. Reprinted in *Gesammelte Werke*, Part One: Volume 12.
[70] AFST/H E 61, *Semler Lehrplan,* 557.
[71] Ibid., 568.

dimensional *Grundriss* had managed to momentarily supplant the model on the *Schauplatz* as a superior conciliatory tool. However, the models and instruments in Francke's orphange remained important "sites" for affecting higher forms of knowledge through desire, or the heart.

Models as Instruments, Instruments as Models

In addition to architectural models and *Rissen*, the Semler plan (and testimonies from former students) reveal that several models of the universe (*Himmelsphären*) were also on display in Francke's orphanage. By all accounts, they were employed in lessons, and the *Lehrplan* provides a useful window into how these lessons worked. The plan's *Himmelsphäre* demonstrations were by far the most detailed of those contained in the lessons and included over 50 individual *demonstreturs* in conjunction with descriptions of almost twenty other astronomical instruments that could be "found in the orphanage."[72] This raises the question of exactly how to understand the relationship between model and instrument in the context of Pietist *philanthropy*. In a recent article, Adam Mosley takes issue with James Bennett's contention that in the sixteenth century, globes and armillary spheres were understood alongside astrolabes and other measuring instruments mainly as calculating devices, not models.[73] Mosley prefers to see mathematical instruments (including the astronomical sphere or globe) "as models embodying and communicating novel cosmological theories," whereas Bennett, in his

[72] AFST/H E 61, *Semler Lehrplan,* 739.
[73] Adam Mosley, "Objects of Knowledge: Mathematics and Models in Sixteenth-Century Cosmology and Astronomy," in Sachiko Kusukawa and Ian Maclean, *Transmitting Knowledge: Words, Images and Instruments in Early Modern Europe* (Oxford: Oxford University Press, 2006): 193-216; James A. Bennett, "Geometry in the Context of the Sixteenth-Century: the View from the Museum" in Early Science and Medicine 7:3(2002): esp. 218-220 and Anthony Turner, *Early Scientific Instruments: Europe 1400-1800* (London, 1987).

estimation, delimits their significance. Mosley's critique, valid or not, points to the liminal or unstable relationship between the categories mathematical instrument and three-dimensional model in any period, including this one. It also lends credence to my contention that in early eighteenth-century Halle, the *Himmelsphäre* could easily have been imagined as a medium capable of doing several things at once—calculating, communicating, assimilating and signifying. It was in precisely this convergence that the boundary between instruments and models was blurred.

As we saw in Chapter Two, in the Meier biography, Samuel Lange explained that the heavenly spheres on display in Francke's orphanage presented "the systems of both Tycho Brahe and Copernicus. Both are ordered in such a way that the precise movement of the whole universe and individual pieces, including the moons of the planets, can be guided with a single twist so that they agree with real time, eclipses and all other movements."[74] In a conciliatory *Anstalt*, oriented around the reconciliation of points of view rooted in fundamentally opposing starting points—the sun vs. the earth or intuition vs. experience—the demonstration of astronomical models provided an ideal opportunity to construct, via the three-dimensional model, a visual solution to seemingly irreconcilable difference. A "system or hypothesis," the author explained in a lesson called simply "On Astronomy," is only "an ordained idea (*ordinirte Vorstellung*) about the places and movements ascribed to planets and made according to observations."[75] Even though the *Systema Ptolemaicum* was "entirely dismissed today," he said, it was

[74] S. Lange, *Leben*, 20-21.
[75] A short note at the outset of this lesson indicates that it was offered for the first time on the day of a real solar eclipse (September 11, 1708), AFST/H E 61, *Semler Lehrplan,* 331. "Systema oder hypothesis ist einer nach den observationen ordinierte Vorstellung aller Planeten nach ihren gehörig Platzen und Bewegungen."

still explained to pupils alongside the *Systema Copernicum* and the *Systema Tychonicum* while directing their attention to the various models representing these *Vorstellungen*.

The "globus coelertis artificialis," the author continued, "is an artfully constructed sphere, upon which the movements of the heavens are transmitted and presented through real cycles and figures."[76] The lesson giver was to use the spheres to illustrate a "system or hypothesis" at the same time as he shared information about the materiality of the medium itself. "Here it is also said," he noted, "how the globes are made and it is also shown how and with what it is they are covered with."[77] A related section in the plans, entitled *Astronomia mechanica or actual models of the universe after the systems of Copernicus and Tycho Brahe*, noted that the models were "built in my ministerial quarters," suggesting Semler produced some of these sections himself. Dreyhaupt noted that the Brahe and Copernican spheres were 12 shoes in diameter, took Semler a total of three years to build and cost around 1000 Taler.[78] Semler stated that he was especially proud of what he called the "unique worth" of these two spheres; they were special because they presented "the planets and fixed stars—including their movements through the heavens."[79] They also were special, he said, because when both were demonstrated together (that is, at the same time), one could see more clearly. "When one has the two

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[76] AFST/H E 61, *Semler Lehrplan,* 330-331. "Astronomia ist eine Wissenschafft von Einrichtung der ganzen Welt. Globus coelestis artificialis ist eine künstliche gemachte Kugel auf welcher das Himmelslauff vermittelst etlicher Circul und Figuren furgestellet wird. Sie ist macherley: Globus solidus eine dichte Kugel, Globus annularis einer Kugel von laut Siegen, Planischphaerium coelerte, wie eine LandCharte gestallt, Coniglobium ein Stern-Kügel, welcher Ohl ist, bestehet aus 2 Stücken, einen Mitternächtigen und Mittagigen...".

[77] Ibid. "Hierbey ist auch gesaget worden, wie die Globi gemacht werden und auch gezeiget, wie und womit sie uberzogen werden."

[78] Dreyhaupt, *Ausführliche diplamtisch-historische Beschreibung des .. .Saal-Kreyses*...(Halle, 1750): 719. Included in Dreyhaupt's description of Semler's inventions are "Zwei himmels-Sphären, das Systema Tychonichum und Copernicanum vorstellend, 12 Schuh im Diameter so über 1000 rthl. Gekostet, und 3 Jahr mit deren Verfertigung zugebracht worden, stehen eben daselbst."

[79] „Astronomia mechanica oder eigentlichen Modell das grossen Welt Gebaudes nach dem Systemate Copernicano und Tychanico," in AFST/H E 61, *Semler Lehrplan*, 739, 741, 763 and 829.

Systemata in *Sphaeris*, the differences between them both fall in a very lifelike manner into the eyes," he remarked. Having both *Systemata* "in *Sphaeris"* was not only a "*singulare*," it opened the door to an extended form of sensibility through observation, or *Anschauung*. The eye's capacity to see was heightened via a form of *betrachten* that conditioned higher forms of comprehending natural laws, contradictory ideas *and* the beauty of the divine. Reflecting on the divine via the inner and outer eye, or heart, allowed one to bring together what only appeared, on the surface, to be radically opposing points of view.

We direct our attention to the model (or *Schauplatz*), Semler explained, just like we direct our eyes to the heavens for inspiration. "The heavens are the most beautiful parts of the world. When we pray, we raise our eyes to the heavens. This is why Solomon inaugurated the temple through a beautiful prayer and stretched out his hands toward the heavens: because the visible heavens are a model *(Fürbild*) of the majesty of God."[80] Three-dimensional models of the universe were representations of an inherently conciliatory (and perfect) world in which substance and supreme wisdom were magically interwoven. "The entire world is like a mirror," Semler continued in a section that could just as well been penned by Leibniz, "wherein one sees God all at once. Especially the heavens present and open up God's majesty through their brilliance, splendor and beauty; they present God's infinitude through their amplitude and size, his wisdom through their beautiful structure, his all-powerfulness through their strength, solidness and consistency, his goodness through their influence and utility and his unity through their circular

[80] Ibid., 859.

form."[81] The world itself also provided the perfect opportunity to witness the *Schauplatz* of the divine. "The world is our almighty God's enormous *Schauplatz*, in which God turns us into spectators and opens up to his power, intelligence and wonderfulness to us," Semler wrote. "But since the human eye cannot take in the entire world and its broad reaching heavens at once, people have invented a few useful machines that are quite current and that present imitations of the heavens and its spheres; they are merely silhouettes of the enormous originals and present a lifelike *coelum representativem*."[82]

Visualizing, through "living representations," the principles of harmony at work in the universe by placing models of the "majesty of God" on the *Schauplatz* was only one component of conciliatory visual training. Another involved the cultivation of the ability to actually adopt (and to assimilate in the heart) different points of view—to see precisely like someone else would see who was approaching the world from an entirely different starting point—and to recognize various gradations of difference. For example, just as Francke urged his followers to test the degree or quality of their faith relative to others (see Chapter Four), the lessons attached a great deal of importance to cultivating

[81] Ibid., 864-865. "Die weite Welt ist wie ein Spiegel darinne man gleichsam Gott siehet. Sonderlich aber präsentiret und offenbahret der Himmel durch seinen Glantz und Pracht Gothes Majestät und Herrlichkeit; durch seine Weite und Grösse, Gottes Unendlichkeit; durch seine schöne Ordnung, Gottes Weissheit; durch seine Krafft, Festigkeit und Beständigkeit Gottes Allmacht; durch seine Influenz und Nütz, Gottes Gütigkeit und durch seine Circul rundte Gestalt, Gottes Einigkeit." Slightly earlier in the text (855 ff.) Semler explained that there was (as of yet) no Astronomer who had argued that the shape of the world best corresponded to a triangle or a square: Es ist noch nicht kein Astronomus gewesen, der die Meynung gehabt, oder mit grundlichen Beweisthum dargethan habe, dass die Welt eine dreyeckichte, viereckichte oder andere Figur ausser der rundthen habe. Alle Astronomische Instrumenta mit welchen man die Phaenomea und beybanheiten am Himmel observiret sind auf eine Rundung gerichtet und gleichwohl treffen sie mit dem Himmel richtig zu. Darum hält man nicht ohne Grund dafür dass der Himmel eine rundte Figur habe."

[82] "Die Welt ist ein grosser Schau-Platz der Allmacht Gottes, in Welchen uns Gott zu Spectatoren gesetz und uns seine grosse Krafft, weissheit und herrlichkeit offenbahret. Weil aber das menschliche Auge auf einmahl die gantze Welt und den weiten Himmel nicht völlig übersehen kan: so hat mann einige nützliche Machinen erfunden, dergleichen auch gegenwärtige sind, welche den Himmel in seinen Sphaerey als ein imitamentum und Schatten bild des grossen Originals und als ein coelum representatium lebhafft vorstellen." Ibid., 739-740.

the pupil's understanding of the appearance of something relative to their position on earth—via the model: "For those of us who live on Earth, the heavens appear as a large, round ball, which surround us halfway with their concavity," Semler explained. But with a *globus coelestis*, the convexity of the heavens can be presented, as if we were extended outside of and above the heavens."[83] While demonstrating the *Systemate Tychonico*, the lesson giver was to say that "in this model, the earth is presented much too largely. In comparison to these heavens it should only be the size of a poppyseed or even smaller."[84] Included in this discourse of proportionality was also a moral lesson about the size of man, "a piece of dust," relative to the earth, and to God.

Several of the instruments demonstrated alongside the heavenly spheres seem to have been directly linked to these efforts to teach pupils how to enhance their abilities to see things from several perspectives—to literally suspend themselves "outside of and above the heavens." There was an i*nstrumentum parallacticum* that was used alongside the *parallaxi plantarum* and "present[ed] the earth in brown points." A *machina cometica* displayed "all the comets that have been seen at some point and can be shown according to a specific hypothesis." The *lucerna astronomica* "show[ed] solar eclipses, the phases of the moon and present[ed] all asteroids in a very lifelike manner."[85] Finally, there was an instrument referred to simply as the "Lit. E," which allowed the viewer to cultivate his ability to see the earth as a non-earth dweller might. "Using the small instrument Lit: E, *Astronomia Selenitarum* will be presented," Semler noted, "or how we

[83] AFST/H E 61, *Semler Lehrplan,* 853.
[84] Ibid., 886. "In diesem Modell ist die Erde viel zu gross vorgestellet. Sie sole nur als ein Mohn-Körnlein und noch viel kleiner auch nur gegen diesen himmel seyn. Denn ein Mensch ist gegen den Erboden als ein Stäublein. Der Erdboden hinwiederum ist gegen den grossen Himmel nur als ein Stäublein. Der Himmel aber gegen den unendlichen Gott noch viel kleiner zurechnen als ein Stäublein. Dann inter finitum, Coleum, et infinitum, (DEUM) infinita est distantia."
[85] Ibid., 896.

would see the world if we were on the moon."[86] Since the moon "turns against the earth all the time," he continued, "if there were people (*Seleniten*) who lived on the side of the moon that faces the earth, they would constantly see the earth." Despite the relative frequency with which they would see the earth depending on their position of residence on it, "it would appear to their eyes four times larger than the moon appears to us."

Semler continued to demonstrate a variety of propositions oriented around helping audience members realize the limitations of their vision based on their relative positions on the earth—and the physical circumstances (like the atmosphere) that affect sight. For example, "if they (the moon dwellers) have no atmosphere to keep the rays of the sun under control, then they would be able to see the stars during the day." This encouraged the viewer to consider the very real effect of the earth's atmosphere on the absorption and distribution of the sun's rays. Or he noted that "the sun is sometimes very close to them and sometimes very far away. This means that the sun will sometimes appear to their eyes to be very big and sometimes it will appear very small." The earth-dwelling viewer, while urged to suspend his formulation of reality and consider the perspective of the moon-dweller, could also come to better appreciate the fact that the moon sometimes appeared near and sometimes far to his eyes—but most importantly know why this was the case.[87] In all of these instances, a discussion about what "moon dwellers" see was

[86] AFST/H E 61, *Semler Lehrplan,* 897. "An dem kleinen Instrument Lit. E wird für gestellt Astronomia Selenitarum, oder wie wir, wann wir im Mond wären, die Welt sehen würden."

[87] Ibid., 897- 901. "Der Mond wendet alle Zeit 1) tandem faciem gegen die Erde, weil er sich nicht circa axin beweget, dahero die jenigen Seleniten (wenn anders welche im Monde vorhanden) welche auf dem Teil des Monden wohnen der gegens gekehret ist, die Erde immer beständig sehen. Die jenigen aber welche auf 2) den finstersten Teile des Monden wohnen, sehen die Erde einmalen, die Sonne aber kriegen alle, so um den Mond wohnen zu sehen. Weil auch nach der hypothesi copernicana sich die Erde motudiurno circa axin beweget, so sehen sie die Erde in perpetua circumrotatione, und zeiget Ihnen die Erde immerhalb 24 Stunden nach und nach alle ihre regioneo in allen 4 Theilen der Welt.... 22) Die Sonne ist ihnen manchmahl sehr nahe, in conjuntione manchmahl ist si von Ihnen sehr entfernet nahml. in

less about the relative truth of their existence than using their "point of view" to help generate an improved way of seeing (and being) in the world.

Showcasing competing *Systemata* in the orphanage was not about explaining to pupils why the Copernican system was "right" and Brahe's geocentric system was "wrong," but instead involved helping them reconcile both systems by understanding their differences and significance—relative to one another. In the section on Astronomy in his *Beginner's Guide*, Wolff did something very similar to the Semler curriculum described above. He explained that in many ways a geocentric system makes perfect sense because "you always stand in one position on the earth, so it appears as if the entire universe with all the stars moves around the earth."[88] Since newcomers to the study of astronomy "only concern themselves with appearances," he continued, "without damaging the truth you can pretend as if the universe, with all its stars, revolves around the earth."[89] Regardless of whether a geocentric worldview is considered "true" or not, it was worth learning about because it served as a useful starting point for understanding the motion of the stars. We know that Francke's *Pädagogium* pupils were taught "the most important hypotheses regarding the system of the universe" and led through astronomy using Christian Wolff's *Beginner's Guide.*[90] There was also a platform for conducting astronomical observations on the top of the Halle Orphanage.

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oppositione. Daher kommt es auch dass die Sonne Ihnen einmal viel groesser und andermahl viel kleiner ihren Augen erscheinet."

[88] Christian Wolff, *Anfangsgründe* Part III [1st ed. 1709] (Halle, 1757): 1127. Reprinted in *Gesammelte Werke*, Part One: Volume 14.

[89] Ibid.

[90] See Freyer's *Verbesserte Methode* (1721).

Part of acquiring the ability to assimilate a variety of perspectives involved mastering the study of optics and the application of optical instruments.[91] The lessons "On Optical Instruments" start, like Wolff's, with the definitions of *Optica* ("involves direct seeing, like what occurs through a straight line"), *Catoptica* ("reflected or *zurück-prallenden* seeing, like what happens through a mirror"), *Dioptrica* ("refracted seeing, like what happens through grinded glass and other *diaphana*") and *Perspectiva* ("involving the designation [*Aufweisung*] of an object as it falls into the eye"). They also included brief descriptions of the instruments on display, especially a *tabur est vel*, *perspectiva*, *laterna magica*, camera obscura, prism, microscope and various sorts of speculums. The lesson writer then formulated two questions: "where is the focus in convex glasses? What is the virtual focus of concave glasses?" and noted that "herewith all of the ways of polishing the glasses, even the blown ones, are shown."[92] Properly comprehending the principles of refraction, concavity and convexity was necessary in order to see properly and directing one's attention to the optical instruments on the *Schauplatz* provided perfect opportunities to explain these same principles. Elaborations on the idea of concavity and convexity appear in the lessons oriented around the armillary spheres too; for example, Semler explained that "with this sphere one can observe the convexity of the heavens just as well as their concavity. If I observe that the side and *superficiem* of the heavens is external or opposite to me, I see the round *sphaera* in its convexity. But if I look through the side that is opposite of me toward the other side,

[91] That children were learning how to use optical instruments is clear from the Semler astronomy lessons as well. The author explained that it was possible to observe a solar eclipse "1) through a tube in the camera obscura etc. 2) If one covered the objective glass with oil dampf and let it turn black etc." AFST/H E 61, *Semler Lehrplan,* 342-43.

[92] AFST/H E 61, *Semler Lehrplan,* 342*;* "Then the principle of refraction was demonstrated using the *Cubus vitreus*, after which, the writer noted, pupils were allowed to "cut figures out of paper, stick them to beer glasses and pour water over them."

then I can observe the heavens in their concavity. And on the same concave side I see the stars in the actual places where they are situated in heaven. On the *globo coelesti*, I see the stars in reverse situ, because whatever stars stand in heaven on the right side, stand on the globe on the left side."[93] Depending on a person's position, or point of observation, one's perception of an object might change depending on the effects of these two principles. But if one knew how to locate a focal point, then one could master the circumstantial quality of sight.

Exerting control over the circumstances of seeing involved understanding how the eye worked. In this regard, the "Optical Instruments" lesson (see Appendix 9) specified that "the following things should be said:"

> 1) our eye is like a mirror very much like a camera obscura, wherein all objects are presented. It has the following parts: a) pupillam…b) iridem… c) 2 Nerven… d) humores…
> 2) Seeing happens by taking the form of an object into the eye, like in a mirror; in the form of a cone or pyramid, the mirror is the eye, the vahir is the top surface of the object.
> 3) A Shadow is an absence of light; it retains the form of the body that it resembles…the shadow of earth makes the night.
> 4) Darkness existed before light because God created light out of darkness.
> 5) Light pleases the eye because the seeing-spirit only has similitude with light; the darkness produces fear because light is what the seeing-spirits need for nourishment.
> 6) Black and white are the main colors, the rest are only a mixture of light and shadow.[94]

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[93] Ibid., 853-854. "An dieser Sphaera aber kan man den Himmel nach der convexität so wohl als auch nach seiner concavität betrachten. Wann ich die Seite und superficiem des Himmels betrachte, so äusserlich ist und gegen mir zu stehet, so sehe ich die runde Sphaeram in ihrer convexität: wann ich aber durch die Seite, so gegen mich stehet hindurch sehe nach der andern seite, so gegen über ist, so sehe ich den Himmel daselbst in der concavität. Und auf derselben concaven Seite sehe ich die Sterne in derjenigen eigendlichen Situation, wie sie am Himmel stehen. Auf dem Globo coelesti sehe ich die Sterne in unverso situ. Denn welche Sterne am Himmel zur rechten Hand stehen, die stehen auf dem Globo zur lincken Hand. Darum haben derglelichen Sphaerae armillares stellatae für denen globis coelestibus hierinnen einen grossen Vorzug."

[94] Ibid., 500-505. "1) Unser Aug ist wie ein Spiegel, oder viel mehr wie eine camera obscura gestalt, darinnen sich alle objecta praesentiren. Es hat folgende Theile.... 2) die Sehen geschieht durch Einnehmung der gestalt eines Objecti ins Aug, als in einen Spiegel, und zwar in Gestalt eines Coni oder Pyramidis, die Spiegel ist ein Auge, die vasir ist die Oberfläche die Objecti. 3) Der Schatten ist einer abwesenheit der Lichtes, er behält die gestallt des Cörpers, so ihn vorursachete....der Schatten der Erde macht die Nachte. 4) Die Finsterniss ist ehe gewesen als das Licht, dann Gott hat das Licht aus den Finsternis hervortracht. 5) Das Licht erfreuet die Augen. Weil die Seh-geister eine Ähnlichkeit mit dem Lichte haben; hingegen verursachet die Finsternüss Schrecken, weil den Seh-geistern das Licht als ihr Pabulum enzogen ist. 6)

At first glance, this comes across as a fairly standard account of the technologies of seeing; it even includes the well known camera obscura metaphor (see Chapter Two). But the list of "things to say" while explaining vision to pupils was much longer:

> 7) Seeing correctly requires
> a) rationality of the soul derived from reason, attention and solid exercise of the anima (*Gemüth*);
> b) rationality of the eye (*ratione oculi ipsig*) so that it is healthy and without movement;
> c) rationality of the object (*ratione objecti*) so that it can be presented to the eye in the proper style, time and manner and not with too much light;
> d) *ratione diaphani*, so that it is moderately illuminated and free from errors.
> 8) A mad, afflicted or angry person does not see the object correctly a) because his soul does not have the proper strength and renounces reason; b) because the movement of the *Gemüth* is so strong that it confuses and distracts the seeing spirits.
> 9) Old people lose their sight gradually because the seeing spirits become weaker and fewer and at the same time the cornea becomes harder and thicker.[95]

Just because the eye functioned like an optical instrument (a camera obscura) or mirror, did not mean that the problem of visual representation was anywhere close to resolved. As the author explained, seeing correctly required a "rationality of the soul derived from reason," the training of "attention" and rigorous exercise of the *Gemüth*. At the same time, it required knowledge of the physicality of the medium and the site of seeing—ensuring that the space in which an object was observed was not illuminated "too brightly" and that the object itself was free from errors. The lesson writer went on to explain that the reason drunk people experienced double vision or "saw doubly" is that the excessive amount of alcohol "confuses the seeing spirits" (again inhibited the rational

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Schwarz und weiss sind die vornehmsten Farben, die übrigen sind nur eine Mixtur des Lichtes und der Schatten."

[95] Ibid. "7) Zur rechten Sehung wird erfordert a) ratione der Seelen, dass sie bey Vernunft, Attent, und von festtiger Gemüths Bewegung betreyet sey. b) ratione oculi iphig, das es gesund und ohne Bewegung sey c) ratione objecti, das es in gehöriger Art, Zeit, Weile und nicht mit all zu grossen Lichte dem Auge furstelle. d) ratione diaphani, das es mässigl erleuchtet und frey von faulen sey. 8) Ein Sehend, Betrübter und Zureiger sieht die Objecta nicht recht (a) weil die Seele in Ihm nicht ihre gehörige Kraft hat und Vernunft erweiset. (b) weil bey diesen 2 legte die hefttige Gemüths Bewegung, die Seh-Geister confundirt und zerrüttet. 9) Der Alter Leuten vergehet das Gesicht nach und nach, weil die Sehgeister wenig und schwach werden, und hingegen die Cornea härter und dicker wird. "

soul's ability to do its job) and "reverses the eyes so that the pictures of objects that fall into the two eyes cannot become unified into a single model or example (*Vorbild*)."[96] Like models, the demonstration of optical instruments presented powerful opportunities for discussions about how conciliatory models or visual examples themselves are formed—and how one's character, reflected in certain behaviors like drunkenness in this instance, determined the didactic (and edificatory) potential of the medium itself.

The Semler lesson plans' preoccupation with ocular demonstration meant that even discussions of mathematical or navigational instruments, including a device for measuring longitude, were bound up with similar kinds of discussions about the ethics of seeing. By the time these kinds of discussions had begun to take place in Halle around 1700, the power of post-Renaissance developments in practical mathematics, especially their capacity to impact the formulation of natural philosophical discourses and methodologies in the seventeenth century, had become especially visible in the flurry of research and attempted solutions to the infamous longitude problem. J.A. Bennett has argued that especially "navigation, longitude and geomagnetism formed a meeting point between mathematical science and natural philosophy, an intersection understood to be relevant to pressing practical problems of the period and across which individuals engaged in such problems could transfer attitudes and techniques."[97] Measuring longitude, then, was an intrinsically conciliatory act, just as demonstrating and publishing a description of a new device for measuring longitude can also be seen as a kind of conciliatory gesture—one that simultaneously championed the contributions of

[96] Ibid., 504-505. Excessive movement of the eyes—on a ship being tossed by the waves, for example—is also described as dangerous; to see "correctly" the eyes should be still and calm.
[97] J.A. Bennett, "The challenge of practical mathematics" in Stephen Pumfrey, Paolo L. Rossi and Maurice Slawinski eds. *Science, Culture and Popular Belief in Renaissance Europe* (Manchester and New York: Manchester University Press, 1991): 188.

mathematicians and those who were endeavoring, like the members of the Royal Society, to integrate the contributions of a "practical mathematics" with natural philosophy. Placing the longitudinal device on the *Schauplatz* was an opportunity to observe this union of *mathesis* and *physica* in action. It should come as no surprise that Semler's lessons plans contain a demonstration of just such a longitudinal device and that in 1723 Francke's orphanage press would publish Semler's reputed "solution" to the longitude problem (see Appendix 10 for frontispiece).[98]

Bennett characterizes the intersection of the practical mathematical science of navigation with astronomy (which he says "encroached on natural philosophy when its postulates had implications for the nature of the earth") in the sixteenth century as an understudied point of convergence between mathematics and natural philosophy. Particularly influential, he writes, was the "realization that magnetic variation might be different in different locations;" the idea was that if these global patterns of variation could be measured somehow, then longitude could easily be found.[99] New magnet compasses were developed, which Robert Norman described in a popular tract called *The New Attraction* of 1581.[100] He wrote a "self-consciously experimental" investigation of the problem of "magnetic dip" that affected all compasses, Bennett notes, and insisted that even though he was simply "an unlearned mechanician," he still had something profound to contribute to the mathematical sciences. In the lesson on the "Magnet and

[98] Francke's press published Semler's solution to the longitude problem under the following title: *Supremo Magnae Britanniae Senaturi Illustrissimo Parlamento Consecrata Humillimeque Submissa Methodus Inveniendae Longitudinis Maritimaee per Acus Verticales Magneticas, Evidentissimis Superstructa Experimentis Terra Marique Factis*. (Halae Magdeburgicae: Orphanotropheum, 1723). It was also referred to as the "Hall Methodus inveniendae longitudinis maritimae**."**

[99] Especially if their variation "altered in a geometrically predictable way according to latitude and longitude;" in Bennett, "The challenge of practical mathematics," 186.

[100] See Edgar Zilsel's discussion of Norman in idem, *The Social Origins of Modern Science* (Dordrecht/Boston/London: Kluwer Academic Publishers, 2000): 85-89.

Compass" in the Semler lessons, the author discusses Robert Norman as someone who had described the tendency of magnetic compasses to "dip" or to "deviate" (*abweichen*), thereby making accurate measurement difficult.[101] He conveys his awareness of a need to calibrate the experiences of individuals like Norman, Carthesius and Rohault (also explicitly named) in order to affect a better understanding of the principle of geomagnetism and the formulation of a universal principle for measuring longitude.[102]

For a director of a conciliatory organization interested in cultivating virtuous and Christian characters that were visible, any and every possible expression of the form of reconciliation would have held enormous appeal. Francke's willingness to align his press with Semler's solution to the longitude problem was, in my view, one of the many ways in which the orphanage announced its status as a site for the propagation of conciliatory strategies via three-dimensional models and instruments. The solution Semler offered rested on the reconciliation of physical and rational forms of knowledge that came together in a single measuring device. Placed in the *Schauplatz*, where it became the focal point of the viewer's attention and senses, the magnetic compass—like the three-dimensional model of a house or the universe—was transformed into a tool of philanthropy. Not only did it contain within itself the ability to improve one's ability to become oriented at sea, it could also help improve viewers' abilities to see and to recognize the value of conciliatory forms of knowledge—including the visible acts or

[101] AFST/H E 61, *Semler Lehrplan*, 571.
[102] There is an extensive literature around the seemingly unending supply of solutions to the longitude problem that were being circulated and tested long before Semler developed his own solution. See William J.H. Andrewes ed. *The Quest for Longitude; the Proceedings of the Longitude Symposium* (Cambridge, MA: the Collection of Scientific Instruments, Harvard University, 1996) and Silvio A. Bedini, *The Pulse of Time: Galileo Galilei, the Determination of Longitude and the Pendulum Clock* (Florence: Olschki, 1991). Michael John Gorman has also noted that solving the longitude problem through magnetic variation was the strategy that Athanasius Kircher preferred. See his "The Angel and the Compass: Athanasius Kircher's Magnetic Geography" in Paula Findlen ed. *Athansius Kircher: The Last Man Who Knew Everything* (New York and London: Routledge Press, 2004): 255-256.

gestures they inspired. Like the demonstrations of astronomical models and optical instruments, the magnetic compass lesson also stressed the magnet needle's capacity to make a certain point of orientation visible. When one observed and appreciated how to apply the magnetic compass to the world, it would always point one in a northerly direction.[103]

Semler's magnetic measuring device fits within the general preoccupation with measurement of several members of the conciliatory Berlin Academy of Science. As we saw in chapter three, Conrad Mel had developed a pantometer, or a device for taking universal measurements that he had circulated to various academy members for comment. Like Semler, he had also invoked the name of the Jesuit Athanasius Kircher as someone to whom his method was especially indebted. Christian Wolff, as we have seen, had become an outspoken advocate by 1714 for the capacity of measuring practices to produce individuals who understood more and were, therefore, intrinsically more virtuous. In addition to a willingness I have discerned in the pages of the Semler lessons to embrace Wolff's emphasis on the superior quality of the two-dimensional *Grundriss,* there is more evidence that the teachers and students of the orphanage schools may have been looking to Wolff for guidance about the construction and application of other kinds of measuring devices—such as the quadrant. A letter penned in 1725 by a missionary and former student of Francke's institutes, Christoph Theodosius Walter, provides a useful example.

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[103] AFST/H E 61, *Semler Lehrplan,* 509-512. The author pointed out that, in practice, magnet needles were not completely accurate all of the time—sometimes off by a few degrees or minutes. "Man hat aber in der Praxi befunden dass dei Magnet Nadel nicht allzeit accurate nach Norder weiset, sondern einige Grad und Minuten, bald nach Osten bald nach Westen abweichet." The lesson also discussed the varied colors of magnets, their material composition and the many places they had been found, including "East India, China and Bengala." The principle of concavity is also reiterated again.

Like many of the Pietist missionaries who found their way to the southeast coast of India (mainly to the Danish trading post of Tranquebar), Walter was asked to recount his sea journey and impressions of "Malabar" upon his arrival. He was then to send his inscription back to Halle, where it could be published in a news letter (likely modeled after the Jesuits' *Lettres édifiantes et curieuses*) that Francke's organization had started, entitled *Halle Reports of the Royal Danish Missionaries in East India*. Francke's pupils, especially those enrolled in the *Pädagogium*, were often asked to relay specific questions to the missionaries through letters in exercises that must be understood, again, in terms of the recognition typology so frequently referenced by Semler. Asking questions of someone who had been to Malabar might not condition a form of recognition as evocative as visiting east India oneself or experiencing it in three-dimensional form, but first hand experience was certainly better than reading about it in a book. The missionaries' specific responses to the pupils' questions were assembled and published as well.[104] Walter's letter was printed in the *Halle Reports* in 1728.[105] It was not, however, printed word for word. In the original letter of 1725, addressed to a "Herr Alemann on the *Pädagogium*," Walter described his journey to India on an English ship—and related some new pieces of information he had encountered on the ship itself. "An English ship goes no more than four times to east India: after that it is either set out to sea or broken up. The quadrant they use, with which one can observe latitude with in the afternoons, is different than the one Herr Wolff describes in his Astron. Tab. 1 Fig. 6, with which one

[104] AFST/M 1 B 1 33 [January 27, 1727] "Herrn Pressiers Schreiben an einen andern vormaligen Collegen im Pädagogio Regio, worin auf mehrere Geographische, Physicalische und andere dergleichen Fragen geantwortet wird;" Pressier lists the specific question of the pupils first and then responded, in bullet form. In response to this question: "What about the Malabar's Astronomy and other physical sciences?" Pressier specifically references the Jesuits' *Lettres édifiantes et curieuses écrites des Missions étrangères* (Paris, 1703ff).

[105] [*Hallesche Berichten* XXI] or *Ein und zwanzigste Continuation Des Berichts Der Königlichen Dänischen Missionarien in Ost- Indien* (Halle, 1728): 681-687.

can only observe stars when one is up high."[106] Walter then drew a picture of the other quadrant and described how the English employed it (see Appendix 11). In the printed version of Walter's letter that appeared in the *Halle Reports*, however, this entire section—including the explicit reference to Wolff—was edited out. Clearly missionaries training in Francke's institutes were acquiring training in the use of a wide variety of measuring instruments before they left for India.[107]

The year (1723) that Francke's press published Semler's description of his longitudinal device was the same year that Wolff was forcibly expelled from Halle. In Dreyhaupt's version of a story that would become eventually become integrated into Halle's landscape of legends, Semler was very interested in sending his solution to England to be considered by the Board of Longitude that had been created there. Too ill and weak to make the journey himself, he sent a field minister named Christian Eberhard, with connections to both Francke and Wolff, in his place.[108] Eberhard took the solution to England, where he had a description of the device published there under his own name. He then submitted it to the Board of Longitude, all the while claiming to have discovered it himself, where it was examined by Isaac Newton and tested at sea by William Whiston—who ultimately found it unsatisfactory.[109] Christian Wolff would write a

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[106] AFST/M 1 B 2 21 [June 19, 1725] Bericht von Christoph Theodosius Walter an Ernst Heinrich Aleman

[107] This is terrain that remains virtually unexplored and that I hope to engage in the future. Considering the hostile reactions of some members of Francke's community (and network of patrons) to Wolff in the wake of his expulsion from Halle in 1723, it makes sense that the published reports would not contain this portion of Walter's letter.

[108] Francke corresponded extensively with Eberhard, who served as a kind of emissary to Tsar Peter I. After completing his education in Halle, where he also taught in Francke's schools, Eberhard went to Russia and served as Peter's Hebrew teacher. He was supposed to go to the island of Kamtschatka and the Alaskan coast in 1725 as part of a Russian expedition but did not make it; his skills in the mathematical sciences were highly regarded. In Theodor Wotschke, "Das pietistische Halle und die Auslandsdeutschen," *Neue kirchliche Zeitschrift* 43 (1932): 475.

[109] Whiston is an interesting part of this story in that he seems to have appreciated the conciliatory aims of Francke's organization. For many years, he was a member of the SPCK, which supported Francke's mission plans and he also endeavored to establish a society for the practice of "primitive Christianity" in

review (*Gutachtung*) of the new solution for the St. Petersburg Academy of Science in 1720, only he would refer to it as "Eberhard's discovery" not Semler's (see Appendix 12).[110] The injustice to Semler's reputation and efforts would be remembered by his son, Gottlieb Christian, who would ensure that the solution (and all of his other "inventions") remained associated with his father's name—not Eberhard's.[111] Revealingly, in the Halle Orphanage's edition of the solution, Semler would link his instrument to the models of the Temple and universe that resided in Francke's orphanage, noting that in was in the same spirit in which he had built them that he now presented his magnetic device and "method."[112]

While deserving of more attention than I can give it here, there is a way in which this final anecdote provides the perfect ending to this chapter on the use of three-dimensional models in the Pietist Orphanage. Most importantly, it brings us back to the claim I made at the beginning of the chapter, following Hopwood and de Chadarevian, that using three-dimensional models as "educational aids" is no excuse for underestimating their significance in the production and circulation of knowledge. The models that Semler produced and that found their way into Francke's orphanage were part of a collective attempt to create a new method for making and replicating knowledge. In early eighteenth-century Halle, Semler's device for measuring longitude was intended for the *Schauplatz* as one of several sites capable of cultivating conciliatory

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London. See his *Primitive Christianity Revived* 5 Vols. (1711-1712) and his *New Theory of the Earth* (London, 1696). Sigmund Jakob Baumgarten produced a German version of Whiston's own description of Solomon's Temple in 1747.

[110] Günther Mühlpfordt, "Halle—Sussland—Sibirien—Amerika: Georg Wilhlem Steller, der Hallesche Kolumbus und Halles Anteil an der frühen Osteuropa und Nordasienforschung," in Johannes Wallmann ed. *Halle und Osteuropa* (Halle/Tübingen: Verlag der Franckeschen Stiftungen im Niemeyer-Verlag, 1998): 65.

[111] Dreyhaupt, *Ausführliche diplomatisch-historische Beschreibung des Saal-Kreyses,* 719.

[112] In Semler, *Methodus Inveniendae Longitudinis Maritimae* (Halle: Waysenhaus, 1723), 8-9.

characters—who used their hearts to stabilize and orient the findings of their inner and outer eyes. The device was also developed to perfect a series of conciliatory solutions to the universal problem of navigation. Semler's models carried knowledge by replicating it in such a way as to allow it to be evocatively demonstrated; instruments demonstrated according to the rubric of his plans were also models designed to teach and to improve. But their status as sites, capable of conditioning *Gemüther* who could see and assimilate a variety of perspectives, was best accessed in Halle's pansophic climate. Here Semler's device was his own and it was appreciated, as I think the orphanage's published description of the device suggests, as a way of conditioning conciliatory personalities through spiritual exercise. But outside of Halle, the instrument somehow lost its power to condition, to improve and to perfect vision. To be sure, it could still be (and was, by all accounts) "tested" but it was not "demonstrated" according to the Halle-specific rubric of *Anschauung*. Removed from its context of application, Semler's model of orientation could no longer be employed as a tool for helping people learn to observe properly by showing them how to orient themselves morally in the world; it became yet another device placed before the Board of Longitude.

In the university town of Halle that A.H. Francke, Semler and Wolff called home, three-dimensional models, instruments and increasingly *Grundrisse* were edificatory sites of observation and orientation. Second only to real experience in the Semler recognition typology, they were seen as conciliatory artifacts that could exercise the senses and cultivate higher forms of recognition; therefore, they were inseparable from the pedagogical regimens that surrounded them—endeavoring to fix their significance just as they fixed or stabilize the disparity between fundamentally opposing ways of knowing.

The person of Christoph Semler and the lesson plans that were integrated into Francke's *Schulstadt* provide a window into a landscape fraught with contradictions in which three-dimensional models are held up not only as signifiers of reconciliation but as philanthropic instruments—carriers of divine love and examples of the heart around which one was to orient one's head and one's hands.

Chapter Six: Drawing to See: Geometrical Projection as a Conciliatory Gesture

> 1st Axiom
> The art of drawing and painting (*Zeichen und Mahlkunst*) is the mechanical science of creating perfectly similar representations of all the particular features of a body and other things that can be placed on an elevated surface and presented through figural concepts using lines, colors, strings, brushes and all kinds of materials.
> …
> 2nd Axiom
> A drawing is nothing other than what has been transmitted through horizontal lines to an elevated surface or plane that is similar to the figure of a body.
> …
> 3rd Axiom
> The resemblance of a picture is the agreement of the same with the certain attributes of the body being pictured, as if he placed the body himself before his eyes.[1]

In 1646, the internationally famous Jesuit polymath Athanasius Kircher published a treatise in Rome called *The Great Art of Light and Shadow* (*Ars magna lucis et umbrae*). It was a treatise that contained several summaries of projection technologies that could help one better understand the material and mathematical properties of light.[2] Much like Andreas Tacquet's interest in the potential of optical machines to mediate opposing conceptions of the universe (see Chapter One), Kircher's text marked one of his many contributions to a universal project that aimed to harmoniously assemble and apply even diametrically opposing forms of knowledge. Kircher's attempts to create a system for the coherent assimilation of all ways of knowing would wield a powerful influence over most, if not all, of Europe's prominent intellectuals until well into the eighteenth century. Robert Boyle and Isaac Newton were avid connoisseurs of Kircher's writings and, in Paula Findlen's estimation, "every major scientific, linguistic and historical

[1] AFST/H E 61 *Semler Lehrplan,* 665.
[2] Despite its significant contribution to the sciences of optics, dioptrics and catoptrics, the text was mocked by several prominent mathematicians because of a problematic attempt Kircher made here to square a circle. See Paula Findlen, "Introduction" in Paula Findlen ed. *Athansius Kircher: The Last Man Who Knew Everything* (New York and London: Routledge Press, 2004): 5.

project" G.W. Leibniz ever undertook was directly inspired by reading Kircher's many treatises.[3] E.W. von Tschirnhaus met a close associate of Kircher's, Giovanni Alfonso Borelli, during a trip to Italy in 1677 and it was mostly likely through him that handwritten copies of the *Ars magna lucis et umbrae* found their way into Francke's orphanage.[4]

The *Great Art of Light and Shadow* is in many ways emblematic of the Baroque preoccupation with light and darkness in the way that it rendered explicit the links between natural magic, geometry, optics and perspectival drawing.[5] It was the first text to offer a thorough description of a *laterna magica* (or the sorcerer's lamp), for example, a device for projecting images that had been painted on glass plates onto a screen using an oil lamp and lens. A variation of this lantern had been described in the second half of the fifteenth century in Giovanni Della Porta's *Magia Naturalis* (Naples, 1558), which had offered readers unskilled in the art of drawing a set of projection techniques for reproducing images ("If you cannot draw a picture of a man or anything else, draw it by this means...").[6] Della Porta also described the camera obscura as an instrument specifically useful for artists and his account was one of the first to directly associate the device with perspectival drawing. He was careful to add that one needed to be conditioned in order for these instruments to function because, as Adrian Johns has noted,

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[3] Paula Findlen, "Introduction" in Ibid., 5-7.

[4] AFST/H E 51: 3-4 Athanasius Kircher, *Tractatus de arte magna lucis et umbrae (Excerpta*) & *Epilogus sive Metaphysica lucis et umbrae tractatui de arte magna lucis et umbrae adjectus (Abschrift)*. Excerpts copied from Kircher's *Mundus Subterraneus* (Amsterdam, 1678) are also on hand in Francke's archive: AFST/H E 51: 2.

[5] For Stuart Clark's treatment of Kircher's *Ars Magna*, see *Vanities of the Eye* (2007): 101-105. See also William B. Ashworth, "Catholicism and Early Modern Science" in David C. Lindberg and Ronald L. Numbers eds. *God and Nature: Historical Essays on the Encounter between Christianity and Science* (Berkeley: University of California Press, 1986): 136-166; idem. "Light of Reason, Light of Nature—Catholic and Protestant Metaphors of Scientific Knowledge" in *Science in Context* 3 (1989): 89-109.

[6] The Francke Foundation library contains an early version of the *Magia naturalis*: Io. Baptistae Portæ Neapolitani, *Magiæ Natvralis Libri Viginti: In Qvibvs Scientiarum Naturalium diuitiæ, & deliciæ demonstrantur. Accessit Index, rem omnem dilucidè repræsentans, copiosißimus* (Frankfurt, 1597).

of the "role of affection in conditioning perspective."[7] In the *Ars magna*, Kircher offered a new and improved kind of projection device, called a *Steganographic mirror*, which, after several years of refinement would be referred to simply as the *laterna magica*.[8] It was a tool he believed helped further the mandate of his assimilatory project.

In 1717, seventy years after Kircher had published the *Ars magna*, Francke's organization published its own guide to drawing and painting (see Appendix 13 for frontispiece) that affirmed the utility and potential of projective tools.[9] In a passage describing how to draw material objects placed standing or lying before the artist, the anonymous author explained that "one needs a few helpful tools that allow one to draw corporeal things with a free hand: for example, the machine that is described by the famous Kircher in *arte magna lucis & umbrae."*[10] Just one year earlier, in his *Mathematical Lexicon*, Christian Wolff had praised the camera obscura as an especially useful tool for drawing. "One can use it when one wants to sketch something very exactly, especially if one is not very experienced in drawing."[11] In Part One I presented evidence of pupils using these instruments in the schools of Francke's universal seminar. Several members of Francke's community were also employing the camera obscura to produce horizontal and vertical projections of various building and surveying projects, including detailed plans to pipe drinking water into the orphanage from a nearby fresh

[7] See Johns, esp. 389-392.
[8] In 1671, Kircher published an updated version of the *Ars magna* that contained an article called, *De Lucernae Magicae seu Thaumaturgae constructione,* in which he attempted to explain in greater detail the unique features of his lantern in comparison to others that had been developed by Christian Huygens, for example.
[9] *Gründlicher Unterricht von der Graphice oder Zeichen und Mahlkunst Worinn von derselben Beschaffenheit, unterschiedlichen Arten, Requisitis, Historie, Vortrefflichkeit, Nutzen und Methode gehandelt wird.* Mit einem doppelten Register. (Halle, Waysenhaus, 1717).
[10] Ibid., 75. The author specifically refers to Book II, Part II of Kircher's text, which is titled *De Actionobolismis Optico* and contains a discussion of how to make an *instrumentum mesopticum*; it offers a discussion of the art of *sciagraphica*.
[11] Christian Wolff, *Mathematische Lexicon* [Leipzig, 1716]. Reprinted in *Gesammelte Werke*, Part One: Vol. 11.

water source.[12] They, too, were participating in a conciliatory project that drew inspiration from Kircher and readily assimilated several of his technologies.

In Chapter Four I argued that Christian Wolff was interested in formalizing proofs for perspective at a moment when its ability to actually produce congruence between images and objects was being openly called into question. His summary of geometrical projection techniques amounted to a standardization of the principle of resemblance and marked another way of thinking about the reconciliation of cognition and sensation that he was interested in promoting. Wolff's discussion of geometry in his *Mathematical Lexicon* also emphasized its potential as a way of measuring "the space taken up by corporeal things," to "sharpen the understanding, … to condition humans to see things more deeply" and to "consider things more deliberately."[13] His preoccupation with turning perspective into an easily applicable science was in every way connected to the conciliatory project he was endeavoring to extend. Members of Francke's organization also participated in this project. They were interested in the ability of perspective to offer the individual a set of reflective practices in which the passions were drawn upon productively. Mastering perspectival drawing in Francke's institutes required "middling instruments" like the camera obscura or laterna magica, which were central for calibrating both "the Attention" and "Experience" at the same time.

Francke's interest in painting, drawing and the science of perspective is especially manifest in the curricular materials affiliated with his orphanage. To illustrate this, I have singled out two texts that have generally gone unrecognized as products of Francke's

[12] See especially AFST/W XV/II/2: Vol. One. Nachrichtung das Röhrwasser und ubrigen Wasserbau bey den Waysenhause.. vom Jahr 1715 .... Vol. Two. Kurtzer Bericht von dem jetzigen WasserBau (1717).
[13] Christian Wolff, *Mathematisches Lexicon* (Leipzig, 1716): 665. Reprinted in *Gesammelte Werke*, Part One: Vol. 11.

Schulstadt. The first is the Halle Orphanage's guide to painting and drawing (or *Graphice*) mentioned above. In conjunction with basic instructions for the inexperienced artist, it presented the reader with a careful synopsis of treatises affirming the status of "drawing and painting" as mathematical or mechanical sciences. Whether or not drawing and painting should be counted as one of these sciences was a question that the earliest proponents of perspective had faced.[14] However, in light of Christian Wolff's exceedingly popular treatment of the mathematical and mechanical sciences in his *Beginner's Guide* (*Anfangsgründe) to the Mathematical Sciences*, it had become a subject or question worth discussing in the community in which he had produced it. The texts I focus on in this chapter offer proof of several Halle Pietists' interest in participating in these conversations.

Wolff treated perspective in the *Anfangsgründe* but not drawing and painting. To make up for this, I propose, members of Francke's organization published the *Graphice* guide and produced the second text I am concerned with here. Contained within the pages of the Semler *Lehrplan*, the second text appears towards the end of these lessons and is without a formal title. It is also handwritten and seems to be a final version of a print-ready document that also provides its reader with a detailed "introduction" to the "mechanical science" of drawing and painting.[15] I do not think it was part of the original Semler *Realschule* curricula but was likely appended after the lessons found their way into Francke's institutes. Interestingly, the text is organized in precisely the same manner that Christian Wolff organized his *Beginner's Guide to the Mathematical Sciences* (see Appendix 14). In other words, while the printed (1717) text makes no secret of its

[14] See Michael Baxandall, *Words for Pictures: Seven Papers on Art and Criticism* (New Haven, CT: Yale University Press, 2003): 13-24.
[15] AFST/H E 61, "Zeichen und Mahlkunst" in *Semler Lehrplan,* 665.

interest in portraying painting and drawing as mathematical sciences, the handwritten version takes this a step further. It comes to us in the very same deductive categories Wolff had embraced for the systematization of these same sciences. These categories included, as we have seen, axioms or explanations (*Erklärungen* or, following Euclid, propositions*),* experiences (*Erfahrungen* or experiments), extras (*Zugaben* or corollaries) and commentaries (*Anmerckungen*). The first axiom contained in the mysterious Semler text defined the art of painting and drawing as a mechanical science. The second axiom endeavored to define a drawing as "nothing other than what has been transmitted through horizontal lines to an elevated surface or plane." And the third axiom defined the principle of resemblance at the heart of perspective (see opening quotation).[16]

These texts confirm that in the pansophic climate of early eighteenth-century Halle, including inside the Pietist Orphanage, the model of pictorial vision that had been championed by Renaissance perspectivists like Alberti was being intensively revisited. The explanations and exercises contained in the Semler *Lehrplan,* in addition to the Halle Orphanage *Graphice* text, offer an unusual and highly instructive glimpse into how Pietist eclectics were endeavoring to resuscitate the conciliatory potential of perspectival drawing. The creators of these texts embraced its potential, following Wolff's schematic framework, as a branch of the middling mathematical or mechanical sciences. They did this, I argue, because the pictorial model of resemblance upon which the science of perspective is based required advanced training in mathematics *and* the conditioning of sensation. It could be applied to produce congruence, conceived of as an expression of philanthropy. And it also allowed the practitioner to productively draw upon and exercise his passions in his attempts to project them rationally as colors (derived from

[16] Ibid.

real substances) onto a two-dimensional plane. These lessons in drawing and painting, like lessons oriented around models and instruments, were about facilitating a more perfect way of being and knowing. But first, drawing and painting had to be turned into a verifiable mathematical science (complete with proofs) to be taught to all young people, not only those training to be artists.

Painting to save the world

Art historians attribute the codification of perspective as a superior "precision technique" to Leon Battista Alberti. His treatise *On Painting*, printed in the 1420s in both Latin and Italian, opened with basic definitions of geometrical terms, specifically Euclid's definitions of point, line and plane. But, perhaps most importantly for my purposes, it analyzed the properties of forms in purely mathematical terms.[17] In Joel Snyder's estimation, Alberti's primary innovation was his ability to provide a systematic explanation for how a painter paints by offering a "mechanical and psychological account of how he sees."[18] He offered his readers a foundation for making "certified" or "completed perceptual judgments" about "sensible things of the world"—that is, unified or holistic judgments "in which we correctly identify objects, their attributes and their interrelations…under specified observation conditions through time, by means of discrimination, comparison and integration."[19] These became, in effect, a systematic set of practices for "depicting the rational structure behind perceptual judgments."[20]

[17] Martin Kemp, *The Science of Art: Optical Themes in Western Art from Brunelleschi to Seurat* (New Haven: Yale University Press, 1990): 22.
[18] Joel Snyder, "Picturing Vision," *Critical Inquiry* 6 (1980): 516.
[19] Ibid.
[20] Ibid., 524.

As one point linear perspective became increasingly popular in northern Europe around 1500, it was regarded as a form of magic or "visual alchemy," which, in the words of Martin Kemp, "transformed the base materials of art into a visionary experience."[21] Albrecht Dürer was one of the first German artists to embrace perspective after spending some time familiarizing himself with it in Italy; he published an influential vernacular treatise about precision measurement in drawing that was essentially a treatise in geometry.[22] The entire piece provided a profound sense of "the reality of geometry in the physical world," and included several discussions of light and shadow as central components of any demonstration of perspective. It would become enormously influential in the German and Dutch context. Not surprisingly, along with the gradual acceptance and application of geometrical projection techniques by artists in northern Europe came intense discussions about whether the representational solutions the model offered were tenable and, if so, how perspectival drawing could be made easier. Dürer claimed in his writings to have stumbled into a "shorter way" of composing "geometrical visions of space and form," for example.[23] In my view, Wolff's consistent expressions of his affinity for Dürer (in the *Mathematical Lexicon* for example) can be read as a sign of his interest in revisiting perspective's metaphysical or alchemical potency—that is, its ability to produce accord between organic materials and their images.

But Wolff and other members of his community were interested in many more contributors to the science of geometrical projection than Dürer, Alberti and the first perspectivists. One of these individuals was Girard Desargues, civil and military

[21] Kemp, *The Science of Art* (1990): 59.
[22] Albrecht Dürer, *Instruction in Measurement with Compass and Ruler in Lines, Planes and Solid Bodies* (*Underweysung der Messung)* (Nürnberg, 1525).
[23] Kemp, *The Science of Art* (1990): 59; Straker, "The Eye Made 'Other'," 7-22.

engineer, prominent member of the French *Academie Royale* and, according to Kemp, "the greatest perspectivist and projective geometer of his generation."[24] Proceeding from the assumption that the production of congruence was the ultimate goal of the geometer, he set about to make practical geometry both easier and more accurate, developing elaborate yet accessible scales that would allow for a broader spectrum of spatial calculations.[25] However, Desargues' insistence on rigorous training and adherence to geometrical axioms by practicing painters was the subject of intense criticism in his own lifetime. In particular, the Jesuit Jean Dubreuil circulated a tract called *Perspectiva practique* (Paris, 1642) that contained some obvious denigrations of Desargues's *Maniere Universelles* and sparked a "war of perspective" between the two figures.[26] However, both parties continued to affirm the assumptions embedded in perspectivist discourse. They believed in the possibility of resemblance.

When Wolff approached the issue of perspective, he integrated both Desargues and Dubreuil's treatises into a discussion that also affirmed the contributions of Nürnberg artists. He championed Johann Christoph Rembold's translation of Dubreuil's *Perspectiva practica* (Nürnberg, 1710), for example, in conjunction with Johann Leonhard Rost's translation of Desargues's *Maniere*.[27] Wolff knew that Dürer's hometown of Nürnberg (not far from J.C. Sturm's Altdorf) had remained an important

[24] Kemp, *The Science of Art* (1990): 120. See J.V. Field and J.J. Gray, *The Geometrical Work of Girard Desargues* (New York, 1987); J.V. Field, "Linear Perspective and the Projective Geometry of Girard Desargues" in *Nuncius* II (1987): 3-40. W. Ivans Jr, *Art and Geometry* (Cambridge, Mass, 1946); L. Cremona, *Projective Geometry* (Oxford, 1885); J. Coolidge, "The rise and Fall of Projective Geometry" in the *American Mathematical Monthly* XLI (1934): 217-28. Desargues' treatises on perspective are also recommended to Francke by Tschirnhaus (see Appendix 2).
[25] Kemp, *The Science of Art* (1990): 120; from N. Poudra ed. *Oeuvres de Desargues* 2 Vols. (Paris, 1864). Philippe de La Hire's *Nouvelle méthode en géométrie* (1673), which dealt with geometrical projections of circles and other forms of Appolonian curves, owed much to Desargues' projective treatises and also profoundly influenced Wolff, who references Le Hire frequently as well.
[26] Ibid., 122-125.
[27] Jean DuBreuil, *Perspectiva practica, oder Vollständige Anleitung zu der Perspectiv-Reiss-Kunst*. Transl. Johann Christoph Rembold (Augsburg, 1710).

site for the refinement and dispersal of perspectivist techniques and the training of German artists in the seventeenth century.[28] He also deemed the "Nürnberg perspectivist" Andreas Alberti's *Two Books on Perspective* (1670) especially "praiseworthy." Possibly following his lead, the anonymous author of the Halle Orphanage *Graphice* guide described the same Alberti text as "especially useful for beginners because of its clearness."[29] The author of the printed Halle Orphanage guide also recommended the translation of Dubreuil offered by Rost, by then a member of the Berlin Academy of Science. Both Wolff and members of Francke's organization would have been well aware of efforts underway in Berlin to create a site for the assimilation of various debates about perspectivism, including new projection technologies. In 1696, the Prussian Elector Frederick III and his wife Sophie Charlotte had founded an Academy of Arts (*Academie der Mahler-, Bildhauer- und Architectur-Kunst*); and, as we have seen, the founding of an Academy for the promotion of the conciliatory mathematical sciences, like perspective, soon followed. Both Wolff and Francke became members of this Academy. It follows that its mandate and the mandate of the new Academy of Arts were closely linked. The two painting and drawing guides produced by affiliates of Francke's organization affirm that they were.

Two figures that are featured prominently in the printed *Graphice* guide, Johann Leonard Frisch (1666-1743) and Samuel Theodor Gericke (1665-1730), best illustrate this convergence between the activities of the Berlin Academy, Francke's organization

[28] The works of Augustin Hirschvogel (*Geometria*, 1543), Lorenz Stoer (*Perspectiva*, 1567), Wenzel Jamnitzer (*Perspectiva corporum regularium*, 1568), Hans Lencker (*Perspectiva literaria,* 1567) and Andreas Alberti (??-1628) remained quite influential in the German context. Wolff also championed the use of a text by two Nürnbergers, Daniel Schwenter (1585-1636) and Georg Philipp Harsdörffer, *Delicae Phyisco Mathematicae: Mathematische und Philosophische Erquickstunden* (1636) in schools. For Stuart Clark's treatment of this text see his *Vanities of the Eye* (2007): 104.

[29] See Christian Wolff, *Kurtzer Unterricht von den arithmetischen Schriften*. Reprinted in *Gesammelte Werke*, Part One: Vol. 16 and the *Graphice* (Halle: Waysenhaus, 1717): 87.

and the Academy of Arts by 1717. At the very beginning of the guide, the following dedication appears: "to the highly honorable and learned man, Johann Leonard Frisch, famous member of the Prussian Society of the Sciences, worthy teacher and friend, …, as a sign of his strong character and along with best wishes from the author."[30] By referencing Frisch, the text immediately signaled that it was affiliated with and intended for a much broader intellectual community. In the Berlin Academy's earliest years, when the links between reconciliation and mission, including the establishment of ties to China via Russia, were their strongest, Frisch served as Leibniz's Russian teacher.[31] He received a personal invitation to join the Academy from Leibniz in 1706, became a close associate of his and the body's vice-president in 1734. And, although it may be difficult to determine precisely why his is the first name to appear in the pages of the Halle Orphanage *Graphice*, the copperplate engravings accompanying his multivolume descriptions of all of the birds and insects of Germany (1730) suggest several ways of connecting a concern with the perfection of the technologies of representation to the activities of Berlin Academy members. In prefaces to the detailed descriptions of insects he eventually published, he would explain that the "real and natural" description the text

[30] *Graphice* (Halle: Waysenhaus, 1717): dedication.
[31] Frisch traveled extensively throughout Russia, Hungary and the Ottoman Empire and upon returning to Brandenburg-Prussia, via Nürnberg, began teaching in Berlin, where he ultimately settled; he was sub-director of the Gymnasium of the Gray Cloister around 1700, precisely the time Spener was court preacher, and directed the Gymnasium from 1731 until his death in 1741. He was especially well known for his dictionaries, as well as his attempts to catalogue every kind of bird and insect in Germany. See his entry in Werner Hartkopf, *Die Berliner Akademie der Wissenschaften* (1992): 106. A eulogy Frisch gave for S. Nicolai Kirchhoff in 1699 is remarkable in its evocative use of the metaphors of friendship, love, reconciliation and sight. See his *Abdanckungs-Rede, als der verblichene Cörper den 5.Martii.1699 auf S. Nicolai Kirchhoff zur Ruhe geleget werden sollen* (Berlin, 1699).

offered was contingent upon the "realistic illumination" of the insects themselves by a capable artist.[32]

Samuel Theodor Gericke is described in the Orphanage *Graphice* guide as a "Professor of Anatomy and Painting in the Royal Prussian Painting Academy of Berlin." His brother, Peter Gericke (1693-1750), was a professor of medicine and philosophy at the University of Halle and became a member of the Berlin Academy in 1731 because of his expertise in anatomy. S. T. Gericke never officially joined Leibniz's organization; however, his expertise in anatomical drawings was apparently well known. In 1706 he published a *Short Summary of Anatomy, how painting and sculpture is necessary for it* that would endeavor to elucidate the links between the physical science of anatomy and the need for precise anatomical drawings.[33] He would also translate and publish a version of the French painter Gerald de Lairesse's *Guide to Drawing*, in which Lairesse also discussed how important it was for young painters to study anatomy carefully so that they could present more perfect renderings of the human form.[34] De Lairesse argued that the best technique for depicting the human body involved a combination of projective strategies for observing that same form.[35]

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[32] And the microscope, which allowed for more exact renderings; he cited: L.Joblot, Professeur Royal en Mathematiques, de l' Academie Royale de Peinture & sculpture, *Descriptions & usages de plusieurs Nouveaux Microscopes tant simples que composez. Avec de nouvelles observations, faites sur une multitude innombrable d'insectes, & d'autres animaux de diverses especes qui naissent dans des liqueurs prepares & dans celles qui nee le sont point* (Paris, 1718). In part IV, Frisch specifically referenced "a book printed in London in 1720 under the title: *A natural history of English Insects, illustrated with a Hundred Copper Plates, curiously engraven from the Live, and (for those who desire it) exactly colored by the Author Eleazar Albin, Painter.*" In Johann Leonhard Frisch, *Beschreibung von allerley Insecten in Teutschland,* (Berlin, 1730).

[33] Samuel Theodor Gericke, *Kurze Verfassung der Anatomie, wie selbige zur Mahlerey und Bildhauerey erfordert wird* (Berlin, 1706).

[34] *Des berühmten Mahlers Gerhard de Lairesse Anleitung zur Zeichen-Kunst, wie man dieselbe durch Hülffe der Geometrie gründlich und vollkommen erlernen könne*. Samuel Theodor Gerike Transl. (Berlin, 1705).

[35] Kemp, *The Science of Art* (1990): 98.

Historians of science and art have become increasingly interested in the relationship between the production of images and the production (and circulation) of knowledge. [36]

After directly associating itself with these two figures, the 1717 Halle Orphanage *Graphice*'s discussion of perspective unfolds within an attempt not only to justify its importance as a science to the skeptical reader but also to explain its status as amalgam or assimilator of various forms of knowledge. For example, the author states that he cannot neglect to mention the science of optics in the treatise and would recommend his readers study it because "it provides the foundation for the art of perspective, teaches us about the nature and properties of the human eye, the nature and properties of colors, the most important points about light and shadow as well as reflexion and refraction."[37] The author was also careful to emphasize that drawing properly required one to study geometry but that it was alright if one just learned the first few axioms (*problemata*) and demonstrations (*aufgaben*).[38] Especially useful were lessons from the "beautiful mathematical sciences" about the different kinds of lines, angles "and a few other important things from geometry;" the author noted that without proficiency in these things, one could not get very far.[39] In order to create a drawing or painting that "resembled its original in every way," the beginner was advised to link his training in geometry, perspective and optics with studies in anatomy, ethics, history, hieroglyphics,

[36] See Wolfgang Lefèvre ed. *The power of images in early modern science* (Basel, Birkhäuser, 2003).
[37] Included in the list of optical treatises recommended at the end of the *Graphice* are: Andreas Alberti, Alhazen and Roger Bacon; in *Graphice* (Halle: Waysenhaus, 1717): 28-29.
[38] Readers were advised to look at Sebastian LeClerc's *Geometria practica super carta & solo* and Anton Ernst Burckhard von Pürckenstein's *Ausserwöhlter Anfang zu denen höchstnutzlich mathematischen Wissenschafften* (Augsburg, 1713).
[39] *Graphice* (Waysenhaus, 1717): 28, 87.

mythology, diplomacy, heraldry, cosmography, architecture, physics and botany.[40] Leonard Christoph Sturm's treatises on architecture are recommended for the artist interested in properly rendering buildings to consult.

The mysterious drawing and painting guide contained within the pages of the Semler lessons also discuss the need for the artist to familiarize himself with the rudiments of practical geometry in order to become proficient in producing resemblance. The author noted that the cornerstone of resemblance, or "the agreement of the picture with the certain attributes of the body being pictured, as if [one] placed the body before [one's] eyes," was geometry. The very first "experience" offered in support of the guide's definition of resemblance urged the reader to place a cube on a table "illuminated with a painter's light."[41] By doing this, the author insisted, "the lowest superfice or base of the cube will appear like a quadrast (square) containing four right angles and four lines that are the same size." The author then cited a passage from Wolff's *Beginner's Guide to Geometry* (S.20) devoted to squares (or the *vier-eckige Raum*). "In the same way," he continued, "the first quality of a body that falls into the eyes—namely its extension in length and width, from which it acquires a place on all sides, and where the same extension ends—one will take a line as true."[42] What lines had in common were their capacities to demarcate, to outline or to establish the real boundaries of visible bodies. However, the author explained, "just like different kinds of bodies and their figures cannot be drawn in only one way with lines because they do not use their space in the same way, so must the painter learn from Geometry and be able to name the different kinds of lines, the different ways in which they can be placed together and the different

[40] Ibid.
[41] AFST/H E 61, *Semler Lehrplan,* 669.
[42] Ibid.

works and figures that come of this placement. Therefore it is important to at least consider the thing using a geometrical approach."[43] Several sections of the text correspond almost word for word with sections from Wolff's *Anfangsgründe der Geometrie.* [44]

After explaining the real and nominal properties of a space, a figure, extension, proportion, shadow and reflection, the author of the Semler lesson offered a definition of perspective that would have appealed to a practitioner of eclecticism:

> When one tries to present different points of view it is called perspectival drawing and perspectival drawing is the art of rendering a body as in falls at a specific distance or height into the eyes in an extremely exact manner….
>
> Most developing artists quit [their studies] before they acquire all that can be taken from this science…this means that often a part or body in a particular placement or position in their drawings loses its natural proportion and appears much shorter or longer than it actually is. …[45]

Readers interesting in learning how to "present different points of view," a conciliatory gesture, were encouraged to consult Rembold's *Perspective* (that is, the German version of Dubreil's *Perspective practique*), Wolff's synthesis of the science of perspective in the *Anfangsgründe* and a text simply referred to as *Lessons in Graphice*—quite likely the Halle Orphanage's *Basic Lessons in Graphice* text.

The published *Graphice* portrayed the need for perspective as especially great; not only did it serve as an agent necessary for recognizing differences, it also helped reconcile or assimilate these differences—thereby producing meaning:

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[43] Ibid., 672-73.
[44] Ibid., 683. For example, the eighth axiom reads: "When one brings two lines together at a single point, their meeting place is called an angle." Section 13 of Wolff's *Anfangsgründe der Geometrie* is then explicitly referenced; this section reads: "When one brings together two lines, AB and AC, at a single point A, their meeting place is called an angle." The treatise also relies exclusively on Wolff in its presentation of the most important figures in Geometry, especially: a sphere, cube, and pyramid, a prism, a cylinder, a conic sphere, a tetraedum, an octaldrum, an icosoedrum and an dodeoadrum.
[45] AFST/H E 61, *Semler Lehrplan*, 689.

> What is perspective supposed to help with? It is known that even a little bit of mathematics is important when sketching and it is the same with this. The words: ground-line or horizon, distance or viewpoint, contain a great deal of meaning. In fact, the importance of perspective is so large that without it, it is completely impossible to distinguish between elevation and depth, the near and the far, darkness and light, the weak and the strong. In sum, perspective is nothing other than the science of representing everything as it falls into the eyes; then one can not only see the drawing itself but where the reason for the drawing lies.[46]

The anonymous author requested all readers to examine Bernard Lamy's *Traite de Perspective* for affirmation of this sentiment. Lamy (1640-1715), a French mathematician and orator, had claimed to offer the readers of his treatise on perspective "guidelines for representing all manner of objects as they appear to the eye in all situations."[47] His *Conversations on the Sciences* (1675) had "reaffirmed Descartes' account of the power of a reformed geometry to help exercise the intellect," Jones explains; however, unlike Descartes, Lamy had faith in the possibility of real representation.[48] His later treatises convey his conviction that with enough training the artist could "represent all manner of objects… in all situations"—exactly as they appear to the eye. The Halle Orphanage drawing and painting guides convey the same kind of optimism.

The process of rendering a visible three-dimensional object onto a two-dimensional plane was a process that the artist controlled by controlling himself, by regulating the movements of his *Gemüth*, his intellect and his body. In other words, endeavoring to perfect the technologies of perspective—even with the help of projective

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[46] *Graphice* (Waysenhaus, 1717): Section 6.
[47] The treatise was translated into English in 1702. Bernard Lamy, *A Treatise of Perspective, or, the Art of Representing all Manner of Objects as they Appear to the Eye in all Situations. Written originally in French and faithfully translated into English by an officer of his Magisty's Ordnance* (London, 1702).
[48] Jones, 49-50. Lamy's *Les Elemens de Géeométrie, ou, de la Mesure de Corps* (Paris, 1684) was especially influential because of its extensive use in schools as an introductory textbook; Jones notes that it was largely derivative in its goals and execution though, relying heavily on Descartes, Nicolas Malebranche, Pierre Nicole and Antoine Arnauld.

devices or machines—was about refining techniques for improving character. It had to involve *paideia*. As Stuart Clark has emphasized in his study of early modern visuality, from the fifteenth century onwards proponents of perspective stressed that the more control the individual had over the production of resemblance, the more control he had over the production of illusions that deceived people and led them astray. The more control he had over himself. Individual artists, experts in the production of congruence between images and objects, had mastered precisely the kinds of conciliatory techniques that Francke's institutes were endeavoring to standardize. They needed to come to terms with their moral obligation to assimilate by making accessible the rational structures behind all perception. In this context, rendering effectively, that is producing likenesses that were as close to the original as possible, was an intrinsically moral act—an act of love. For members of Francke's community in Halle, being an artist, or even dabbling in the art of drawing and painting, was simultaneously an act of self cultivation and an act of philanthropy. Everyone needed to learn how to do it. Only by embracing the assimilatory promise of perspective to cultivate the intellect, in conjunction with its capacity to productively and evocatively direct sensation, could the individual exert some measure of control over what was seen, including the things some people claimed to see but could not explain.

That "painting" was capable of being imagined in this context as a form of restorative mathematical science to be more widely accessible in schools is apparent from Leibniz's comments in his *Grundriss eines Bedenkens* (1671), in which he imagined a "kind of gentry school institution that teaches handicrafts with new instruments… that's able to allow pupils to try everything in *chymicis* and *mechanicis*—including

glassmaking, the study of perspective, machines, water-arts, clock-making, turning wood, *painting*…".[49] If we take another look at Heinrich Neubauer's description of the *Pädagogium* (see Chapter Three), he makes a very clear statement about "the scholars" being called upon to show "how one could increase and decrease most observations through artistic machines," likely geometrical projection devices, which he said "can lead an educated mind to many new discoveries."[50] In a *Short Sketch of Organization of the Pädagogium* (circa 1696?), several "recreational activities, which the scholars engage in to move their bodies and freshen up their characters in their free periods" were described, including: "polishing glass for long distance lenses, burning glasses, burning mirrors, microscopes, perspectival lenses, telescopes, camera obscuras and optical lanterns," making geometrical instruments like the lineal, rulers, ruling pens and transporteurs, and drawing.[51]

Hieronymous Freyer's description of the *Pädagogium*'s *Improved Method* also indicates that drawing and painting were featured prominently as key exercises:

> They all begin together from the very beginning and learn first how to draw with pencil on paper and then with chalk on a board; and to be sure, they sketch according to copperplate engravings that are placed in front of them as models, where they can proceed from the easiest to the more difficult by first depicting geometrical lines and figures and then natural and artistic things in the easiest and most fundamental way, one after the other. That one, with time, also learns how to draw the human body and all its parts and is allowed, at the beginning, to make it larger than it is… is not entirely without purpose: because they learn the art of rendering more easily through large and clear linear features….
>
> After this they move towards a short introduction to light and shadow and then towards coloring and painting after nature. Whereby they either copy something already drawn or even something more difficult, like symbols (*Sinnbilder*) or strange scenes or coats of arms or even perspectival things (according to the properties of the subject and the

[49] See Chapter Three for a full citation from "Grundriss eines Bedenkens von Aufrichtung einer Societät" in *G*ottfried Wilhelm Leibniz, *Sämtliche Schriften und Briefe*. Fourth Series: *Politische Schriften* Vol. 1: 1667-1676 (Berlin, 1983): 537.
[50] AFST/H A129b: 21 Description of the Pädagogium (*Beschreibung des Pädagogii*)
[51] AFST/S A I 236 (1705), 237 (1708), 238 (1705) Kurtzer Entwurff der Einrichtung des Pädagogii Regii zu Glaucha an Halle [Broadsheet].

> previously mentioned *Introduction to Perspective*) can be used: until finally an entire landscape or history could come out of it.[52]

The author was careful to note that wherever there was one who was "still unable to do perspective," then the instructor would "give him a short introduction without many rules" and "be satisfied with especially simple or poor drawings." [53] Since the main purpose of the mathematical and mechanical exercises in the *Franckesche Stiftungen* was, according to Freyer, to allow the *Gemüth* to exercise itself and develop, producing imperfect renderings did not present an immediate problem. It was part of the process of self cultivation. The orientation of Francke's pedagogy was intended to be affirming so that even "simple or poor drawings" were better than nothing; and there always existed the possibility that one who could not "do" perspective would eventually learn it.

Francke's organization was oriented around the promise of perspectival drawing and painting as a way of sharpening and ultimately reconciling both the intellect and the senses. In other words, the culture of moral regeneration and conciliation Francke and his circle participated in was uniquely suited to the set of techniques codified by late medieval perspectivists like Alberti. In this context, the quality of the art itself did not matter so much; it would contain faults as long as it was produced by someone whose *Gemüth* and senses were not (yet) in full alignment with each other. This explains why scholars have tended to see Halle Pietists as ambivalent towards (or even completely against) art in general.[54] They were, even as radical Lutherans, still part of a long tradition that continued to promote the didactic function of images in spaces of

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[52] Hieronymous Freyer, *Verbesserte Methode des Pädagogii Regii zu Glaucha vor Halle* (Halle: Waysenhaus, 1721): Section IV n. 3.
[53] Ibid.
[54] See Thomas Müller-Bahlke's discussion in "Der Hallesche Pietismus und die Kunst: Bemerkungen zu einem alten Vorurteil" in Rainer Lächle ed. *Das Echo Halles: Kulturelle Wirkungen des Pietismus* (Tübingen: bibliotheca academica, 2001): esp. 243-244.

worship—or to challenge the iconoclasm of the "papists." This is a tradition that has been derided by generations of art critics, historians and philosophers for having contributed to an overall decline in the quality of art produced in the early modern period as a result. However, as Joseph Leo Koerner has shown in his study of Reformation art, "the Reformation image" should be seen as a kind of mirror or participant inside the "interpretative enterprise in which it stands."[55] Halle Pietists had embarked upon a new interpretive enterprise. They were attempting to return to the original aims of the first apostles and Christians—before Christendom had become corrupted by divisiveness, false displays of piety and images that did not resemble the "truth" of their originals. This new endeavor required a new set of strategies or conciliatory technologies and perspectival drawing was one of these.

In his *Short and Simple Lessons*, Francke explained that "parents have a Christian obligation to ensure that their children are exposed to the "art and manner" of the "middle path" (*Mittelstrasse*) and that no child is "left without instruction.[56] To this end, he continued, "real copperplate engravings and figures, which children find charming, can be used;" he emphasized that such things also "nicely demonstrate the teachings of the holy scriptures and other symbolic books."[57] This was something that would benefit the entire *Anstalt*, not only the pupils of the *Pädagogium*. A 1698 contract between Francke and Gottfried Wolfgang, an engraver from Augsburg, specified that Wolfgang would

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[55] Joseph Leo Koerner, *The Reformation of the Image* (London: Reaktion Books, 2004): 14.
[56] The word *Mittelstrasse* was employed by Daniel Ernst Jablonski in a letter to Leibniz from October 15, 1698. He described the Anglican Church as maintaining a "reverent middle path… between Catholic superstition and Calvinist disengagement (*Kalsinnigkeit*)." In Hartmut Rudolph, "Zum Nutzen von Politik und Philosophie für die Kirchenunion. Die Aufnahme der innerprotestantischen Ausgleichsverhandlungen am Ende des 17.Jahrhunderts" in Martin Fontius, Hartmut Rudolph, Gary Smith eds. *Labora Diligenter*. Potsdamer Arbeitstagung zur Leibnizforschung von 4. bis 6. Juli, 1996 [Studia Leibnitiana] (Stuttgart: Franz Steiner, 1999): 115, n. 23.
[57] Francke, *Kurzer und Einfältiger Unterricht* (1702): 17-18. The Semler painting and drawing lesson also provide instructions for "How to illuminate a copperplate engraving." AFST/H E 61, *Semler Lehrplan,* 717.

"provide his knowledge in drawing and copperplate engraving to the children and students, who were turned over to him," and aim to "perfect" at least "a few who have the ability to be useful and can then begin teaching it themselves in the *Anstalt*."[58] Exercise in drawing, engraving and painting was not something Francke necessarily intended only for his most elite pupils. As a set of practices, codified as mathematical/mechanical sciences, they could benefit the conciliatory instincts of all individuals.

De Lairesse had articulated a similar attitude towards the pedagogical utility of "real copperplate engravings and figures" in his *Introduction to the Art of Drawing* when he explained that "one shows copperplate engravings to youth:"

> 1) to delight them, 2) to wake up their spirit, 3) to stimulate in them a new curiosity to inspect, through observation, the different thoughts that are to be found within it—because rarely do they see such things and so they long to know who produced it and what kind of contents it contains, 4) the different names and praise of the best artists gives them a great amount of encouragement, especially those who intend to stay with art will be invested with a hope that they too will achieve a large name in the world, 5) so that they will learn by making their own annotations, and the things they find in the work itself will prepare them for any lessons to be given to them.[59]

In acknowledging the ability of engravings and figures to "nicely demonstrate" things and to charm or delight children, Francke was aligning himself with forms of pedagogical innovation that would have been just as easily recognized by his French and English contemporaries, as his learned contacts in the German states. And yet, in Francke's case, the wide spread interest in "waking up" the spirit was connected to a much larger preoccupation with a carefully prescribed set of exercises intended to do completely transform the individual and to make him a carrier of light. The benefits of the conciliatory *Mittelstrasse* would become manifest through training in perspectival

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[58] AFST/W XI/-/4 [August 26, 1698] Original Contract zwischen Gottlieb Wolfgang u. Hr. Prof. A.H. Francke den Kindern das Kupferstechen zu lehren

[59] *Des berühmten Mahlers Gerhard De Lairesse Anleitung zur Zeichen-Kunst*, Transl. Samuel Theodor Gericke (Berlin, 1705): 14.

drawing and ultimately the very way in which one produced resemblance would signify the quality of the transformation itself.

Managing illusion and color

The Dutch painter Samuel van Hoogstraten defined painting in the 1660s as a science for representing ideas or notions produced in nature and "for deceiving the eye with drawing and color." But he was careful to emphasize that "a painter whose work it is to fool the sense of sight also must have so much understanding of the nature of things that he thoroughly understands the means by which the eyes are deceived."[60] As Hoogstraten and other advocates of geometrical projection understood, the science of perspective was also very much about controlling illusion by becoming proficient in the art of deception. Once the tools were mastered, a philanthropically minded artist could affect the quality of what was seen in his or her viewer for the better. Looking out for the viewer's best interest, the artist could enhance the quality of the viewing experience by signifying the highest and most beautiful forms of knowledge possible in the images he presented. Kemp likens van Hoogstraten's sentiments to those of Aguilonius and the Swedish humanist Johannes Scheffer (1621-1679), who argued for the "placing of illusion in service of natural representation" in his treatise on drawing (Nürnberg, 1669).[61] Scheffer also believed that new drawing and painting regimens could be everywhere implemented that would affect improvement by helping individuals master

[60] Quoted in Kemp, *The Science of Art* (1990): 118.
[61] Ibid., 119.

the technologies of illusion. The drawing and painting guide contained within the pages of the Semler lessons includes several references to Scheffer's treatise.[62]

Christian Wolff treated perspective as a branch of the mathematical sciences that could be divided into three sub-categories: one was oriented around the production of resemblance through geometrical calculations, one relied more heavily on instrumentation (*perspective mechanica*) and one was explicitly concerned with the management of illusion (*perspectiva anamorphotica*). In his attempt to create universal proofs for perspective, Wolff had also endeavored to produce axioms for *anamorphosis*, or the geometrical projection of "shapeless figures." He defined this kind of perspective as the "science of presenting a picture in such a way that the thing that it is supposed to represent no longer looks similar to it but that it returns to its similarity when it is observed at a certain distance with the naked eye, or with a certain kind of mirror or polygonal glass."[63] For Wolff too, individuals had an ethical obligation to become proficient in the science of perspective because, simply by becoming a practitioner, one would be able to consistently stabilize viewing experiences even when, on the surface, the possibility of resemblance seemed far away.

Both of the Halle Orphanage texts on drawing and painting affirm a need to manage illusion in order to improve people. But there were times when adjusting the circumstances of seeing did not allow for the proper management of real objects, let alone illusory ones. The boundaries of visible bodies that were round and uneven, for example, were harder to demarcate with precision so they required their own set of

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[62] Johannis Scheffer, *Argentoratensis Graphice Id est*, *De Arte Pingendi*: *Liber Singularis*; *Cum Indice necessario* (Nürnberg, 1669). His name appears in the first commentary of the handwritten guide; see AFST/H E 61 *Semler Lehrplan*, 665.

[63] Christian Wolff, *Mathematische Lexicon* [Leipzig, 1716]: 1046. Reprinted in *Gesammelte Werke*, Part One: Vol. 11.

special techniques. The author of the Semler lesson argued that in these cases the artist should first form an impression of the visible body in his *Gemüth* before endeavoring to create an outline of the awkwardly shaped object:

> One can make very clear sketches of bodies with corners, but with round or dissimilar figures, one must first imagine them in the *Gemüth*. The first (kind of body) one calls known, certain, affirmed, but the unknown ones are doubtful, fleeting transmissions.
>
> Aside from this, observation of the situation in which the drawing is made affects differences in expression and appearance …. This only becomes clear to artists who combine verbal, visual and practical lessons and who are properly constituted.[64]

Only artists who had been properly constituted and had received enough training were ready to begin representing awkwardly shaped objects. The author's insistence that the artist first imagine these objects in his *Gemüth* before representing them is very similar to Francke's insistence in his basic instructions for reading and approaching the Holy Scriptures that individuals form a picture in their minds while meditating before they begin.[65] Once the artist had formed an image of the round or dissimilar figure in his imagination was he ready to employ a special set of techniques to the canvas.

The Semler guide to painting and drawing text can also be read as an assortment of exercises for the moral perfection of representation. The tenth exercise, for example, is titled "How to sketch (*entwerfen*) the picture of a body or a figure out of one's own imagination." The "solution" included six steps:

> 1) First draw the dividing-lines of the object, whether it may be a person or animal or some other kind of body.
> 2) Give them their extension in width and height with a kind of raw sketch or outline.
> 3) Test how well you have rendered their proportions or not and make improvements where necessary.
> 4) Then secure the invention with a quick outline as well.

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[64] AFST/H E 61, *Semler Lehrplan*, 673.
[65] August Hermann Francke, *Einfältiger Unterricht, wie man die Heilige Schrift zu seiner wahren Erbauung lessen solle* [Halle: Waysenhaus, 1694] (Reprinted in Halle: Kleine Texte der Franckeschen Stiftungen): 2-3.

> 5) Record it on a working sketch, on a page following the directions in the fifth exercise above.
> 6) If you want to draw a clothed human figure, you have to ... first draw the body without its main features and afterwards lay the garments over top according to the qualities of its Action.[66]

The imagination was a powerful tool for producing "inventions;" however, as the fourth step indicated, these inventions needed to be anchored or *sichert* via the *Riss* or other tools of precision and standardization.

Only when dealing with the representation of non-visible forms, did the Semler guide advise the burgeoning artist not to concern himself with "extension" but to make use of "barely visible" lines. Johann Daniel Preissler, an artist from Nürnberg, is cited as having most thoroughly developed in his "beautiful work," the author continued, a "theory" for the implementation of this technique.[67] Preissler had become the director of Nürnberg's painting Academy in 1706 and, by 1716, had established a school for drawing that was affiliated with the Academy and, in turn, developed his own curriculum for it. His *Die durch Theorie erfundene Practic* explored the status of curved lines as intrinsic carriers of higher forms of incorporeal knowledge in conjunction with the art of managing these properties so as to produce images of essences (like love, hate, virtue etc.) that could not be seen.[68] Following Preissler, the author of the Halle Orphanage's *Graphice* explained that "when forms were invisible, but known, they had no verifiable

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[66] AFST/H E 61, *Semler Lehrplan*, 714.
[67] Ibid., 678. "Auf solche Art verfahret Herr Preisler und lehret in Seinen schöne Werke, die durch die practic ensunden theorie genannt." This is likely a reference to Johann Daniel Preissler, *Die durch Theorie erfundene Practic [Praktik]: Oder Gründlich-verfasste Reguln deren man sich als einer Anleitung zu berühmter Künstlere Zeichen-Wercken bestens bedienen kann* (Nürnberg, 1721-25).
[68] Johann Gabriel Doppelmayr (1671-1750), a mathematics professor in Nürnberg's Aegidien Gymnasium, member of the Royal Society (1713) and the Berlin Academy of Science (1715) would write about both Preissler and his father (also a highly regarded artist who had spent many years in Rome) in his *Historische Nachricht Von den Nürnbergischen Mathematicis und Künstlern ... mit vielen nützlichen Anmerckungen und verschiedenen Kupffern versehen von Johann Gabriel Doppelmayr* [Nürnberg, 1730] (Reprinted in Hildesheim; New York: Georg Olms, 1972).

extension and had to be approached in a different way."[69] One could offer a gesture (or *Entwurf*) in the direction of these ideas but the techniques for mastering their precise replication were still being developed. *Entwurf* lines were defined as "a mixture of curved and straight lines" that "best serve" an artist attempting to work on something "of his own invention." The application of colors to drawings, and in painting, was also deemed an effective strategy (in both Halle Orphanage guides) for the advanced artist's attempts to render known but invisible or non-linear forms.

In addition to his treatise *On Characteres*, Aristotle's pupil Theophrastros—whom we met in Chapter Four—would produce a treatise *On Colors* rooted in a similar principle. Color, like character, was a real property of objects, and just like different characters contained within themselves the markers of their own constitution, so too did different colors. *De Coloribus* followed Aristotle's division of color into two extremes, white and black (the fundamentals), with several intermediate colors that were loosely connected to the physical properties of the four elements: air, water, fire and earth.[70] This "Aristotelian scale" would dominate the way in which color was understood and organized, even around the time that the Halle Orphanage *Graphice* guide was published. But by this point, the scale had been subjected to countless modifications, expanded by several individuals (including Athanasius Kircher) into comprehensive tables of "composite" colors and their corresponding essences. The publication of Newton's ideas about color in his *Opticks* (1704) based on his extensive experiments with prisms had

[69] AFST/H E 61, *Semler Lehrplan,* 678.
[70] Kemp, *The Science of Art* (1990): 264; Aristotle discusses color explicitly in *De sensu et sensibili*. Countless painters and theorist would embraced this "Aristotelian scale," including Leonardo Da Vinci who explained that "white is the first amongst the simple colors, and yellow the second, green the third of them, blue is the fourth, and red is the fifth, and black is the sixth. And white is given by light, without which no color may be seen, yellow by earth, green by water, blue by air and red by fire and black by darkness which stands above the element of fire." Quoted in Idem, 268.

also forced contemporaries to reflect on the possibility of color's inherent subjectivity.[71] What better moment to adopt a conciliatory stance than by endeavoring to embrace the validity of both theories? Was color accidental and illusory or was there something formal, substantial and theoretical about it?[72] Were colors perceptions perceived by the soul or were they intrinsically resident in objects?[73].

Reconciling these opposing stances involved finding a way of illustrating color's own status, like the *Gemüth*, as a material site invested with a set of symbolic meanings—its intrinsic nominality and physicality. The orphanage *Graphice* author's interest in embracing this middle path is manifest in the influence of Samuel Theodor Gericke's translation of C.A. du Fresnoy's the *Theoretical Art of Painting* (*De Arte graphica*) and de Lairesse's *Art of Painting* throughout the text.[74] Du Fresnoy's *De Arte graphica* dealt with what he called the "chromatic delights of color," which he defined as the "the soul and ultimate realization of painting;" the text emerged in the midst of vigorous discussions in France in the 1660s and 70s about the abilities of color, despite its immaterial properties, to help create an awareness of the unseen.[75] Gerald de Lairesse's *Great Book of Painting*, or *Groot Schilderboek* (Amsterdam, 1707), appealed to advocates of perspective because it unequivocally embraced the idea that colors were universal signifiers or carriers of essential meanings. Kemp writes that de Lairesse

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[71] For Newton's experiments with prisms see Simon Schaffer, "Glassworks: Newton's Prisms and the Uses of Experiment," in David Gooding, Trevor J. Pinch and Simon Schaffer eds., *The Uses of Experiment: Studies of Experimentation in the Natural Sciences* (Cambridge: Cambridge University Press, 1989).
[72] Kemp, *The Science of Art* (1990): 283.
[73] Stuart Clark, *Vanities of the Eye* (2007): 339. Descartes argued that colors were perceptions, not qualities that existed in objects. A primary aim of Newton's experiments with prisms was to refute or overturn this assertion.
[74] C. A. du Fresnoy, *Kurtzer Begriff der theoretischen Mahler-Kunst,* transl. Samuel Theodor Gericke (Berlin, 1699); *Des berühmten Mahlers Gerhard De Lairesse Anleitung zur Zeichen-Kunst*, Transl. Samuel Theodor Gericke (Berlin, 1705).
[75] Kemp, *The Science of Art* (1990): 283.

"assigned 'emblematic' meanings to his three 'chief colors' and three 'mixed' colors: yellow was equated with 'luster and glory'; red displayed 'power and love'; blue was associated with deity; purple denoted 'authority and jurisdiction'; violet signified 'subjection'; and green stood for 'servitude.'[76] Like the typologies of virtues and vices offered by Joseph Hall's version of Theophrastros' *Characteres,* the meanings of these colors (like the *Gemüth*) were fixed, but were constantly in motion—or in a constant state of gradation or variability. De Lairesse's color schematic corresponds quite closely to the one employed by Athanasius Kircher in the *Ars magna lucis et umbrae* [Kircher derived it from F. Aguilonius's *Opticorum libri* (Antwerp, 1613)], which attached cosmic significance to the sequence of color types he presented. The only difference perhaps is that de Lairesse was more willing than Kircher to adhere to mainly nominal modes of signification, whereas Kircher's scheme retained a preoccupation with color's intrinsic materiality.[77] It seems that the Pietist producers of the two texts under discussion were drawn to both Lairesse and Kircher's schemes precisely because of their interest in color as a conciliatory medium and in systematizing axioms for the "science" of painting and drawing that were both nominal and real.

S.T. Gericke eventually translated Du Fresnoy and de Lairesse's treatises into German, thereby introducing two of the leading proponents of color as a signifier of non-visible essences into the landscape in which Spener, Francke, Leibniz and Wolff navigated. Gerike was also a "Professor of Perspective" who had started a *Perspective Collegium* in Berlin in 1699.[78] The influences of de Lairesse and Du Fresnoy (via

[76] Ibid., 280.
[77] Ibid.
[78] Samuel Theodor Gericke, *Das Collegium in der Perspectiv*, *welches [auf Aller_ Veranlassung S. K. M. in Preussen: auf Dero Academie der Künste und Mechanischen Wissenschaften Allhier] in Berlin, [öffentlich]*

Gerike) are manifest in the introduction of the Halle Orphanage's *Graphice,* where the author explained that color was a specially designated means through which ideas are rendered:

> We also find that not only visible and corporeal, but also non-visible and incorporeal things can be painted; it is not impossible to represent virtues, vices, and expressions of character. As soon as we can acquire a concept of incorporeal things from the influence of a painting and what it presents us with, then this painting can be called a properly constructed one….
>
> Color gives the nature and quality of the things that are represented their guiding principle and purpose and no one can properly understand it (i.e. the essence of color) better than those who have rooted themselves firmly in the other arts and sciences. We will also notice from this description that it is not entirely correct when one says that painting is the modeling of visible things only because…it endeavors to represent still more, namely non-visible things. [79]

For the members of the Pietist community that sponsored the publication of this treatise on *Graphice*, color contained within itself the capacity to invest representations with "guiding principles and purpose." It invested a drawing with a kind of metaphysical significance that only a properly trained artist or viewer could see.

In addition to serving as living carriers of symbolic meanings, colors had to be derived from physical substances in order to be applied to a canvas, thereby reinforcing longstanding Aristotelian links between color and substance. The two orphanage drawing guides offer instructions for how to apply the latest techniques in projective geometry in conjunction with preparing the "real materials" necessary for making a particular color appear.[80] The Semler text describes "corpus colors," derived from minerals, as well as colors derived from "vegetable extracts and tinctures" which

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gelesen werden wird (Cölln an der Spree, 1699). S.T. Gericke is referred to in the Halle Orphanage *Graphice* text as a "Professor of Anatomy & Painting in the Royal Prussian artist Academy of Berlin" but his biography also indicates that he was a "Professor of Perspective" and published a *Teaching Guide to Perspective* for this *Collegium*.

[79] *Graphic*e (Halle: Waysenhaus, 1717): 5-7.

[80] AFST/H E 61, *Semler Lehrplan*, 690.

painters-in-training were to learn how to turn into solvents.[81] The author then provided detailed instructions for how to prepare watercolors, the "juice" (*Safft*) colors, or colors derived from vegetable extracts, as well as oil paints. This is all in addition to a separate lesson contained in the Semler plan, entitled "About colors, about Painting, and what is similar in painting," which includes detailed recipes for deriving different colors from other physical substances.[82]

Immediately following the sequence describing the ability of color to serve as a signifier of certain essences and to be comprised of these same essences, the author of the Semler text moves into a substantive discussion about capturing the movement of bodies and their affections. On the surface, the exercises seem to be about how not to let the passions hold much (or any) sway over the constitution of the painting. However, just like Francke urged the members of this community to stir up the passions so as to come into a more meaningful communion with the divine (thereby acquiring heightened abilities to intuit and to perceive) the author of the *Graphice* seems open to the possibilities of artistic imagination to project his "inventions" onto a two-dimensional space in a controlled and edificatory manner:

> It is often thought that one who is unable to draw from his own fantasies or out of his own head must practice by drawing other drawings, paintings, models and sketching from life. I can only to a lesser extent repeat this here and say that really the best use that we can derive out of copying paintings or things standing before us is this: that we also can put down on paper something of our own invention.
>
> Of course no rules about how exactly to go about doing this can be provided here because whoever has come so far that he can sketch something out of his own head will already be able to provide those rules for himself. If I were to provide a reminder to someone who is so far along I would ask him to take a look back at our description of painting here and assure him, if he wanted to know, of just what this description is about—especially

[81] Ibid., 691.
[82] Ibid., 85.

> so that he remembers that painting is about artful and, yes, living or natural representation (*Abbildung*). By remembering this, his inventions will not be falsely carried out.[83]

Francke's organization eventually provided these rules, or steps, for "drawing from the imagination" in the "painting and drawing as mechanical science" guide modeled after Wolff's systematic framework. They did this quite deliberately, I propose, as yet another expression of their attempt to regulate the processes through which the passions could mingle—strategically, productively, morally—with projective technologies and substance in order to produce more perfect renderings of real forms.

Conclusion

Both the printed Halle Orphanage's *Graphice* guide and the guide contained within the pages of the Semler lessons must be seen as invitations to participate in a set of practices. They were part of the *Stiftungen*'s wider assortment of guides for reading the scriptures or viewing models of the Temple of Jerusalem that could affect a transformation in an individual's ability to appreciate the conciliatory meanings at the heart of these same models, practices and texts. One learned how to draw and to paint in order to see correctly, not necessarily to become a famous painter; however, the hope was that through rigorous training in the technologies of geometrical projection, representations themselves would become significantly improved or more lifelike. Part of learning how to see correctly was learning to recognize visible and invisible essences, including virtue, vice, affections and faith. Part of practicing true Christianity, in Francke's estimation, was being able to use perspective (and perspective-glasses, or lenses) to properly mediate and eventually reconcile distances between near and far, now

[83] Ibid., 78.

and tomorrow, visible and invisible. Infidelity and Faith look both through the same perspective-Glass, but at contrary Ends, he wrote:

> Infidelity looks through the wrong End of the Glass, and therefore sees those Objects which are near afar off and makes great things little, diminishing the greatest spiritual Blessings and removing far from us threatened Evils. Faith looks at the right End and brings the Blessings that are far off in time, close to your Eye, and multiplies God's Mercy, which in a Distance lost their Greatness.[84]

True Christians, practicing eclectics, used the conciliatory medium of the perspective-glass or projection device, such as the lanterna magica, correctly; they could see "the blessings that are far off in time" and bring them closer—thereby making them real. Drawings and engravings may not have conditioned the highest forms of recognition, but they were still valuable, especially when they were produced while looking through the "right end" of the perspective-Glass. But even more importantly, painting and drawing were especially potent forms of conciliatory mathematical and mechanical exercise in this context that could help train the properly constituted *Gemüth* to render restoratively—or to draw in order to save the world

[84] August Hermann Francke, *Introduction to the Practice of Christianity* (London, 1708): viii.

Chapter Seven: Seers, Machines, *Naturalia* and Song in the Culture of Understanding

> Of the most important and useful truths for which a foundation is laid in school, some emphasize the improvement of the will over morals, others emphasize *the culture of understanding, which I count as the mathematical and the physical*. In my opinion, it is a rational kind of morality that should be taught to the youth as early as possible because it is through this that the will is improved and made obedient, which is the main goal of youth and the foundation of all happiness.
> …
> I like the Institutions in which one finds the *Pädagogium* and the Orphanage better than many other schools because there the youth are directed more toward real things (*Realitäten*) and forms of knowledge (*Wissenschafte*n) that exercise (*excoliren*) their understanding than things that only confuse the memory.
> …
> There the youth are provided with practical opportunities to practice (*ausüben*) their morality and given direction in the grasping (*Begreiffung*) of the mathematical and physical sciences through many experiments.
>
> -Friedrich Hoffmann[1]

When A. H. Francke characterized his *Seminar Universali* as "an orderly medium" that—like the Temple of the Jerusalem and the "prophet schools started by the prophet Samuel"—communicated God's "best intention" while cultivating the healing powers of the soul, he was making a direct reference to descriptions of prophet schools that were circulating in Europe during the second half of the seventeenth century. In Nürnberg Professor of Theology and Philosophy Johann Michael Dilherr's *Prophet School* (published in 1662), prophets are described as truth Sayers (*Weissager*) who receive wisdom directly from God.[2] While relying on God's Word, Old Testament prophets like Samuel, Isaiah, Jeremiah, Daniel and Ezekiel also reportedly made use of

[1] Friedrich Hoffmann's Foreward to Johann Hecker*, Einleitung in die Botanie* (Halle, Waysenhaus, 1734).
[2] Johann Michael Dilherr, *Propheten Schul. Das ist Christliche Anweisung zu Gottseliger Betrachtung des Lebens und der Lehre heiliger Propheten Altes Testaments; derer Bildnussen, in schönen Kupferstichen mit sind beygefüget. Allerlei Stands Personen erbaulich zu lesen* (Nürnberg, 1662): 2-3. Before accepting a theology professorship in Nürnberg in 1640, Dilherr was a Professor of Eloquence (1631), History and Poetry (1631) at the University of Jena. In Ferdinan van Ingen, "Johann Michael Dilherr (1604-1669)" in Udo Sträter ed., *Orthodoxie und Poesie* (Leipzig: Evangleische Verlagsanstalt, 2004): 47-48.

"external signs and ceremonies" and were called Seers or visionaries because they could see things that other people could not.[3] They were translators, who mediated divine knowledge for mankind and, as an expression of their obligation to convey illuminated truths to the rest of the world, they started schools. Dilherr explained that "it is worth knowing that in the Old Testament, the priests and teachers of God's churches were also professors." Synagogues were not only churches and public houses of worship where one prayed and heard sermons; rather, there were also *Auditoria* and resident visionaries could be found there who "instructed the youth in godliness and the free arts (*freie Künsten*) so that there would always be well educated people who could be useful to both God and the fatherland."[4] In his own description of the lives of the prophets, Leiden preacher David Knibbe would also explain that the people of Israel "came together in the houses of prophets as they would in a school, to hear an explanation of the word of the heart."[5]

The schools of the prophets were for everyone. They were sites where a prophet made visible the divine powers he had been invested with through his godly teachings, evidence of the fulfillment of these teachings or through "huge and wonderful acts" that made clear why he had been chosen by God for the office of prophet in the first place. Because of the prophet's ability to make his powers visible, individuals looked to these "prophets of the heart" for advice and gathered in their houses or synagogues to partake

[3] Ibid., 4.
[4] Ibid. "Es ist wissens wohl werth, dass in den Alten Testament, die Priester und öffentliche Lehrer der Kirchen Gottes auch Professores gewesen. Denn die Synagogen wahren nicht allein Kirchen und öffentliche Gotteshäuser; in welchen man zu bethen und die Predigen pflegte anzuhören: sondern man hatte auch Auditoria, oder solcher Gemächer und Losamter dabei in welchen dei Priester Schule hielten und die Jugend in der Gottesfurch und freien Künsten unterrichteten: Damit immer mögten Leute erzogen werden; welche Gott dem Herrn und dem gemeinen Vatterland könnten nützlich seyn."
[5] David Knibbe, *Histori der Propheten in 4 Bücher abgetheilt* (Bern, 1709): 203.

in their wisdom.[6] By directing their attention and their eyes to evidence of the higher forms of wisdom the prophet had been granted access to, viewers would experience edification. They would find themselves drawn to the forms of insight expressed to them from the prophet's heart, which they would begin to recognize after sustained periods of observation. They would be moved to emulate the prophet by exercising their minds and their bodies—all the while calibrating these two different forms of motion via their hearts. Dilherr relayed the story of how the prophet Elisha encouraged his followers to build houses or to use their hands to learn a craft *at the same time* as they reflected on the Holy Scriptures. Even the apostle Paul, Dilherr noted, understood that "next to studying, one should learn an honest craft (*ein sauberes Handwerk*);" he drew nourishment from his work as a carpet maker while he preached and studied.[7] "We work day and night," wrote Paul in his second letter to the Thessalonians (3:8-9), "so that we can give ourselves to you as examples that you can follow."[8]

In addition to ability of the term orphanage to serve as a metaphor for the mandate of universal benevolence around which Francke's entire project revolved, the phrase "prophet school" evocatively signifies the entire organization's underlying ethos. The Halle Orphanage was imagined as a modern Temple of Jerusalem, within which certain gifted or promising youths were placed under the tutelage of holy men, prophets or *Herrscher*, who directed their exercises of self-cultivation. Probably the most important characteristic of the exercises they engaged in was their sheer variety. Even in the most

[6] Ibid., 201.
[7] Dilherr (1662): 16. "Sondern sie haben sich neben der Erlernung der heiligen Schrifft auch wohl auf die Architectur oder Baukunst verstanden. Wie dann vor veil hundert Jahren es nicht ungewöhnlich gewesen: neben dem Studiren auch ein fein sauberes Handwerck zu lernen: inmassen wir von dem Apostel Paulo wissen; dass er ein Teppichmacher gewesen: zu seinem Unterhalt solch Handwerck so viel sein Predigamt zugelassen, bisweilen getrieben und sich damit ernehret habe."
[8] Ibid., 17. "…dass wir uns selbst zum Fürbild euch geben uns nachzufolgen."

elite school of the complex, the *Pädagogium*, boys of noble birth learned how to turn wood, make paper, paint, draw and grind glass in their "periods of motion" or recreation. They were taken on field trips to the workshops of local artisans, where they could acquire the highest form of recognition possible (according to the Semler typology) simply by seeing these sites in person. Just as Paul had recommended, rigorous training of the intellect (via mathematics, language learning, Biblical exegesis) was combined with a duly rigorous training of the *ausserliche Sinne* in Francke's *Schulstadt*. Learning to mediate this wild assortment of activity, as we have seen, was the end goal of the seemingly endless regimens. Mediating or calibrating even contradictory forms of knowledge was about bridging the same dichotomies that continue to inform our own epistemological landscape; only Halle's Orphanage offered a conciliatory solution. It must be read as an extended, dystopic space endeavoring to channel all forms of knowledge into itself so that these forms could be filtered through the medium of the heart, the single point where all knowledge came together.

Just as stirring up and reconciling competing forms of knowledge could be practiced inside the orphanage's physical edifice, one could stir up and reconcile the passions of the lower regions of the soul in order to see the world more clearly. This involved introducing several key techniques that could induce the necessary stirring and hone the cognitive skills necessary to discern. The techniques also allowed practitioners to usefully apply the forms of insight that came out of productively stirring the passions and to offer up visual representations of desirable conciliatory forms. As we have seen, models and instruments, *Grundrisse*, paintings and drawings were the Halle prophets' favorite tools because these objects productively juxtaposed craft and intuition,

mathematical precision with substance. In addition to being an intrinsically conciliatory form of exercise, painting and drawing also offered up a unique set of opportunities for creative expression, for the capturing (and projecting) of emotions, virtues and vices on a two-dimensional plane. This was also the case for three-dimensional models, especially machines, which provided the orphanage's illuminated Seers with an especially striking means of representing on the *Schauplatz* how mathematical precision and nature coalesced to give each machine a unique and beautiful animating principle. I aim to show in this chapter how, like the medium of the heart, machines could become conciliatory containers of insight, which, in the very act of mediating and embodying several forms of knowledge made themselves useful as tools of philanthropy. Part of learning to appreciate these machines involved participating in exercises that stirred the heart, like singing *Lieder* (a fundamental component of all Francke's schools), moved the body, like turning wood, and trained the mind, like learning geometry. Only then was one ready to observe and reconcile through love.

The resonant intermingling of *naturalia* with various regimens of instrumentation, measurement, geometrical projection and machination was a signature of the "culture of understanding" that Friedrich Hoffmann recognized in the landscape of Francke's *Schulstadt*. This intermingling is powerfully resonant in the Semler lesson plans (see Appendix 15), which are explicitly designated as "mathematical and mechanical school" curricula but at the same time include detailed lessons on the properties of metals, minerals, stones, flowers, trees, herbs, birds and fish. They are in many ways entirely consonant with a physico-mathematical approach to knowledge that Newton famously advocated in his *Philosophiæ Naturalis Principia Mathematica* (1687). And yet, I also

read these lessons as unique testimonies of the vision- and love-oriented culture that produced them—one that privileged the "seeing heart" because it held the key to investing overtly mercantilist economies and their arbiters with moral compasses. Properly viewing scale models of "useful" machines would ensure a perfectly proportional relationship between expenditures of force and applications that were intrinsically ethical—or that would promote the common good. Understanding the significant role of machines in the Semler lesson plans and the *Stiftungen*'s culture of understanding requires some amount of sustained attention to the vociferous debates around mechanics, especially the related problems of force and substance, taking place precisely at this moment. While I certainly cannot do justice in this chapter to the extensive literature around the liminal status of mechanics since antiquity, I can emphasize its ability to function, like optics, as a "mixed" or conciliatory area of inquiry fundamentally oriented around visual representation.

Despite the repeated insistence in precisely this period that the world of the mind and the world of the hand ought to be kept separate, there have been several attempts among historians of science recently to map out the varied ways in which intuition and skill have been manifestly conjoined over time. In their introduction to the *Mindful Hand*, Simon Schaffer and Lissa Roberts explain that while the classical opposition of *epistemē* and *technē* has been in place since the time of Aristotle, "this distinction took on new significance in the specific historical milieu that also saw the emerging dominance of early-modern European markets and political economies…" They rightly observe that "in a society of orders, the steeply graded hierarchy of head and hand was vital to defining persons and their social places;" but that maintaining the hierarchy itself

involved often precarious and ambitious maneuverings.[9] Since mechanics was considered, "neither natural philosophy nor mathematics nor technology but a mix of all these," careful study of the meanings practitioners attached to it has a great deal to teach us about how the process of joining minds and hands worked.[10]

In 1729, Christoph Semler would publish a description of the objects he had demonstrated in a *Collegia Mechanica* he had offered at the University of Halle that same year. Each object, he explained, was equally valuable because each one "illuminated the goodness, strength and wisdom of God when they were viewed by rational and Christian eyes." In this *Collegium*, the following "well constructed models and material figures were presented and demonstrated ocularly":

> 1) A warship, especially all of its external and internal parts … and how it holds up on long trips by storms and in sea battles, including burials of the dead
> 2) A newly discovered machine that determines the true cause of the ocean's tides, taking into account all circumstances but without relying upon the influence of the moon
> 3) The Temple of the Holy Grave in Jerusalem, according to all of its parts, as it would appear to pilgrims there today
> 4) A horizontal projection (*Grundriss*) of the city of Halle, according to which it has been turned into a model
> 5) An entire city with its walls, graves and public buildings
> 6) A house that shows the work of a carpenter, also the tools of a carpenter in a model
> 7) A Fort
> 8) The Attaquirung of the same
> 9) An entire field encampment with army, with tents, alleyways and circumvallation und contravallation lines
> 10) A battery
> 11) A salt mill with all relevant parts
> 12) A German salt fountain
> 13) The Metritzer fountain in a model
> 14) An open air inhalatorium (*Gradierwerk*) through which the strength of the soul will be brought to a higher grade

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[9] Lissa Roberts, Simon Schaffer and Peter Dear eds., "Preface," *The Mindful Hand* (2007): xiii.
[10] Mary Henniger-Voss, "Working Machines and Noble Mechanics: Guidobaldo del Monte and the Translation of Knowledge" *Isis* 91:2 (June, 2000): 234. James A. Bennett argues that the emergence of a "dominant mechanical tradition in natural philosophy" was profoundly influenced by the mechanical arts and mathematical sciences in "Mechanics' Philosophy and the Mechanical Philosophy" *History of Science* 24:1-63 (March, 1986): 1-2. See also Alan Gabbey's discussion of the different ways in which mechanics has been defined over time in his "Historiography of Early Modern Mechanics," in J.V. Feld and Frank A.J.L. James, *Renaissance and Revolution*: *Humanists, Scholars, Craftsmen and Natural Philosophers in Early Modern Europe* (Cambridge: Cambridge University Press, 1993).

15) A new bee-hive invented by an Englishman
16) A mill with two gears
17) The Mayland plough of Marquis Borro, which allows one man to accomplish in the preparation of fields that which had required two men and a horse previously
18) A new invention of a plough, which plows and sows and puts seeds in the ground at the desired depth and width from each other—all at the same time
19) A mine through which the work of the miner and all of his tools will be presented
20) A clock and all of its parts—including how they all fit together and each piece separately
21) A singing clock and its structure
22) An *experimenta magnetica*, as well as the *magnetica verticalis*, which still no one has attempted to use at sea for the good of the sailor and of which the same thing, when it is combined with an *acu horizontali*, can be used to happily find longitude maritime using the specially developed *mapparum magnetico-hydrographicarum*.[11]

Semler referred to all of these objects as "models, whose demonstrations not only allow us to enjoy their many uses but whose musters and examples excite the *ingenia* to attempt similar advancements and give us another reason for bringing these new discoveries to light."[12] Most of them are scale models of machines.

At the same time that Christoph Semler was demonstrating his machines and instruments in Halle, Leiden professor of experimental physics, Willem 's Gravesande, was situating models of working machines next to experimental instruments in his University's physics cabinet. Lissa Roberts explains that in Leiden "these devices (instruments and machine models) were used to demonstrate the physical principles that gave witness to the orderly working of divine creation while celebrating the creativity and ingenuity with which nature could be harnessed for human benefit. The collection pointed, in other words, simultaneously to the worlds of theory and practice, tying them

[11] *Wochentliche Hallische Anzeigen* (April 17, 1730): 231-234. "Vergangnen Winter über hat Hr. M. Christoph Semler, diaconus an der Kirche zu St. Ulrich alhier in einem collegio mechanico fürzustellen und klärlich zu beweisen sich bemühet, wie dass man bey allen Professionen in denen objectis mechanicis und physicis die Fünckleín der Weissheit Güte und Allmacht Gottes überall hervor leuchten sehe, wenn man dieselbe nur mit vernünfftigen und Christlichen Augen zu betrachten belieben möchte. Und in solchem wohlgemeynten Absehen sind alle folgende objecta, in wohlausgearbeiteten Modellen und in materieller Figur, präsenter und ocularíter von ihm demonstriret worden."
[12] Ibid. (1730): 233.

together with the multi-faceted concept of utility."[13] If models of machines were, as Roberts' and my own evidence suggests, devices whose assimilatory strength lay in their appeals to applicability, proficiency and improvement, this was almost entirely because these appeals were made to the eye. In Halle, as in Leiden, models of machines linked theory and practice by displaying the ways in which natural materials could be made to benefit society through human invention; however, when manipulated by Halle's prophets of the heart, models of machines could increase desire or one's own ability to apply the machine to the world in love. When a machine model was deemed useful in Halle's conciliatory climate, it was morally sound, compulsory and to be placed on the *Schauplatz* for all to see. It was to be integrated into the Pietist Orphanage's rigorous program of conciliatory exercise.

In the first section of what follows I focus exclusively on the Semler lessons' treatment of machine models so as to highlight the sustained amount of energy the Halle Seers were investing in their potential to both assimilate and to inspire. To be true to Semler's organizational framework, I attempt to do this in conjunction with his treatment of *naturalia*—including the materials manipulated by the machines and individuals he presented ocularly. In the second section, I move from exercises directly associated with the models and materials of the *Schauplatz* to other forms of exercise developed so as to prepare children to properly observe—especially the geometrical, musical and motion-oriented training regimens of all Francke's "prophet schools."

[13] See Lissa Roberts, "Mapping Steam Engines and Skill in eighteenth-century Holland," in Lissa Roberts, Simon Schaffer and Peter Dear eds *Mindful Hand* (2007): esp. 197-204. See also Roberts' treatment of utility in "Going Dutch: Situating Science in the Dutch Enlightenment," William Clark, Jan Golinksi and Simon Schaffer eds. *The Sciences in Enlightened Europe* (Chicago: University of Chicago Press, 1999): 351-352.

Semler's Machine Models as Expressions of the Heart

Christian Wolff, J.C. and L.C. Sturm and Christoph Semler's interest in creating "mechanical and mathematical school" curricula (or introductions to these middling sciences) signals their participation in a much broader set of discussions surely not limited to the German states. Yet they were among the first to produce descriptions of these new schools for a German-speaking audience; and they did this within the unique conciliatory context of pansophy. All their contributions came before Nicolas Bion's description of a *Newly Opened Mathematical Work School* in Paris was translated into German by Berlin Academy member, Johann Gabriel Doppelmayr, in 1712, for example.[14] In his own beginner's guide to the mathematical sciences, Wolff assured his readers that he was not only going to describe how certain machines were made, but that he was going to explain what materials one should direct the attention to when constructing and using them—and why.[15] Because one of the central goals of his guide was to demonstrate things that "have visible applications (*augenscheinliche Nutzen*) in human life," he explained that the underlying goal of the lessons was to allow the principles under girding "not only of the instruments and other works of art, but also the wonderful movements in the bodies of animals and humans" to show themselves, to make themselves visually manifest so that his readers would take notice of them (*vormerken*).[16]

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[14] Nicholas Bion, *Traité de la construction et des principaux usages des instrumens de mathématique*; *Neu-eröffnete mathematische Werck-Schule, oder gründliche Anweisung, wie die mathematische Instrumenten nicht allein ... zu gebrauchen, sondern auch ... zu erehalten sind ...*. Transl. Johann Gabriel Doppelmayr (Franckfurt; Leipzig; Nürnberg, 1712; reprinted Nürnberg, 1717, 1721, 1726, 1727 and 1728).
[15] Christian Wolff, *Beginners Guide to Mechanics* (1st ed. 1709), 745. Reprinted in *Gesammelte Werke*, Part One: Vol. 13.
[16] Ibid., 749

In a similar manner, the writer of a Semler lesson entitled simply *On Mills* explained that "Mills are named according to the way in which (*wie und wodurch*) they are made to move."[17] Some were made to move through water, some through wind; others were powered by horses (*Rossmühlen*), humans (*Tretmühlen*), weights (*Gewichtmühlen*) and hands (*Handmühlen*), thereby determining their quality and how they were recognized. The scale model of a mill that the lesson indicates was placed on the *Schauplatz* on March 5, 1708, was called a *Zieh-Pomster* because of its observable and motion inducing relationship to a Pomster or "because it hangs on *Pomster-ketten*, which it mediates by allowing it to be wound up and let out again."[18] Other mills acquired their purpose and, of course, their different names from the "materials that are processed or produced from them."[19] Examples included flour and barley mills, pepper, coffee, oil, herb, powder and mustard seed mills and paper mills, "whose structure is almost the same."[20] There were also "bohr mills," which the lesson writer described as "carrying the most power" and as including a new kind of mill for *Wasserkunst*, in addition to "the machine that Professor Wolff is having built." [21]

The Semler lesson *On Mechanics* was mostly derived from Leonhard Christoph Sturm's treatment of this mathematical science in his *Kurzer Begriff der Gesamten Mathesis*—a treatment markedly similar to the one he had offered readers of his *Machinen-Hauss* (1702/1704).[22] The writer specifically indicated that "because it is

[17] AFST/H E 61, *Semler Lehrplan*, 194.
[18] Ibid., 182.
[19] Ibid., 195. "die darauf tractiret und gearbeitet wird..."
[20] Ibid., 197. "dann die lumpen werden auf den meisten Papier Mühlen mit Hammern zuschlagen. In Holland aber werden sie mit Metallen Hobeln zerschnitten..."
[21] Ibid.
[22] Leonhard Christoph Sturm, *Kurzer Begriff der Gesamten Mathesis* (Frankfurt an der Oder, 1707). According to his entry in Johann Heinrich Zedler's *Grosses vollständiges Universal-Lexikon*, Vol. 40 (Halle, 1744), L.C. Sturm was the author of a three-volume text published anonymously in Hamburg

called a mechanical school, one explained to the children in great detail several exercises in *Mathesis*, which were also repeated, and also Herr Sturm's *Kurtzen Begriff der Mathesis*, especially the part on Mechanics was laid down as the foundation."[23] According to Marcus Popplow's recent assessment of the *Machinen-Hauss*, the discussion of mechanics that the younger Sturm offered deliberately distanced itself from the newly emergent and highly polarizing discussions around mechanization—including what some considered to be the intrinsic dangers of mechanical philosophy.[24] Sturm's treatment was much more oriented around sixteenth-century discussions about the essential components of all machines. He identified four: namely the lever (*Hebel*), the cogwheel and gearbox (*Kammrad und Getriebe*), the screw (*Schraube*), and the cable and block (*Seyl und Kloben*).

Several classificatory schemes found in the writings of Archimedes and the writings of Heron von Alexandria offered analysis of these and more components, including the scale (*Waage*) and the law of the lever—considered the "foundation for the understanding of all machines" by several champions of Renaissance mechanics.[25] Characteristic sixteenth-century treatises interested in revisiting the contributions of what Popplow calls "pre-classical mechanics" included Guidobaldo del Monte's

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between 1702-1705 entitled *Der geöffnete Ritter-Platz*. It is occasionally cited in the Semler lessons. The second volume was called *Das Neueröffnete Machinen-Hauss, worinnen Curiösen und Reisenden angewiesen wird was sie vornehmlich von Machinen, so bey Schiffahrten, Wasserkünsten, Opernhäusern, Mühlen, Berg- und Uhrwercken, gebrauchet werden, wissen und verstehen müssen wan sie selbige mit Nutzen und Vortheil auf Reisen besehen wollen* (Hamburg, 1702). Another edition appeared two years later under a slightly altered title: *Das Neu-eröffnete Rüstzeug oder Machinen Hauss* (Hamburg, 1704). See Marcus Popplow's "Popularisierung von Technik um 1700. Das neu-eröffnete Machinen-Hauss' von Leonhard Christoph Sturm" in Lars Bluma, Karl Pichol, Wolfhard Weber eds. *Technikvermittlung und Technikpopularisierung. Historische und didaktische Perspektiven* (Berlin: Waxmann, 2004).

[23] Ibid., 556.

[24] See William Clark's treatment of the discourses around "minds, machines and miracles" in eighteenth-century Prussia in "the Death of Metaphysics in Enlightened Prussia," William Clark, Jan Golinski and Simon Schaffer eds. *The Sciences in Enlightened Europe* (1999): 427-431.

[25] Mary Henniger-Voss, "Working Machines and Noble Mechanics: Guidobaldo del Monte and the Translation of Knowledge" *Isis* 91:2 (June, 2000): 238. Popplow, 176.

Mechanicorum liber (1577) and Galileo's *Le mecaniche*; Guidobaldo Monte's treatise was translated into German by Daniel Mögling as the *Mechanischer Kunst-Kammer* (*Mechanical Arts Chamber*) in 1627.[26] L.C. Sturm's (and Semler's) treatment of mechanics is much more closely in line with Guidobaldo's treatment, or what J.A. Bennett has called "the mechanic's philosophy"—meaning it comes out of the praxis-oriented mathematical sciences of the early Renaissance that is later co-opted or integrated into a philosophical framework. As we saw in Chapter Two, L.C. Sturm's father was at the forefront of attempts in the German-speaking world to popularize the insights of Archimedes and practical mathematics in conjunction with the eclectic methodology he was championing. This, in tandem with a tendency among sixteenth-century Italian writers on mechanics, like Guidobaldo, to talk about how those who understood machines did so through a combination of their intuition and their bodies (they did not necessarily need a full understanding of rational causes)[27] made them appealing to the Sturms, to Tschirnhaus, to Leibniz and to those, like Francke, interested in the machine's ability to generate impassioned motion or movement in the world that could be felt and immediately grasped by the hearts of others.

L.C. Sturm's treatment of mechanics explained that there were three essential things that allowed the human being to function: "his organic body through which he is

[26] Guidobaldo produced an influential treatise on screws called *De cochlea* (Venice, 1615) and an important treatise on theories of centres of gravity called *In duos Archimedis Aequeponderantium libros paraphrasis* (Pesaro, 1588); not surprisingly, he also wrote about perspective (Perspectivae libri sex [Pesaro, 1600]) and astronomical instruments (Planisphaeriorum universalium theorica [Pesaro, 1579]). See Henniger, 237 n.8 and Domenico Meli, "Guidobaldo del Monte and the Archimedean Revival," *Nuncius* 7 (1992): 3-34.

[27] See Chapter One; Henniger-Voss, 244. "According to Guidobaldo, theoretical understanding of the causes behind the effects of mechanics was beyond the ken of workers. In fact, the mechanic as a human agent is of minimal importance…Perhaps extrapolating from the pseudo-Aristotle's prologue to the *Questions on Mechanics*, Guidobaldo holds that the common mechanic could understand the machines with which he worked only intuitively, while the man of erudition had knowledge of causes. The difference between the learned response to machines and that of the common people is a kind of leit motif in Guidobaldo's prefatory essays."

made capable of working; his soul, which directs the body; and his external senses (*ausserliche Sinne*), through which he grasps or understands the work." In the same way, Sturm continued, "we must conceive of each machine in a three-fold manner: 1. the machine itself as it is comprised of wheels, gears etc., 2. the driving force applied to it and 3. the tool (*Werkzeug*) that is made to function via the machine. It is of these three parts that a properly constituted mechanics must engage."[28] In other words, in Sturm's formulation the machine and all of its composite parts was the human body, an organic substance, the force involved in activating the machine was the soul and the "seeing heart"—the neutral, third site—became a conciliatory tool that affected change through its capacity to recognize and properly apply the force of the machine in the world. This was the formulation that the writer of the Semler lesson referred to when he specified that L.C. Sturm's treatment of *Mechanica* served as the foundation for his own understanding and presentation of mechanics to pupils.

Of course, L.C. Sturm was not the only proponent of the idea that machines or mechanical forms were holistic, organic entities that joined the nominal and the real in a "beautiful" union. Robert Boyle, whose devotional treatises on reconciliation appeared in German via Francke's orphanage press, had also argued much earlier than L.C. Sturm that mechanical form includes, simultaneously, "corpuscular structure" and "the resulting

[28] L.C. Sturm, *Kurzer Begriff* (1707): 323: "Wie wird Mechanica rechtmässig eingetheilet? Weil diese Eintheilung weitläufftig ist, will ich dich zu meinem Tract. De Nat&Const. Matheseos verwiesen haben, hier aber dieselbe nur über haupts mit wenig Worten verfassen. Wie an einem Menschen wenn eer arbeitet dreyerley zu consideriren ist, der organische Leib dadurch er capabel ist zu arbeiten, die Seele welche den Leib treibet und die äusserliche Sinnen dadurch er die Arbeit angreiffet; Also müssen wir an jeder Machine auch dreyerley concipiren. 1. Die Machine selbst wie sie aus Rädern, Schrauben usw zusammen gesetzet ist, 2. die daran applicirte Bewegungskrafft, 3) das Werckzeug welches von der Machine getrieben wird. Von diesen drey Theilen muss die Mechanica ordentlich handeln. Wie nun dieses biss dato noch in keinem einigen Buche so viel ich immermehr erfahren, geschehen ist, so wird mir niemand verueblen, wenn ich sage, dass es allen denselben Scriptis an behöriger Ordnung und Vollstandigkeit mangle... "

properties necessary to classify it."[29] Jan-Erik Jones argues that a tendency among scholars to read Boyle as a kind of proto-Lockean, or as anticipating Locke's empirical taxonomies, has meant that Boyle's interest in redefining, yet retaining, the Aristotelian idea of forms, or species, has been overlooked. As Wolff would later affirm in the *Beginner's Guide*, Boyle insisted that "the reason we can successfully classify objects…is because the internal structure reveals itself via the observable properties."[30] In Boyle's view, when one observed an object on the *Schauplatz*, what one saw was an assimilation of corpuscular structures or "essential forms" arranged in such a way that they "denominate" a body or make it visually accessible, and therefore knowable. Leibniz, for his part, also advocated revisiting the "substantial forms" of Aristotle (and the Scholastics) so as to reconcile, or promote harmony between, the soul and the body (although his treatment of substance and theory of monads is quite different from what Boyle was advancing in his "mechanical" theory of forms).

Donald Rutherford explains that from the 1680s onward, despite some adjustments, "Leibniz remains committed to a set of basic assumptions about substance," that connect with L.C. Sturm's above cited insistence on the capacity of the machine to function as a *Werkzeug*, or tool of action and/or improvement. For Leibniz, continues Rutherford, "to be a substance is, minimally, to be an individual principle of action, which persists through change and which serves as a ground for the existence and properties of all other things."[31] Without going into the strenuous terrain of Leibniz's metaphysics here, for my purposes it is enough to emphasize his interest in the machine

[29] Jan-Erik Jones, "Boyle, Classification and the Workmanship of the Understanding Thesis," in *The Journal of the History of Philosophy* 43:2 (2005): 178.
[30] Ibid., 179.
[31] Donald Rutherford, "Metaphysics: the Late Period" in Nicholas Jolley ed. *Cambridge Companion to Leibniz* (Cambridge: Cambridge University Press, 1995): 126.

as assimilation of active, living substances capable of being directed through love. When properly joined together, these "individual principles of action" would unite to move (and improve) perpetually. Not surprisingly, Leibniz, L.C. Sturm, Wolff, Semler and their contemporaries were enormously interested in the promise of perpetual motion and rumors of local mechanics who had managed to create continually moving machines abounded. According to the Dreyhaupt chronicle, Christoph Semler spent hundreds of Talers and worked for over thirty years on developing a *perpetui mobilis*, "but never reached his goal."[32] His curricula indicate that an introduction to the problem of perpetual motion concluded the lesson *On Mechanics*.[33]

Johann Ernst Bessler (1680-1745), also known simply as Orffyreus, was one of those local mechanics, originally from Zittau, whom everyone seemed to be talking about at the time Semler and Francke were active in Halle. In his own investigation of the popularity of perpetual-motion machines in the early eighteenth century, Simon Schaffer explains how these machines were in many ways perfectly "apt occupants of the courtly and academic world of baroque absolutism" as they were "easily understood as emblems of the permanent workings of the divinely ordered world-machine and thus rationally managed state."[34] Interest in them was inextricably linked to an overall interest in new engineering schemes and devices needed to power pumps in mines and mills, for example. "Orffyreus' wheel," as it became widely known—and referred to in correspondence between Newton, Desaguiliers and other luminaries of this period—was,

[32] Zedler, *Universal-Lexicon* Vol. 36 (Halle, 1743): 900: "Unter die besondern Umstände seines Lebens ist zu rechnen, ... dass er gantzer 30 Jahr an Erfindung eines Perpetui mobilis gearbeitet, und darauf über 6000 Rthl verwendet ohne seien Endzweck zu erreichen."
[33] AFST/H E 61, *Semler Lehrplan*, "Zum beschluss hat man von perpetuo mobili gesaget, was davon zuhalten..."
[34] Simon Schaffer, "The Show that Never Ends: Perpetual Motion in the Early Eighteenth Century," *The British Journal for the History of Science* 28:2 (June 1995): 161.

Schaffer rightly argues, also "touted as a viable commercial investment" that sheds a great deal of light on the "rival ways of estimating value in early modern culture." But at least in Brandenburg-Prussia, or the Prussian outpost that was Halle in the early years of the eighteenth century, Orffyreus' perpetually moving wheel was also understood as a tool of love and reconciliation. In a text he called the *Rightly Believing Orffyreer*, Bessler laid out his plans for a union of hearts that would "put the love of Christ at the heart of all knowledge" (Ephesians 3:19) and bring together "true believers" from all confessions, including Roman Catholics, Lutherans and Calvinists.[35] In this same treatise, Bessler specifically referred to the Halle Orphanage as a "house of unity" (*Haus der Einigkeit*) firmly situated upon a foundation of wisdom (*Weissheit*) that itself was rooted in love. He was cognizant of how, in a way similar to the perpetually moving wheel that made him famous and the other Semler machines on display in Francke's orphanage, the Halle Orphanage could serve as an assimilatory juncture point that promised to improve the world by teaching certain souls how to harness the active properties of all substances for the best—in part by viewing scale models of machines.

The Semler plans also, for their part, provide some evidence of how highly technical demonstrations of various machines could be embedded with morally prescient meanings—including their historical precedents. The Semler *On Mills* lesson, for example, links Biblical evidence (Genesis 18:6 specifically) and evidence from antiquity to support the idea that mills could and had been employed to perfect society "since the time of Abraham." It relates the story of how, according to Homer, there were fifty maidens who milled for a King Alcimi but because the work was so unpleasant, they

[35] Johann Ernst Bessler, *Der Rechtglaubige Orffyreer: Oder die Einige Vereinigung der uneinigen Christen in Glaubens Sachen. Sie nennen sich gleich; Evangelisch-Lutherisch, Evangelisch-Reformirt, Römisch Catholisch oder Papistisch* (Kassel, 1723).

were relieved of their duties and instead the king started requiring criminals (*Ubelthäter*) who had landed in prison to mill as penance for their sins. The lesson writer also specified that Sampson, imprisoned by "his enemies the Philistines," was put to work milling (in Judges 16).[36] There was a corrective element manifest in the culturally constructed applications of the mill over the centuries that had been recognized by both the ancient Greeks and the Old Testament fathers. Not only did the technology of the mill improve society as a whole, making it possible to more efficiently grind flour and other foodstuffs necessary to sustain a community, but the mill was used to improve and correct individuals—providing them with the opportunity to offer up some sort of penance whose value to the whole was visible to all.[37]

Also, as Schaffer points out in his discussion of Orffyreus, the Semler lessons explicitly linked the mill to the new engineering plans of the Prussian state, especially their interest in opening new mines. In a lesson *On Mines*, there is a specific reference to Veit Ludwig von Seckendorff's description of the art of water milling or water arts as key to a powerful cameralist state. "One needs the large *Wasserkünste*, *Züge* and *Pompwercke* that the experienced miners know about," he insisted.[38] This text, called the *German Prince-State* (1656), had issued a call for the development of new educational strategies (*Bildungswesen*) that was directed mainly towards the first estate, or nobility. Francke too had referenced Seckendorff in his *Grosse Aufsatz*, aligning his plans as, in

[36] AFST/H E 61, *Semler Lehrplan,*198.
[37] Not surprisingly, L.C. Sturm also wrote entire treatise about mills: *Vollständige Mühlen Baukunst: Darinnen werden I. Alle Grundreguln so zu der Praxi nöthig, die doch gar wenigen recht bekant sind, treülich angewiesen; II. Die Vortheile, die man bey Anlegung der Wasserräder alle Sorten von Machinen zutreiben in acht nehmen muß, Auf den höchsten Grad der Vollkommenheit gebracht; III. Was insonderheit an Korn-, Graupen, Papier-, Öhl-, Pulfer, Säg-, Steinschneide-, Bohr-, Schleiff-, Sensen-, Kessel-, Eisendrat-, Hächsel-, und Dreschmühlen zuverbessern, aufrichtig entdecket ...* (Augsburg, 1718).
[38] Veit Ludwigs von Seckendorff, *Deutscher FürstenStaat mit einer gantz neuen Zugabe, sonderbahrer und wichtiger Materien um ein grosses Theil vermehret* (Franckfurt und Leipzig, 1703): 369.

part, responding to this same call. Yet, like Leibniz, Francke and Semler were interested in circulating the forms of knowledge contained in the von Seckendorff treatise to a much broader audience—including a steadily growing *Bürgertum* and new communities of skilled workers, including engineers or mechanics. Francke's community had actually acquired mines in Göddelsheim (containing shafts named "King David"); there existed a very real incentive to show able pupils from all backgrounds models of mines and related machinery in the *Stiftungen* schools.[39]

Whether they were managing the entire mining operation or operating the machines necessary to extract valuable substances, young men in this society needed to cultivate an intimate grasp of the "observable properties" of corpuscular structures (to return to Boyle). And, more importantly, in order to "understand" how to apply these properties, they needed to appreciate the links between their own eyes, hearts and the *Werkzeuge* they would ultimately control. It makes perfect sense, in this context, that the Semler "mathematical and mechanical school" curricula would devote a significant amount of time and energy to describing the "observable properties" of metals, minerals, stones, flowers, trees, herbs, birds and fish.[40] Natural history was just as important to the mining enterprise, for example, as the ability to construct accurate geometrical projections of shaft depths and widths or to properly calculate weights, as well as the distribution of net forces needed for extraction. Being visually proficient in the observation of natural forms was a fundamental part of mechanics, just as much as a

[39] For evidence of the Halle Orphanage's involvement in mining copper in Göddelsheim see Stab/F 10, 2/7: 218 [June 30, 1720] Johann Daniel Herrnschmidt to August Hermann Francke. See also AFST/P 43/1/1 – 43/1/33 AFST/P 43/1/1 – 43/1/33 Kupferbergwerk Goddelsheim Planentwürfe und Skizzen and AFST/P 43/2/1 – 43/2/12 Kupferbergwerk Nordenbeck Planentwürfe und Skizzen.

[40] The lesson immediately preceding the *On Mechanics* lesson is entitled simply, *On Animals*, for example. Boyle is referred to directly in the lesson *On Stones*.

certain proficiency in devising and applying measurements was essential for constructing and applying the machines themselves. It is this overt marriage of material and mind (or natural history and mathematics) that these lessons take as their central task.

In addition to the machine models and instruments on display in the Halle Orphanage building, the site became a kind of repository for the housing of natural objects. Francke created a *Naturalien*- or *Wunderkammer* that by 1732 (when Dreyhaupt described it in his *Saalkreis* chronicle) contained "a collection comprised in part of *Naturalien*, which, since the orphanage was built have been mostly donated from benefactors and friends, and in part of *artefactis*, which are completed for the good of the schools and academies and are finished according to a certain cause, whose beginnings are spelled out again and again in the *Fusstapfen*."[41] Among the natural objects one could observe in the collection included over 500 shells (conch, snail and mussel), a variety of insects (many sent from India), salamanders, chameleons, a scorpion, a tarantula, a "three and a half foot long nerve worm that a medical student pulled out of the foot of a patient," a crocodile (14 ½ feet long), the rib of a whale (18 feet long), a cabinet full of minerals and precious stones found in mines in Hungary, Saxony, India and Sweden, over 120 types of marble sent from Venice, a four-foot long leaf from a coconut tree and several kinds of sea herbs sent by the Pietist missionary Ziegenbalg from the island of Ceylon.[42] For an educated person of high status to house a *Naturalienkammer* in and around 1700 was by no means unusual; Francke's collection marked his interest in and ability to demarcate his own worldliness according to the

[41] Dreyhaupt, 224. This is an explicit reference to A.H. Francke's *Footsteps of Divine Providence* (1701), in which he spells out the miraculous and divinely inspired benevolence that enabled him to finance the founding of his orphanage and associated institutions.
[42] Ibid. See also AFST/W XI-/71 Inventarverzeichnisse (Kataloge) der Schränke der Kunst- und Naturalienkammer, especially Verzeichnisse 1-11 von Gottfried August Gründler (1741)

standards set by those around him.[43] And yet, even Dreyhaupt is careful to note in his description of this collection that the objects themselves were donated by various inspired benefactors, not acquired through standard commercial channels and that they were seen as necessary for the realization of the orphanage's primary cause. *Naturalia* too were essential components of the true *consilia* of all knowledge that the Halle prophets taught their pupils to accomplish with their hearts.

The preoccupation of Francke's community with *naturalia* and *physica* has been more thoroughly treated than its collective interest in the mathematical sciences—albeit mainly by historians of medicine interested in Halle Pietists' chemiatric and naturopathic regimens.[44] The Semler plans, for their part, affirm (and I think extend) the most recent assessments of Pietists' preoccupation with medicine, including Renate Wilson and others' insistence that an extremely varied collection of pharmaceutical remedies were employed in the *Stiftungen* that combined botanical and chemical *materia medica*, in addition to several other forms of therapy—like diet and mineral baths.[45] While the Semler lessons contain a direct reference to Paracelsus in the Apothecary lesson (specifically in a description of Borax), suggesting the Swiss physician's preference for chemiatric remedies was known among the Halle Seers, the lessons by no means endorse a purely chemiatrical approach to therapeutics. Herbs and other botanical remedies feature just as prominently in the same Apothecary lesson, for example. Indeed, the

[43] There is an extensive literature on the early modern *Wunderkammer* and collections of *naturalia*. For an introduction see Paula Findlen, *Possessing Nature: Museums, Collecting, and Scientific Culture in Early Modern Italy* (Berkeley: University of California Press, 1994) or Pamela Smith and Paula Findlen eds, *Merchants and Marvels: commerce, science, and art in early modern Europe* (London: Routledge, 2002).
[44] For some recent work on Pietist medicine see Jürgen Helm, *Krankheit, Bekehrung und Reform : Medizin und Krankenfürsorge im Halleschen Pietismus* (Tübingen: Verl. der Franckeschen Stiftungen Halle im Max-Niemeyer-Verl., 2006).
[45] Renate Wilson, *Pious traders in medicine: a German pharmaceutical network in eighteenth-century North America* (University Park, PA: Pennsylvania State Press, 2000): 56.

"Halle Orphanage medications" that were eventually shipped around the world in standard medicine chests also contained a combination of chemical and botanical regimens, including the famous *essentia dulcis*, a "tincture of gold" that served as a general fortifier (i.e. "increased the vital spirits") and the *essentia amara*, an extract of bitter herbs that purified the blood.[46] But their production relied not only on a wealth of knowledge about all kinds of natural substances, or *Materialen*, but also on several types of instruments that made extracting and manipulating them easier. The Semler lessons contain descriptions of the instruments apothecaries used in addition to their descriptions of substances; there is also an especially detailed presentation of the instruments found in a chemical laboratory.

Previous attempts to link Pietists to physics have also almost always emphasized their preoccupation with physico-theology and commitment to what Wilson calls a "biblical and Christian doctrine of health" that saw the curing of disease as a "divine gift."[47] Often linked to the contributions of John Ray (1629-1705) and William Derham (1657-1735), physico-theology is essentially a way of thinking about man's ability to know the divine that involves using reason to discern the workings of God in nature.[48] In Johanna Geyer-Kordesch's view, Pietists were likely more influenced by the ideas of Georg Ernst Stahl, the noted professor of medicine who was active in Halle in the early years of the eighteenth century, than physico-theological treatises. For Stahl, Geyer-

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[46] Ibid., 72.

[47] See especially Fritz Krafft's *Christus als Apotheker: Ursprung, Aussage und Geschichte eines christlichen Sinnbildes* (Marburg, 2001); Gisela Dehmel, *Die Arzneimittel in der Physikotheologie* (Münster: LIT Verl., 1996); Renate Wilson, "Book Review: *Pietismus, Medizin und Aufklärung in Preußen im 18.Jahrhundert: Das Leben und Werk Georg Ernst Stahls*" in *Bulletin of the History of Medicine* 75:2 (2001): 52.

[48] It was mostly popularized in Germany via Christian Wolff's Vernünfftige *Gedancken von den Absichten der natürlichen Dinge* (1724) and only really blossomed from the 1730s to the 1760s. See William Clark, "The Death of Metaphysics in Enlightened Prussia" (1999): 434.

Kordesch contends, physico-theology amounted to an entirely superficial and unsatisfactory attempt to resolve the mind-body problem—including the caveats so many had about imagining the body as a kind of machine. Instead, as Renate Wilson affirms in her review of Geyer-Kordesch's book, Stahl and his many followers (including the physician Michael Alberti) "insisted there was an essential, direct and divinely driven linkage between the body as patient and the soul as agent; motion—the *motus tonicus vitalis*—acted as their intermediary within an organic entity that was split asunder only by death."[49] Geyer-Kordesch lays out Stahl's personal connections to the Francke Foundation and argues that there is a great deal of convergence between Piestist theology and Stahl's preoccupation with unifying body and soul. Several of Stahl's followers, including Johann Juncker and the Richter brothers (Christian Friedrich and Christian Sigismund), lived and worked in the *Stiftungen* Apothecary and the Halle Orphanage press published several of their own treatises—always in the vernacular, which meant a much wider distribution of Stahlian ideas.[50]

As we have seen, for L.C. Sturm the external senses comprised the critical third or unifying element of machines that linked together material and force. In other words, the external senses, especially the eyes and the hands, were the tools (*Werkzeuge*) that were activated in the union. Tools move—or at least that is the only way they affect change. Stahl's introduction of the *motus tonicus vitalis* as the third critical point of conjuncture between body and soul fits neatly with Sturm's formulation. Movement must be registered sensually to mean anything; it is also an observable phenomenon *and* it is inextricably linked to the Aristotelian idea of substantial, or intrinsically action-oriented

[49] Renate Wilson, "Book Review" (2001): 52.
[50] Especially Christian Firedrich Richter's *Höchst nöthige Erkenntnis vom Leibe und natürlichen Leben* (Leipzig, 1715), which Geyer-Kordesch argues was derived directly from Stahl.

forms. In my view, Semler and the teachers of Francke's institutes who employed and extended the Semler lessons saw value in both a Stahlian approach to the body as a holistic entity united by motion *and* L.C. Sturm, Leibniz and Wolff's affirmation of the affinities between bodies and machines (and their three essential components). They managed, for the most part, not to succumb entirely to the kind of fatalistic rhetoric Joachim Lange would later use on the eve of Wolff's banishment to describe the dangers of understanding bodies as machines.[51] Semler and Francke's schools introduced pupils to machines via *Anschauung* on a regular basis precisely because of these objects' potential to initiate conciliatory gestures in the very act of viewing the mathematical and material forms of knowledge on display *and* their capacity to offer up visible evidence of the intrinsically unifying power of motion. This helps explain the enormous amount of emphasis placed on all forms of exercise, or motion, in Francke's *Stiftungen*. It was used as a medical antidote in the Foundation hospital (founded 1708), for example, meaning that sick children and adults were encouraged, unless they were simply too weak, to turn wood for several hours a day on wood turning machines so as to activate the conciliatory (i.e. healing) power of motion in their bodies. Motion periods were also standard features of the curricula of all of Francke's schools, providing children with the opportunity to observe—i.e. to unify the pillars of wisdom, *Erkenntnis* and *Erfahrung*—while they moved.

Seeing through Music and Motion

[51] Joachim Lange, *Bescheidene und ausführliche Entdeckung Der falschen und schädlichen Philosophie in dem Wolffianischen Systemate Metaphysico Von Gott, der Welt, und dem Menschen: Und insonderheit von der so genannten harmonia praestabilita des commercii zwischen Seel und Leib* ...(Halle: Waysenhaus, 1724).

In the *Stiftungen*'s motion periods, children exercised their bodies and their minds via their eyes, with the help of an able director (*Herrscher*), who told them where to direct their gaze. In one description of how these periods worked, Francke painted the following picture of the myriad forms of knowledge being taught in his schools—including how these forms came together in the motion periods to benefit children of all economic backgrounds. "All of the orphans," he wrote, "are led by a student of herbal medicines so that they learn to know herbs; this certainly allows for certain advantages especially for those who, over time, should end up studying either medicine or the apothecary-arts. Those who are led to the other arts and handcrafts like printing, running a book shop and the like learn at least Latin, Greek and Hebrew, including how to decline and conjugate in Latin so that they can more easily perform their occupations, for which knowing this is of highest importance."[52] Francke continued his description of the motion periods by noting that it was important that even those who were not planning to attend university should learn the basic principles of Astronomy, Geography, Physics and History so that they could become "useful men;" this meant that outside of the regular hours of instruction, they were taught "in a playful way" (*spielender Weise*)—again borrowing from Comenius and Leibniz's emphasis on the *scholae ludus*—"the most

[52] August Hermann Francke, *Ordnung und Lehr-Art, wie selbige in denen zum Wäysen-Hause gehörigen Schulen eingeführet ist: Worinnen vornemlich zu befinden, Wie die Kinder in und ausser der Schul in Christlicher Zucht zu halten, und zum Lesen, zierlichen Schreiben, Rechnen, wie auch zur Music und andern nützlichen Dingen anzuführen sind.* (Halle: Waysenhaus, 1702): 235. "Alle Waysen-Knaben werden des Sommers über dann und wann von einem Studioso Medicinae herbatim geführet, dass sie die Kräuter kennenlernen, welches sonderlich denen ein guter Vortheil ist, die mit der Zeit entweder Medicinam studiren oder zur Apothecker-Kunst kommen sollen. Diejenigen, die zu andern Künsten und Handwercken als zur Buchdruckerey, Buchhandel und dergleichen sollen gebraucht werden, lernen zum wenigsten Lateinsich, Griechisch und Hebräisch lesen, auch im Lateinsichen decliniren und conjugiren, damit sie ihren künfftigen Beruff darinnen ihnen solches zu wissen höchst nöthig ist, desto leichter antreten können."

important things from these forms of knowledge."[53] From these lessons they would also "learn from examples how to recognize God in nature and "how they should be led to create horizontal projections worthy of praise by viewing his works;" they would learn how to distinguish between different faraway lands and how to travel, how to measure or properly distribute a field, how to use a calendar etc."[54] In other words, it was in seeing or observing actively that the lessons acquired their purpose.

As I have been endeavoring to show throughout this chapter, seeing correctly was also about moving or acting, as a *Werkzeug*, out of love. This was a kind of love that only appeared when several competing forms of knowledge were made to cohere. The opening quotation evidences Friedrich Hoffman's willingness to recommend the *Stiftungen's* "culture of understanding" because of its special capacity to unite both physical and mathematical forms of knowledge. Bessler (or Orffyreus) also had more to say about the special conciliatory qualities of the Francke's orphanage, a site which had uncovered the secret for generating true wisdom. "Acquiring wisdom is my goal and at the heart of everything I do!" he wrote; and everything, including the "union of believers," must first "flow out of wisdom." His treatise on reconciliation included an *Ode to Wisdom* that described the Halle Orphanage as a "house of unity" where:

> Many boys allow themselves to be taught wisdom through the arts and sciences,
> To God's praise and honor and their parents' reputation and happiness,
> Although not every son, without difference, can study there.
> Only the best ones are sent,

[53] Ibid.
[54] Ibid. "Weil auch einer der nicht studiret dennoch die Principia Astronomiae, Geographiae, Physicae, Historiae, und was feines Orts oder Landes Policey-Ordnung sey, zu wissen wohl vonnöhten hat, wo er ein verständiger und em gemeinen Wesen nuetzlicer Mann werden will, wird ihnen auch ausser denen ordentlichen Schul-Stunden neben dem dass sie zum Stricken angehalten werden, gleichsam spieleender Weise von allen diesen Wissenschafften das Nöthigste beygebracht, dass sie zum Exempel lernen wie sie Gott aus der Natur erkennen und sich durch seine Wercke zu feinem Lobe reissen lassen sollen , wie sie ein Land vom andern unterscheiden, wie sie reisen sollen, wie sie einen Acker messen oder theilen, wei sei den Calender brauchen sollen u."

So that they will immediately begin to blossom and begin to love,
Until the spirit of wisdom begins to peek out of his soul,
And raw utility becomes corporally actualized.
In this school of wisdom one only takes in boys
Who, by their natures, are oriented towards knowledge,
The parents can even be Jews and Turks
Really, Protestants attend there alongside Papists.
The children do not hear about even the slightest hint of confessional strife,
But instead learn virtues and the arts from all sides,
So that they grow in years and in wisdom,
And this means they have to work, themselves, on hundreds of things.[55]

For Bessler, the special qualities of Francke's orphanage resided in its ability to serve as a seat of wisdom, virtue and action, where male adolescents were taught to work or exercise themselves in "hundreds of things." It was a space where utility could be "corporally actualized" and "the spirit of wisdom" made to flow out of childrens' souls. It was also in many ways a site of exceptions, where a pansophic vision necessitated alternative sorts of social norms and made the seemingly impossible real. Children of Protestants, Catholics, Jews and Turks were supposed to attend school here together, he reported, thereby learning how to understand and to assimilate many points of view. Francke Foundation records confirm that several efforts were made to realize this goal. In 1703, a young boy from Astracan (Central Asia) arrived in Halle and was housed in the orphanage.[56] We know that poor boys were learning Hebrew, Greek, Latin and even Arabic.[57] Some were conducting experiments with expensive machines and being sent away to distant lands while children from titled families (or those planning to "study") were being taught how to turn wood and grind glass. Following the advice of the

[55] Johann Ernst Bessler, *Der Recht-glaubige Orffyreer* (1723): 7. Bessler noted that he planned to build his own copy of the Halle Orphanage in Carolshaven (Hesse).
[56] Juliane Jacobi ed., *"Man hatte von ihm gute Hoffnung": Das Waisenalbum der Franckeschen Stiftungen, 1695-1749* (Halle: Franckesche Stiftungen Verlag, 1998): 46.
[57] This is confirmed by Francke in his *Ordnung und Lehrart… Waysenhaus gehörigen Schulen* (1702): 6: "At the moment, eight orphans are learning Arabic, which they have already perfected very finely."

prophets, teachers in Francke's schools advised a rigorous mixing of several forms of motion so as to bring into perfect alignment minds, hearts and hands.

Notably, "calculating and singing" were often discussed in the same context, to be taught to "all children who are able to read." Francke explained that he had learned from experience that especially in arithmetic, "some are more gifted than others," so one needed to pursue a different art or style of teaching it. "In particular," he continued, "a printed calculating book is used in which many exercises through all the *species*, rules of three (*regulam de tri*), *practicam* and other calculations can be found." The book that Francke found "especially good" was written by Tobias Beutel, a mathematician and royal secretary of the prince of Saxony in Dresden, which he said provided the teacher with the following advantage:

> namely, that he does not have to dictate exercises to the children but instead every child can copy exercises from Beutel's book and elaborate each example in peace and quiet. The teacher then goes around to the children and observes what each one does, and where one child cannot progress any further or is missing something the teacher shows him the way and helps him move ahead.[58]

Francke's description is notable for its emphasis on the meditative stillness or "peace and quiet" of the lessons, suggesting the way in which lessons in basic arithmetic provided real opportunities for personal reflection, practice and improvement. In some of these lessons, especially when "examples appear in Beutel's calculations book with unknown numbers, which happens a lot in Species," Francke wrote, "then the teacher should introduce names like *Taler, Gülden, Pfund* and *Centner* so that the children immediately see the uses of calculating." He also indicated that he was encouraging teachers, "in all periods, to let a boy put an example on the board so that a specific calculation can be

[58] Ibid.

grasped from it…".[59] Gazing upon the example on the board was intended to activate intuitive grasping of the principle at work in the calculation, whereas the introduction of names like Taler inspired the recognition of a quantity's nominal properties and uses.

These lessons in basic arithmetic had other purpose: they made children more inclined to intuitively grasp certain musical concepts.[60] Boys in the higher and middle level schools of Francke's *Schulstadt* were given lessons in arithmetic on Mondays, Tuesdays, Thursdays and Fridays, but on Wednesdays and Saturdays they were taught "the principles of figural music according to the following method," which Francke noted that "someone experienced in music" had provided him with. From the description he offers, the link between the eye, mathematics, music and motion in Francke's schools immediately becomes clear. Music, too, involved a powerful combination of figural principles and denomination united in conciliatory exercise. Francke's description directly linked seeing to the act of singing:

> The teacher should lead the boys to the board and place them in order so that the small ones are in front and the big ones in back, so that they all can see over the other one… The notes should be written on the board so that all of the notes fall clearly and distinctly into their eyes, even the eyes of those standing at a bit of a distance.
> …
> The teacher should introduce the boys to the principles of music in the shortest and easiest way, and this means only teaching the most essential things at the beginning while also immediately starting with singing exercises so that they learn, in a very short time, how to sing a few songs thereby taking the uses of singing as true, which makes it easier to awaken them so that they will want to learn the overarching principles.
> ...
> This means that the teacher should make the scales (Claves) known to them and show them how they extend upwards and downwards through spaces (Spatia) and lines.[61]

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[59] Ibid.

[60] Beutel indicates the value of his lessons in arithmetic for grasping certain musical concepts; he specifically points to the significance of progressions; Tobias Beutel, *Neu aufgelegte Arithmetica, oder sehr nützliche Rechen Kunst Mit kurzen Reguln und Exemplis nach der Practica* (Leipzig, 1735): 26.

[61] August Hermann Francke, *Ordnung und Lehrart… Waysenhaus gehörigen Schulen* (Halle, 1702): 34; see also AFSt/W XI/-/1 Instruction wie die Music in den Knabenschulen tractirt werden solle, sine dato.

In this formulation, both seeing and singing stirred up the unifying potential heart, which would bring together and inspire a greater understanding of the "overarching principles" and their notation. The placement of the boys, the distances between their eyes and the notes displayed on a board, as well as the spatial/linear qualities of scales were given special attention. Francke continued:

> The boys who are naturally inclined toward fine singing and are led to have a good time in the singing periods should be directed further and given lessons in a special class. There the teacher should make known to them the different kinds of notes and their pauses and teach them how to give each note its proper tempo and to sing according to the beat. Also their voices should be investigated and they should be divided into two groups, one the discant and the other the altisten, and both should be led to practice fine, spiritual arias.
> …
> The arias that are undertaken with them in the beginning should all come out of a upward beat and should get the boys used to the same beat; at a designated time this should be practiced with them, before they are made aware of the triple beat, so that the triple beat, with its very non-straightforward number of notes, does not confuse them.
> …
> After they have become accustomed to the beat, one can lead them to the next thing without worrying about confusion. The teacher should be trying to show (*anzeigen*) the boys the nature of the triple beat, which, *because they have received lessons in arithmetic and a few of the same in geometry and in the mathematical sciences—especially arithmetic, geometry and music—there is a special harmony*, meaning that through these sciences figures and representations (*Fürstellungen*) that are already known to them can help them understand the nature of the triple beat more easily. For example, just like he can represent the upward beat as a geometrical square, so he can compare the triple beat to a triangle, because just like the same has three angles, two below and one above, so does the triple emerge out of three notes, two are sung in the downbeat and one in the upward beat. Actually only three notes of the same length belong in each triple; and that in 6/4, 6/8 and 12/8 triple, six and even 12 long notes are calculated in one beat.[62]

In Francke's prophet schools, gifted pupils learned to see the "nature of the triple beat" and its "special harmony" through certain "figures and representations" made familiar to them through a combination of rigorous geometrical exercise and the exercise of their own voices. The nature of the triple beat, like the triangle, also best represented the kind of reconciliation Francke's house of unity was intended to signify. In musical exercise one also found the perfect expression of mind and sensation's inherent unity in the heart.

[62] Ibid., 36-37.

Several generations of scholars from an assortment of fields have affirmed the importance of a harmonic ideal in European musicology since the Renaissance—one that invested the triple beat with symbolic meaning because of its capacity to represent the three fold nature of God.[63] Central to the links between harmony and music theory that early modern contemporaries—among them Descartes, Kepler, Kircher etc.—imagined were the affections.[64] As we have seen, the affections were stirred through the external senses, which always involved much more than the ears. If one imagined both music and the eye as inherently conciliatory or harmony-inducing mediums, then the juxtaposition of the two (when properly realized) could lead to higher forms of edification and awareness. Simply put, because of its capacity to affect the *sensus communalis*, music affected seeing and vice versa. *Musikanschauung* is the German word used to capture the essence of this relationship—mainly used in conjunction with Athanasius Kircher's treatment (in his *Musargia Universalis*) of musical affectation—although the implications of the "observation" component of this compound noun have been mostly underestimated.[65] Musical affectation offered Halle Pietists yet another way of mediating the relationship between music's mathematical and experiential qualities in a "third site,"

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[63] Francke was participating in a long tradition of musical pedagogy hugely influenced by both Renaissance humanism and Jesuit musicology. For the heightened influence in musical training for children in the German states see: Susan Forscher Weiss, "Musical Pedagogy in the German Renaissance," in James Van Horn Melton ed. *Cultures of Communication from Reformation to Enlightenment: Constructing publics in the early modern German lands* (Burlington, VT: Ashgate): 198-224 and John Butt, *Music education and the art of performance in the German Baroque* (Cambridge: Cambridge University Press, 1994).

[64] Descartes' *Compendium of Music* (1618) "belongs among the Renaissance accounts of music as a rational means for controlling and directing the passions and, in some cases, leading people to divine furor," in Jones, 59.

[65] For the term *Musikanschauung*'s ability to signify a form of spiritual exercise involving visualization see Hermann Zenck, *Numerus und Affectus* (Kassel: Bärenreiter Verlag, 1959): esp. 19-36. *Musikanschauung* "bedeutet eine dem gesamtmenschlichen Sein entspringende und ihm verhaftete geistige Schau der musikalischen Phänomene überhaupt; eine übergreifende musikalische Grundanschauung, die in einer bestimmt gearteten Stellungnahme des Menschen zur Welt der musikalischen Erscheinungen ihren Ursprung hat und darum als bewegende Kraft das Schaffen wie das Ausüben zu durchwirken vermag." See also Walter Blankenburg, "Der Harmonie Begriff in der lutherisch-barocken Musikanschauung," in *Archiv für Musikwissenschaft* 16.Jahrg., H.1/2 (1959): 44-56.

or in the heart. It certainly is not a coincidence that one of the defining features of Pietist songs (*Lieder*) was a heavy emphasis on the triple beat; this included most of the songs in Johann Anastasius Freylinghausen's songbook, which was the Halle Orphanage's primary source for musical exercise.

While the most advanced pupils of Francke's schools received instruction in musical theory, all pupils, regardless of age or ability, were expected to participate in collective "singing and praying periods" at least twice a week (usually Wednesdays and Saturdays). The first "singing periods" (*Singstunden)* were held, starting in 1703, in the main Halle Orphanage building until August 4, 1711, when it was reported that around 1400 children came together in a room specially built to contain the reverberations of what were carefully calculated exercises for the generation of love. "The main goal of these periods," wrote the acting director of the Foundation in 1794, "was to practice the new melodies that the holy Johann Anastatius Freylinghausen had collected in his new songbook." Contemporaries reported that "the singing was so pleasant that it soon drew a large crowd of listeners so that the room sometimes contained well over 2000 people."[66] Orphanage records also indicate that an additional *Musik Collegium* also met on Wednesdays and Saturdays, in which those who were especially musically inclined "could practice more so that they would not forget what they have already learned."[67] By 1721, the *Pädagogium* was offering its own *Musik Collegium* from 1:00 to 2:00 p.m. on Mondays that was also open to the public.

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[66] J.L. Schulze, G.C. Knapp, A.H. Niemeyer eds. *Frankens Stiftungen. Eine Zeitschrift zum Besten vaterloser Kinder* Bd. 2 (Halle, 1794) Quoted in Thomas Müller-Bahlke, "Der Hallesche Pietismus und die Kunst" in Rainer Lächle ed., *Das Echo Halles* (2001): 248. See also AFST/W XI/-/5 [1748] Die zum Behuf Classis 1 Mus. Und der Singestunden auf dem grossen Erbauungs. Saal angeschaffte neue Orgel

[67] AFST/W V/-/14 General Reglement für das Waisenhaus und Pädagogium

Christian Thomasius reported in 1698 that the singing of songs and playing of musical instruments in the *Pädagogium* was always done in conjunction with the reading aloud of edificatory material. In his estimation as well, it was through these kinds of exercises that more kinds of edification and awakening would be generated.[68] The use of music in motion periods was desirable when it was organized or expressed in certain ways, so as to properly condition the amount, but more importantly, the quality of the affectation experienced. These were calculated uses of experience regulated by the soul and the extent of its spiritual progress. Francke warned in his pedagogical writings that music in general was not something to be taken lightly. He said he had seen first-hand its ability to move the youth of most schools and universities towards "harmful ways"—meaning they directed their attention "more toward the superficial desires of the world then to the honor of God." As a result, he said he did not recommend music to *most* people.[69] In a 1702 letter to Francke, Gottfried Hoffmann, who had just become director of Zittau's Gymansium, indicated that he intended to take Francke's advice and to read Gottfried Vockeredt's *Misuse of the Free Arts, especially Music* but in the meantime he would see to it that the theatrical and musical productions of his own Gymnasium were more oriented towards presenting biblical stories that offered spectators "good *moralia*" at the same time as offering them productive opportunities to exercise their affections.[70]

Gottfried Vockerodt (1665-1727) was the director of Gotha's Gymanasium by 1702 and became a follower of Francke's after meeting him in Gotha and undergoing a conversion experience in 1691/92. In several treatises, Vockerodt stressed the way in

[68] AFST/S A I 200 [1698-99] Historische Nachrichten von dem ersten Anfang des Pädagogii, 18.
[69] August Hermann Francke, *Von Erziehung der Jugend zur Gottseligkeit und Klugheit* (1698): 25.
[70] Gottfried Vockerodt, *Mißbrauch der freyen Künste, insonderheit Der Music, nebenst abgenöthigter Erörterung der Frage* (Franckfurt: Zunnern, 1697).

which musical exercises were being improperly employed or "misused" in several venues, including schools. He emphasized the moral effects of "the Modi" (Tonality—*Tongeschlechter*) and the need to develop new musical forms that allowed these effects to be more fully realized.[71] In several other texts, some of which were published on the Halle Orphanage press, Vockerodt emphasized the importance of inventing and employing new mediums, or what he also called "middle things," that functioned in the same way that Pietist *Lieder* functioned. Middle things enhanced one's ability to desire piously.[72] Middle things, whether a song composed by Freylinghausen or a three-dimensional model, provided new spaces for reconciliation to occur that were conspicuous and rooted in love. These "things"—songs, models of machines, *naturalia*, motion—were not only the products of a *consilia* of thinking, feeling and loving but by virtue of their special status as mediums, as mediators, spoke directly to the mediatory faculties of the heart. This meant that these "middle things," these mediators, also enhanced one's visual aptitude—which included one's ability to not only see more clearly and distinctly but also more passionately.

All of those trained in Francke's schools participated in varying degrees in exercises that took the power of "middle things" very seriously. According to the *Pädagogium*'s printed curricula, pupils moved themselves in music during their periods

[71] See Gudrun Busch's brief discussion in "Die Beer-Vockerodt-Kontroverse im Kontext der frühen mitteldeutschen Oper" in Rainer Lächle ed. *Das Echo Halles* (2001): 157.
[72] Even the titles of all the "middle things" treatises state this quite explicitly. For example, Gottfried Vockerodt, *Erleuterte Auffdeckung Des Betrugs und Ärgernisses, So mit denen Vorgegebenen Mitteldingen und vergönneten Lust In der Christenheit angerichtet worden* (Halle: Waysenhaus, 1699); Albrecht Rotth, *Eilfertige und Kurtze Abfertigung Des weitläufftigen und vergallten Geschmadderes ... Gottfried Vockerodts, ... , Welches er Erleuterte Auffdeckung des Betrugs und Ergernisses von Mittel-Dingen nennet und dem Unterricht von Mittel-Dingen entgegen setzet, ...* (Erben, 1699); For Vockerodt's direct response to Rotthen see his *Sieg der Wahrheit: In dem zeitherigen Mitteldings- und vergönneten Lust-Streit von Herr M. Rotthen, einem Prediger in Leipzig in seiner so genannten Eilfertigen un[d] kurtzen Abfertigung eingeräumet* (Halle: Waysenhaus, 1700).

of recreation after participating in several forms of vision-oriented exercises in the free arts—just as the Old Testament's "prophets of the heart" had recommended. These advanced forms of motion, or recreational exercises, divided in the following categories by 1721: I. Preparation for Physics and the Bible, II. Mechanical Disciplines, III. Disciplines that Belong to Physics and IV. Disciplines that Belong to Mathematics. Freyer explained that the scholars undertook these exercises according to a "certain, previously prescribed order" so that their "bodies and characters could undergo a positive transformation."[73] The first set of exercises were preparatory and involved 1) visiting artisans and handworkers [instructors were advised to look at Comenius' *Orbis Pictus* before leading this exercise, in addition to Weigel's *Abriss der Hauptstände*], and then being introduced to 2) the types, names and unique qualities of animals, herbs and trees 3) metals, stones and other minerals, 4) earth, water, air, fire and many kinds of meteors, 5) *Öconomie*, 6) *Materia medica* and finally, 7) an explanation of the Temple of Jerusalem, which culminated in a visit to the Orphanage building to view Semler's models.[74]

Then the *Pädagogium* pupils were ready to exercise themselves on machines. They first learned how to turn wood "not to make finished products," Freyer continued, "but rather for the sake of knowledge and motion" more generally. They would construct models of machines and other instruments and, "because of the good motion that one achieves through turning, the scholars are given an extraordinary number of opportunities to do so."[75] Some exercised during lunchtime, from 1:00 to 2:00 pm, others turned for a couple of hours in the afternoon. Approximately 30 boys could turn at the same time.

[73] Hieronymous Freyer, *Verbesserte Methode* (1721): 116.
[74] Ibid., 116-160.
[75] Ibid.

The next priority was constructing machines, cabinets, stereometrical bodies and other geometrical figures out of cardboard. The most proficient of them performed exercises on the optical machines and polished glass necessary for the lenses. The final two categories of exercise included viewing herbs *in natura* so as to achieve high quality recognitions of botanical specimens (in the spring and summertime) and carving various parts of the body out of wood as an introduction to the science of anatomy. Older students were introduced to the study of hydrostatics, aerometry and hydraulics (with the help of Wolff's *Beginner's Guide*) and were then offered the opportunity to conduct experiments with the pneumatic pump and "many other instruments." Other scholars approached the "disciplines that belonged to mathematics" by being taken to the observatory that had been built in the *Schulstadt* and "shown the stars from time to time." It was always in conjunction with these mathematical exercises that they exercised themselves in instrumental music, drawing and painting.[76]

These were the forms of exercise that the famous professor of medicine, Friedrich Hoffmann, was referring to when he described the many opportunities the pupils of Halle's Orphanage and *Pädagogium* had to exercise their morality through rigorous training in the mathematical and physical sciences. He recognized the "culture of understanding" that had become the signature of Francke's enterprise, just as Bessler had recognized the ability of the Halle Orphanage to signify a "house of virtue," wisdom and unity, where children "allowed themselves to be directed in the arts and sciences" and opened up their souls to the spirit of wisdom. Just as in the prophet schools housed in the holy shrines of Israel (and described by several of Francke's contemporaries), individuals exercised their minds at the same time that they learned how to use their hands. They

[76] Ibid.

moved themselves, like the tools animated by the movement of machines, in order to affect visible improvements upon the rest of the world. And they were moved or inspired to do this by the "middle things" they had visualized during their preparatory exercises. Everything they had been shown during their tenure in the temple, or Pietist Orphanage—the *naturalia*, the scale models of machines, music and assorted forms of motion—had been deliberately placed before them by the prophets or Seers so that they too might seek, grasp, assimilate and perfect.

Part III: Extending the Method

Through the sovereign providence of our highest worthy God, who not only bends and directs everything that happens in the world for the benefit of the true church but also, from the beginning on has used special tools and entities in order to accomplish the same, the building up and further development of many Orphanages in different locations since the end of the last and the beginning of the current Seculi has greatly increased. Through these [Orphanages] many thousands of souls have come much earlier and much closer to a recognition of the truth, which otherwise either would not have happened at all or would have been made to happen with great difficulty. Because one finds no traces of such healthy and useful institutions in the old and even the newest history books, reports are being written for us from all sides with news about them, which is alluring to God-loving souls, who heartily praise the goodness of God. He has kept these priceless blessings for our times and aims to prove to the world what he always has been: a father to fatherless and a nourisher of the poor and needy.

Because of this, such an Orphanage still in this Seculo has been started up in **Augsburg** and is always talked about in conjunction with an abundance of spiritual and corporeal blessings. There is one in **Nordhausen**, headed by the preacher Herrn M. Kindervater, which now already has been standing in full bloom for a few years. And another foundation has been laid in **Wiese**, a village near the city of **Greiffenberg**, where Herr M. John Christoph Schwedlern, who started out as a preacher there, has been prepared through divine blessings to build a beautiful house to take care of many poor children's souls and bodies. One in **Langendorf** near **Weißenfels** has been started by a Christian and god-fearing farmer in reliance on the living God, whose plans have already been fully realized. One in **Königsberg**. Two in **Berlin**, of which the biggest was built at the cost of the king and the smaller at the cost of the widowed and recently deceased Frau Kommesserin. One in **Leipzig**. One is **Sorau**, which is taken care of by a dominion of counts. And the one that I should have named first, which was started in **Halle** by the honorable Herr Prof. Francke in 1694, who was not carrying out his own intentions [but God's]. Because of its tremendous and varied uses [the Halle Orphanage] is known much more widely to the world and it is more beautiful than what I am able to express here. Finally, God also thought about our dear city **Züllichau** and prepared a clever tool (*Werkzeug*) through many tests of faith, Sigismund Steinbarthen, … who was strongly awoken, in God's name, also to found [an Orphanage], which in this historical news bulletin will be laid out, multifariously, before the eyes.

-Johann Christoph Wilcke in *Warhafftige und umständliche Nachricht (1723)*

Chapter Eight: The Orphanage as *Vorbild*

Wer was auf Gottes Kosten bauet	Whoever builds something at God's cost
Allein auf Gottes Hülfe trauet,	Relies only on God's help,
Und suchet nichts als Gottes Her,	And searches after nothing but God's honor,
Demselben fehlt es nimmermehr.	Which he will never lack again.
Und dieses soll der Bau beweisen,	And this is what this building is meant to show
Der Gottes Waysenhaus soll heiβen.	Which should be called God's Orphanage.
Wer Gott hier nichtes will vertrauen,	Whoever does not want to trust God,
Der mag dies Waysenhaus anschauen:	**He should observe this Orphanage**
Dadurch Gott seine Herrlichkeit	Through which God has demonstrated
Erwiesen hat zu dieser Zeit.--	His splenour in these times.--[1]

Throughout the eighteenth century, the Halle Orphanage served as an international symbol of philanthropy and reconciliation. Its picture graced the cover of medicine chests that found their way to the North American continent, the East Indies and southern Africa.[2] Several idealized portraits of the entire institutional landscape were circulating in France and in England by 1710 (see Appendices 1, 17). However, the iconic status of the building itself served more than simply to generate admiration and monetary support of the illuminated "culture of understanding" that Pietist "prophets of the heart" had constructed. Donations, of course, were extremely important and marked the easiest and most common way that an individual could act, thereby becoming a kind of figurative *Werkzeug* in the machinery of Francke's project. But the Halle Orphanage building itself was intended to inspire other sorts of responses, including new collective efforts to replicate and extend the conciliatory mandate of its founding to the farthest reaches of the world. Most of the attempts to replicate Francke's orphanage and institutional complex gained momentum mainly in the territories of Brandenburg-Prussia, including the (now Polish) regions of Pomerania and Silesia. There were some notable

[1] L.Bethmann, "Geschichte der Anstalt" in *Landwaisen-Anstalt Langendorf Festschrift zur Feier ihres 200 jährigen Bestehens* (Langendorf, 1910): 8.
[2] See Renate Wilson, *Pious Traders in Medicine* (2000).

attempts to either build exact replicas of the *Stiftungen* or to reconfigure existing city orphanages according to the Halle standard in parts of Saxony, Hesse, Bavaria, Denmark, Sweden, Russia, India (in the Danish trading outpost of Tranquebar) and in the North American colony of Georgia. The influence of Halle for the construction of orphanages in India and North America especially has received some amount of sustained attention by historians, but the many varied attempts to replicate it within Europe have been less systematically treated.[3] In order to fully appreciate the power and import of the Halle method—as it was imagined at the confluence of several overlapping intellectual currents and personalities, including E.W. von Tschirnhaus, G.W. Leibniz, J.C. and L.C. Sturm and Christian Wolff—it is important to think of each individual attempt as being at the center of a kind of dialogue between the world and these prophets of the heart.

The very existence of the many copies of Francke's model in and around Brandenburg-Prussia evidence the Pietist Orphanage's capacity to function as a visual medium or temple of *Anschauung*, intended to orient (like the three-dimensional models and *naturalia* housed in Francke's *Stiftungen*), inspire and communicate. But what I would like to show here is that in order to be considered replicas, these institutions had to offer more than simply a similar aesthetic—that is, edifices that connoted a philanthropic ethos and, therefore, could edify or stir the soul simply when people viewed them. They had to somehow provide proof that they too should be imagined as sites for the refinement of conciliatory gestures through the teaching of *nützliche Wissenschaften*. There were several ways that they could do this but the most common seems to have been the establishment of orphanage printing presses, like Francke's, and the circulation of

[3] See the recently published collection of essays edited by Andreas Gross, *Halle and the Beginning of Protestant Christianity in India*: Vol. One: *The Danish-Halle and the English-Halle Mission* and Vol. Two: *Christian Mission in the Indian Context* (Halle: Frankeschen Stiftungen, 2006).

printed reports or updates regarding the quality of the educational programming in place there, as well as what often amounted to simply lists of the kinds of donations they were receiving. Interestingly, the lists of donations especially attest to these institutions' preference for donations of books and material objects—sometimes models and scientific instruments—as often as hard currency. And some of the remaining descriptions of the curricula in place in the orphanage replicas confirm that the visual training methods so characteristic of the *Stiftungen* were, indeed, in place. In keeping with my argument throughout I want to show that especially here, in these sites outside of Halle, *Anschauung* or visual exercise was essential for extending the aims of philanthropy. It was the preferred way of introducing children to the "useful sciences" while simultaneously conditioning conciliatory personalities that could reconcile competing forms of knowledge. Outsiders participated in the exercises by viewing the children and the building, thereby improving their own *Gemüther*. The donation records of these institutions seem to suggest that their supporters were aware of the power of these gestures, or conciliatory exercises, and sought to help or extend them by actually donating objects. I see the Pietist Orphanage building, including the various forms of spiritual practices refined and the donated objects on display there as examples of how Pietists "transmitted knowledge," drawing upon their own love-oriented method or juxtaposition of several assimilatory strategies.[4]

Like most historians and sociologists who study networks, I have been forced to confront the very real problem of how to demarcate this network and its actors. As we have seen, Halle Pietists saw the value of accepting the validity and integrity of all

[4] Sachiko Kusukawa and Ian Maclean: *Transmitting Knowledge: Words, Images and Instruments in Early Modern Europe* (Oxford: Oxford University Press, 2006) for several examples of how objects and visual practice cohered to circulate, extend and refine knowledge throughout the early modern period.

competing points of view and were, for the most part, confessional pluralists. At the same time, they believed in the cause of universality or in inspiring each individual heart to recognize the universal truths of primitive or apostolic Christianity. The success of their movement depended on the mediation of this tension and, unlike us, these actors felt they had successfully mediated it by embracing middling objects or stances—including models, music, affectivity, neutrality and, as I will show in what follows, spiritually gifted children. We no longer recognize the value of "middle things" or the conciliatory significance of the Pietist Orphanage, but we live amidst many of the same pluralisms, antagonisms and quests to find common ground that Pietists faced. As those around them wrestled with the growing cosmopolitanism of their cities, marketplaces and epistemologies, individuals inspired by Francke's movement promised local communities that their new orphanages could help individuals learn to reconcile these pluralisms. They presented themselves to the rest of the world as prophets, who held the key to stability: conciliatory love.

Instead of taking as true the categories Pietists reified so as to mediate or stabilize them, I endeavor here to show how the founders of Pietist Orphanages 1) upheld the integrity of the local sites in which they were built, 2) introduced a vision of universality and 3) transmitted knowledge from site to site through the circulation of instruments, images, texts and individuals. Pietist Orphanages were always constructed in local, or indigenous, sites. Each scheme, while profoundly affected by the accidents of local circumstance, also involved what were often sustained efforts to mimic Halle, the universally applicable model, and then to mediate, assimilate, inspire and extend again—via *Anschauung*, which made it possible to do this. My research shows that attempts to

extend by mimicking the Halle Orphanage were often administered by the Halle prophets themselves—or individuals who had been trained in Halle. Francke certainly knew (in most but probably not all cases) that people were copying him and expressed his excitement about this. Many of the founders had met or corresponded with him personally and professed to becoming inspired or awakened after viewing his own Orphanage complex. Each site was actively imbued with universal characteristics that are still recognizable to us today at the same time as it contained the unique marks of the location in which it was built.

Framed this way, the Pietist Orphanage was, in effect, a sign or marker indicating that reconciliation had occurred, or was occurring, in a specific locality. Local actors had agreed to collaborate with the prophet, who marked his alignment with a specific extended or universal project by constructing a building, in some cases, but in all cases introducing the conciliatory program in some form. The Halle prophets understood the value of becoming chameleons like Jesuits, who were famous for their attempts to adapt to local demands and customs while continuing to pursue the universal goals of their order when they arrived in new places. They knew what the best strategies for extending any sort of universal message had to involve: the slow, steady, localized acceptance and visual affirmation of a worldview, not direct or overt imposition of an idea or a plan. Like the Jesuits, Pietist prophets pursued several nuanced strategies for infiltrating or embedding themselves in localities so that the attempts at replication themselves seemed locally generated. These strategies mostly involved individuals who, upon completing their training in Francke's institutes, returned to their places of origin or took on positions

as preachers or teachers in new locales where they were able to mobilize their communities to get behind a new institutional effort.

Each universally transferable characteristic that church historian Udo Sträter has identified as unique (when taken together) to the Pietist Orphanage was deliberately constructed by the founders themselves in order to remain true to Francke's vision of philanthropy. In other words, while I will accept and apply Sträter's topoi here, there are several ways in which I would extend and refine them to allow for further reflection on what they mean—and why it was so important that specifically these characteristics animated each attempt. According to Sträter, the six universal characteristics of a Pietist orphanage include the following:

1) The institutions housed mainly children from legitimate families.
2) Francke's pedagogy was central to educational programming.
3) If children engaged in labor, no profit was derived from it.
4) They were funded by a network of private individuals.
5) They were not organized by the state.
6) Religious and ethical concerns, not economic ones, were behind the founding.[5]

These were not workhouses, even though children could very frequently be found spinning wool, sewing socks and turning wood here. As we saw in Chapter Seven, in Pietist orphanages children exercised themselves on turning machines to facilitate the union of their bodies and souls. There was a very specific reason these sites could not expect to profit from the tasks the children housed there engaged in and that founders highlighted the forms of motion they made available to their charges.

[5] Udo Sträter, "Pietismus und Sozialtätigkeit. Zur Frage an der Wirkungsgeschichte des Waisenhauses in Halle und des Frankfurter Armen-, Waisen- und Arbeitshauses," *Pietismus und Neuzeit* 8 (1982): 201-230. For a summary of Stäter's criteria and application of it in her history of Göttingen's Waisenhaus, see Elizabeth Quast, "Sozialpolitische Institutionen im 18.Jh.: Armenschule und Waisenhaus als resultate pietistische Reforminitiative," Hans-Peter Müller ed. *Aufklärung und Sozialpolitik. Johann Beckmann und die Folgen: Ansätze moderner Sozialpolitik im 18.Jahrhundert* (Münster: Waxmann, 1999).

Certainly, as Sträter has affirmed, Francke's pedagogy was central to the educational programming of Pietist orphanages, but only insofar as this connotes an understanding of these techniques as spiritual exercises that were fundamentally about unifying cognition and experience—the two pillars of wisdom—via the eye. My use of Sträter's list must include this significant adjustment to his second criterion, which should read: "Francke's pedagogy, or a basic preoccupation with unifying cognition and experience via the 'seeing heart,' was central to the educational programming." I also concur (following criterion number one) that these sites gave preference to educating children of legitimate birth, as did most German orphanages; what this means, however, is that Francke's conciliatory program was not immediately accessible to everyone. Nor were replica orphanages constructed as remedies to the very real problems of poverty and abandonment. They were selective institutions, whose philanthropic programs were intended for children who could not only prove their legitimacy and intelligence but that they had been bestowed with spiritual gifts. To demonstrate this in what follows, I will also present an example of an ideal child in this context—one not only intended to give other children a *Vorbild* to emulate but that gave parents and educators a collection of visible indicators they could use to measure their own child's spiritual potential.

I should add that in several of the cases I have studied, the founding of these institutions involved individuals either teaching in or with direct connections to advanced secondary academies (mainly *Gymnasia*) or universities. This feature is so common to all the cases I will present here that it deserves to be listed as perhaps an entirely separate criterion. In the rare cases where the links to an advanced academy are not clearly discernable, the institutions themselves seem to have been more closely monitored by

A.H. Francke himself, at least while he was alive. I see this juxtaposition as further evidence of each orphanage's imagined ability to participate in a system of voluntary charity oriented around a "meritocratic" school system. It was to introduce a "hierarchy of hearts," so to speak, with those attending the most advanced classes being the farthest developed in their exercise—intellectual, physical and spiritual. As in the Halle Orphanages, in these local replications there remained a residual commitment to the prospect of channeling those furthest along in their exercises into advanced academies and universities.

Finally, I would add a minor caveat to Sträter's fifth criterion regarding the relationship of these institutions to the state, noting that while they may not have been directly organized or administered by state authorities, these institutions (including Francke's own orphanage) were very often, albeit discreetly or indirectly, state subsidized. These spaces were very often dependent on the will of the state for their survival *at the same time as* their directors worked to further a pansophic vision that would ultimately undermine state authority by producing perfect *Gemüther* who no longer needed the state. This paradox at the heart of Pietists' relationship to the ruling elites who allowed them to build their orphanages is yet another indicator of their commitment to conciliatory stances. As the Halle model became replicated in other parts of Brandenburg-Prussia and Saxony, new attempts managed to communicate at least some semblance of the paradox resolved beautifully and visually via the medium of the orphanage and the exercises engaged in there. Replicas became special sites where the absolute authority of the ruler—the prince, the duke etc.—and his access to higher truths were affirmed in the very act of tearing down and reassembling the structures that

invested the monarch's power/knowledge with legitimacy in the first place. They were inclusive *and* exclusive sites for the marrying together of absolutism and voluntarism. They were about letting individuals inside who otherwise would be relegated to the margins of contemporary hierarchies—but only certain individuals, with clearly discernable and desirable characteristics that presented themselves to the eyes of those who had already been trained to see correctly. The chosen ones, the prophets, would eventually be released back into the world to perpetuate the conciliatory gestures that would eventually make the state obsolete. When that day came, when traditional hierarchies of birth and status were eliminated via the proliferation of perfected *anima* who truly understood how to see, the world would be literally brimming with orphanages because these proportionally perfect *and* organic structures were the hearts and hope of humanity.

After presenting a sketch of the children these organizations both set out to produce and encouraged observers to emulate, what follows are three case studies, or sketches of individual orphanages in Langendorf (Weiβenfels), Zittau and Züllichau. The sketches themselves are based mainly on printed reports (and some letters) and are intended to help bolster my case for the Pietist Orphanage's ability to connote a set of practices or gestures that were visible, conciliatory and action-oriented. Because of the varying quality of the sources, some of them are longer than others; I have also compiled a list (likely still incomplete) of sites that fit the criteria discussed above—including relevant printed and archival materials (see Appendix 16). This evidence certainly suffices to demonstrate that "a network of orphanages" existed and that the visual/conciliatory pedagogies of Francke's *Stiftungen* extended well beyond Halle. In

keeping with my own project's aims, I mainly focus here on demonstrating how individuals from a specific place of origin came into contact with, applied and extended a universally imagined project through conciliatory gesturing, which almost always included exercises in *nützliche Wissenschaften* designed to appeal to and to train the eye.

Christlieb Leberecht von Exter aus Zerbst

In 1708, the Halle Orphanage press printed a small book entitled *The Christ-directed course of life of a 10-year old boy, Christlieb Leberecht von Exter, together with a small tract about true Christianity, including his letters and songs*.[6] The *Buchlein* told the story of young Christlieb, who had died suddenly in 1707, from the perspective of his tutor, Wilhelm Erasmus Arends. It was apparently quite popular. At least three editions were published by the Orphanage press between 1708 and 1709 and the story was also translated into English and published in London in 1710. In the English edition, the story appeared alongside Francke's *Practical Christianity* and a text about a "poor ignorant country maid in France," Armelle Nicolas, whose "daily conversations with God" became the defining characteristic of her exemplary "holy life."[7] It was integrated into the same series of edificatory materials that had, just two years before, told the story of some "extraordinary pious motions and devout exercises observed of late in many

[6] Wilhelm Erasmus Arends, *Eines zehen-jahrigen Knaben Christlieb Leberecht von Exter aus Zerbst, Christlich geführter Lebens-Lauf, nebst dessen angefangenem Tractätlein vom wahren Christenthum, ingleichen seine Briefe und Lieder etc...* dediciret von August Hermann Francke (Halle: Waysenhaus, 1708).

[7] William Erasmus Arends, *Chrisian Leberecht von Exter of Zerbst... Account of his life compiled by his Tutor. The remaining part of this Book contains the edifying Mediations, which the Pious Child wrote and left according to the Measure of that Knowledge he had obtained from the Word of God in such Hours as others of his Age trifle away with Childish Plays: whereto are likewise adjoined his Christian letters, hymns and prayers* (London, 1710); Jeanne de la Nativité, *Daily Conversation with God: Exemplified in the Holy Life of Armelle Nicolas, a poor ignorant Country Maid in France; commonly known by the Name of the Good armelle, deceased in Bretaigne in the year 1671* (London, 1710).

children in Silesia."[8] Something miraculous was happening and "Christian readers" needed to be kept abreast of the latest developments. They also needed to know what the telltale signs of a spiritually gifted individual were so that they knew how to recognize and derive edification from their interactions with these prophets. In the German edition of the Christlieb Leberecht story, the text was also printed alongside Francke's *Wahres Christentum*, a collection of "spiritual songs," and a *Spiritual Book of Examples for Children*, in which the reader was offered a "detailed report on the conversion to a holy and exemplary life."[9]

For the communities that consumed these texts, children were not only imagined as the targets of spiritual reform efforts, their special attributes could also provide examples that all could follow. Their behaviors were signifiers of the state of their hearts, or the quality of their love. And all individuals—even the most intellectually sophisticated—needed to know how to find this love in order to correctly pursue the middle way. Christlieb Leberecht's story presented the reader with a collection of signs, or easily recognizable characteristics of his advanced affective state, which readers could then use to measure the state or quality of their own conversion to a higher mode of existence that involved seeing better and correctly. In learning about his life, they would see how their own abilities to understand even the most advanced forms of knowledge could be enhanced through "true Christianity." Christlieb's tutor Wilhelm explained that young Christlieb had acquired an unparalleled ability to understand, to grasp or to

[8] *Praise out of the mouth of babes: or, a particular account of some extraordinary pious motions and devout exercises, observ'd of late in many children in Silesia.* Anton Wilhelm Böhme transl. (London, 1708).
[9] James Janeway, *Geistliches Exempel Buch für Kinder, das ist ein ausführlicher Bericht von der Bekehrung heiligem und exemplarischen Leben, wie auch fröhlichem Tode unterschiedlicher junger Kinder vormahls in Englischer Sprache zusammen getragen durch Jacob Janneway* (Lübeck, 1702)

apprehend things because he had allowed "the love of Christ" to "actuate all his powers and faculties:"

> The Gifts of Nature in this Child were easily discovered as well in his happy Memory, as in his clear Understanding, and Readiness of Apprehension in any Matter. But when the Love of Christ began to actuate all his Powers and Faculties and prov'd now the Spring of all their Movements, he began to turn and apply whatsoever he learnt to the true Edification of his Soul.[10]

Wilhelm then provided a very detailed list of all the "movements" that illustrated these special gifts or powers. Christlieb could, for example, "without any great Premeditation produce upon any Text in the Bible such Meditations as riper persons, nay Divines themselves, needed not have been ashamed of." And since "from his younger years he had already treasured up in his heart a good Stock of the Knowledge of God:

> it was now not difficult to him, to speak for half an Hour together on one and the same Subject, so that he needed to be advertised of the End. In these ex-tempore Discourses there did not appear either Want of Judgment or Tautology or Affectation. He spoke so fluently, that to every one's Admiration he would propose and explain without any Hesitation a text with Scriptural and Theological Expressions and with proper Similitudes. He was never tired with Reading, Praying, Studying and Meditating; as the Means by which, under the Blessing of God and the gracious Operation of his Holy Spirit, he arrived to that extraordinary Dexterity and Discretion.[11]

Ten-year-old Christlieb could offer, extemporaneously, discourses that were both affective and tautological, meaning (for a logician at least) that they were universally true.[12] He read, studied, prayed and meditated constantly but always in conjunction with his receiving of the Holy Spirit, which allowed him to "arrive" at extraordinary levels of (cognitive and affective) spirituality and to acquire a kind of "dexterity and discretion" that generated feelings of admiration in others.

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[10] William Erasmus Arends, *Christlieb Leberecht von Exter aus Zerbst* (1710): 5-6.
[11] Ibid.
[12] Tautology can also imply excessive wordiness or redundancy but I think that here it is meant to connote Christlieb's astounding abilities to offer statements that were true in every possible interpretative setting they were placed in.

Christlieb inspired others to emulate him and to work on cultivating their own spiritual gifts. His tutor emphasized that the young prophet had an especially profound effect on his servants and on other children, who became enamored and inspired in his presence. In his "Leisure Hours," Wilhelm wrote, "he was frequently found with the Servants of the House, to awake and animate them through the Word of God and Prayer …. He made himself so entirely beloved through his engaging and hearty Expressions that they … would with a hearty Desire, hear, and receive from him the word of God; and often joined with him in Prayer and Devotion. Hereby this Child accustomed and inured the Domesticks to pour out themselves their Hearts before God."[13] The "spirit of grace and prayer" that consumed Christlieb's person affected his countenance, his gestures and his words. Wilhelm reported that Christlieb regularly engaged in "ardent discourse" with his eleven-year-old sister, whom he entreated to pray with him while she observed the "inward State of his soul." Of "his own free motion," he wrote a treatise of 25 chapters called *True Christianity* (a very direct reference to Francke's movement) as well as several hymns, which were appended to the story for readers to apply in their own edificatory exercises.

Readers were exhorted to allow themselves to feel Christlieb's message and to "not receive these delicious Sensations as Children of this world do the sweetmeats given them, only out of Custom, but rather [to] take them as so many strengthening Encouragements, the better to hold out here in the Christian Warfare under so many Anxieties, Calamities, Persecutions and Afflictions." The example of 10-year-old Christlieb was a kind of tonic, which, like the Orphanage's *essentia dulcia* or other *medicina corporis* could strengthen, fortify and enhance. At the same time, readers were

[13] William Erasmus Arends, *Christlieb Leberecht von Exter aus Zerbst* (1710): 6-7.

offered an example of how not only their bodies but their minds, especially their ability to know or (most importantly) to understand could be affected by mimicking Christlieb. Wilhelm reminded his audience that Christlieb also had a "great measure" of "excellent Knowledge" and could "explain Matters according to the genuine Intent of the Holy Spirit."[14] In Christlieb viewers had their model, which, like a three-dimensional model of the Temple of Jerusalem or a windmill, offered a separate site to which one could direct his gaze and reconcile his mind and his body, in love.

For the communities of benefactors who supported Pietist philanthropy, spiritually gifted children were revered or romanticized not only for their perceived innocence and humility, although that certainly was part of it, but for their ability to engage in authentic conciliatory gestures. Christlieb *felt* knowledge and could thereby effortlessly integrate the activities of his hands and his mind through his heart. He showed others how to do what he was doing. Although he was young, there was still something about him that had been realized; his *Gemüth*, the cultivation of his *animus*, was so far advanced that he could lecture others who were much more advanced in age (though not in their spiritual exercises) than he was. The directors of Pietist orphanages actively looked for Christliebs. They wanted these kinds of children in their institutes to provide all those around them, even their teachers, with living examples of a human being who was constantly assimilating all things, all knowledge, into himself and then spitting out truths—universal truths that could change the world for the better. The orphanages also functioned quite a bit like Christlieb. For in their application of the Halle method, they also placed a great deal of emphasis on the importance of offering children visual examples to follow. If they could not follow a "real Christlieb" (in turn

[14] Ibid., 10.

acquiring the highest form of cognition according to the Semler typology I presented in Chapter Five) than they ought to be shown three-dimensional models or drawings of examples they could follow. And these real or three-dimensional models were not only useful for enhancing the *paideia* of the children housed in these institutes, but for outside observers as well, who were welcome to come and observe the conciliatory exercises transpiring on these sites. Like Christlieb, the Pietist orphanages presented in what follows set a universally verifiable, and thereby visible or observable example of how to engage in authentic conciliatory acts.

Case One: Langendorf (Weiβenfels)

The village of Langendorf lies just a few kilometers outside of Weiβenfels, which in the early eighteenth century was a small but vibrant seat of the Duchy of Saxony-Weiβenfels. It was (and still is) not far from Halle, meaning that then it was quite strategically situated along the border that the Kingdom of Saxony shared with Brandenburg-Prussia. Today it is a kind of ghost town. In 1910, the director of the Langendorf Orphanage (L. Bethmann) was invited to produce a *Festschrift* to celebrate the institution's 200 year anniversary. He told the story of the farmer's son Christoph Buchen (1678-1727), who founded the Orphanage on May 5, 1710. While employed as a simple "houseboy" in a Weiβenfels guesthouse, Buchen formed a Spenerian conventicle with three friends (Christoph Burkhardt, Georg Günther and Caspar Bach). A pastor Chryselius from the nearby town of Obergreisslau reported on January 16, 1709 that "these four young people came together on Sundays in order to discuss a sermon that they had heard or read with each other." In keeping with the "spirit of their times" (or

Zeitgeist), Bethmann continued, "they also took it upon themselves to collect some money and each time they came together, they laid aside a few coins—which otherwise might have been spent at the tavern—in a small box." Pastor Chryselius, "who preached the word in the spirit of Spener and Francke, often visited the boys and came to like Christoph Buchen especially, whom he encouraged to follow the wishes of his heart and to [take up the cause of] poor orphans." Buchen "courageously" decided to build an orphanage, Bethmann wrote, and went ahead with his plans—with Pastor Chryselius' support and encouragement. But the story does not, by any means, end here; it only gets more interesting.[15]

Bethmann recounted that Duke Johann Georg of Saxony-Weiβenfels (r. 1697-1712) was "made aware of Buchen's plans" and sent a copy of the *Canones* according to which the children of Buchen's Orphanage were to be raised. A sampling of these *Canones* read as follows:

> 1. The newly built orphanage between Langendorf and Muttel, not far from Weiβenfels, should not be named after any person but rather be called "the Orphanage built at God's cost."
> …
> 3. The reigning Landesherr of Weiβenfels should have the highest rights of inspection and directorship in spiritual as well as in worldly things over the Orphanage.
>
> 4. The highest rights of inspection regarding spiritual matters should involve the superintendents of Weiβenfels and for worldly matters, Herr Voigt, as both are patrons of the church and the schools and are pastors.
>
> 5. Lower inspection duties will belong to the preacher of Obergreiβlau and Langendorf, who will serve as a caretaker of souls and report to the over inspectors.
>
> 6. The Orphan father, whose name is Christoph Buchen, should have the power to choose student teachers (*Informatoren*)…
> …
> 9. The Orphan father should see to it that another Informator is taken on especially for music, so that the Orphans learn something from music in order to be able to offer something special to the school master.

[15] Details derived from Bethmann's narrative, 7-8.

> …
> 11. The Orphan father should see to it that as much as possible only honest children are taken in, so that the orphanage can realize its real purpose.
>
> 12. If pious, Christian people want to send other children here, whether they are orphans or other poor, honest children with a little bit of money…, they should be allowed to come in and to be instructed in all the good sciences (*Wissenschaften*).[16]

Good sciences were useful or *nützliche Wissenschaften*, precisely the phrase Francke and Semler used to describe the forms of sciences taught in their schools, and that Leibniz had advocated should be taught in "unrestricted orphanages." A report about the institution's progress, first printed in 1721 and reprinted several times, would also later confirm that the useful sciences were a key feature of the Langendorf curricula; in this house, boys and girls were "instructed in Christianity and other useful sciences, and made accustomed to all different kinds of work."[17]

Duke Johann Georg responded to Buchen's plans by granting him a place to build (a *Bauplatz*) in a "friendly" valley that belonged to a titled family; and he "promised to further support this Christian work," Bethmann noted. Like the accounts of Francke's miraculous founding of the Halle Orphanage with only a few *Talers* and anonymous donations that mysteriously carried the project forward, Bethmann's narrative emphasizes Buchen's lack of funding, especially how he had to "sell three horses and two wagons" in order to cover all of the costs and that, in spite of the hardship, his "trust in God was never-ending." But Buchen continued to have the support of the dukes of Saxony-Weiβenfels. While Duke Christian was in power, from 1712 to 1736, his wife "donated amounts up to 200 *Talers* to the foundation often enough," Bethmann wrote. Later, "and

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[16] Ibid., 104-05.
[17] *Die gnädige Vorsorge Gottes, in einer wahrhafftigen Nachricht von dem Waysen-Hause bey Weißenfels an Langendorf gelegen: Welches ein armer Fuhrmann so wohl vor Knaben als Mädgen erbauet*; *Daß dieselben darinne im Christenthum und andern nützlichen Wissenschaften unterrichtet, und zu allerhand Arbeit angewöhnet werden* (Leipzig, 1721).

at the cost of the duke, 11 orphans were raised up in the foundation with each year 220 *Talers* being provided for them." And that was not nearly all. This portion of Bethmann's story is worth quoting in full:

> Not only did the court of Weiβenfels support the young work, but rather persons of high and low status vied with one another to actuate their Christian Love. Hardly a day went by without some "Christian do-gooder" considering the Foundation in some way. To keep track of these daily offerings, Buchen kept a house book with an exact register. Also contributions poured in from far away, for example from Halle Missionaries in the East Indies, from Copenhagen, Vienna, Hamburg, Berlin, Augsburg, Gotha, Cöthen, Dessau, Weimar, Dresden, Jena, Merseburg, Naumburg, Weiβenfels, and above all Leipzig. From Lisbon 294 Taler and 6 Groschen came in once and from London 100 Taler from an Earl's wife. Many gifts from the Halle *Waisenhaus* found their way to Langendorf and, as the house book demonstrates, were often delivered by Professor August Hermann Francke himself.[18]

According to this account, A.H. Francke not only took the time to visit the Langendorf Orphanage in person, but his Orphanage is depicted here as a participant in an enormous network of private donors, contributing artifacts and capital to Buchen's Foundation as an material expression of love.

By 1714, several reports started circulating that described the quality of the spiritual exercises that the children of Langendorf's Orphanage were engaged in daily, including how they were instructed in "Christianity and other useful sciences" and what forms of donations the house was receiving.[19] The lists of books and objects the institution received functioned as a form of proof that the project was working, i.e. inspiring individuals to unite their heads and hands in expressions of love that were verifiable, visible and measurable. In one of the lists of donations contained in a 1721 report, the anonymous author notes that "upon his retirement, a former teacher sent a six

[18] Bethmann, 10.

[19] For example: *Nachricht von der gütigen Vorsorge Gottes oder kurtzer und aufrichtiger Bericht von der Auferbauung, bißheriger Unterhaltung und Zustand des bey Weißenfels zu Langendorf gelegenen Waysen-Hauses*, mitgetheilt von einem Freund, der die Wahrheit bekennt (Jena, 1714; reprinted Leipzig, 1716); see Appendix 16.

volume set of Würtemberg Bibles" and a goldsmith from Naumburg sent a small book that he acquired during a trip of his to Switzerland; in the same *Bericht*, a Christian student (*Studioso*) from Leipzig is reported to have given a Bible to the institution "with a preface written by Professor Francke" and one entry noted that "a few students from Jena sent over real musical instruments."[20] Around the same time as these donations arrived, a "Christian Master" from Dresden reportedly sent, "out of a correct and well meaning heart," Canstein's *Harmonie of the Four Evangelists*, "entirely new and bound and for the use of the teacher for when he explains the New Testament to the children."[21] But this was a deliberately chosen text; it had a very special set of meanings to this community. Donating a text on harmony by Canstein, a friend and benefactor of Francke's, becomes in and of itself a kind of conciliatory gesture—a way of both affirming the donor's support of the institution and ensuring that the special purpose animating the machinery of the Pietist Orphanage was properly carried out in the new location.

The accounts also make distinct correlations between the quality of edification (*Erbauung*) happening on site thanks to all the donations with the facility's physical setting; they also convey an interest in emphasizing these sites' status as "opportunities" for individuals outside the institutional community to enhance or heighten their own spirituality simply by viewing the structure:

> The building was designed with two floors, each with four large, four-cornered rooms and one smaller room, a fine hall and two large (with a few smaller) sleeping and eating chambers…. What the external situation offers is a the beautiful atmosphere and positioning near woods and fields, where the children can be led to botanize in their free periods during the summertime … Many Christian souls are less concerned with this and

[20] *Die gnädige Vorsorge Gottes* (Leipzig, 1721): 39.
[21] Ibid. "Ingleichen hat auch ein Christl. Magister aus Dresden des Herrn von Cansteins Harmonie und Auslegung der 4.Evangelisten in fol. Ganz neu und gebunden, zum Gebrauch des Lehrers, der das Neue Testament den Kindern erkläret, aus recht und wohlmeynenden Herzen übersendet."

> more interested in the actual use that a work like this could bring a city or a land and say it should be placed in the city. That way more Christian souls from the city than those [infrequent] travelers who now pass by [the Orphanage], would visit the work more frequently. For here they can not only observe God's good provisioning but also be inspired with a flaming love for the poor. But because it lies at such a distance from the city, some say the work is robbed of its main purpose (*Haupt-Endzweck*) and that is, that it should be an object or opportunity to praise God.[22]

Like Francke's orphanage, this was an intrinsically edificatory or moralizing site. By viewing or observing it first hand, one simultaneously experienced its simple proportions and beautiful physical location and achieved a higher level of cognition that coalesced in expressions of higher forms of felicity, of passion and desire. For members of Pietist communities, it functioned in a manner similar to a three-dimensional model of Solomon's Temple, which, as Francke had explained to the Prussian crown-prince in 1721, was also "a medium for the channeling of the spirit of God," that could generate higher forms of love and desire.[23] The best way to praise God and to understand the true meaning of Pietist philanthropy was to actually stand in front of an orphanage and to acquire an instinctive understanding of the practices engaged in there. The orphanage reports described these practices in order to further the reader's edificatory journey.

In the same 1716 report, the author described the Langendorf Orphanage's daily regimens, or the "daily method of education" (*Aufferziehung*). "Because most of the children are under nine years old, they are allowed to enjoy their rest in the early morning until six a.m. After they are woken up from their sleep and clothed in an orderly manner, they are brought around seven a.m. to the morning hour of prayer." Their *Informator* then applied the following method with them:

> After he has awoken their senses, ridding them of distractions that might hinder their *Gemüth* and orienting them to praise of God, a morning song is sung in conjunction with morning prayers in which they especially pray for their Christian benefactors. Soon after

[22] Ibid., 26-27.
[23] Quoted in Kramer, *August Hermann Francke*, 326-327.

> a piece from the New Testament, especially from the Evangelists, is read which is explained in the easiest manner-and that is the method of the catechism, through questions and answers; and the children are asked how they would go about applying it, in part to strengthen the truth that they grasp from the catechism but also so they can practice (ausüben) how to live a Christian life. This is summarized in a small prayer by all the children, presented to God, and the hour is brought to an end with a small song.[24]

After breakfast, the children were divided into groups according to ability and schooled. Some were instructed in Latin, using the "improved and easier grammar" of Francke's colleague at the University of Halle, Joachim Lange.[25] Bethmann notes that Greek was also taught there and that the quality of education boys could receive by the 1720s or so was as high as what they could receive in a city Gymnasium or even in the famous *Fürstenschule Pforta*, an elite boarding academy for boys from titled families not far from Weiβenfels (or Halle).[26] In addition to this obvious emphasis on exercising the higher and lower faculties of the soul, the 1721 description makes clear that after school all children were led to *Handarbeit*, or made to work with their hands. Boys knitted, girls spun and sewed, and all were expected to "take their motion" in the garden, where they planted vegetables in the summertime and carried wood in the winter. They were given lessons in geography, participated in singing periods every day and, on Wednesdays and Sundays, received instruction in "*arithmeticis* and *musica instrumentali*."[27]

All believers, Christoph Buchen wrote in a tract he sent back to Halle, should learn to work like the children of the Pietist Orphanage and could derive edification by observing the qualities of bees:

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[24] Ibid., 28-30.
[25] Joachim Lange, *Verbesserte und Erleichterte Lateinische Grammatica, in welcher durch hinlängliche Paradigmata, Richtige Grund-Regeln und nöthigen Vorrath an Vocabulis, Eine deutliche kurtze und doch völlige Anweisung zur Lateinischen Sprache gegeben wird: Mit einer Vorrede Von Verbesserung des Schul-Wesens Joachim Langens* (Halle: Waysenhaus, 1707).
[26] Bethmann, 14.
[27] *Die gnädige Vorsorge Gottes* (Leipzig, 1721): 111.

> All bees allow themselves to be ruled by their king and are placed, in a beautiful order, as his obedient underlings. I can see this in the way they arrange their houses and places of residence without question around the king… no one's house is bigger or smaller than the other one's. One is the builder, one carries building materials, one carries water, still others carry honey and others bear children; others keep watch so that foreign bees don't rob them. This all happens in the most beautiful, loving and harmonious order. In this way Christians should serve according to their order (*Stand*), but in love and peace, remain of one sense (*auf einem Sinne bleiben*). … We should all help plant and build the kingdom of God. I like to think of the city of God, where… all of our hearts can be living temples of the tri-unitary God. Amen. [28]

The exercises in industry that residents of the Langendorf Orphanage engaged in were not intended to bring immediate material profit to the institution, but instead to awaken children so that they were attuned, or oriented, to the systems of harmony manifest in both this world and the next one. These patterns, or systems of harmony, were manifest in certain natural systems that provided abundant opportunities to derive moral lessons—to acquire edification—via the eyes. When one knew what to observe—i.e. the beehive or the Pietist Orphanage—and how to see, one could more easily learn how to reconcile, how to bring about harmony so that it was everywhere manifest.

Buchen's text, which Francke's organization never printed, is a kind of locally produced copy of the genre of physico-theological treatises that would become characteristic of early Enlightenment Prussia. In this instance, we see an individual participating—admittedly at a distance and in a less polished or erudite manner—in the same kinds of conversations about harmony, unity and reconciliation going on in and around the University of Halle. Christian Wolff wrote about bees in his own treatment of *Ackerbau* and they made an appearance in the Semler lessons as well. It was as if Buchen's orphanage was on the receiving end of a special kind of discourse that captured the harmonic ideal so many of Francke and Wolff's contemporaries sought. Several

[28] AFST/H D 94 b. 62-63; Christoph Buchen's *Einfältige Gedancken zur seligen Erbauung in unsern Christenthum über die gute Ordnung der Bienen*.

forms of knowledge were transmitted to him via donations of various objects (including books) and his adaptation of a conciliatory pedagogy associated with a telltale, conciliatory site of origin: Halle. His institution also received instructors who had been trained in Francke's schools. However, eventually Buchen gave back. He produced his own treatise on bees, his own conciliatory reflections; and he also appended to the end of his treatise a medicinal recipe that the Halle Orphanage could assimilate into its treasure trove of herbal and chemiatric regimens. This is what the Halle Orphanage was built to do. It introduced universally envisaged conciliatory gestures under the guise of a carefully constructed methodology. It distributed missionaries, teachers and preachers. It distributed objects—namely books, models, *naturalia* and other gifts. But it also demanded a return—feedback from the sites it touched and local forms of knowledge that it could assimilate into its archive, apothecary and other knowledge-processing facilities. Buchen's recipe may have been simple but to assimilate it alongside all the other forms of knowledge out there in the world was the reason both his and Francke's orphanages existed.[29]

The Langendorf Orphanage was also capable of providing a return when it unearthed an especially gifted (in this culture male) child and successfully sent him "back" to Halle. A letter from the pastor Chryselius to Francke from May 5, 1717 indicates that children's progress through their daily exercises was carefully monitored with the hope that the most spiritually gifted *Gemüther* could be sent off to Halle—where it was possible to reach even higher forms of wisdom and clarity while residing amidst the prophets. Chryselius wrote specifically regarding one boy, a H. M. Jüngling, whom

[29] Ibid. The recipe read as follows: "One takes a few large handfuls of grass and puts it in a large glass and then submerges it with corn-?? wine. Let it sit for 2-3 days, and afterwards have the patient drink a spoonful every morning and evening. It breaks up, without pain, the [kidney] stones."

he had at one point taken into the Langendorf Orphanage and found to be especially pious and promising—although his *Gemüth* was a bit restive (*unruhig*). If more efforts were made to help him develop a calmness in his body, his mind and his *Gemüth*, Chryselius wrote, he was confident that "something could still become of him" (*so könte doch noch was aus Ihn werden*).[30] Chryselius said he was pleased to learn that Francke had decided to accept Jüngling into his institutes and would pray for his authentic conversion. His and Buchen's institution were contributing common cause, oriented around Francke's "temple" (the term preferred by Chryselius).

Halle continued to give to Langendorf as well. In 1723, Johann Wilhelm Kruckenberg, a young theology student from Halle who had trained in Francke's institutes, was sent to Langendorf as an *Informator* and would become the Inspektor, or director, of the Orphanage from 1730 to 1741.[31] Although Kruckenberg's tenure as Inspektor falls just beyond the scope of this study, it is worth noting that Kruckenberg corresponded with Francke's son, Gotthilf August, during this period primarily about transmitting information and donations regarding the Tranquebar missionaries. In one letter (1739) Kruckenberg asked G.A. Francke to send him the newest missions report—just recently off the Francke Foundation presses—and several copies at that.[32] Kruckenberg's post as Inspektor also apparently involved sending a certain portion of the donations he received on site in Langendorf back to Halle so that the younger Francke could distribute the donations for the mission in Halle. In addition to Kruckenberg, Francke sent Johann Michael Schumann, who was a pastor at St. Moritz church in Halle from 1694 to 1719 and a member of the city Ministerium alongside Christoph Semler. In

[30] AFST/H A 170: 42 (May 5, 1717)
[31] Bethmann, 11-14.
[32] AFST/M 3 L 8: 140

1719, Schumann left Halle to serve as a Pastor and Professor of Theology at the Gymnasium of Weiβenfels. According Bethmann's account, Schumann eventually became the superintendent of all educational institutions in the vicinity of Weiβenfels, which meant he conducted visitations and helped develop curricula. Once Kruckenberg took over the Orphanage, he decided to raise extra money by accepting pupils whose parents could afford to pay for their education and housing. This, of course, meant an increased amount of pressure on the institution to subject itself to external standards; but Schumann was the standard maker, and he had spent a considerable amount of time in Halle. He could (and apparently did) insist that the schools of the Halle Orphanage should be the standard. Bethmann reports that under Schumann and Kruckenberg's guidance, "five *praeceptores* come together every Thursday at a certain hour where they conferred with the director of the educational foundation and with each other; they discussed the art and manner through which the foundation could be improved and how they could immediately correct any disorderliness. Each one was called upon to present his report (*Gutachtung*) or opinions about what he felt could improve it. This is the same arrangement that we find with August Hermann Francke in Halle."[33]

Case Two: Zittau

Before Johann Michael Schumann arrived in Halle in 1694, he had attended Gymnasium in Zittau until 1687, when he left to study Theology and Philosophy at the University of Leipzig—precisely the period that Francke was teaching exegesis there and leading conventicles. Zittau, like Weiβenfels in the early eighteenth century, was also part of Saxony, but it was east of Halle, east of Dresden even, in a lush valley that now

[33] Bethmann, 16.

forms the border between Germany, Poland and the Czech Republic. Beginning in the 1670s, the city became famous, like the city of Gotha, for its Gymnasium—or more specifically the high quality education one could receive there. This was due, in large part, to the personality and talents of Christian Weise, sometimes referred to as the "German Cicero," who directed the Zittau Gymnasium from 1678 until his death in 1708. Weise also had ties to Weißenfels, having served there for eight years as a professor of poetry and eloquence before returning home to Zittau. He taught Johann Hübner, who would go on to direct the famous Hamburg *Johanneum* and to devise new methods for teaching children geography using color-coded maps that Francke would use in his own schools.[34] He engaged in vigorous exchanges with Jesuits in Prague (from the *Collegio* S. Clementis), especially Bohuslaus Balbinus, about the latest innovations of their order.[35] Weise championed the virtues of a humanist education, training children in the rudiments of rhetoric, poetry, even theater so that they could exercise their sensible souls at the same time as they sharpened their intellects. He also supported the founding of a Pietist Orphanage in Zittau in 1701.

In his 1716 description of the six most important cities of Oberlausitz, called the *Historical Showplace*, Johann Carpzov wrote that before he described "the beautiful orphanage," of Zittau he needed to say something about its location and proportionality. The orphanage had been built on the site of a cloister that had at one time housed monks of the Celestine order. It was "almost in the middle of the city" next to the main church.

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[34] Johann Baptist Homann and Johann Hübner, *Kleiner Atlas scholasticus von 26 Charten ... edirt durch Joh. Baptista Homann u. durch eine accurate Illumination zu seinen geograph. Fragen accomodiret, durch Joh. Hübnern* (Leipzig; Nürnberg, 1700); Johann Hübner, *Kurtze Fragen Aus der Neuen und alten Geographie* (Leipzig, 1693).

[35] Christian Godorf Hoffmann, *Christian Weise*, *Epistolae Selectiores... quibus multae observationes tam ad rem Scholasticam quam universam literariam spectantes continentur* (Budiβin, 1715).

Its proportions were "perfect," 62 Ellen long, 47 Ellen wide and 21 Ellen high. The building was structured according to the "newest architecture" and was "not only useful and considering its purpose, very comfortable, but also constructed very gracefully."[36] Christian Weise also commented that the Zittau Orphanage had been built especially well and "built high enough" so that "whoever wants to observe it as a good reminder, he can easily come to it." The time was right, Weise wrote in 1702, for a "good model to lie before the eyes."[37] In speeches he gave each year to commemorate its founding and to reaffirm its mandate, he referred to the Zittau Orphanage as "an example" of something "new that God had started." It was a "living library," he said, containing children who could be "read like books," into whom the names of their benefactors had been imprinted and eventually would be read by God.[38] "Praise God that the apparatus (*der Apparat*) for the presentation of these living books has been proliferating," he proclaimed, through the founding of this orphanage and many others.[39]

The genealogy of the Zittau Orphanage is not as easy to trace as that of Langendorf/Weiβenfels and there is some evidence suggesting that city council members, not local territorial leaders, got behind the initial funding of the venture. However, the descriptions quoted above, in addition to a few other clues, point to Weise's and other supporters' interest in constructing a new kind of orphanage that embraced the spirit in

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[36] Johann Benedict Carpzov, *Analecta Fastorum Zittaviensium der Historischer Schauplatz der löblichen Alten Sechs Stadt des Margrafthums ober Lausitz*… (Leipzig, 1716): 127-128.
[37] Christian Weise, *Das erste Jahr-Gedächtnüs der wohlgehaltenen Bet-Woche, das ist: dei wiederhohlte Dancksagung des neuerbauten und numehr in Stand gebrachten Waysenhauses in Zittau* (Zittau, 1702).
[38] Ibid. "Ach was vor eine schöne Bibliothec können wir uns dabey einbilden! Welche wir mit allen recht vivam bibliothecam, das ist einen lebendigen Bücher-Vorrath nennen mögen. Das sind Bücher, da rein der liebste Jesus bald in ihrer Tauffe seinen Nahmen eingeschreieben hat. Das sind Bücher, da ein wol gezogenes Kind die Copie seines Beruffes aus dem Buche des Lebens auffweisen kan. Ja darf ich noch mehr sage. Das sind Bücher, darein die Wolthätigen Christen ihre gute Wercke zu guten Andencken schreiben können, dass sie auch am jungsten Tage, wenn die Güter selbst verbrennen werden noch sollen zu lesen seyn."
[39] Ibid.

which the Halle Orphanage had been founded. First of all, two individuals with direct ties to Francke were active in Zittau in the orphanage's early years. Gottfried Hoffman (1658-1712) corresponded with Francke from his post in Lauben before going to Zittau in 1708 to take over Christian Weise's position. And Martin Grünwald (who had also attended Gymanasium in Zittau under Weise), encountered Francke in Leipzig, where he become so moved that he would start an orphanage in the nearby city of Bautzen and then become involved in promoting the cause of the Zittau Orphanage. He published a description of it in 1710 while serving as a *Mittagsprediger* in the area. Grünwald and Weise's descriptions of the orphanage employ the same rhetorical strategies we saw operating in the Langendorf case. They constantly hold up the affective or aesthetic qualities of the building, especially its ability to serve as a living *Vorbild* housing living models or children, like Christlieb Leberecht, who could be "read." This building had the remarkable ability to move and inspire people—to serve as a site of visual edification, a *Schauplatz*, where the sensitive soul accessed higher forms of knowledge. And especially Grünwald's account provides us with a glimpse of what he explicitly referred to as the children's *praxis pietatis*. Their spiritual exercises were inspiring, worthy of emulation and they included exercises in the "useful sciences."

Grünwald's description of the Zittau orphans' practices of piety begins with a brief introduction to their early morning prayers, like the monks who inhabited the space before them had also engaged in. They began their exercises by singing a "morning song," by asking the blessings of Martin Luther on their house, by reciting the main piece of a catechism, by offering "real biblical sighs (*Seuffzern*)" imploring God to "accomplish something inside" of their bodies and to open their eyes (*Herr, öffne mir die*

Augen), praying, reciting their "rules for living," and singing more songs.[40] At this point other children, whose parents wanted them to be educated in the Orphanage but who lived at home, were allowed to enter. All children were reminded, constantly, of the institution's main purpose (*Hauptzweck*), which Grünwald described as "instruction in true and living Christianity." They were introduced to the "pure word of God" and to the "symbolic books of the evangelical church." And as they became more adept in the art of "recognizing God" they would also learn to understand the things of the world. To this end, they would receive training in the "useful sciences" during their periods of motion. As they acquired proficiency in these sciences, Grünwald proudly observed that the heightened spirituality of these children would make them stand out or "shine like stars" in their professions.[41]

Grünwald's description notes that several Zittau orphans went on to become apothecaries, sculptors, bookbinders, printers, instrument makers and goldsmiths and that the orphanage's training regimens readied them for entrance into these professions. The vocational training one received was "oriented around the talent of each child," he explained. And since each child was allowed to exercise themselves however they wanted (*aus eigenen Triebe*) in their free periods, they would be more inclined to discover, on their own, what they were good at doing. "If during their free periods and of their own accord through making horizontal projections (*rissen*), painting, cutting and building they discover their own inclination and inborn dexterity," Grünwald wrote:

> then they are given the opportunity to learn mathematical principles, including how to use the Circul, the Lineal usw. Special periods are set aside wherein they should also act out

[40] M. Martin Grünwald, *M.G. Ausführliche Beschreibung des Zittauischen Waysenhauses, und dessen Loblichster Einrichtung aus heiligen Absehen entworffen und allen welchen Gottes Väterlichen Vorsorge gebührend verwundern zu danckbarhere Uberlegung* (Leipzig and Zittau, 1710): 30.
[41] Ibid.

> all of the various and curious examples from mechanics so that, after some time, they learn the names of the instruments, including the technical terms and special turns of phrase that artists and handworkers need and use. It can only be God who has made the usually selfish and superficial members of the "geschickten nachwelt" willing to prove their good will (*Wohltätigkeit*) by inspiring certain people who are experienced in the free arts and the handiworks of the mechanical exercises to make accurate models and other helpful aids available to be grasped by the poor. It should not be doubted that in our orphanage, poor children carve wood and prepare tools whose varied uses will serve many purposes in the future world.[42]

One of the primary ways in which an observer could actuate his or her spirituality after visualizing the Zittau Orphanage was to donate models and other learning aids to the institution, which would further the conciliatory exercises of the children housed there and, ultimately, the conciliatory mandate of the entire project. The presence of these objects also affirmed that the children of Zittau's Orphanage *were* the instruments and machines they handled. They reminded them of their prominent position as showpieces, as books and other valuable objects who, regardless of where they were sent, would be able to inspire similar gestures of piety, of love, as those that had imagined them as models and instruments in the first place.

As we saw with the Langendorf/Weiβenfels case, donating models, instruments and books was a way of participating in Pietist philanthropy and in the network of orphanages. It also seems to have been one of the primary ways in which Pietist benefactors attempted to change or enhance the educational programming of orphanages that had been founded before the Pietist Orphanage turn. Erfurt's Evangelical Orphanage offers a useful example of this. It had been founded well before Halle's and seems not to have linked itself up directly with Francke's movement.[43] But around 1735 its directors decided to open up a *Kunst*- and *Naturalienkammer*. This was, in part, a tactical move

[42] Grünwald (1710): 105-106.
[43] Francke mentioned Erfurt in his *Projekt zu einem Seminario universali* (1701) as a site where an institution had been built in the image of Halle's; however, both of Erfurt's Orphanages (the Evangelical and the Catholic) had been founded in the 1670s. See Sträter, "Pietismus und Sozialtätigkeit," 217-18.

that (as Francke's creation of a *Wunderkammer* had proven) really did draw more curious visitors to the orphanage complex, who were then more inclined to make a donation after their visit. But it also affirms how powerful Pietists' emphasis on the conciliatory power of visualizing objects, models and instruments on the *Schauplatz* was for their movement and for eighteenth-century contemporaries' understanding of philanthropy more generally. Among the models on display in Erfurt's Evangelical Orphanage were various kinds of ships, mills and houses, and the collection even contained a copy of Christoph Semler's description of his famous Solomon Temple model (printed by the Halle Orphanage in 1718). The collection of optical and mechanical instruments available for viewing here was perhaps the most remarkable, including several sun clocks, magic lanterns, mirrors, magnifying glasses, two small microscopes and a "needle microscope," which the lists describing the collection (none of the objects remain) indicate were donated in 1736 by Joachim Lange's son Johann, who had taken Wolff's position as a mathematics professor on the University of Halle in 1723.

Long before the directors of Erfurt's Evangelical Orphanage decided to fall in step with the vision-oriented programming of the pietist Orphanages around them, Zittau's Orphanage, like Francke's, had made the observation of models, *naturalia* and instruments a defining feature of the modus of *paideia* that their schools offered. They did this in conjunction with frequent affirmation of children's special powers. When observed while engaged in pious and conciliatory motion, children of these sites transmitted knowledge to the viewer, who was supposed to be transformed in the act of witnessing these motions. Even the act of observing a pietist orphanage held the possibility of transformation because, as Christian Weise explained, God had strategically

placed these buildings and the children they housed "in the middle of all the confusion of Europe" to bring its inhabitants a message of "calmness and pleasure."[44]

Case Three: Züllichau (Sulechow)

The city of Züllichau is now part of Poland but in the early decades of the eighteenth century it was part of Brandenburg-Prussia. According to Carl Hinrichs, it was known for its cloth making industry and also became famous for the *Erziehungsanstalt* that was founded there, "in the spirit of Halle," in 1719.[45] Like Christoph Buchen, the poor farmer who had been inspired to found the Langendorf Orphanage, the founder of Züllichau's orphanage, Siegmund Steinbart (1677-1739), was remembered as a poor *Nadler*. However, by the end of the eighteenth century his orphanage complex contained a *Pädagogium* and its very own royal academy for training teachers. Siegmund's son Johann Christian (1702-1767) would attend school in Francke's institutes, study at the University of Halle and return to Züllichau to direct the orphanage. Siegmund's grandson, Gotthelf Samuel (1738-1809), was educated in the elite Pietist school of Kloster Bergen (near Magdeburg) and then sent to study in Halle with the theologian (and *Stiftungen* alumnus) Siegmund Jacob Baumgarten. He would also teach in the former Francke Foundation pupil Johann Hecker's *Realschule* in Berlin before returning to Züllichau, where he, too, would direct its orphanage—having acquired an international following as a philosopher, pedagogue and theologian.[46] At the time of its founding, the Züllichau Orphanage was conceived of as a kind of outpost—

[44] Christian Weise, *Die Gottgefällige Betwoche der Gesammten Kinder aus dem Zittauischen wolangelegten Waysenhause* (Zittau, 1705): "Er hat uns mitten in der Confusion von Europa ruhig und vergnuegt wohnen lassen."
[45] Carl Hinrichs, *Preußentum und Pietismus*, 340-42.
[46] P. Tschakert, "Gotthelf Samuel Steinbart," in *Allgemeine Deutsche Biographie* 35 (1893): 687-89.

like the orphanages of Zittau and Langendorf-Weiβenfels—built according to Halle's *Vorbild*.

Francke and Steinbart were in contact with each other as early as 1716, when the Pietist professor invited Steinbart and his wife to visit Halle.[47] Apparently one of Züllichau's prominent cloth making firms had donated money to the Halle Orphanage and Steinbart served as a point of contact for this transaction—as Francke himself indicated in a 1716 letter to one of his closest friends and advisors, Heinrich Julius Elers.[48] Steinbart sent his son to school in Halle before he witnessed the *Stiftungen* personally; Johann Christoph would enroll in Francke's Latin School April 13, 1717. The elder Steinbart (although eulogized as "poor") was apparently doing quite well in his profession—so well that he could afford to send his son to Halle and, in 1719, was able to travel to the Leipzig *Messe*. Since he was in the neighborhood, he stopped in Halle of course. Legend has it that he was so overcome, so inspired, by the physical structures of the buildings and what he saw there that he decided to start an orphanage in Züllichau upon returning home.

Steinbart's project was declared a "public work" that had been funded entirely at God's cost even though he received an immediate approbation from the Prussian king, who also provided him with money and building materials. Steinbart was heralded as a tool (*Werkzeug*) whose heart was so full of love that he never wanted for anything he needed to get the project off the ground.[49] He obtained permission for his *Anstalt* to acquire its own printing press and bookshop and began receiving large donations from prominent Prussian families—including the wife of General Friedrich von Derfflingen,

[47] Carl Hinrichs, *Preußentum und Pietismus*, 340-42.
[48] Ibid.
[49] Ibid., 341.

who sent Steinbart 1000 Taler in cash in 1728. This same benefactress would later send donate another 6000 Taler to the institution and set up a scholarship fund for theology students.[50] Hinrichs notes that the orphanage was especially loved by elite "officer circles" who preferred to send their boys there and lavished the institutional with all manner of gifts. Like most Pietist orphanages, the *Anstalt'*s yearly reports listed the various donations that individuals were sending from near and far. A 1730 edition notes that the king had given the institution a mine and that benefactors from Halle had sent an array of medicines.[51] Commenting on the receipt of 100 Taler from three preachers, the writer of this same report exclaimed: "Father, refresh these true souls with the peace of your countenance, for your love for the poor, not only strengthens what you are attempting with this orphanage but also in other institutions, especially in Halle and Landsberg, as well as the Evangelical Danish mission in Tranquebar…."[52] The Züllichau Orphanage was able to function, as most Pietist orphanages, as an institution that could meet the needs and aspirations of several different kinds of people and unite them all around a single point. Loved by elite Prussian officer families for the education it could provide their sons, it also inspired and served as a site for the direction of a visible expression of one's benevolence, one's love.

The 1723 Orphanage news report stressed that the "very first thing" Steinbart constructed when he started was a "single fountain so that the rest of the work would never lack the necessary water and it could constantly signify the project's final purpose, which is namely to bring all souls into the fountain of living water, which lead to eternal

[50] Ibid., 342.
[51] *Warhafftige und umständliche Nachricht Derjenigen Tropffen, Strömlein und Flüsse* im October 1730 (Züllichau, 1731): 167.
[52] Ibid., 156.

life."[53] Fountains held a great deal of rhetorical and symbolic power as objects in these communities, which appreciated the convergence of skill, intuition and beauty that the constantly moving stream of water shooting upwards and into the world represented. The director of Nordhausen's Pietist Orphanage, Heinrich Kindervater, was also fond of describing his institution as a site into which the "Father of Light" had allowed the "inexhaustible fountains of all goodness" to flow. The miracle was reminiscent of the "wonder fountain" in Allifa, which flowed even more strongly when one played the harp or other musical instruments. King Solomon had also said, "let your fountains flow outside of yourselves and onto the streets" (Proverbs 5:16), and this is what those who made donations to Pietist orphanages were doing when they gave.[54] Francke's organization had drawn up several plans for the construction of a fountain outside of the Halle Orphanage in order to provide the world with yet another visible symbol of the conciliatory mandate (and promise) of the site. Herr Rost explained how by 1717, Francke was deliberating "whether or not the institutes could be helped through a fountain (*Wasserkunst*) with water from the Saale."[55] A fountain in front of an orphanage building would not only help signify the forms of technological innovation available inside the institution, it could also help demonstrate—ocularly—the consilia of motion or perfection that the Pietist prophets claimed to have mastered and to be offering to members of their community. Francke and those around him prayed for God to show them a water source that could be directed, through pipes, to the orphanage building just

[53] *Warhafftige und umständliche Nachricht Derjenigen Tropffen, Strömlein und Flüsse* (Berlin; Züllichau, 1723): 27.
[54] Johann Heinrich Kindvater, *Eigentliche Nachricht von der Gelegenheit und Anfange des in der kayserl. fr. Reichs-Stadt Nordhausen zu erbauenden Waisen-Hauses.* Vortrag 4: *Der Brunn des Göttlichen Seegens* (Nordhausen: Waysenhaus, 1717): 7.
[55] AFST/W XV/II/2: [1715] Vol. I. Nachrichtung das Röhrwasser und ubrigen Wasserbau bey den Waysenhause ... Specificatio dere in diesen farcical entfallen Nachriften und Vorstellungen der Wasserbau bey dem W.H.; [1717] Vol. II. Kurtzer Bericht von dem jetzigen WasserBau

"like the water sources on high in Gideon were directed to the city of David."[56] The power of the fountain to function as a symbol of the entire project was reiterated by several orphanage "founders," including (in this case) Steinbart.

The youth of Steinbart's Orphanage were also "directed towards Christian virtue." Their worth was regularly validated through several "visual tests" (*augenscheinliche Proben*) used to determine "whose hearts had been truly transformed and filled with the Holy Spirit." The institution aspired to serve as a container and assimilator of knowledge as well—although this was never easy. The 1731 *Bericht* clearly demonstrates that Steinbart and his circle were attempting to develop a collection of objects—including *naturalia* and models. "Regarding a collection of *naturalia*," the report writer explained, "so far we have had a slow beginning." However, they were working on remedying the situation. "Three years ago I brought back from my trip to Austria an artful … chain, like the ones that very pious Catholics place upon the naked body.[57] And "a little over a half year ago, a friend gave us a model of a mine contained in a sealed glass bottle, in which all the different mine related occupations are represented. In 1730, an honored do-gooder donated a Turkish spoon. In addition to this," he continued, "several different benefactors have offered up different kinds of curious *naturalia* that they maybe have more than one of…. We would be very grateful towards those who might be willing to send similar kinds of things to us."[58]

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[56] Ibid.

[57] *Warhafftige und umständliche Nachricht Derjenigen Tropffen, Strömlein und Flüsse* im October 1730 (Züllichau, 1731): 168. "... dergleichen die schwerlich büssende im Papsthum um den blossen Leib zu thun pflegen."

[58] *Warhafftige und umständliche Nachricht* (1723): 235. That the mathematical sciences were being taught in Züllichau is evidenced in the orphanage press production of its own guide to "Biblical mathematics": Johann Jacob Schmidt, *Biblischer Mathematicus Oder Erläuterung der Heil. Schrift aus den Mathematischen Wissenschaften Der Arithmetic, Geometrie, Static, Architectur, Astronomie, Horographie* und Optic (Züllichau, Waysenhaus, 1736).

Francke's own conversations with one of the first members of the Berlin Academy of Science, Conrad Mel, about the links between his project, philanthropy, mission and educating the youth with the new method seems to have set the stage for the way in which these relationships were understood by future network participants like Steinbart and his son/grandson—including how they thought about circulating and receiving donations of objects. It also helps demonstrate even more links between the aims of Academy members like Mel, Francke's organization and the new Pietist orphanage/educational complexes that seemed to be sprouting up everywhere. Mel and Francke corresponded about Berlin Academy projects, like calibrating the proportionality of Solomon's Temple or developing a universal language and measuring devices, in the same context as they discussed Mel's plans to start an orphanage in Hersfeld modeled after Halle's, Francke's mission plans and Mel's own collection of *naturalia* (which he offered to sell to Francke).[59] Francke's correspondence with Friedrich Christian Lesser, son of the director of Nordhausen's Pietist Orphanage and Berlin Academy member, suggests a similar pairing—to be borne out by future research.[60]

Johann Julius Hecker's Realschule

Pietist orphanages would have an enormous influence on the organization and orientation of other kinds of related educational complexes founded in Prussia over the course of the eighteenth century—including the extension and refinement of training programs in the mathematical and mechanical sciences. Although it falls beyond my

[59] See Appendix 16 and Stab/F 15, 1/5: 1-18 [1706-1723] Conrad Mel letters to A.H. Francke
[60] Friedrich Christoph Lesser produced several popular physico-theological tracts; see, for example, his *Insectotheologia: Vernunft und Schrifmässiger Versuch, wie ein Mensch durch aufmercksame Betrachtung derer sonst wenig geachteten Insecten, zu lebendiger Erkäntniss und Bewunderung der Allmach, Weissheit, der Gute und Gerechtigkeit des grossen Gottes gelangen könne* (Leipzig, 1738).

project's timeframe, the founding of Johann Julius Hecker's *Realschule* in 1747 in Berlin illustrates the fluid relationship between Pietist orphanage and *Realschule* quite effectively so it is with this example that I have elected to close this discussion for now.[61] Hecker (1707-1768) came to Halle in May of 1726 to study theology and ended up working for six years as an *Informator* in Francke's *Pädagogium*. His biographer notes that he learned all of the "most important forms of knowledge" from his teachers Justus Breithaupt, Paul Anton, August Hermann Francke, Joachim Lange and Johann Jakob Rambach in the theology faculty of the University.[62] While teaching in the *Pädagogium*, Hecker befriended professor of medicine Friedrich Hoffmann and became increasingly interested in the study of medicine, anatomy and botany. Regarding the diversification of Hecker's interests while in Halle, his biographer explained that "One is foolish if one thinks that a theologian is not a theologian if he knows more than what is important for his field. What form of knowledge is it that does not contribute to an explanation of the Holy Scriptures?"[63] Through his study of theology, Hecker acquired "perfect love" (*reine Liebe*), which he then applied to "setting afire the hearts of the common way" and further discovering and developing all of the new talents and interests God began to show to him.[64] He taught languages but wrote a textbook on Anatomy and Physiology and an introduction to the study of herbs.

In 1735, after a short tour of the Netherlands, Hecker landed in the Pietist "Military Orphanage" of Potsdam, where he served as an inspector and pastor. In 1739,

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[61] For a useful treatment of Hecker, including his interest in creating a "school of unity" or *Einheitschule*, see Friedrich-Franz Mentzel, *Pietismus und Schule: Die Auswirkungen des Pietismus auf das Berliner Schulwesen, 1691-1797* (Hohengehren: Schneider Verlag, 1994): 110-147.
[62] *Leben des hochgelahrten Herr Johann Julius Hecker* in *Ehrengedächniss des weiland Hochwürdigen und Hochgelahrten Herrn Johann Julius Hecker... Pastoris bey der Dreyfaltigkeitskirche und Directoris der Königl. Realschule und des Frankfurtschen Waisenhauses* (Berlin, 1769): 49.
[63] Ibid.
[64] Ibid., 52-53.

he was called to Berlin to preside as the pastor and teacher of a new "Church of the Trinity" (*Dreyfaltigkeitskirche*), which had been founded by the Prussian king the year before. It was here that he was given license to start a Mathematical *Realschule*, or universal (*allgemeine*) school, where all members of the "common way"—soldiers, artists, handworkers and servants—could be educated alongside children from elite and middling families. His biographer's assessment of the school's orientation directly references Hecker's exposure to the Orphanage schools while teaching at the *Pädagogium* that led him to conceive of such a space. "Is it not important," he asked, "that architects, artists and *Öconomen* are at least able to attempt to become learned?" Even those who might become half or corrupted intellectuals, Hecker argued "ought to be provided with the tools to save themselves from their own "shipwrecks.'[65] Hecker's understanding of a *Realschule* corresponded to the ecumenical vision of the Pietist Orphanage. In his estimation, "a *Realschule* is a school for everyone, the learned (*Gelehrte*) as much as artists and handworkers (*Künstler* und *Handwerker*), who must all be raised according to their future purpose."[66]

Like Francke, he divided his *Realschulanstalt* into three components: a "*Pensionairanstalt* organized like a *Pädagogium*," a Latin school ("nothing other than a language and arts school") and a German school ("actually a handworkers school").[67] There were a total of eight theology classes in the *Anstalt*, six Latin classes, two Greek and Hebrew, six Geography and History, seven Calligraphy, six Orthography, three Epistolography, two Mathematics, seven Arithmetic, four Drawing and two "orders" for the practicing of vocal music. Individual lessons were offered as needed in Botany,

[65] Ibid., 68-69.
[66] Ibid.
[67] Ibid., 73-74.

Anatomy, the science of manufacturing and small proprietorship (*Handlungs und Manufacturwissenschaft*), mining (*Bergwerkskunde*), mechanics and the "science (*Wissenschaft*) of *naturalia* and artifacts (*Kunststücke*)." More than 30 teachers reportedly "busied themselves with well over 1000 pupils" in the earliest years of the project.[68] In these schools, Hecker insisted that his teachers apply the method he had learned to apply in Halle: "a method that awakens an initial recognition of the arts and sciences in children through tables and pictures and does not just stick (*ankleben*) ideas onto the *Gemüth* but ensures that they are clasped on (*einschrauben*)."[69] Unfortunately, he wrote in his own description of the *Realschule Anstalt* in 1748, "still only a few people have had the good fortune to have been led in their youth in schools to *the thing* itself, whose name they have only heard about and memorized."[70]

In this published description, Hecker explained that he was compelled to elucidate the proper meaning and components of the *Realschule* for his readers because most them likely did not have a proper understanding of it. Hecker explained that often people tended to understand the *Realschule* as a school for training *Pansophos* or *Polyhistores*—who seem to know everything about everything—and saw this as unrealistic since the average person simply could not grasp all forms of knowledge. Or they saw the *Realschule* as something designed to refine the training of those who were destined to work with their hands: saddlers, carpenters, bricklayers, builders. Those who interpreted the mission of the *Realschule* this way, he said, tended not to see the purpose of training those headed for the trades in languages and other forms of knowledge that they would

[68] Ibid.
[69] Ibid.
[70] Johann Julius Hecker, *Nachricht vom guten Fortgang der neuangelegten Real-Schule bey den Schul Anstalten der Dreyfaltigkeitskirche* (Berlin, 1748): 8.

not need for their occupation. In Hecker's opinion, both sides were misconceptions of the *Realschule*'s mandate. First, in these institutions, languages, several forms of knowledge (*Wissenschaften*) and the arts (*Künste*) needed to be engaged in; "not that the scholars have to learn everything at once though. No! Instead, each pupil should be able to learn what he—with the aid of his parents and teacher and considering the central purpose of his future mode of living—thinks is important." Second, in order for these schools to honestly be called *Realschulen*, "from the very beginning of their schooling:

> children have to be directed to the things of the world that they will be confronted with and their understanding needs to be cleaned up (*aufgeräumet*) in order to learn about these things. One should just as much in spelling as in reading, in calculating as in writing, … direct children to the things themselves (*auf die Sache selbst*) and do not simply fill their memories with a difficult array of hard to understand words that mean nothing and are not useful. For example, if they can read, then give them a book where there are things inside that are also in the world, and are partly oriented around cultivating a recognition of God, partly of mankind and partly other creatures in order to ensure that their own composition is styled according to a natural order. Or if they are to learn the saying: "Do penance and believe in the Evangelium," then it would be good and healing to direct them to make the necessary adjustments to their senses—to (practice) hating evil and to seek out and love the good. One should lead children to trust in Jesus, who gives Israel penance and forgiveness of sins… This would be *Realien*.[71]

In order to help pupils learn how to appreciate where, why and how to use real things, Hecker remarked (in a manner reminiscent of Christoph Semler and Francke's sentiments) that "one should not only explain things with descriptive words that are clear and understandable to children…but, as often as possible, to present everything that can not be shown in *natura* or in models and machines at least in copperplate drawings and horizontal projections that are drawn correctly."[72] Hecker's *Anstalt* reportedly contained a massive "Model and Machine Room" where his biographer noted that "at large

[71] Ibid., 7-8.
[72] Ibid.

expense, the most exact models of machines, buildings, columns and famous paintings from antiquity were finished" and used in lessons.[73]

The final characteristic of the Hecker *Realschule* perhaps best illustrates the convergence of Pietist theology with his vision for a mathematical *Realschule*—for "true" lessons in *Realia*:

> An institution could be called a *Realschule* if youth are led here to understand from their earliest years onward why God created them as rational people and placed them in the world; one should show them how they have been baptized by God and taken in by him as children of his nation… One should demonstrate to them, should they fall away from the promise of baptism, how or in what way they can be brought back to the most peaceful, holiest and pleasurable states…. One should convince them that this alone can only happen through Jesus Christ… One should encourage them, from day to day, to learn how to recognize Jesus more rudimentarily, to love him more tenderly and to desire him constantly (I Cor. 1:30). One should see to it that through their effusive recognition (*überschwänglichen Erkenntnis*) of Jesus Christ they learn to appreciate that in the foolish, superficial objects in the world are only wretched, empty and worthless things which contain few or no pieces of reality and to choose real, essential things that calm the conscious (*Gewissen*) and direct them towards eternal life.[74]

Real and essential things, grasped by an individual who had obtained an "effusive recognition" of Christ and therefore was able to calibrate these things with his own perception of them would lead to higher forms of improvement, prosperity and technological advancement for the "common way." Whether or not Hecker and others inspired by the example of Halle continued to believe in the mandate of universal benevolence by the middle of the eighteenth century is difficult to say; future research will perhaps gesture towards a way of answering this question. However, it is clear from Hecker's biography and his own descriptions of his *Realschule* complex that his training in Halle had shown him the value of using his faith, his love, to pursue and assimilate as many forms of knowledge as possible.

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[73] *Leben des hochgelahrten Herr Johann Julius Hecker* (Berlin, 1769): 77-78.
[74] Ibid.

Hecker's biography reveals close connections between his *Realschule* and several Pietist orphanages—or *Erziehungsanstalten*. Johann Adam Steinmetz (1689-1782), the director of the Kloster Berge school complex just outside of Magdeburg came to help Hecker with the school in 1752 and, as I indicated above, Siegmund Steinbart's grandson, Gotthelf Samuel, would teach at the *Realschule* in Berlin before returning to Züllichow to direct the Orphanage there.[75] In the 1760s, Johann Julius Hecker's brother, Andreas Petrus Hecker would start another *Realschule* in the Pietist Orphanage of Stargard (now Szczeciński). Much more work is needed to clarify the links between these organizations, especially the ways in which certain ways of knowing circulated between them via material objects and individuals, traveling in and out of Halle and these other sites. Obviously, as these Orphanage complexes grew and time passed, the meanings of the practices and objects they housed—including the meaning of philanthropy itself—changed. But the sites continued to function as highly visible testimonies of the practitioners' special abilities as assimilators and prophets.

While there is only so much one can conclude about the orientation, mandate and extension of a Pietist network of orphanages after three case studies, I think the orphanages of Langendorf/Weißenfels, Zittau and Züllichau—in addition to the case of Christlieb Leberecht and the Hecker *Realschule*—provide enough evidence to demonstrate that Pietist philanthropy involved more than an abstract network of benefactors. It involved a set of material practices housed in extended sites. These sites, these orphanages, were specifically constructed for the application of Pietist pedagogies,

[75] Friedrich Gabriel Resewitz's description of the curriculum of Kloster Berge suggests that it too was strongly oriented, like Hecker's, around the morality of middling objects; see his *Nachricht von der gegenwärtigen Einrichtung in Unterricht, Lehrart und Erziehung auf dem Pädagogio zu Kloster Bergen* (Magdeburg, 1776). In addition to Steinmetz, one of Francke's closest colleagues, Joachim Just Breithaupt (1658-1732), served (beginning in 1709) as the director of Kloster Berge.

thereby illustrating the fundamental importance of a conciliatory methodology for the extension of universal benevolence more generally. They were solutions or sites, as illustrated beautifully by Christian Weise's comments, placed firmly in the "middle of the confusion of Europe" in order to eliminate this confusion, to remedy it by providing a two-fold solution. First, any and everyone could observe both the structure and the children inside of it, which would move and inspire them, making them feel peaceful and, therefore, better able to be discerning. Second, and probably most importantly, the conciliatory capacities of children were being honed there so that they themselves would emerge as prophets who could extend the new method and further harmonize instability, conflict and pluralisms. Children were key participants in the extension of Pietist philanthropy because they could be observed in these sites engaging in a set of practices or motions designed to inspire individuals of all ages to perfect themselves—and eventually the world.

Conclusion

> I have heard a few properly fashioned *Gemüther* say that that the Orphanage Period is over and that the blessings that these institutions achieved have come to an end. But I would like to ask, where has this been written down? Especially if one pays attention to experience, one could never uncover the reason for such a strange sentiment. Through until this very hour I have known of no cause that could explain why the universal God of the orphans should stop working through these kinds of institutions.
>
> Some like to think that aside from the Halle Orphanage no similar institution has managed to remain standing, but rather their good beginnings have been disregarded and they have all gradually slipped away. Alone the grace of God disputes this. This is a God who does not deprive anyone of his goodness nor does he offer it only to certain people so they can erect a monopoly. In addition to this, visible experience (*augenscheinliche Erfahrung*) offers indisputable proof of the opposite. The merits of the Halle Orphanage also validate this.
>
> A thorough collection of reports from all the institutions ever developed according to this art would form a huge and useful part of the history of schooling.
> …
> Yes, I must tell my readers a little bit about how my faith in our *Anstalt* has been powerfully strengthened. I have in my library not only Francke's news from the Halle Orphanage and *Pädagogium* but also Steinbart's news from the Züllichau Orphanage (and alone the foreword introduces still more of the same kinds of houses); I have every half year reports from the Orphanage in Cotbus; I receive news from the famous *Realschule* in Berlin and also reports from the Orphanage in Görlitz. Awhile ago a friend lent me the news reports from the new Orphanage in Grünstadt, founded in 1749. And even though I do not have the news reports from the Langendorf Orphanage near Weiβenfels, I still possess a short description of the life of the founder himself.
>
> -Gottfried Zahn, 1754[1]

For those involved in founding and funding Pietist orphanages in the German states throughout the eighteenth century, the "orphanage period" had only just begun. Each Pietist orphanage constructed in Brandenburg-Prussia and Saxony in this period was imagined as a participant in a new, universal or conciliatory network—a pedagogical

[1] Gottfried Zahn, *Erste Nachricht von einer auf Gr. Königlichen Majestät allergnädigste Concession angefangenen Waisen und Schul Anstalt zu Bunzlau in Schlesien Welche sich auf den Fond der Göttlichen Vorsehung gründet. Mit beigefügten Gedanken von dergleichen Unternehmungen* (Bunzlau: Waisenhaus, 1754): 13-14, 36.

project and pansophic mission centered in Halle.[2] During the years upon which this study has been focused (1695-1730), Pietist philanthropists were busily endeavoring to assimilate perceived tensions between state authority and voluntarism, between theology and philosophy, between reason and experience, by making the Pietist Orphanage—especially the practices it housed—the material symbol and site of their conciliatory enterprise. They did this very deliberately, I have proposed, precisely because of the orphanage's ability to serve as a neutral or "middling" medium that consistently made powerful visual appeals, like a three-dimensional model, both to those who trained on site and to those who came to view these *Schauplätze* in order to increase their pious desires.[3]

Several scholars working on Pietism today have pointed to an active state of dialectical exchange between exterior and interior expressions of religiosity as key to understanding Spener and Francke's movement. In his study of the *Eighteenth-Century Origins of Compulsory Schooling in Prussia and Austria,* James Van Horn Melton wrote that Pietists' concern with the state of their individual souls, their "inwardness," was "accompanied by a determined social activism" and that the "relationship between the two positions was dialectal, not contradictory."[4] Jonathan Sheehan, too, has pointed to the simultaneity of Pietists' preoccupation with both subjective and objective ways of knowing or arriving at truth.[5] Those interested in Halle Pietists' relationship to state authority have noticed a dialectic operating here as well, only they tend not to characterize it as such—instead they refer to this relationship as "vexing" or "anything

[2] I readily extend this claim to Pietist orphanages constructed in Russia, Denmark, southern India and North America; however, because my study has not treated these sites, it will have to remain a tentative one.
[3] Philipp Jakob Spener, *Pia Desideria. Oder Hertzliches Verlangen nach Gottgefälliger Besserung der wahren Evangelischen Kirchen* (Frankfurt, 1676).
[4] James Van Horn Melton, *Eighteenth-Century Origins,* 28.
[5] Jonathan Sheehan, *The Enlightenment Bible*, 58-59.

but straightforward" precisely because of the persistent tendency for dialectical exchanges between opposing positions to often appear as precisely this: oppositional or contradictory.[6] Was Francke co-opted by the Prussian state or, by founding the Halle Orphanage, was he strategically manipulating the state in pursuit of his own agenda? Most continue to choose the first option—despite the caveats they offer—and thereby even more deeply interweave the story of the Pietist Orphanage within a Berlin-centered narrative, not a Halle-centered one.[7]

Contradictions are usually portrayed as implicit in Halle Pietism—silently present, perplexing and crying out to be resolved. And, at first glance, the duplicitous arrangements that seem embedded in Halle Pietists' relationship to state authority can be read as yet another manifestation of precisely the kind of dialecticism that Melton, Sheehan and others have insisted was central to the movement's ethos. But a dialectic implies a constant and constructive exchange between two distinct sites; it does not quite do justice to Francke's interest in portraying his movement as a "third way"—a phrase that Christopher Clark also uses to characterize Pietism in Brandenburg-Prussia and that my entire study has been oriented around elucidating.[8] What if, instead of imagining Francke's community as in a state of constant, dialectical exchange with state authorities,

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[6] Jonathan Strom, "Comment" in *Covenant Quarterly* 65:4 (2006): 2-3.

[7] For a recent example of a Berlin-centered narrative that includes a discussion of the Halle Orphanage see Christopher Clark, *The Iron Kingdom: the Rise and Downfall of Prussia, 1600-1947* (Cambridge, MA: Harvard University Press, 2007): 115-144. In Benjamin Marschke's view, affiliates of Francke's organization were "massively" co-opted by the Prussian state, thereby becoming, "Absolutely Pietist;" however, he has conceded that *at the same time* Pietists' "influence on Prussia under Fredrick William was tremendous." See his "Lutheran Jesuits: Halle Pietist Communication Networks at the Court of Frederick William I of Prussia" *Covenant Quarterly* 65:4 (2006): 19-38 and *Absolutely Pietist: Patronage, Factionalism and State-Building in the Early Eighteenth-Century Army Chaplaincy* (Tübingen: Verlag der Franckeschen Stiftungen Halle im Max Niemeyer Verlag, 2005). For an alternative view see Thomas Bach, *Throne and Altar: Halle Pietism and the Hohenzollerns: A Contribution to the History of Church State Relations in Eighteenth-Century Brandenburg Prussia* (Syracuse University: unpublished dissertation, 2005).

[8] Christopher Clark, *The Iron Kingdom*, 124.

we took seriously the practices his community refined and circulated that came to define their organization, their network as a "third way"? What if the Halle Orphanage was deliberately constructed to serve as precisely the kind of neutral or extended site for the remediation of what Pietist eclectics insisted only *appeared* to be fundamentally incompatible forms of social organization, mandates or agendas? If everyone learned to see correctly through the conciliatory training regimens housed in the Pietist Orphanage, the gaps between state, collective and individual wills could be bridged. In the orphanage they could come together in love, in an assimilatory juncture point, where individuals could influence the state in innovative ways and vice versa.

I concede that my study has not directly confronted the problem of Prussia and Halle Pietism, whose configuration is still profoundly influenced by Carl Hinrichs' monumental *Preußentum und Pietismus* (1971) and the legacy of the confessionalization paradigm that continues to dominate German historiography.[9] However, I have indirectly offered up a conciliatory solution to this and many other dilemmas haunting Pietism studies today, including the lingering tendency to want to see Pietism and Enlightenment as two distinct sites also engaged in a kind of dialectical conversation. I have done this by highlighting the profound significance of the Pietist Orphanage as an assimilatory instrument. I have endeavored to emphasize throughout the way in which Pietists merged practice and invention through visual exercises intended to calibrate, or bring into alignment, the always unpredictable juxtaposition of cognition and experience, reason and faith and other dualisms.

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[9] Joel Harrington and Helmut Walser Smith, "Confessionalization, Community and State Building in Germany, 1555-1870," *Journal of Modern History* 69 (March 1997): 77-101; Ute Lotz-Huemann, "The Concept of 'Confessionalization': A Historiographical Paradigm in Dispute." *Memoria y Civilization* 4 (2001): 93-114.

By training individuals to realize their eye's potential as a conciliatory instrument, Halle Pietists pursued an agenda that was contingent upon their promise to the ruling elites who gave them licenses to build orphanages that their pedagogical regimens would produce perpetually moving *Werkzeuge*, who would improve the state at the same time as they improved and perfected the world. Eventually this would make the need for any form of authority, whether absolutely or collectively generated, unnecessary; and to a pious ruler, who believed in the promise and mandate of pansophy, trading perfection for a usually deficient (or less than perfect) state apparatus would have held enormous appeal. In this pre-1730 moment, it was precisely the active remediation (*inside* the orphanage) of the contradictions that continue to perplex those of us who study their movement that set Halle Pietists apart from those around them and that allowed them at the same time to *both undermine and further* the agendas of the ruling elites who sponsored them. We will never "resolve" the paradox underlying Halle Pietists' relationship to the state because it was precisely the affirmation and assimilation of this paradox that the movement depended upon for its very survival.

This project has shown that key to understanding the assimilatory orientation of Francke's movement is the diverse assortment of especially vision-oriented techniques and strategies that he readily drew upon to create the Halle method. In Part One, I laid out Francke's connections to five individuals who devised and/or helped standardize some of these techniques: Ehrenfried Walters von Tschirnhaus, Johann Christoph Sturm, his son Leonhard Christoph Sturm, Gottfried Wilhelm Leibniz and Christian Wolff. Of course, there were many more individuals whose presence in Halle influenced the orientation of Francke's universal seminar, including Johann Franz Buddeus, Christian

Thomasius, Friedrich Hoffmann and Georg Ernst Stahl. But in order to illustrate how and why especially the mathematical sciences came to be viewed as important, middling disciplines for Francke, it has been necessary to carefully consider his relationships to Tschirnhaus, to the Sturms, to Leibniz and to Wolff—all of whom believed in the promise of an eclectic method or means of filtering all knowledge through the individual, whose increasingly perfect senses (improved by viewing models or objects in *natura*) were in direct alignment with the cognitive faculties he was also consistently improving through geometrical exercise. Tschirnhaus, I argued, was interested in what Spener and Francke had to teach him about how the cultivation of instinct worked through illumination, meditation and exegesis. And Francke implemented Tschirnhaus's method for reconciling mathematics and physics because he recognized that his movement had a powerful place in it. He also recognized the powerful impact that Sturmian eclecticism had had on Tschirnhaus's project and brought it to bear on his own, displaying and demonstrating to the pupils of his *Schulstadt* both heliocentric and geocentric models of the universe so that they could assimilate these competing *Vorstellungen* in their hearts.

My treatment of Leibniz and Francke's relationship has certainly not been the first; however, in arguing that the Halle Orphanage should be viewed as a material expression of a thought once expressed by Leibniz (not necessarily his thought alone though) I have challenged Carl Hinrichs' still dominant portrayal of their mutual interest in Protestant mission as *unabhängig voneinander* or not closely intertwined.[10] The large amount of correspondence in Francke's *Schulstadt* (and archive) from members of the Berlin Academy of Science, including especially Leibniz's co-founder Daniel Ernst Jablonski, clearly indicates a great deal of convergence between Francke's institutes,

[10] Hinrichs, 41.

Protestant mission and the conciliatory orientation of the Academy. The preoccupation with pantometry, with developing universal measuring devices, a universal language and universal media for reconciling and systematically presenting all knowledge would remain central to the ethos of the Halle Orphanage—including the Protestant mission it endeavored to organize and orient around itself with the help of especially the Danish and English crowns, not the Prussian one. This preoccupation would linger well into the 1740s, 50s and 60s, when Johann Heinrich Zedler printed the first German "universal lexicon" on the Halle Orphanage press.[11] My treatment of both Wolff and Francke's mutual interest in the mathematical sciences as a form of *paideia* that could help the individual realize himself *at the same time* as he compensated for the deficiencies of his senses by habituating them also illustrates both figures' commitment to a universalizing or assimilatory project oriented around the *Gemüth* as a critical juncture point. While I certainly would agree that there were differences between these two figures, as Wolff himself acknowledged, these same differences should not be used (as they have been consistently over the years) to uphold an overly dramatized polarity between Francke and Wolff—or between Francke and Leibniz for that matter.

Pressed to explain the differences that slowly developed between Francke and Wolff, I would point to Francke's preference for the three-dimensional models his friend Christoph Semler liked to build as an expression of his *pia desideria* over Wolff's preoccupation with the two-dimensional *Grundriss*. Again, this is not to say that Wolff wanted nothing to do with models of machines or that Francke refused to assimilate the technology of the *Grundriss* into his *Anstalt*; as I have shown throughout Part II, this was

[11] There were 12 volumes printed between 1732-1754. For a recent treatment see: Christine Haug, "Das "Universal-Lexicon" des Leipziger Verlegers Johann Heinrich Zedler im politischen Konfliktfeld zwischen Sachsen und Preußen" in *Leipziger Jahrbuch zur Buchgeschichte* 16 (2007): 301-331.

not at all the case. However, in articulating his preference for three-dimensional forms of representation over two-dimensional forms, including the model's strategic placement as the second best means of sponsoring high quality forms of recognition and piety in individuals (other than seeing something in *natura*), Francke was saying something very powerful about his movement's orientation. Models were better *Schauplätze* than *Grundrisse*; they were better able to illustrate the three-fold *consilia* of thinking, feeling and loving that Francke preferred by mimicking the heart's—or third site's—intrinsic materiality *and* proportionality. Yet, despite this difference in taste or orientation, neither Francke nor Wolff would have disputed the superior status of the middling mathematical sciences or the conciliatory power of the eye.

To put it another way, Francke was heading a rather loosely organized yet coherent movement comprised of radical Protestants who, like Comenius, Leibniz and Wolff, were convinced that there were gains to be had from copying Jesuits—especially their visual pedagogies. All of the *literati* I discussed in Part One, including Francke and the teachers of his schools, embraced and assimilated Jesuits' own preference for the mathematical sciences. They recognized the conciliatory significance of and helped further Athanasius Kircher's work on refining the technologies of geometrical projection. They accepted the validity of Andreas Tacquet's interest in assimilating oppositional stances via the medium of the soul. Halle Pietists, in tandem with so many of the intellectuals they associated with, made the Jesuit order's preoccupation with visuality and a coherent network oriented around the supposedly transcendent cause of Christian mission their own. In their construction of conciliatory technologies of discernment—housed within assimilatory juncture points or orphanages—members of this community

were refining and codifying a set of practices that were imagined as easily replicable in new and far away surroundings.

Jesuits sent out missionaries who were expected to blend into new territories at the same time as they endeavored to understand and transform them by building churches and schools.[12] Pietists also trained missionaries and teachers and sent them into distant parts of the world to found new institutions and to gather up pieces of what they discovered there. Trained to assimilate their findings *in* love, they were to circulate the materials they encountered and to send them back to Halle—the heart of the conciliatory enterprise. They were to accept the validity of the various forms of difference they encountered at the same time as they assimilated or mediated it. They were to transform the souls of those they encountered by serving as living models or *Werkzeuge,* inspiring active forms of impassioned emulation. Founding new Pietist orphanages was part of the standardization of a universalizing impetus so characteristic of this period and yet marked an attempt to make the instrument of assimilation the heart—to make it the critical juncture point for all forms of reflective practice.

Future research into the nuances of these extended sites, and there were many of them, will help demonstrate more conclusively than I have been able to show here how exactly this worked. Yet, I have illustrated in Chapter Eight that the founding of a Pietist orphanage provided Francke's movement, a privately sponsored enterprise centered in Halle (not Berlin), with the gathering points it needed to maintain its momentum—thereby allowing it to grow and improve upon itself. In theory, these sites allowed more individuals to participate in furthering the conciliatory project than could ever participate as agents in the Jesuit organization. Individuals admitted themselves into the ranks of

[12] Steve Harris, "Jesuit Scientific Activity in Overseas Missions, 1540-1773," *Isis* 96 (2005): 71-79.

benefactors that comprised Halle Pietists' patronage networks simply by donating, and thereby supporting, the enterprise. All forms of donations were acceptable, from hard currency to books and musical instruments. Forms of participation in Pietist philanthropy were just as varied but always involved some kind of measurable act, some kind of conciliatory gesture. These included founding new orphanages in locales outside of Halle, becoming a teacher or missionary or even standing in front of the physical structures so as to experience calming or pleasant emotive forms. In Halle, Pietist teachers—usually students from the university—gave tours of their orphanage complex to interested visitors; they told people not only what to look at but *how* they could learn to see it correctly by becoming a patron, a participant, of the organization. [13]

Participating in the network of Pietist orphanages, in Pietist philanthropy, was a subjective experience that involved the reasoned application of passion, *and* the impassioned application of reason. In saying this, I do not wish to simply repackage yet another of Carl Hinrichs' influential claims about Halle Pietists' influence on the cultivation of interiority, on the individual and on the rise (or production) of modernity. Instead, I am interested in pointing out Francke's own insistence that cognition, that the internal forms of knowledge and modes of reflection that Pietists became famous for championing, was (in their view) only one pillar of wisdom. The other pillar was comprised of interiority's opposite, experience, and the two pillars came together in the eye—that is, following Comenius, in the heart. Especially those intellectuals who championed the Halle method believed that the production of new forms of knowledge leading, eventually, to the perfection of the world would only be possible through

[13] AFST/W VII/I/20 [1732, 1746] Instruktionen für die Herumführer

practical reflections or the cultivation of increasingly precise and passionate reflective practices, which were always visible. They sought to eliminate precisely the kinds of categorical distinctions between ideas and practice, exteriority and interiority that continue to inform the world we live in.

This feature of Pietist philanthropy and education marks the most critical component of the plea I am making for the Pietist orphanage's conciliatory significance. The very kinds of distinctions that we take for granted today—between the idea of childhood that Pietists were promoting, for example, versus how children were actually handled in their institutions—are distinctions that these historical actors also recognized and sought to do away with entirely. [14] In their orphanages, children were assimilatory sites, who both taught their adult *informators* and allowed themselves to be taught by them, who were observed and, themselves, observed. They were hearts and models like the orphanage building itself and their special status as children was revered by Pietists precisely because of children's tendencies to allow their actions and their reflections, their reflective practices, to be dictated by their instincts, by their sense of non-jaded wonderment and desire. This is where my central contribution to the history of childhood and education lies. I see this project as an attempt to break out of the binary straightjacket that usually amounts to a methodological choice between studying children's "real experiences" versus a given historical epoch's ideas about them. Instead we should be assembling genealogies of the reflective practices in which children are implicated.

[14] For a succinct treatment of this tension and its repercussions on the field of childhood studies see Hugh Cunningham, "Histories of Childhood," in *The American Historical Review* 103:4 (October, 1998): 1195-1208 or his *Children and Childhood in Western Society since 1500* (London; New York: Longman, 1995). For the relationship between the idea of childhood and interiority see Carolyn Steedman, *Strange Dislocations: Childhood and the Idea of Human Interiority*, 1780-1930 (London, 1995).

My aim here is not, nor has it been, to impose a value judgment on these sites—thereby deeming them inherently good or bad. If my portrayal of them comes across as especially sympathetic this is primarily because of my conviction that Pietist orphanages, as conciliatory sites, are central to the histories of youth, education, philanthropy and science in eighteenth-century Germany but have been mostly misunderstood and neglected over the years. I readily conceded that these were exclusive institutions designed mostly for gifted (though in some cases poor) male children. Francke and his circle basically ignored immediate social problems in an effort to impose broadly imagined yet practice-oriented solutions to the problems of intolerance, discord and incongruity that eventually caused poverty, illiteracy and conflict. When these institutions were established in colonial contexts, like southeastern India, they became implicated in colonial projects. But Pietists' preoccupation with introducing the conciliatory method in these new contexts suggest even more reason to study these sites, including the global, philanthropic network of which they were a part.

It is not a coincidence that Pietist orphanages emerged when they did, at precisely the moment when already deeply entrenched, yet fluidly imagined, hierarchies of heads and hands were being reified by ruling elites so as to summon up the necessary men, materials and ideas necessary to sustain increasingly large and pluralistic "imagined communities."[15] These were communities linked together by newsprint and new technologies, which, as the quote I cited at the outset of this section also indicates, Pietists were drawing upon to connect their own network. Their orphanages were devised as a deliberate response to this process of reification. Their founding marked an

[15] Benedict Anderson, *Imagined Communities: Reflections on the Origins and spread of Nationalism* (London; New York: Verso, 2006); Lissa Roberts, Simon Schaffer and Peter Dear eds., *The Mindful Hand* (2007).

attempt to show the world another way. And one could say that at least until the 1750s or 1760s, the network of Pietist orphanages—including the visual appeals of the first *Schauplatz* in Halle—was remarkably coherent and extensive. The Halle Orphanage remained the network's central node or gathering point and was not only producing universal *lexica* but was experimenting with the production and circulation of measuring instruments as well.[16] Future research will help clarify just how extensive the network was and why the "orphanage period" came to end, including how the Pietist orphanage complexes of Brandenburg-Prussia in particular became state institutions no longer entirely beholden to their original conciliatory mandate. But during this first phase, in this early "orphanage period," the visual pedagogies collected and refined in Francke's *Schulstadt* promised to change the world—and they most certainly did.

[16] See, for example, AFST/W XI/-/6 [1765] Die Anschaffung eines Quadranten und Berechnung der Kosten

Bibliography

Abbreviations:

AFST Archive of the *Franckesche Stiftungen* [Halle/Saale]
- /H Main archive (*Hauptarchiv*)
- /M Mission archive (*Missionsarchiv*)
- /P Planning archive (*Planarchiv*)
- /S School archive (*Schularchiv*)
- /W Organizational archive (*Wirtschaftsarchiv*)

GSPK Geheimes Staatsarchiv Preuβischer Kulturbesitz [Berlin]

BBAW/A Berlin-Brandenburgische Akademie der Wissenschaften/Archiv [Berlin]

STAB/F Staatsbibliothek (Preuβischer Kulturbesitz)/Francke Nachlass [Berlin]

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AFST/H C 836:12 [July 14, 1721] Schreiben von Christian Wolff an August Hermann Francke

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AFST/M 1 B 2 21 [June 19, 1725] Bericht von Christoph Theodosius Walter an Ernst Heinrich Aleman (Bericht über die Seereise, Alltagsbeobachtungen in Tranquebar, Zeichnung eines Quadranten)

AFST/P 43/1/1 – 43/1/33 Kupferbergwerk Goddelsheim Planentwürfe und Skizzen

AFST/P 43/2/1 – 43/2/12 Kupferbergwerk Nordenbeck Planentwürfe und Skizzen

AFST/S A I 197 [1705-1754] Verhalten der Schüler und Beschäftigung ehemaliger Scholaren (*Pädagogium*)

AFST/S A I 200 [1698-99] Historische Nachrichten von dem ersten Anfang des Pädagogii

AFST/W V/-/14 General Reglement für das Waisenhaus und *Pädagogium*

AFST/W VII/I/20 [1732, 1746] Instruktionen für die Herumführer

AFST/W Rep. 2 Fach 245 Nr. 5 Specification der Einahmen und Ausgaben wegen der Mechanischen Disciplinen 1704 bis 1723

AFSt/W XI/-/1 Instruction wie die Music in den Knabenschulen tractirt werden solle, sine dato

AFST/W XI/-/2 *Ordnung und Lehrart wieselbige in den zum Waisenhaus gehörigen Schulen eingeführt ist*, Druckheft

AFST/W XI/-/3 D Mel Judicium und Entdeckte Meynung um sie Erlangte Königliche Preussische Societät der Wissenschaften wegen des von einem sinnreichen Author; ihrer königlichen Maiester von Preussen übergebenen projects vom einem Charactere Universali ob und weit derselbe practicabel durch 50 Characteren und deren Determinitiones ohne erlernung fremder sprachen mit allerley Volckern der Welt zu reden

AFST/W XI/-/4 [August 26, 1698] Original-Contract zwischen Gottlieb Wolfgang u. Hr. Prof. A.H. Francke den Kindern das Kupferstechen zu lehren

AFST/W XI/-/5 [1748] Die zum Behuf Classis 1 Mus. und der Singestunden auf dem grossen Erbauungs. Saal angeschaffte neue Orgel

AFST/W XI/-/6 [1765] Die Anschaffung eines Quadranten und Berechnung der Kosten

AFST/W XI/-/71 Inventarverzeichnisse (Kataloge) der Schränke der Kunst- und Naturalienkammer

Verzeichnisse 1-11 von Gottfried August Gründler 1741 angefertigt

1. Schrank III C: Seegewaechse
2. Schrank VII G: Zum Mathematischen Gebrauch gehörige Sachen
3. Schrank VII H: Zur Astronomie gehörige Sachen
4. Schrank IX I: Sachen, so zur Mechanik gehören
5. Schrank X K: Sachen, so zur Mechanik gehören
6. Schrank XI L: Sachen, so von der königlichen danischen und königlichen Englischen Indischen Missionen aus Malabarn, an hiesiges Waysenhaus überschicket worden.
7. Schrank XII M: Sachen aus verschiedenen Religionen welche be denselben für heilig gehalten werden.
8. Schrank XIII N: Sachen, welche zu Speiss und Trank gehören, oder als Werckzeuge dabey gebraucht werden, einige zum Krige gehörige Instrumente, wie auch verschieden andere künstliche Sachen
9. Schrank XIV O: Sachen, so zur Kleidung gehören
10. Schrank XV P: Gemälde, Kupferstiche, Risse und Wachsfiguren
11. Schrank XVI Q: Zum Schreiben gehörige Instrumente, wie auch geschrieben und gedruckte in- und ausländische Sachen.
12. Catalogus derer Sachen, die sich in der Naturalien-Kammer des Waysenhauses befinden nach 1740.
13. Erster gedruckter Katalog der Kunst und Naturalienkammer: Specification derer Sachen welche zu der für die Glauchische Anstalten angefangenen Naturalien-Cammer bis anhero verehret worden. Vor 1740.

AFST/W XI/-/72 *Demonstration des Modells der Stiffs Hütte Mosis*

AFST/W XV/II/2 [1715] Band I. Nachrichtung das Röhrwasser und ubrigen Wasserbau bey den Waysenhause ... Specificatio dere in diesen farcical entfallen Nachriften und

Vorstellungen der Wasserbau bey dem W.H.; [1717] Band II. Kurtzer Bericht von dem jetzigen WasserBau

STAB/F 7/14: 38-41, 43-44 [February 16 & 20, 1719; March 3 & 5, 1719; February 2 & 12, 1720] Briefe von Johann Franz Buddeus an August Hermann Francke

STAB/F 10, 2/7: 218 [June 30, 1720] Brief von Johann Daniel Herrnschmidt an August Hermann Francke

STAB/F 15, 1/5 [March 7, 1706] Brief von Conrad Mel an August Hermann Francke

STAB/F 17, 1/4: 10-11 [1725] Brief von Johann Porst an A. H. Francke (re: D.E. Jablonski, Potsdam Waisenhaus)

STAB/F 20, 2/13: 1 [June 13, 1701] Brief von Leonhard Christoph Sturm an August Hermann Francke (re: Mathematik Stelle)

STAB/F 20, 2/13: 2 [March 6, 1702] Brief von Leonhard Christoph Sturm an August Hermann Francke (re: Medikamente)

STAB/F 20, 2/13: 3 [July 1, 1709] Brief von Leonhard Christoph Sturm an August Hermann Francke (re: Informator)

STAB/F 20, 2/13: 4 [November 22, 1709] Brief von Leonhard Christoph Sturm an August Hermann Francke

STAB/F 20, 2/13: 5 [February 2, 1711] Brief von Leonhard Christoph Sturm an August Hermann Francke

STAB/F 20, 2/13: 6 [September 7, 1711] Brief von Leonhard Christoph Sturm an August Hermann Francke

STAB/F 20, 2/13: 7 [October 8, 1711] Brief von Leonhard Christoph Sturm an August Hermann Francke

STAB/F 20, 2/13: 8 [November 29, 1711] Brief von Leonhard Christoph Sturm an August Hermann Francke

STAB/F 20, 2/13: 9 [May 30, 1713] Brief von Leonhard Christoph Sturm an August Hermann Francke

STAB/F 20, 2/13: 10 [October 9, 1713] Brief von Leonhard Christoph Sturm an A.H. Francke

STAB/F 20, 2/13: 11 [April 30, 1714] Brief von Leonhard Christoph Sturm an August Hermann Francke (re: son Georg Samuel Christoph Sturm to Pädagogium)

STAB/F 20, 2/13: 12 [June 17, 1715] Brief von Leonhard Christoph Sturm an August Hermann Francke

STAB/F 20, 2/13: 13 [September 20, 1718] Brief von Leonhard Christoph Sturm an August Hermann Francke

STAB/F 20, 2/13: 14 [April 1, 1719] Brief von Leonhard Christoph Sturm an August Hermann Francke

STAB/F 28/1: 2 [1697] Ergänzende Fragen Georg Heinrich Neubauers zum Studium der Waisenhäuser in Holland

STAB/F 28/1: 3 [December 24, 1697] Aufzeichnungen von Georg Heinrich Neubauer über seinen Besuch im diakonischen Waisenhaus Amsterdam

STAB/F 28/1: 4 [1697] Aufzeichnungen von Georg Heinrich Neubauer über die finanziellen Quellen der Armenfürsorge in Holland, insbesondere für das Diakonische Waisenhaus, das Bürgerwaisenhaus und das Almoseniers-Waisenhaus in Amsterdam.

STAB/F 28/1,2: 4 [1697] Bautechnische Beschreibung des Frauenhauses in Amsterdam, angefertigt von Georg Heinrich Neubauer

GSPK [1721-1749] I HA Rep 52 Nr 159b

BBAW/A I-III-47 Table of Academy Members

BBAW/A I-V, 5a [1705] Gutachtung von J.L.Frisch zu der von L.Ch. Sturm eingesand Abhandlung über den von König Salomo im Jerusalemer Tempel gebauten Springbrunnen

BBAW/A I-V, 5a [1708] Gutachten von L.Ch. Sturm über das Pantometrum Nauticum des K. Mel

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von dem Werk ihres Amts und Bekehrung der Heyden daselbst Halle: Waysenhaus, 1710-1772.

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Bericht dessen was wegen der zwischen den Evangelisch-Lutherischen Geistlichen von der Universität und Stadt Ministerio in Halle, eine zeithero geschwebten Differentien, durch von seiner Churf. Durchl. zu Brandenburg Gnädigst verordnete Commission abgehandelt und zu dero Beruhigung in Göttlichem Segen ausgerichte worden. Colln an der Spree, 1701.

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----"Christian Wolffs Eigene Lebensbeschreibung." Reprinted in *Gesammelte Werke*, Part One: Volume 10.

----*Mathematisches Lexicon, darinnen die in allen Theilen der Mathematick üblichen Kunst-Wörter erkläret, und zur Historie der Mathematischen Wissenschafften dienliche Nachrichten ertheilet, auch die Schrifften, wo iede Materie ausgeführet zu finden*. [Leipzig, 1716]. Reprinted in *Gesammelte Werke*, Part One: Volume 11.

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Anderer Theil, welcher die Artillerie, Fortification, Mechanick, Hydrostatick, Aerometrie und Hydraulick in sich enthält, und zu mehrerem Aufnehmen der Mathematik so wohl auf hohen, als niedrigen Schulen aufgesetzt worden...Neue, verbesserte und vermehrte Auflage (Halle, 1757). Reprinted in *Gesammelte Werke*, Part One: Volume 13.

Dritter Theil, welcher Die Optick, Catoptrick und Dioptrick, die Perspectiv, die Sphärische Trigonometrie, Astronomie, Chronologie, Geographie und Gnomonick in sich enthält. Reprinted in *Gesammelte Werke*, Part One: Volume 14.

Letzter Theil, welcher so wol die gemeine Algebra, als die Differential- und Integral-Rechnung, und einen Anhang Von den vornehmsten mathematischen Schrieften in sich begreifet. Reprinted in *Gesammelte Werke*, Part One: Volume 15.

Kurtzer Unterricht von den arithmetischen Schriften. Reprinted in *Gesammelte Werke*, Part One: Volume 16.

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----"Solutio non nullarum difficultatem circa mentem humanam obviarum: ubi simul agitur de origine notionum & factultate rationnandi," in *Acta Eruditorum* [November 1707]. Translated as "Auflösung einiger Schwierigkeiten, welche bey der menschlichen Seele vorkommen. Dabey zugleich von dem Ursprung der Begriffe und dem Vermögen Vernunfftschlüsse zu machen, gehandelt wird," in Christian Wolff, *Gesammelte kleine philosophische Schriften* (Halle, 1737): 169-186. Reprinted in *Gesammelte Werke*, Part One: Volume 21-2.

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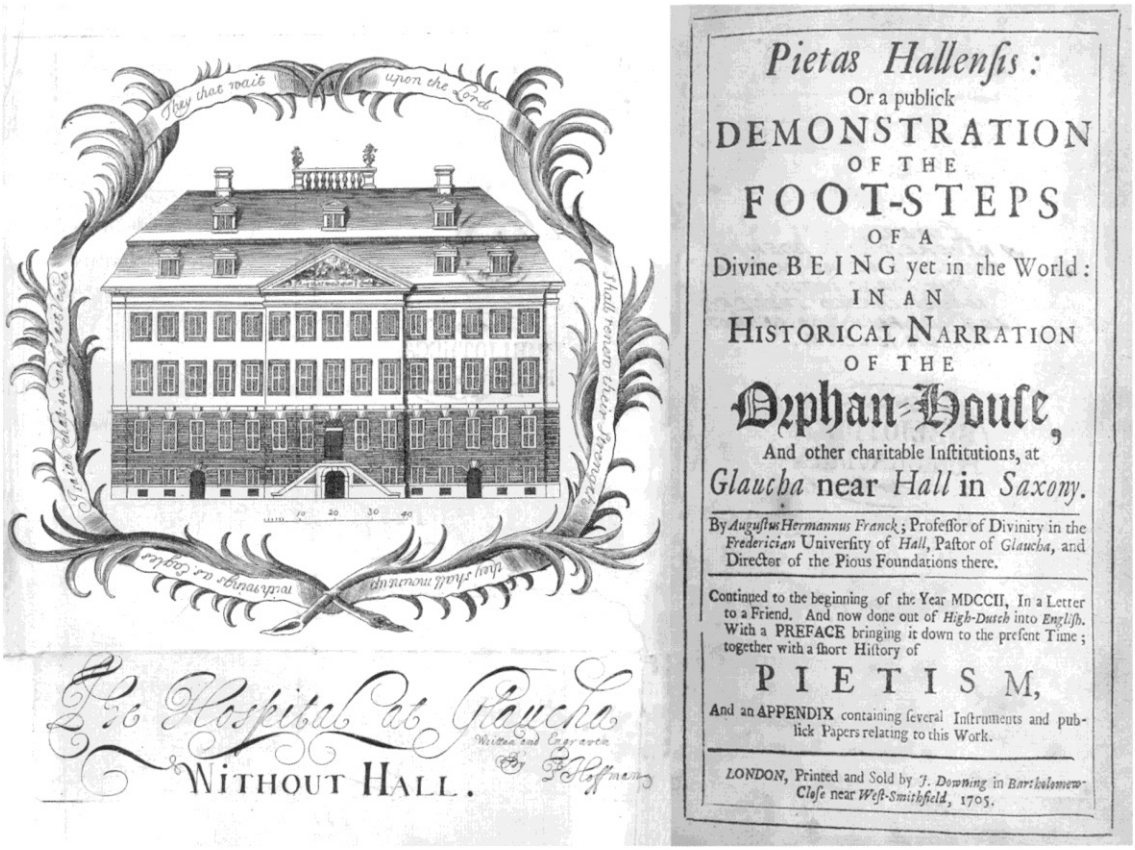
Appendices

1: "Das historische Waisenhaus" (Copperplate engraving by F. Hoffmann): Frontispiece and title page from *Pietatis Hallensis* (London, 1705)



Courtesy of *Franckesche Stiftungen* (Halle): BFSt: 99 H 8

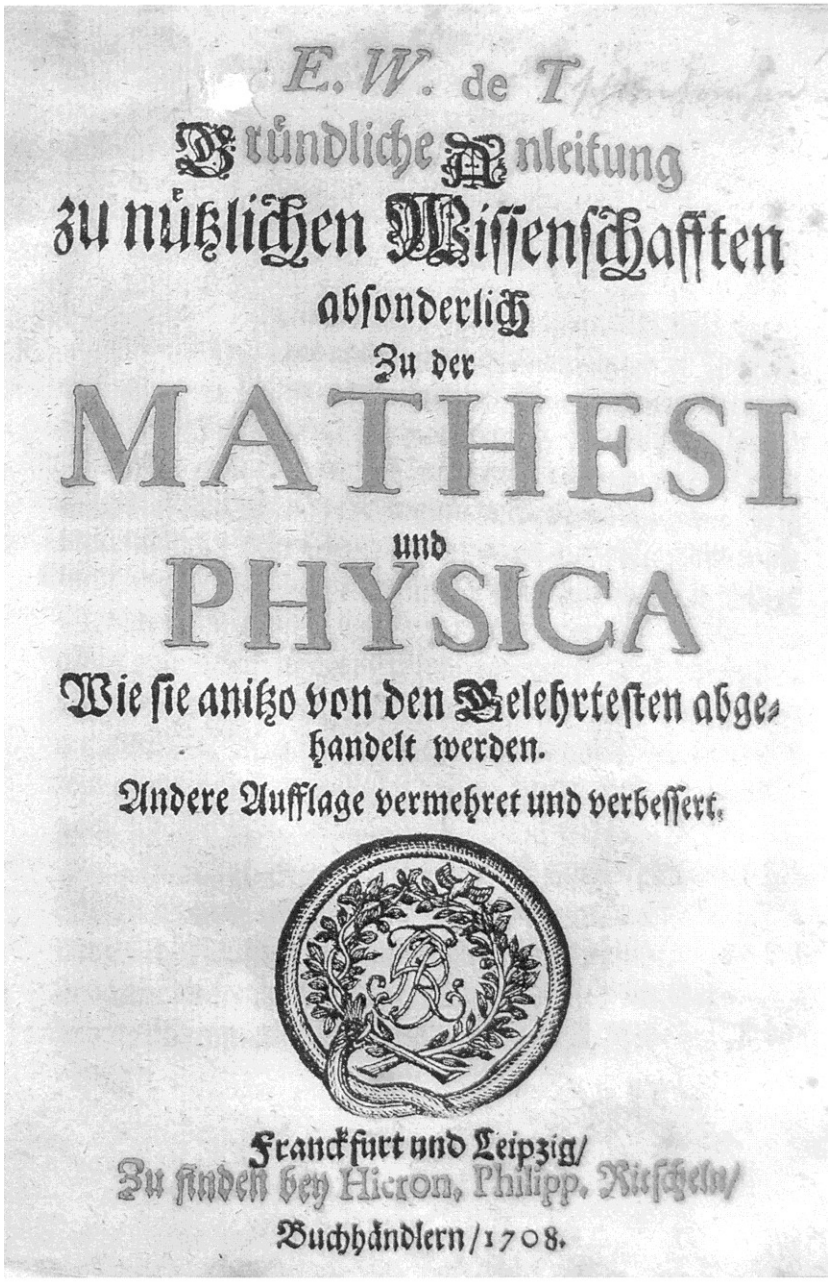
2: Texts recommended to A. H. Francke by E. W. von Tschirnhaus

Step	Author Name	Text Name	Subject
1			**Praxis: awaken curiosity, passion**
	Daniel Schwenter (1585-1636)	*Delicae Physico-Mathematicae (1636)*	(privilege art of invention, discovery)
	Jacques Ozenam (1640-1717)	*Recreations Mathematiques et physiques (1694, 2 vols.)*	
	Johann Christoph Sturm (1635-1703)	*Collegium Curiosum (1674)*	
	Samuel Reiher	*Arithmetic*	Easy introduction
	Daniel Schwenter	*Geometriae Practicae (1627)*	Field praxis
	Wilhelm Schickard	*Astroscopio (1689)*	Astronomie
			Geography
			Optics
	Gaspar Schott (1608-66)	*Cursus Mathematicus (1661)*	Mechanics, Hydrostatics, Hydraulics
	A.M. Mallet	*Les travaux de Mars ou la fortification nouvelle…(1671)*	Fortification
	Leon Battista Alberti	*Perspective*	Perspective
	Perrault	*Abrege d'Architecture vom Vitruvio*	Perspective
			Gnomomica
2			**Theory behind praxis**
	Andreas Tacquet	*Elementa Geometriae*	Ex. Archimedes Theoremata
	Andreas Tacquet	*Euclidi*	Sectiones Conicas
	Bramerus	*Apollonio Catto*	Sectiones Conicas
	Claude Francois Milliet Des Chales (1621-78)	*Mundus Mathematicus (1690); 4 vols.*	Sectiones Conicas
	De Le Hire	*Sectionibus Conicis*	
	Ozanam	*Sectionibus Conicis*	
	Bernard Lamy	*Nouveaux Elemens de Geometrie, ou dela Mesure du corps*	
3			**Apply theory: learn algebra**
	Francisci Schotenii	*Commentarii*	Descartes' Geometry
	Abr.de Graaf	*Algebra oder Stelkunst*	
	Von Kinckleysen	*Algebra ofte Stelkunst; Geometria ofte Meetkonst*	
	De grondr	*Der Meet-konst*	
	Batrovv	*Lectionibus Geometricis*	Mathesi Infinitorum
	Nevventiit	*Analysi Infinitorum*	
	Marquis d' Hospital	*Analyse des infiniment petits*	
	Johann Christoph Sturm	*Mathesi Enucleata*	Neoterici, Archimedes, Apollonio

4			**The learning of particular disciplines**
	Des Chales	*Mundo Mathematico*	
	Zyn	*Natuurlyke gedaante*	Geheele Mathesis
	Abraham de Graaf		Geheele Mathesis
	Tacquet	*Opera*	Arithmetica, Geometrie
	Tacquet		Astronomie
	Kepler		Astronomie
	Seth Ward	*Astronomia Circularis & Elliptica*	Astronomie
	Blaev	*Atlante*	Geography
	Dapper/Mallet	*Die Geographia Universalis Varenii*	Geography
	Zahn	*Oculo Optico*	Optics
	Kepler, Cavalerius, Faber, Cartesius, Hugenius &c.		Optics
	Galileo & Descartes		Mechanics
	De Felden, Pagan, Vauban,Wertmüller, Rimpler		Fortification
	Desargues, Bosse		Perspective
	Blondel, Vignola (Sturm), Goldmann		Architectur
	Boyle	*Utilitas Philosophiae Experimentalis*	Physica
	Sturm	*Collegii Experimentalis*	Physica
	Verheyen, Bidloo		Neoterici, Anatomie
	Mangeti	*Biblitheca Anatomica*	Anatomie
	Lemery	*Cours de Chymie*	Chymia
	Agricola, Ercker/Olaus Borichius	*Docimastica oder Probier-Kunst*	Metallen und Mineralien
	Jungnickel	*Clavi Machinarum*	Mechanics
	Boeckler	*Theatro Mechanico*	Mechanics
	Weigel	*Haupt-Stände*	
	Rohault	*Physica*	Physica
	Hamel	*Philosophia Vetus & Nova*	
	Sturm	*Philosophia Eclectica*	

[Source: E. W. von Tschirnhaus, *Gründliche Anleitung zu nützlichen Wissenschafften* (Frankfurt and Leipzig, 1708)]

3: Title page from E.W. von Tschirnhaus's *Gründliche Anleitung zu nützlichen Wissenschafften* (Frankfurt and Leipzig, 1708)



E. W. de T

Gründliche Anleitung
zu nützlichen Wissenschafften
absonderlich
Zu der
MATHESI
und
PHYSICA
Wie sie anitzo von den Gelehrtesten abgehandelt werden.
Andere Aufflage vermehret und verbessert.

Franckfurt und Leipzig/
Zu finden bey Hieron. Philipp. Rieſcheln/
Buchhändlern/1708.

Courtesy of *Franckesche Stiftungen* (Halle): BFSt: 129 D 9b [41]

4: Members of the Berlin Academy of Mathematics and Physics with correspondence in Francke's archive (1701-1727)

Member name	*Dates*	*Became Member*	*Origin, Main Residences*	*Letters in FS archive*
Gottfried W. Leibniz	(1646-1716)	Founder	Leipzig, Hannover	12?
Daniel Ernst Jablonski	(1660-1741)	Founder	Danzig, Lissa, Königsberg, Berlin	500+
Gottfried Kirch	(16??-1710)	11.07.1700 OM	Guben, Berlin	1
Conrad Mel	(1666-1733)	20.01.1701 OM	Bad Hersfeld, Königsberg	19
Johann Fabricius	(1644-1729)	11.03.1701 OM	Altdorf/Nürnberg, Helmstedt	80
Philipp Müller	(1640-1713)	11.03.1701 AM	Sangerhausen, Schul-Pforte, Jena	5
Maturin Veyssière Lacroze	(1661-1739)	11.03.1701 OM	Nantes, Basel, Berlin	7
Johann Andreas Schmidt	(1652-1726)	11.03.1701 AM	Worms/Augsburg, Jena, Marienthal	2
Christian Maximilian Spener	(1678-1714)	11.03.1701 OM	Frankfurt/Main, Halle, Giessen, Berlin	2
Johann Friedrich Sturm	(16??-1702)	11.03.1701 OM		
Friedrich Hoffmann	(1660-1742)	01.04.1701 AM	Halle, Jena, Berlin	4
Christian Walter	(1655-1717)	08.07.1701 AM		
August Hermann Francke	(1663-1727)	12.10.1701 AM		
Ferdinand Helfreich Lichtscheid	(1661-1707)	12.10.1701 OM	Würmling/Regensburg, Wien, Cölln/Spree	11
Hiob Ludolf	(1624-1704)	12.10.1701 AM	Erfurt, Leiden, Frankfurt/Main	65
Johann Franz Buddeus	(1667-1729)	01.12.1701 AM	Anklam, Jena, Halle, Gotha	132
Christoph Cellarius	(1638-1707)	01.12.1701 AM	Schmalkalden, Jena, Halle, Weimar, Zeitz	2
Leonard Christoph Sturm	(1669-1719)	21.07.1702 AM	Altdorf, Wolfenbüttel, Frankfurt/Oder, Blankenburg	14
Ernst Salomon Cyprian	(1673-1745)	02.04.1703 AM	Ostheim/Rhön, Helmstedt, Gotha	5
Samuel Reyher	(1635-1714)	29.09.1702 AM		
Joh.Leonard Frisch	(1666-1743)	06.12.1706 OM		
Charles d'Ancillon	(1659-1715)	09.05.1707 OM	Metz, Paris, Berlin	14

Joh.Michael d.J.Heineccius	(1674-1722)	09.05.1707 AM	Eisenberg, Jena, Helmstedt, Halle	3
Gottfried Wegener	(1644-1709)	09.05.1707 AM	Oels, Königsberg, Frankfurt/Oder, Halle	2
Louis Bourget	(1678-1742)	??	Nimes, Zürich, Neufchâtel	18
Marquard Ludwig Printzen	(1675-1725)	07.08.1710 OM	Berchingen, Moskau, Halle, Berlin	4
Christian Wolff	(1679-1754)	08.01.1711 AM	Breslau, Halle, Marburg	1
Michael Lilienthal	(1686-1750)	25.01.1711 AM	Liebstadt, Königsberg	1
Heinrich Jakob v.Bashuysen	(1679-1758)	09.03.1712 AM	Hanau, Leiden, Hanau, Zerbst SPCK	14
Joh.Christoph Wolf	(1683-1739)	06.04.1712 AM	Wernigerode, Hamburg, Wittenburg	1
Samuel Grosser	(1664-1736)	30.06.1712 AM	Pasckerwitz/Schlesien, Leipzig, Görlitz	4
Johann Arnold Pauli	(1682-1741)	30.11.1712 AM	Königsburg, Feldpred.-Russland, Memel	16
Christian August Schlegel	(1667-1722)	30.11.1712 AM	Saalfeld, Coburg, Jena, Gotha	3
Berhard Walter Marperger	(1682-1746)	12.14.1715 AM	Hamburg, Halle, Nürnberg, Dresden	54
Samuel Faber	(1657-1716)	03.10.1715 AM	Altdorf, Nürnberg	1
Jac.Paul Freiherr v.Gundling	(1673-1731)	?? OM Präs: 1718	Kirchsittenbach, Schulpforta, Berlin	2
Johann Gerhard Meuschen	(1680-1743)	08.11.1719 AM	Osnabrück, Jena, Hanau, Coburg	2
Christoph Langhansen	(1691-1770)	29.11.1719 AM		6
Joh.Gustav Reinbeck	(1683-1741)	03.07.1720 OM	Celle, Halle, Berlin, Schönwalde	10
Christoph Matthaus Seidel	(1668-1723)	03.07.1720 OM	Weissenfels, Schulpforta, Schöneberg, Berlin	12
Michael Alberti	(1682-1757)	??	Nürnberg, Halle	1
Christian Gottfried Hoffmann	(1692-1735)	19.06.1726 AM	Lauban, Leipzig, Halle, Frankfurt/Oder	1
Daniel Friedrich Hoheisel	(1698-1732)	??	Danzig, Leipzg, Halle	1
Johann Burkhard Mencke	(1674-1732)	19.06.1726 AM	Leipzig, Halle	1
Jakob Karl Spener	(1684-1730)	19.06.1726 AM	Frankfurt/Main, Leiden, Halle, Wittenberg	1

5: Gottfried Wilhelm Leibniz's letter to Philipp Jakob Spener, June 8, 1700 (Berlin)

Highest worthy and learned Sir,

I am sending back Herr von Tschirnhaus's beautiful thoughts concerning a *Gründliche Anleitung zu nützlichen Wissenschaften* with my indebted gratitude; I would have wished that they were more extensive and that he, so as with others before him, would be more oriented towards the specifics (*ad Speciala*). But there are certainly already many good and useful things in here. In the meantime, I have also received a letter from him and see that he has also sent me an exemplar of the text.

I wish that he would be less inclined to hold his beautiful things to himself and could be made to share from time to time, perhaps monthly, something with the common way (*mit dem gemeinen Wesen*). People easily dismiss such things and so many wonderful thoughts become suddenly lost as a result.

Aside from this it is especially to be praised that one builds up the sciences toward virtue (*dass man Scientiam ad virtutem richte*); this is the direction that my thoughts are going in. It will happen through nothing other than a good education (*Erziehung*). Therefore, it is to be wished that the holy Herr Weigel, Francke and other well-intentioned people's projects and suggestions should be realized and, wherever necessary, improved upon—and that they allow themselves to be represented so that, at the same time, the useful purpose is understood and applauded by people in the world—and to refrain from allowing all these good things to remain as mere wishes.

Before I leave Berlin I will have the honor of saying goodbye to you in person and always remain…

Gottfried Wilhelm Leibniz

[Source: Gottfried Wilhelm Leibniz, *Sämtliche Schriften und Briefen*. First Series: *Allgemeiner, Politscher und Historischer Briefwechsel*, Volume 18: January – August 1700 (Berlin, 2004): 703-704. Translated from German.]

6: Frontispiece from Conrad Mel's *Thoughts Concerning a Universal Character*

Courtesy of *Franckesche Stiftungen* (Halle): AFST/W XI/-/3

7: Frontispiece and title page from Claude Fleury's *Die Sitten der Israeliten* (Hannover, 1709)

Courtesy of *Franckesche Stiftungen* (Halle): BFSt: 64 F 32

8: Frontispiece and drawing of a model from Christoph Semler's *Der Tempel Salomonis* (Halle: Waysenhaus, 1718)

Courtesy of *Franckesche Stiftungen* (Halle): BFSt: VERL:2315

9. Semler Lesson on Optical Instruments

Optica is about direct seeing, what happens through a straight line.
Catoptica is about reflected seeing, what happens through a mirror.
Dioptrica is about refracted or broken up seeing, what happens through polished glass and through other diaphana.
Perspectiva is about providing evidence for an object by how it appears.
Anamorphotica is about optical presentations using polyedra specula, lylindica conica etc.

Technica
for the preparation of 3 basins,
for the testing of the glass for polishing
for putting together the glass with the instruments

1) Tabur est vel (Astonomicy Coelestir) vel terrestir
This is comprised of 4 glasses, 3 Ocular and 1 Objective Bluste (?)…
What the coverings and openings are. How one uses them.

2) Perspectiva
Its ocular is a concave vitrum; in addition, how a small Tubur can be used in it.

3) Laterna magica. Why it is called magica.
With this an illuminated mirror or lamp that is free of movement and that uses convex glasses can present a picture painted on glass on a wall on the other side of the room.

4) Camera obscura
It is a four cornered box; can also take other shapes and be made out of other materials. On it is a converse glass, at the back a white wall. How one makes camera obscuras using another art.

5) Prism
Makes all different kinds of colors. Through it one can make an object short and long and see the appearance of an amphitheater.

6) Microscope
Makes the smallest things larger, different ways with different instruments through which one can observe a hair, stems and other pigments in a tubular capillary.

7) Plane Speculum
Under it one sees the object in its normal size, the mirror can be small and large and one moves the object forward from the right or the left, or so far until it appears to be behind the mirror etc.

8) Concave Speculum

When the eye of a human is within the center of the mirror, he will see himself large and upright behind the mirror, curving forward; if he stands direct in the center, he will see himself small and turned around in the mirror.

9) A Convex Speculum burns and enlarges. The object will be depicted every time smaller than it is behind the mirror …

10) A Cyclical (?)Speculum makes the object very long and small because it has… a mirror that allows the object to be larger than it is naturally and also has convex mirrors that make the object smaller.

11) A Conical Speculum makes the object not only small, but also elevated because it is nothing other than a reflective mirror ...

All kinds of mirrors are made out of glass and metal; one makes them as well out of wood and then covers them with Marin-glass or with a mirror-foil and a bit of chalk. …

One also has vexir mirrors.

12) Vitrum lauticum
They are either convex on one or all sides. The power to burn comes from concentrating many rays of the sun in one point.

What should the focus be by converse glasses?
What is the virtual focus of the concave?
At this point all of the different kinds of polished glass, also those that are blown, are shown.

E.g. 1) Plane, 2) Plan und Convex 3) auch beyden Seiten convex aber ex diversis patinis 5) convex un concav 6) plan und concav 7) concav und concav, 8) concav und concav ex diversis globulis 9) polyedra etc.

Exercises and still more instruments …

a) Cubus vitreus to show the refraction. A: cut figures out of paper and stick them to a beer glass and pour water over them

b) oculus artificialis

c) Common Glasses. Hollow Glasses pro minoribus, Staar Glasses.

d) Glass pro minoribus.

e) Polyedron. So that the object is increased 24 times.

How to polish concave, convex, large and small.

Of glass polishing, from model to the containers, to the globes upon which the concave is polished. Of the different arts and manners of polishing.

…

Here also the following things are said:

1) our eye is like a mirror, very much like a camera obscura, wherein all objects are presented. It has the following parts: a) pupils…b) iridem… c) 2 nerves… d) humores…
2) Seeing happens by taking the form of an object into the eye, like in a mirror; in the form of a cone or pyramid, the mirror is the eye, the vahir is the top surface of the object.
3) A shadow is an absence of light; it retains the form of the body that it resembles…the shadow of earth makes the night.
4) Darkness existed before light because God created light out of darkness.
5) Light pleases the eye because the seeing-spirit only has similitude with light; the darkness produces fear because light is what the seeing-spirits need for nourishment.
6) Black and white are the main colors, the rest are only a mixture of light and shadow.
7) Seeing correctly requires

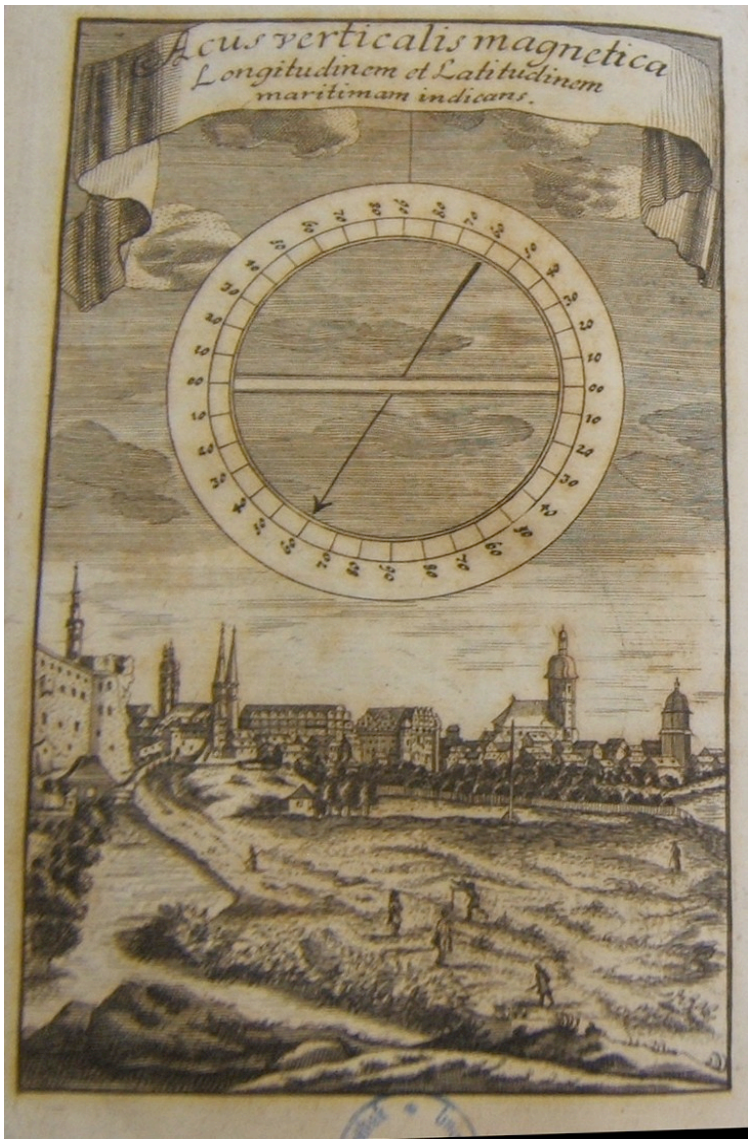
a) rationality of the soul derived from reason, attention and solid exercise of the anima (*Gemüth*);
b) rationality of the eye (ratione oculi ipsig) so that it is healthy and without movement;
c) rationality of the object (ratione objecti) so that it can be presented to the eye in the proper style, time and manner and not with too much light;
d) rationality of the lens (ratione diaphani) so that it is moderately illuminated and free from errors.

8) A mad, afflicted or angry person does not see the object correctly a) because his soul does not have the proper strength and renounces reason; b) because the movement of the *Gemüth* is so strong that it confuses and distracts the seeing spirits.
9) Old people lose their sight gradually because the seeing spirits become weaker and fewer and at the same time the cornea becomes harder and thicker.
10) To the passengers of ships it appears as if the ocean is moving and this is because of the movement of their eyes, which need to be held still and calm to see correctly.
11) Glaucoma is when the eye crystals lose their natural colors.
12) Drunk people see everything double because they confuse the seeing spirits and reverse the eyes so that the pictures of objects that fall into the two eyes cannot become unified into a single model or example.
13) In the sun and everywhere that is very bright, one cannot see correctly because this object presents too much (an all too large) light to the eyes.
14) Through a red glass, everything looks red because of the diaphonum of its colors transmits the appearance of the object to the eye and the radu visui that come into the eye take on the color of the lens.
15) The sun shines greater in the morning than in the afternoon because one looks through a thick haze, which makes the object appear larger.

16) One can see no further than four miles across the earth because the earth has a curvature and around four miles noticeably begins to bend.
17) One closes one eye when one aims to shoot because with one eye one can best grasp the straight line of the bullet, something that is impossible with both eyes.
18) The large amount of light and sunshine make it so that during the day one cannot see the stars; by large solar eclipses and in a deep shaft, one can see them.
19) When one observes something very green for a long time, afterwards everything will appear green because the color green has been deeply impressed on the eye and this does not disappear so easily.
20) When one sees the half of a rod in water through a double lens, the same thing appears thicker and more curved than another.
21) Through the smoke from hot coals objects appear especially noteworthy because the diaphonon move themselves.
22) With a drunk everything moves in a circle because the seeing-spirits in the nerves are stirred up into a vapor and mostly bump into one another.
23) A fire shines brighter by night than by day because the eye that is closest to the fire cannot distinguish illuminated air from the fire and because the eyes can stay open longer in the dark. That is why one also likes to stand in the dark.
24) By one who is yellow, everything appears yellow because his eye crystal is unhealthy and damaged.

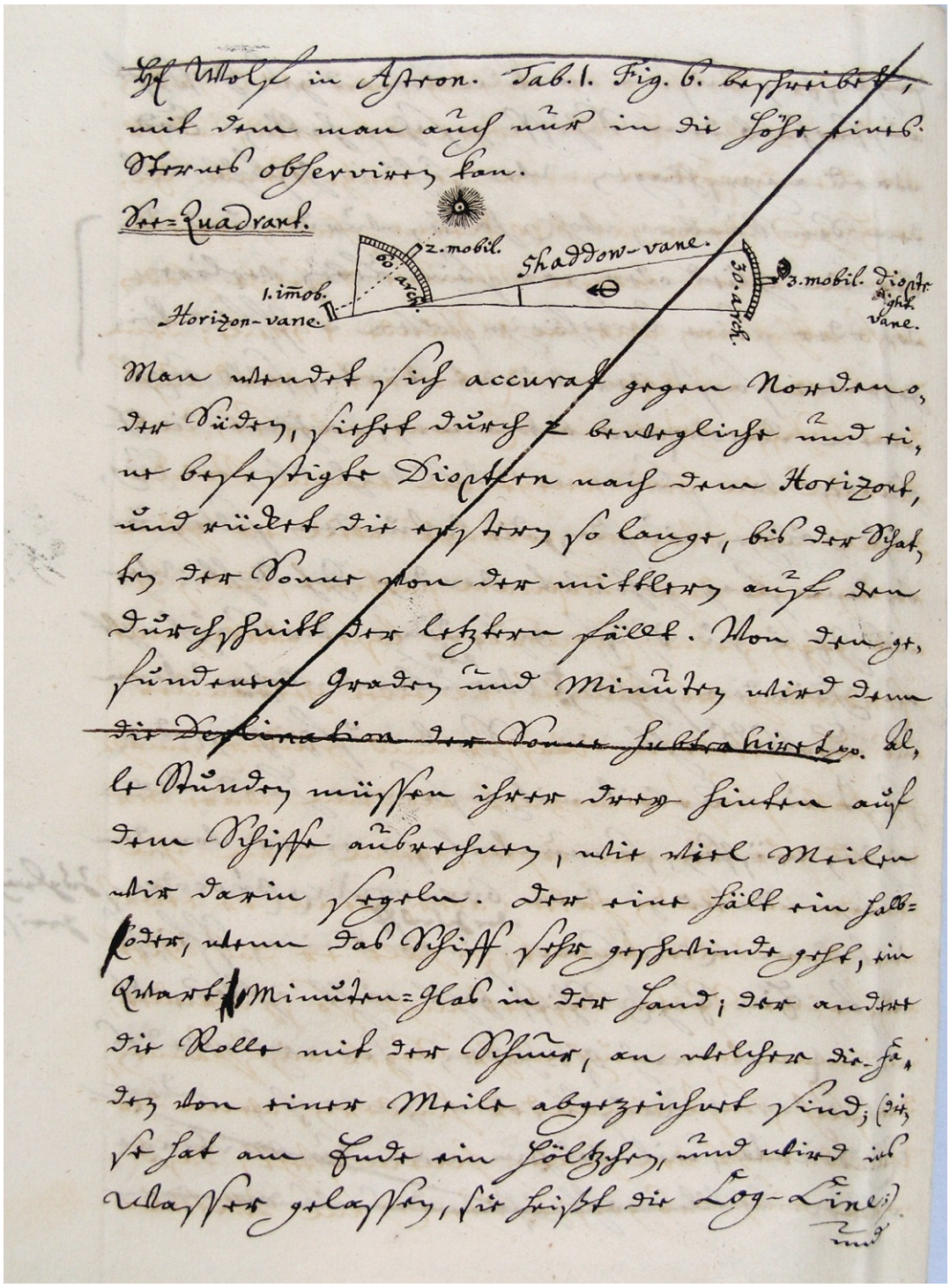
[Source: AFST/H E 61 *Semler Lehrplan*, 497-506. Translated from German.]

10. Frontispiece from Christoph Semler's *Methodus Inveniendae Longitudinis Maritimaee per Acus Verticales Magneticas* (Halle: Waysenhaus, 1723)



Courtesy of the *Franckesche Stiftungen* (Halle): BFSt: VERL: 1831

11: Excerpt from Christoph Theodosius Walther's letter to *Pädagogium* pupils (June 19, 1725)



Courtesy of *Franckesche Stiftungen* (Halle): AFSt/M 1 B 2:21

12: Christian Wolff's assessment (*Gutachtung*) of the Christoph Semler / Christian Eberhard *Methodus Inveniendae Longitudinis Maritimaee per Acus Verticales Magneticas* for the Academy of Science in St. Petersburg

[Weil Herr Pastor Eberhard von mir gefordert hat, dass ich ihm seine Mitteilung über die Erfindung seiner Meeresausdehnung veröffentliche; dank dessen ich damit bezeugen und offen bekenne, dass, meiner Meinung nach, mit der Abweichung der vertikalen Nadeln gegen Osten, man die Meeresausdehnung aufstellen kann:

1) Wenn die Nadeln so gross sind, dass man die Abweichung akkurat zeigen kann,
2) Wenn durch einen geraden Strich oder durch obere Observation im voraus wissend, wie gross die Abweichung in jedem Meridian ist, und zwar (wie ich hoffe, dass es darin einen Unterschied gibt) unter jedem Breitengrad,
3) Wenn bestätigt wird, auf welcher Art und Weise die Abweichung an jeder Stelle zu einer bestimmten Zeit sich ändert.

Und so ist anzunehmen, dass mit den von Herrn Eberhard erfundenen Instrumenten auf dem Meer Untersuchungen durchgeführt werden können.]

Because Pastor Eberhard requested me to circulate information about his discovery of a device for navigating at sea, I am willing to testify that, in my opinion, because of the variation of the vertical needle when pointed eastward, one can deploy the device:

1) if the needle is large enough so that one can accurately show the variation,
2) if through a straight line or through other observations it is known in advance how large the variation along each Meridian is and (how I do hope there is a difference) along each degree of latitude,
3) if it is proven in what way the variation in each place changes at a given moment of time.

And so, I suspect that with the instrument Herr Eberhard has discovered investigations can be conducted at sea.

Halle, June 15, 1720

Christian Wolff
Royal-Prussian Court Advisor

[Translated from Russian into German by Bärbel Vinz, Latina August Herman Francke. Source: Christian Wolff, *Briefe von Christian Wolff aus den Jahren 1719-1753: ein Beitrag zur Geschichte der Kaiserlichen Academie der Wissenschaften zu St. Petersburg*. (St. Petersburg: Eggers, 1860): n. 152, pg. 239.]

13: Frontispiece and title page from the Halle Orphanage's *Graphice* guide
[*Gründlicher Unterricht Von der Graphice. Oder Zeichen- und Mahl-Kunst* (Halle: Waysenhaus, 1717)]

Courtesy of *Staatsbibliothek zu Berlin Preußischer Kulturbesitz*: Nu 4726

14: Excerpt from "Semler" painting and drawing guide

[Note the use of the same categories Wolff employs in his *Anfangs-Gründe aller Mathematischen Wissenschaften* in the organization of the lesson: Explanations (*Erklärungen*), Experiences (*Erfahrungen*), Extras (*Zugaben*) and Commentaries (*Anmerckungen*).]

1. Explanation

1) The art of drawing and painting (*Zeichen und Mahlkunst*) is the mechanical science of creating perfectly similar representations of all the particular features of a body and other things that can be placed on an elevated surface and presented through figural concepts using lines, colors, strings, brushes and all kinds of materials.

Commentaries

a. How this art has been titled in other languages one can read in Joh. Schefferi *Graphice* and in a tract called *Basic Lessons in Drawing and Painting.*[1] Idem: Davis' experienced artist (*Kunsterfahrene*) and curious (*Curieuser*) and signmaker (*Schildener*) and painter (*Mahler*).

b. Painting and drawing should be called the same thing considering their similar etymological origins (John: Schefferi Graphic; Geor.Andr: Boechlers *Kunstverständiger Discourse von der Mahlerey*) but many painters, in light of their undertakings, make notable distinctions between them. … But especially since both are necessary in order to be a good painter, one finds both brought together in a general definition.

c. Only certain things should be attempted when painting. …

d. The division of a painting into its many categories is rooted in the following distinctions:

> 1. The observation of the materials of the colors that one paints with. Oil painting, water colour painting, al fresco, with dry colors….
>
> 2. Observation of the materials that one paints upon—like allatempera al fresco. Emaille. Glass painting.
>
> 3. Observation of the manner in which the colors are put onto the canvas. ...
>
> 4. Observation of the things that will be portrayed. Portraits, histories, landscapes, flowers … (Joh. Scheffer's Graphice S. 10. 20 Lessons from drawing and painting, chapter two).

[1] This is most likely a direct reference to the Halle Orphanage's printed *Graphice* guide.

5. Observation of the real objects that one seeks to represent in the picture. Painting from nature, from one's own invention, copying.

2. Explanation

S.2.) A drawing is nothing other than what has been transmitted through horizontal lines to an elevated surface or plane that are similar to the figure of a body.

3. Explanation

S.3) The resemblance of a picture is the agreement of the same with the certain attributes of the body being pictured, as if he placed the body himself before his eyes

Extra

The certain properties of all corporeal things are especially the following:

1) Extension, 2) Proportion, 3) Light and Shadow, 4) Perspective 5) Color 6) Expression-movement of the *Gemüth* 7) Situation

1) The spreading out of something into a certain space. Extension.
2) The remonstrance of something in relation to another. Proportion.
3) The darkening and lightening of an object and its colors. Light and Shadow.
4) The different representations and manipulations of a figure according to experience and position. Perspective.
5) The color.
6) The movement of the *Gemüth* and the body. Expression.
7) The positioning. Situation.

1. Experience

S. 4) When one sets a cubum (*Würfel*) on a table illuminated with painter's light, the lowest superfice or base of the cube will appear like a quadrast (*Vier Eckes*) containing four right angles and four lines that are the same size (Wolffs *Beginner's Guide to Geometry* Section 20). In the same way, the first quality of a body that falls into the eyes, namely its extension (*Ausspannung*) in length and width, from which it acquires a place on all sides, and where the same extension ends, will one take a line as true.

4. Explanation

S. 5) The lines in the art of painting and drawing are the external outlines and boundaries which demarcate the stretched out room of a thing, including its length, width and thickness (S. 4) and distinguish it from other similar bodies or even from different kinds as a special thing. They are called by painters Umriβe, Umzuge, contours, termini and also Grund-Riβe.

Extra

When one wants to put together an accurate drawing of something on paper as it exists in nature, then a Riβ or drawing, Der sein, delineation, must be put forward, the art and manner of this drawing and the rules those experienced in this work have developed, is called especially the art of drawing (ars delineanda sive graphica).

Commentaries

a) One can make very clear sketches of bodies with corners, but with round or dissimilar figures, one must first imagine them in the *Gemüth*. The first (kind of bodies) one calls known, certain, affirmed, but the unknown ones are unknown, doubtful, fleeting transmissions.

b) Aside from this, observation of the placement (or situation) in which the sketch is made affects differences in expression and appearance, …. This only becomes clear to artists who combine verbal, visual and practical things they have learned and who are properly constituted.

c) Finally, just like different kinds of bodies and their figures cannot be drawn in a one way with lines because they do not use their space in the same way, so must the painter learn from geometry and be able to name the different kinds of lines, the different ways in which they can be placed together and the different works and figures that come of this placement. Therefore it is important at least to consider the thing using geometrical problemata…

5. Explanation

S.6) A geometrical line is certain line or stripe whose beginning and end is only a point, which has a certain length but no special width.

[From AFST/H E 61 *Semler Lehrplan* pp. 665-676. Translated from German.]

15: Semler lesson topics (bold topics also covered in Wolff's *Anfangsgründe*)

I. Models and Instruments

Das Uhrwerk
Modell des Hauses
Modell des Wagens
Der Tuchmacher Stuhl
Vom Schiffe
Von der Festung und ihren Theilen
Vom SalzKoth und Salzwesen
Von den Mühle
Vom Bergwerck
Vom Drechsler
Von der Stadt Hall
Von der Glasshütte
Von der Buchdrucherey
Brauhaus
Das Modell des Backhaus
Blumen und Baumgarten (in Model)
Vom Chymischen Laboratorio
Instrumentis Mathematicus
Optischen Instrumenten
Pferdschmuck
Fischer Instrumenten
Magnet und Compass
Von der Mechanica
Model einer Stadt
Von der Hebelbank
Honigbau/Vielzucht/Ackerbau
Von den Barometris, Thermometris, Hygrometris
Von den Wasserkünsten
Astronomia Mechanica
Von der **Astronomia** bey Gelegenheit damalige Finsterniss

II. Naturalia

Vom Tuch und Zeugen an Wolle
Leinen Zeuge
Seidenen Zeuge
Von den Farben von dem Mahler
Von allerhand Arten der Steine
Sceleton/Anatomie
Das Pferd
Von dem Semi metalles sive Mineralibus
Gewürtze
Würzeln Radices et Gummata
Semina
Holz
Fisch
Arten der Vogel
Arten der Thiere
Vom Papier
Vom Leder

III. Neither Model nor Naturalia

Gewichte
Maase
Munzten
Calender
Wappen
Grundriss eines Gebaudes
Zeichen und Mahlkunst

16: Pietist orphanages, affiliated individuals and related primary materials

The following list includes Pietist orphanages that conform to the criteria I discuss in Chapter Eight. In addition to the location and founding date, I have listed the names of those individuals involved in starting and/or maintaining each institution. Wherever possible, I have included the signatures of relevant archival materials—including letters, reports specifically printed about these institutions and tracts printed on their own institutional presses.

Location: **Augsburg (f. 1723)**

Affiliated Persons: Gottlieb Spitzel
Samuel Urlsperger (1685-1776)
Johann August Urlsperger (1728-1806)

In AFST:

ALMW/DHM 5/7 : 54-55, 57, 58, 59
Urlsperger to Ziegenbalg and J.E. Gründler (1712, 1713, 1718, 1732)

/M 1 C 8: 31 C. B. Michaelis to Urlsperger (1715)
/M 3 A 2: 2-4, 6, 8 Urlsperger to G.A. Francke (1730)
/M 3 A 2: 12ab, 13, 14ab, 21c, 23 Urlsperger re: *Missionswerk* (1730)
/M 3 G 6: 38, 55
/M 3 H 3: 82
/M 3 H 6: 24, 99
/M 3 H 8: 94a
/M 3 H 9: 80
/M 3 H 11: 61
/M 3 H 16: 75 List of Donations from Urlsperger (1740)
/M 3 H 17: 42, 108
/M 3 H 19: 66
/M 3 H 20: 4
/M 3 H 22: 138
/M 3 H 24: 90
/M 3 H 25: 36
/M 3 H 38: 98 List of Donations from Urlsperger (1746)
/M 3 H 29: 91 List of Donations from Urlsperger (1746)
[...]

In STAB/F:

STAB/F 21, 2, 1/7: 1 – 109 letters from Urlsperger to A.H. Francke (1710 to 1727)

STAB/F 30/35: 23 From London (1712)

Bautzen (f. 1698)

Affiliated Persons: M. Martin Grünwald (1664-1716)
Henriette Katharina von Gersdorf

STAB/F:

STAB/F 1a/2B: 4 A. H. Francke to H. J. Elers re: Grünwald, Bautzen (1704)

Bunzlau

Affiliated Persons: Gottfried Zahn
Pastor Woltersdorf

Printed on Orphanage Press:

Erste Nachricht von einer auf Gr. Königlichen Majestät allergnädigste Concession angefangenen Waisen und Schul Anstalt zu Bunzlau in Schlesien Welche sich auf den Fond der Göttlichen Vorsehung gründet. Mit beigefügten Gedanken von dergleichen Unternehmungen. Bunzlau: Waysenhaus, 1754; reprinted each year until 1777.

Herrsfeld (f. 1709)

Affiliated Persons: Conrad Mel (1666-1733)

STAB/F:

STAB/F 15, 1/5: 1 Mel to Francke (1706)
STAB/F 15, 1/5: 2 Mel to Francke re: plans to start an orphanage (1707)
STAB/F 15, 1/5: 3 Mel to Francke re: building of the orphanage has commenced, evangelical mission, description of a longitudinal device (1709)
STAB/F 15, 1/5: 4 Mel to Francke re: Hersfeld Orphanage and plans to send a student to Halle to learn the teaching methods of Francke's schools (1709)
STAB/F 15, 1/5: 5 Mel to Francke re: pleased that Francke will tell potential donors about the orphanage in Hersfeld (1709)
STAB/F 15, 1/5: 6 Mel to Francke re: Hersfeld Orphanage and schools (1709)
STAB/F 15, 1/5: 7 Mel to Francke re: *missionarius evangelicus*; copperplate engraving from his book *The Tabernacle* (1709)
STAB/F 15, 1/5: 8 Mel to Francke re: orphanage (1710)
STAB/F 15, 1/5: 9 Mel to Francke re: orphanage, selling *naturalia* collection (1710)
STAB/F 15, 1/5:10 Mel to Francke re: sending a catalogue of the *naturalia* he's selling; has also sent the catalogue to D.E. Jablonski (1711)
STAB/F 15, 1/5:11 Mel to Francke re: news report from orphanage—please circulate to inspire more donors; decision re: *naturalia?;* news re: various scientific projects (1711)

STAB/F 15, 1/5:12 Mel to Francke re: *naturalia* (1711)
STAB/F 15, 1/5:13 Mel to Francke re: *naturalia* (1711)
STAB/F 15, 1/5:14 Mel to Francke re: *naturalia* (1711)
STAB/F 15, 1/5:15 Mel to Francke re: Hersfeld Orphanage report, *naturalia* (1712)
STAB/F 15, 1/5:16 Mel to Francke re: orphanage report, Canstein's Bible press (1713)
STAB/F 15, 1/5:17 Mel to Francke re: orphanage report, student from Halle teaching in Hersfeld Gymnasium (1723)
STAB/F 15, 1/5:18 Mel to Francke re: orphanage report, mission (1720)

StAB/F 11, 2/9: 1 Daniel Ernst Jablonski to Mel (1692)

Orphanage Reports:

Bericht wegen derjenigen Gaben, welche die herßfeldischen Waysenkinder von gutthätigen Christen empfangen haben. Hersfeld, 1763-1770.

Langendorf (Weißenfels) (f. 1710)

Affiliated Persons: Christoph Buchen (1678-1727)
Christoph Andreas Chryselius (1671-1747)
Johann Wilhelm Kruckenberg (??-1741)
Johann Michael Schumann (1666-1741)
Georg Güntner

In AFST/F:

/H A 107: b 30-34, 53-55 Schumann
/H A 107 b 45-46 Schumann
/H A 170: 42 Chryselius to A.H. Francke (1717)

/H C 49: 2 Güntner
/H C 796: 19 Chryselius to A.H. Francke (1720)
/H C 796: 27

/H D 79, 99-101 Schumann

/H D 94 b 62-63 Christoph Buchen: *Einfältige Gedanken zur seligen Erbauung in unserem Christentum uber die gute Ordnung der Bienen*
/H D 95, 429-35 Schumann

/H K 20 b 81 & 85
/H K 25 b 185

/M 1 C 2: 30 J.E. Gründler to Schumann from Tranquebar (1709)

/M 3 G 10: 83 G. A. Francke (1734)
/M 3 A 3: 10 Cellarius (1737)
/M 3 H 14: 16 G. A. Francke (1739)
/M 3 L8: 140 G. A. Francke to Kruckenberg re: distributing copies of Halle Mission reports (1739)
/M 5 A 9: 36, 36a G. A. Francke re: Buchen (1741)

In STAB/F

STAB/F 16/4F: 10/1: Buchen thanks G.A. Francke for a donation (1728)
STAB/F 16/4F: 10/7: Buchen sermon re: Chryselius (1729)
STAB/F 16/4F: 10/5: Buchen Lebenslauf (by Chryselius)
STAB/F 1b/4F: 10/2 Johann Friedrich Franz to Ludwig Johann Cellarius re: who should follow Buchen as director of the Langendorf Orphanage (1730)

Printed Reports:

Nachricht von der gütigen Vorsorge Gottes oder kurtzer und aufrichtiger Bericht von der Auferbauung, bißheriger Unterhaltung und Zustand des bey Weissenfels zu Langendorf gelegenen Waysen-Hauses, mitgetheilt von einem Freund, der die Wahrheit bekennt. Jena, 1714; Leipzig, 1716; Leipzig, 1726

Die gnädige Vorsorge Gottes, in einer wahrhafftigen Nachricht von dem Waysen-Hause bey Weissenfels an Langendorff gelegen: Welches ein armer Fuhrmann so wohl vor Knaben als Mädgen erbauet; Daß dieselben darinne im Christenthum und andern nützlichen Wissenschaften unterrichtet, und zu allerhand Arbeit angewöhnet werden Leipzig, 1721-1723; Weiβenfels, 1747 and 1751; Leipzig, 1751

Kurze Nachricht von dem Kraft höchster Landesherrl. Concession angelegten Stifte zu Langendorf bey Weisenfels. Leipzig: Breitkopf, 1758

Kurze Nachricht von denen sämmtlichen von einander unterschiedenen Evangelisch-Lutherischen Etablissements, welche theils zu Langendorf bey Weissenfels, theils nahe bey diesem Langendorf gelegen sind. Leipzig: Köhl, 1767

Niederwiesa (bei Greifenberg) (f. 1701)

Affiliated Persons: Johann Christoph Schwedler (1672-1730)

In AFST:

/H A 168: 43-44 Schwedler to Francke

In STAB/F:

STAB/F 25/9 1-7

Nordhausen

Affiliated Persons: Johann Heinrich Kindervater (1675-1726)
Philipp Jacob Lesser
Friedrich Christian Lesser

In STAB/F

STAB/F 24, 1/25: 1 Kindervater to Francke

Printed Reports:

Kindervater, Johann Heinrich. *Eigentliche Nachricht von der Gelegenheit und Anfange des in der kayserl. fr. Reichs-Stadt Nordhausen zu erbauenden Waisen-Hauses ...*

> Vortrag 2*: Die Neue Krafft Des Beständigen Harrens auf Gott, Das ist*: *Fernere Nachricht von dem Nordhäusischen Waisen-Hause*: *Darinne sowohl die bißherige Güte des Höchsten hertzlich gepriesen; als auch die Mildigkeit vieler Christen danckbarl. gerühmet wird* ... von M. Ioh. Henr. Kindervatern .... Nordhausen, Waysenhaus, 1716.
>
> Vortrag 4: *Der Brunn des göttlichen Seegens*. Nordhausen, Waysenhaus, 1717.
> Vortrag 8: *Die Supplic der Armen*
> Vortrag 9: *Der Stadt Bestes*
> Vortrag 11: *Das Heil zur Zeit des Trübsals*
> Vortrag 14: *Gott geliehen, unverlohren*
> Vortrag 14: *Das Besuch der Waisen als einen reinen Gottesdienst*
> Votrag 15: *Der beste Freund der Welt*
> Vortrag 16: *Das bewehrte Mittel eine Stadt in Flor zu bringen*

Die wahrhafftigen Spuren des noch wirkenden Gottes, wie solche bey Erbauung und Wachsthum des nordhäusischen Waisen-Hauses eigentlich erkant ... ; in 10 unterschiedlichen Vorträgen von Johann Henrich Kindervater. Nordhausen, 1720.

Potsdam Großes Militärwaisenhaus (f. 1724)

Affiliated persons: Friedrich Wilhelm I. König in Preußen
Daniel Ernst Jablonski
Johann Porst
Johann Ulrich Christian Köppen

In STAB/F:

STAB/F 17,1/4: 10 Johann Porst to A.H. Francke re: Francke should go to Potsdam for the opening of the orphanage, D. E. Jablonski will be the Inspector (1725)

STAB/F 17,1/4: 11 Johann Porst to A.H. Francke re: Jablonski to be Potsdam Orphanage Inspector (1725)

Stargard

Affiliated Persons: Johann Wilhelm Zierold (1669-1731)
Andreas Petrus Hecker (1709-1771)

Printed on Orphanage Press:

Die Weissagung Des Propheten Obadiae, Vom Auffgang des Reiches Christi, und Untergang des Wider-Christen, in den sieben Zeit-Ordnungen des Neuen Testaments : Aus dem Grund-Text deutlich übersetzet, ... erläutert, und ... gründlich erkläret / Von D. Johann Wilhelm Zierolden, ... Franckfurt; Leipzig: Stargardisches Waysenhaus, 1719.

Kurtze Anleitung zum rechten Verstand des Catechismi des sel. Lutheri : in Fragen und Antworten denen Einfältigen zu gut mitgetheilet; nebst Luthers kleinen Catechismum. Stargard: Waisenhaus, 1721.

Stettin "an der Lastadie" (f. 1730)

Affiliated Persons: Johann Christoph Schinmeier (1696-1767)

In STAB/F:

STAB/F 19,1/16: 1 F.A. Schultz to G.A. Francke re: Schinmeier, Schule (1737)
STAB/F 20,1/4: 74 Steinmetz to G.A. Francke re: Schinmeier (1751)
STAB/F 22/6: 31 Schinmeier moving to Giessen (1751)

Printed on Orphanage Press:

Schinmeier, Johann Christoph. *Lebens-Lauff und Glaubens-Bekändtniss des Herrn Lichanofski, welches er ... in der St. Johannis-Kirche öffentlich abgeleget ... und folglich die römisch-catholische mit der evangelisch-lutherischen Religion verwechselt, an welchen eine hertzliche Vermahnung zur Beständigkeit hinzu gefüget wird*. Stettin: Waisenhaus, [1733].

Schinmeier, Johann Christoph. *Anweisung Erbaulich Zu Predigen, Worinnen XV. Hindernisses des Seegens angezeiget werden: auf Verlangen solcher, Denen es um einen reellen Seegen im Lehr-Amte zu thun ist*. Stettin: Waisenhaus, 1736.

Schinmeier, Johann Christoph. *Gespräch Einiger Hoff-Leute Von der Möglichkeit Eines thätigen Christenthums, Oder Daß man am Hofe ein rechtschaffener Christ seyn könne aus Verlangen zum Druck befördert Von Joh. Christoph. Schinmeier*, ... Stettin, Waisenhaus 1736.

Helmund, Egidius Guntherus. *Diarium pastorale oder sehr erbauliches Tage-Buch, worinne von dessen Vocation, Leiden, Gefährlichkeiten, Stärckungen, Reisen, Zuspruch, Unterredung, Besuchungen, Predigten ... überaus erweckliche Nachrichten ertheilet werden, daß es Nimanden, er sey Prediger, oder gemeiner Christ, gereuen wird, es durch gelesen zu haben*. Stettin: Waisenhaus, 1737.

Zittau (f. 1701)

Affiliated Persons: Christian Weise (Rector Zitta Gym 1678-1708)
Gottfried Hoffmann
M. Martin Grünwald (1664-1716)

Printed Reports:

M. G. Danck-Gebet Der Zittauischen Waysen: wie solches in dem daselbst neu aufgerichteten und den 3. Maji 1701. Mit grosser Andacht eingeweiheten Waysen-Hause, Wochentlich An dem Freytage Nach Mittags um 3. Uhr in öffentlicher Versammlung gehalten wird. Zittau, 1701.

Weise, Christian. *Das erste Jahr-Gedächtnüs der wohgehaltenen Bet-Woche, das ist: die wiederholte Danksagung des neuerbauten und numehr in Stand gebrachten Waysenhauses in Zittau, welches am Dienstag nach Vocem Jucunditatis MDCCI mit hertzlicher udn Christlicher Andacht eingeweihet worden, numehr aber in eben dieser Woche, durch einen Umgang der armen Kinder, allen Wolthätern wünschet recommendiret zu seyn, wird zu schuldiger Grulation an die Patronen, zu rühmlichen Erkäntnüs gegen alle Gönner; so dann auch zu getreuer Liebe gegen das gesammte Vaterland.* Zittau, 1702.

Weise, Christian. *Das Jahr-Gedächtnüs der gesegneten Bet-Woche, darinnen ehmals ein guter und erfreulicher Anfang zum Neuen Waysenhause in Zittau gemacht worden: Sol die Woche nach Vocem Jucunditatis M DCCIII. Gott zu Ehren, der alles Gedeyen darzu gegeben hat; denen Patronen zur Vergnügung, welchen die Mühwaltung wol ausgeschlagen ist; Vielen mildreichen Herzen zur Versicherung, dass Ihr Liebes Opffer viel gutes mit sich bringt. Endlich dem geliebtesten Vaterlande zur Freude, dass Gottes Gnade in unseren Mauren wohnet.* Zittau, 1703.

Weise, Christian. *Die bisherige Vergeltung des wolerhaltenen und wolversorgeten Waysenahuses in Zittau*. Zittau, 1704.

Weise, Chrisian. *Die Gottgefällige Betwoche der Gesammten Kinder aus dem Zittauischen wolangelegten Waysenhause.* Zittau, 1705.

C. W. R. *Was die Worte heissen PANEM PROPTER DEUM, sol im Nahmen des Zittauischen Waysenhauses... von den gesammten Waysenkindern im Thon: Wer in dem Schutz des Höchsten ist besungen werden*. Zittau, 1706.

Grünwald, M. Martin. *M.G. Ausführliche Beschreibung des Zittauischen Waysenhauses, und dessen Loblichster Einrichtung aus heiligen Absehen entworffen und allen welchen Gottes Väterlichen Vorsorge gebührend verwundern zu danckbarhere Uberlegung*. Leipzig und Zittau, 1710.

Züllichau **(f. 1719)**

Affiliated Persons: Siegmund Steinbart (1677-1739)
Johann Christain Steinbart (1702-1767)
Gotthelf Samuel Steinbart
Johann Christoph Wilcke
Pastor Woltersdorf

In AFST:

/M 3 H 2: 27 S. Steinbart to G.A. Francke re: donations for Tranquebar (1733)
/M 1 E 2: 119 F. M. Ziegenhagen to G.A. Francke re: pious children of Silesia reported by Siegmund Steinbart (1736)
/M 3 L 8 : 172 G.A. Francke to J.C. Steinbart re: *Hallesche Missionsbericht* (1739)
/M 3 H 22 : 7 J.C. Steinbart to G.A.Francke (1742)
/M 3 C 14: 4a G.S. Steinbart to J.L. Schulze (1791)

In STAB/F

STAB/F 30/23: 3 Isaac Hollis to A.H. Francke re: J.C. Steinbart (1727)
STAB/F 20,1/3: 5 J.C. Steinbart to Heinrich Zopf re: starting a Bible printing press in Züllichow and printing the New Testament in Greek (1737)
STAB/F 20,1/3: 6 J.C. Steinbart to Jakob Gottfried Böttcher re: giving the Halle Orphanage printing rights over Züllichow's Bible printing press (1744)
STAB/F 20,1/3: 3 J.C. Steinbart re: story of orphanage's founding to G.A. Francke (1760)
STAB/F 20,1/3: 2 J.C. Steinbart to G.A Francke (1760)
STAB/F 20,1/3: 1 J.C. Steinbart to G.A. Francke re: donations (1761)
STAB/F 20,1/3: 4 J.C. Steinbart to G.A. Francke re: money troubles (1765)

STAB/F 20,1/3: 7 J. C. Steinbart re: money troubles (1765)

Printed Reports:

Warhafftige und umständliche Nachricht Derjenigen Tropffen, Strömlein und Flüsse, so aus Gottes reicher Seegens Quelle in das von ihm selbst vor der Stadt Züllichow bey Krausche nicht so wohl zu blosser Erzieh und Unterhaltung armer verlassener Kinder, als vielmehr zu Erweckung und Stärkung des Glaubens gestifftete Waysen-Haus, Als welches einzig und allein im Vertrauen auf die herzlenckende Krafft seiner ewige Liebe und Gnade angefangen und bis auf gegenwärtige Zeit fortgesetzet worden. Seit den 12.Juli 1719 bis den 13.Sept. 1721 nach und nach gestossen; zum Preiss des Höchsten und danckbarlichsten Erkänntnis gegen die Wohlthäter aufgesetzet vom Waysen Vater Siegmund Steinbart. Berlin, 1723; 1724; 1726; 1728; 1731; 1737; 1744.

Printed on Orphanage Press:

Rambach, D. Johann Jacob. *Sieben Buß-Reden über auserlesene Texte des Alten Testaments : an allgemeinen Buß-Tagen in der Schul-Kirche zu Halle öffentlich gehalten*. Leipzig; Züllichau: Waysenhaus, 1732.

Rambach, D. Johann Jacob ed. *Des geist- und trostreichen Lehrers Sel. Johann Arnds weiland General-Superintendenten des Fürstentuhms Lüneburg, sechs Bücher vom Wahren Christenthum : Handelnd von Heilsamer Busse, herzlicher Reu und Leid über die Sünde und Wahren Glauben, auch heiligem Leben und Wandel der rechten Wahren Christen ... nebst dem Paradiesgärtenlein*. Züllichau: Waysenhaus, 1733.

Rieger, M. Georg Conrad. *Die Alte und Neue Böhmische Brüder, Als deren Merckwürdige und erbauliche Historie Zur Erkenntniß und Wiederholung, besonders bey gegenwärtiger Zeit, Der Kirchen Gottes wieder nothwendig zu werden scheinet : Aus richtigen Urkunden also hergeleitet, Daß es zugleich zu einer verlangten Fortsetzung des ehemaligen Saltz-Bundes dienen kan*. Züllichau: Waysenhaus, 1733.

Schmidt, Johann Jacob. *Biblischer Mathematicus Oder Erläuterung der Heil. Schrift aus den Mathematischen Wissenschaften Der Arithmetic, Geometrie, Static, Architectur, Astronomie, Horographie und Optic: Mit nöthigen Kupfern und vollständigen Registern herausgegeben; Als ein Anhang ist beygefüget ...* Versuch einer Anwendung der Mathematic .... Züllichau: Waysenhaus, 1736.

Lachmann, Joachim. *Die wahre Ursache der trübseligen Zeiten wurde in einer Buß-Predigt aus Jesaia 24 v. 5. 6 den 24. Mart. 1739 der Stadt-Gemeine in Züllichau vorgestellet ...* Züllichau: Waysenhaus, [1739].

Lösecken, Christoph Albrecht. *Der erklärte kleine Catechismus Lutheri: worin die Wörter kurtz und nach dem Sinn Lutheri erkläret, deren Nachdruck gezeiget und durch Anmerkungen erläutert*. Züllichau: Waysenhaus, 1739.

Runtze, Georg. *Die Großachtung der menschlichen Seele wurde am II. Pfingst-Feyertage 1739 ... aus Joh. III, 16 - 21*. Züllichau: Waysenhaus, [1739].

Evangelische deutsche Original-Bibel. Das ist, Die gantze Heilige Schrift Altes und Neues Testaments, dergestalt eingerichtet, daß d. hebr. oder griech. Grundtext u. d. deutsche Übers. Martin Luthers neben einander erscheinen. Züllichau: Waysenhaus, 1740-1741.

Frommann, Gottlieb Benjamin. *Zuverläßige Nachricht von den Büchern der privilegierten Buchhandlung des Waysenhauses zu Züllichau.* Züllichau: Waysenhaus, 1740.

Sarganeck, Georg. *Überzeugende und bewegliche Warnung vor allen Sünden der Unreinigkeit und Heimlichen Unzucht: darinnen aus Medicinischen u. Theologischen Gründen vernünftig vorgestellet wird, I. Was für Gefahr und Schaden, II. Schulden und Gerichte, und III. Für Rettungs-Mittel vorhanden. Aus Liebe und Verbindlichkeit zum menschlichen Geschlecht sonderlich aber zur studirenden Jugend auf Schulen und Universitäten mit züchtiger Feder und tiefer Ehrfurcht vor Gott entworfen*. Züllichau: Waysenhaus, 1740.

Das Neue Testament unsers Herrn und Heilandes Jesu Christi - Ē Kainē Diathēkē: dergestalt eingerichtet, daß der Griechische Grund-Text und die Deutsche Übersetzung D. Martin Luthers neben einander stehen ... mit den wichtigsten Lectionibus variantibus des Griechischen Textes, iedes Capitels reichen Summarien .... Züllichau, Waysenhaus, 1740.

Hensel, Martin. *Kleine Schriften vom Wahren Christenthum für Einfältige absonderlich auf dem Lande*. Züllichau: Waysenhaus, 1740.

Rambach, Johann Jakob. *Gründliche Erklärung des Propheten Esaiä : Darin nach einer Einleitung ... alle Theile desselben ordentlich zergliedert, und aus der Philologie und Hermeneutic erklärt, insbesondere aber den Kern aus dem weitläuftigen u. kostbaren Wercke des Campegii Vitringae*. Züllichau: Waysenhaus, 1741.

Moser, Johann Jakob. *Theologische Gedancken von der ehlichen Beywohnung unbekehrter, erweckter und wiedergebohrener Personen: Nebst des seeligen D. Speners Bedencken hievon und einem dreyfachen Anhang*. Züllichau: Waysenhaus, 1743.

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Neumann, Caspar. *Eine Sammlung von 66 Liedern ... zum Gebr. der Kinder*. Züllichau: Waysenhaus, 1744.

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Woltersdorf, Ernst Gottlieb. *Fliegender Brief evangelischer Worte an die Jugend, von der Glückseligkeit solcher Kinder und jungen Leute, die sich frühzeitig bekehren*. Züllichau: Waysenhaus, 1752.

Other sites

[The following are Pietist orphanage sites for which I have not yet determined the extent of available documentation.]

Cottbus
Görlitz
Göttingen
Grünstadt
Jena
Königsberg
Pyrmont (Waldeck) und Wildungen[2]
Sorau

[2] For a limited discussion of Pyrmont see Sträter, "Pietismus und Sozialtätigkeit" (1982): 213-215.

17: The Halle Orphanage as *Schauplatz.* Copperplate engraving by David Ulrich Boecklin (Leipzig, 1730)

Courtesy of *Stadtarchiv* Halle (Saale): II,154