

2025

# Reimagining the Potential of Feminist Epistemologies in Science: Epistemic Achievements, Social Structure, and Diversity

Piper Sledge

*University of Arizona*

psledge@arizona.edu

Collin Rice

*Colorado State University*

Collin.Rice@colostate.edu

---

## Recommended Citation

Sledge, Piper, and Collin Rice. 2025. "Reimagining the Potential of Feminist Epistemologies in Science: Epistemic Achievements, Social Structure, and Diversity." *Feminist Philosophy Quarterly* 11 (2). Article 2.

## Reimagining the Potential of Feminist Epistemologies in Science: Epistemic Achievements, Social Structure, and Diversity

Piper Sledge and Collin Rice

### Abstract

Standpoint and feminist epistemologies have provided a number of theoretical advancements concerning the ways we ought to think about the production of knowledge across scientific disciplines. Despite these theoretical contributions, in this paper, we critique what we call the “thin” application/implementation of diversity within the epistemic practices of science and academia. As an alternative, we place these theories in conversation with recent philosophy of science and Indigenous epistemology focused on the epistemic aims of communal explanation and understanding. We contend that conceptions of diversity that focus on the standpoints of individual researchers and attempts to merely “add diversity and stir” make it more difficult for these epistemic goals of science to be achieved. We then argue that for diversity to contribute to increasing the variety of explanations and promote more substantive understanding of epistemic communities requires a “thick” implementation that incorporates lessons from standpoint, feminist, and Indigenous epistemologies into the heart of scientific practices.

**Keywords:** standpoint, feminist epistemology, Indigenous epistemology, explanation, understanding, epistemic diversity

### 1. Introduction

In this paper, we provide an *epistemic* foundation for increasing diversity in science inclusive of, but exceeding, representational diversity—acknowledging that the term “diversity” is itself contentious. Specifically, we argue that diversifying science is epistemically motivated because it will improve the *explanations* and *understanding* produced by scientific inquiry. But we argue that achieving these epistemic benefits requires us to move beyond focusing on the diverse characteristics of individual researchers and focus on the interwoven and hierarchical social structures of scientific inquiry in which scientific explanations and understanding are constructed, tested, and adopted.

We build on contributions from several feminist scholars and from Indigenous epistemology to show how the philosophy of science literature on explanation/

understanding and various feminist/standpoint epistemologies have been insufficiently implemented in the context of the Western European genealogy of current scientific inquiry. Despite each of these theoretical literatures refocusing on structural aspects of scientific communities, within scientific practice—and academia more generally—social categories of identity such as gender and race tend to be treated as an aspect of the situated knowledge of *individual* researchers who are impervious to the cultural conditioning implicit in scientific training. Inclusion of diverse individual standpoints are, then, expected to lead to alternative ways of interpreting data and to infuse a degree of creativity in the generation of different explanations and understanding.

We contend that these in-practice attempts to promote diversity in science and academia would be more effective if they more robustly engaged with fundamental aspects of standpoint, feminist, and Indigenous theories. Rather than focusing solely on the characteristics (or perspectives) of individual researchers, calls for the diversification of science *must account for the complex social structures of scientific inquiry in order to effectively promote the generation and consideration of wide-ranging sets of explanations and ways of understanding*. While many feminist philosophers have noted the importance of social structures for generating scientific objectivity (Harding 1995, 2015; Longino 1990, 2002) or rational decision-making (Solomon 2001), our approach is novel in focusing on the ways that science's epistemic aims of *explanation* and *understanding* are generated, justified, and integrated by communities of scientists rather than individual researchers.

Our argument brings various feminist and Indigenous epistemologies into conversation with recent debates within philosophy of science centering on explanation and understanding. Bringing these literatures into conversations is beneficial since, we will argue, *in-practice* attempts to leverage diversity into improved epistemic outputs for scientific and academic communities have typically fallen short. First, we argue that updated views about explanation/understanding can provide unique epistemic arguments for diversifying scientific and academic communities and bolster the case for incorporating many of the social interventions suggested by feminist and Indigenous epistemologies. Second, attending to the shortcomings (and strengths) of recent attempts to diversify science can improve our philosophical accounts of how scientific communities produce explanations and understanding.

Let us be explicit about the main argument of the paper and how it will structure our discussion:

P1. Section 2: While the recent philosophy of science literature on explanation and understanding provides strong epistemic reasons for diversifying science, effectively implementing those changes requires more detailed engagement with

feminist and Indigenous investigations concerning the social structures that produce explanations and understanding.

P2. Section 3: Similarly, while feminist and standpoint epistemologies provide additional reasons for diversifying science, effectively implementing those changes requires a more detailed understanding of the social structures that produce explanations and understanding than is currently used in what we call “thin” implementations of diversity within science and academia.

P3. Section 4: In response, drawing inspiration from Indigenous epistemology, we propose a structural/“thick” implementation of these literatures that pays more attention to social structures, entrenched power relations, and place involved in the construction of scientific explanations and understanding.<sup>1</sup>

C. Section 5: We conclude that a structural/thick implementation of the lessons of standpoint, feminist, and Indigenous theories will substantially improve/deepen the explanations and understanding produced by scientific communities and academic institutions.

Unfortunately, these literatures—philosophy of science debates concerning explanation/understanding, standpoint/feminist epistemologies, and Indigenous epistemologies—have rarely been put into conversation, despite their many overlapping aims. Debates concerning social epistemology of explanation and understanding have been limited in their claims by a lack of engagement with the epistemic benefits of alternative ways of understanding that coexist with scientific practices that themselves represent distinct (i.e., Eurocentric) standpoints. Additionally, in-practice attempts to diversify academia and science to date have been overly focused on (tokenizing) the characteristics of individual researchers and, as result, have neglected many of the social structures and power relations involved in the ways that epistemic communities construct explanations and understanding. This lack of crossover is unfortunate because there is a significant potential payoff from bridging these subfields in both theory and practice. We suggest that by characterizing current normative scientific practices as only one way of understanding, rooted in a Eurocentric, masculinized standpoint, creates possibility space for imagining new ways of doing science that enhance representational diversity and give life to more complete explanations and understandings of the phenomena studied by scientists.

We first investigate the epistemic arguments for diversifying science that can be drawn from the recent philosophical literature concerning explanation and understanding, and examine where this literature would benefit from engaging more fully with standpoint, feminist and Indigenous epistemologies. We then explore how, despite standpoint and feminist *theories* highlighting many of the social structures of

---

<sup>1</sup> “Thick” here is an intentional play on the work of Geertz (1973) and Cottom (2019).

science and academia, current “thin” *implementations* of diversity, in terms of unique standpoints of individual researchers, makes the achievement of these epistemic goals much more difficult.<sup>2</sup> In response, attempts to diversify scientific and academic communities must take into account the limitations and opportunities that social structures (for which individual identities typically serve as proxies) provide. Only by addressing the structural contexts of the epistemology of scientific communities will alternative perspectives be effectively incorporated into the processes by which the broader scientific community develops, tests, and accepts different ways of explaining and understanding phenomena.

Our interest in this paper lies not in rehashing debates over the *theoretical* arguments of various feminist or standpoint epistemologies. Instead, our focus is to investigate how a more substantive understanding of the relationship between the epistemic aims of science and the lessons of feminist, standpoint, and Indigenous epistemologies suggests practices through which those aims may be more effectively *implemented in practice*. While many of the epistemic benefits we seek are evident in the expanse of feminist epistemologies and standpoint theories, attempts to diversify academic communities built around implicit logics of white supremacy and settler colonialism have largely missed the mark and have largely failed to produce the kinds of epistemic benefits envisioned by feminist scholars. Put differently, standpoint, feminist, and Indigenous epistemologies stand as an epistemic intervention that we have not actually made yet because diversity has largely been implemented by focusing on the properties of individuals rather than restructuring aspects of epistemic communities, which these theories support.

The epistemic case for diversity that we make here relies on conceptualizing scientific understanding and explanation as rooted in experience, values, and background assumptions and on adopting a culture of inquiry that includes and values ways of understanding that are currently omitted from, or marginalized within,

---

<sup>2</sup> We use the difference between thick and thin rather than between individual and social since the latter fails to capture the distinction we aim to highlight here. Individuals (and their characteristics) are one aspect of the social structure of science and the larger matrix of social structures within which science occurs. Thus, thin and thick implementations are both social conceptions of the processes of science. We aim to highlight that a “thin” conceptualization of the social aspect of science focused on additive conceptions of individual characteristics is crucially different from a “thick” conceptualization of the social aspects of science that focuses on the social structures, interactions, power relations, and places in which science happens. Thus, it is the *way* in which these approaches conceive of the social aspects of science that is importantly different, not that one is social and one is individual. Thanks to an anonymous reviewer for pressing us to be clearer on this point.

normative scientific processes, while being attentive to the power dynamics at play. After critiquing several ways that diversity has been implemented within science and academia, we lean on and honor the traditions of Black feminism and Indigenous knowledges (especially Indigenous feminisms) that have long made clear the epistemic benefits of multiple ways of knowing and their interactions (e.g., Collins 1986, 1989, 2000, 2019; Barker 2019; Cajete 2000; Dotson 2015; hooks 1989; Moreton-Robinson 2013; Kimmerer 2013; Kovach 2009; Patterson et al. 2016; L. Smith 2012). Most importantly, these epistemological cultures make clear the types of *multilevel structural* changes that must occur to decenter Eurocentric conceptions of science/objectivity and to instead establish *a context of relationships across multiple ways of knowing*, rather than an additive or inclusive model by which these ways are assimilated into (or subsumed by) Eurocentric science. By echoing and bringing together these traditions, we hope to bring renewed attention to the power of these perspectives for scholarship and change within practices of science and academia more broadly.<sup>3</sup>

The following section argues that, while recent literature within the philosophy of science suggests unique epistemic arguments for diversifying science, in-practice implementation of those arguments requires a more thorough engagement with the structural hierarchies and power relations of scientific communities. In section 3, we argue that, despite numerous theoretical advancements from standpoint and feminist scholars, “thin” understandings of diversity focused on increasing the number of standpoints of individuals have been, and will continue to be, insufficient for improving the explanations and understanding of scientific communities. Section 4 draws on Indigenous epistemology to develop an alternative “thick” implementation of diversity that draws on standpoint, feminist, and Indigenous epistemologies focused on improving the explanations and understanding generated by epistemic communities. Finally, section 5 explores empirical evidence and interventions required to discover mechanisms of change that will most effectively promote these epistemic payoffs.

## **2. The Social Epistemology of Explanation and Understanding**

### *2.1. Shifting from Individual Knowledge to Communal Explanation and Understanding*

Within the epistemology literature, a crucial shift has been moving away from the exclusive focus on individual agent’s *knowledge*—which traditionally has required

---

<sup>3</sup> Following Ahmed (2012), we aim to investigate what work “diversity” currently does in science and imagine the possibilities for deeper engagement with the full spectrum of what diversity *could* do if we shift away from implementing diversity as a type of property or resource of individuals and instead tap into the potential of relationships among multiple ways of knowing within epistemic communities.

truth, objective justification, and individual belief—toward a focus on the epistemic concepts of explanation and understanding and the ways these are produced by scientific inquiry (Elgin 2017; Khalifa 2017; Potochnik 2017; Rice 2021). There has also been a growing literature on the *social* epistemology of these concepts that recognizes the various ways they are produced (or accomplished) by groups and communities rather than individual scientists. In this section, we show how these shifts within the literature (2.1) enable novel kinds of epistemic arguments for diversifying science (2.2). We then contend that the implementation of those arguments would benefit greatly from deeper engagement with standpoint, feminist, and Indigenous epistemologies (2.3).

While knowledge tends to focus on singular propositions that are believed by individual knowers (indeed, this is the overwhelming focus of traditional epistemology), explanations and understandings are typically thought to consist of “bodies of information,” different parts (or aspects) of which might be grasped by different agents (Elgin 2017; Rice 2021). In addition, unlike the knowledge literature’s focus on believing truths about the actual world, most accounts of explanation and understanding have focused on how these epistemic aims require investigating what would (or would not) be different in various counterfactual situations (Grimm 2006; Elgin 2017; Le Bihan 2017; Potochnik 2017; Rice 2021; Woodward 2003). For example, there is a growing consensus in the philosophical literature that an explanation is constituted by a set of information that provides answers to a range of what-if-things-had-been-different questions about the phenomenon of interest (Woodward 2003). Similarly, numerous philosophers have argued that scientific understanding requires grasping how the phenomenon would be different in a range of counterfactual (i.e., possible) systems/situations (Le Bihan 2017; Khalifa 2017; Rice 2021). What is more, several philosophers of science have argued that explanation and understanding, instead of knowledge, are the ultimate epistemic aims of scientific practice (Elgin 2017; Potochnik 2017; Rice 2021).

The next piece of reconceptualizing the epistemic aims of science is to recognize that the development, justification, and adoption of explanations and understanding is produced *through the social-structural processes of scientific communities*. This has resulted in a growing literature on the social epistemology of science that argues that different researchers can focus on different aspects of the phenomenon such that the understanding of the group or community can go beyond the understanding of any individual within the group. For example, both Catherine Elgin (2017) and Angela Potochnik (2017) argue that different researchers can focus on different aspects, features, or causal patterns within a phenomenon and thereby contribute different ways of understanding that phenomenon. Similarly, on Collin Rice’s (2021, 269) account, “diverse individuals’ different ways of understanding (and explaining) the same phenomenon can all contribute different pieces to the overall

body of information that constitutes the understanding of the entire scientific community.”<sup>4</sup> In general, many epistemologists and philosophers of science have come to recognize that the epistemic achievements of a group/community can go beyond the understanding of its individual members and is a communal achievement dependent on a variety of social interactions (Boyd 2021; Delarivière 2020; Malfatti 2022; Rice 2022).

## 2.2. *Epistemic Arguments for Diversifying Science*

These developments within the philosophy of science literature make possible distinctively *epistemic* arguments for diversifying scientific practice.<sup>5</sup> Because alternative ways of knowing will recognize different possibilities as interesting, valuable, or worthy of exploration, additional perspectives and ways of knowing will (typically) be able to generate more counterfactual (or modal) information about the possible ways a system (or our world, more generally) could be and what would be different in those situations. Another important feature of this approach is that it shows how multiple conflicting explanations for the same phenomenon might improve a scientific community’s overall understanding of the phenomenon. For example, scientific modeling of complex phenomena from within different research programs, perspectives, or ways of knowing often results in many explanatory models for the same phenomenon that involve conflicting assumptions, idealizations, and representational frameworks (Longino 2013; Morrison 2015; Mitchell 2009, 2012; Weisberg 2007, 2013). Since each of these perspectives might provide information about different counterfactual situations, scientific communities that include multiple conflicting approaches will often produce a wider range of explanations and deeper understanding of a phenomenon than more homogenous communities.

The most pressing challenge for this kind of approach is to show precisely *how* inconsistent approaches, models, or theories can be interwoven so as to generate improved explanations and understanding of the phenomenon. At this point, it is crucial to remember that the generation, testing, and development of scientific explanations and understanding are achieved only via interactions among diverse members of scientific communities that take place within various kinds of power structures. Specifically, it is *the interactions between* different members of the larger

---

<sup>4</sup> Rice also draws on the work of Morrison (2011, 2015) and others to show how the use of multiple conflicting models and methods can contribute to explanation and understanding.

<sup>5</sup> While we do not claim that the above accounts provide necessary and sufficient conditions for all instances of explanation or understanding, we contend that they do capture a central feature of these epistemic achievements that is directly impacted by the diversity and social structures of science.

scientific community *within complex social structures* that integrate these various pieces of counterfactual information into a body of information that constitutes the scientific community's set of accepted explanations and overall understanding of a phenomenon. Only by looking at the social contexts that structure the ways scientists interpret and use their models/theories and how they interact with one another can we determine how (and what) the scientific community explains and understands.

In addition to expanding the range of possibilities considered by a scientific community, increasing diversity can also improve the social methods science uses to justify or accept a way of explaining (or understanding) a phenomenon (Okruhlik 1994). For example, one of the primary ways that scientific explanations are adopted is through the process of inference to the best explanation (IBE). Inferences to the best explanation have the following kind of structure:

- P1. A set of observations to be explained:  $\{O_1, O_2, O_3, \dots\}$ .
- P2. A set of hypotheses that provide possible explanations of those observations:  $\{H_1, H_2, H_3, \dots\}$
- P3.  $H_n$  provides the best explanation of the available observations.
- P4. The best explanation is typically true.
- C. Therefore, we ought to adopt/accept/believe  $H_n$ .

Much has been written concerning the details and reliability of using IBE in science. We will not enter those debates here. We do, however, wish to highlight that the strength of this kind of IBE argument is directly proportional to the range/diversity of possible explanations compared in premise two (Stanford 2006). It is also dependent on the range of observations collected and considered legitimate by the community in premise one (Okruhlik 1994). As a result, the degree of justification for the adoption of a particular scientific explanation (or way of understanding) by the scientific community directly depends on the range and variety of observations and possible explanations generated and given epistemic authority. In short, IBE only tells us which hypothesis (or explanation) *of the set of alternatives the scientific community has considered* is the most supported *by the evidence considered relevant by the scientific community*. Unfortunately, as Kyle Stanford (2003) argues, when it comes to science, *there will always be a plethora of unconceived alternative explanations that scientists have yet to think of*.<sup>6</sup>

---

<sup>6</sup> Stanford's evidence for this claim comes from the history of science in which (relatively homogenous) scientific communities have routinely failed to think of a relevant alternative theory—alternatives that would later be adopted by the scientific community.

We will not provide a solution to Stanford’s problem of unconceived alternatives (or enter further into the realism debate). We simply point out that the strength of the inference involved in any application of IBE is directly proportional to the range of observations and the number of (genuine) alternative possible explanations being considered within a scientific community. Given that different ways of knowing will collect different observations (and experiences), investigate different counterfactual situations, and develop alternative possible explanations, improving diversity will directly strengthen scientific communities’ justifications for adopting some of those explanations and understandings. Together, these arguments show how incorporating diverse ways of knowing within scientific communities will yield numerous *epistemic* benefits.

### 2.3. Implementation Challenges: From Theory to Practice

It is an important theoretical development to provide explicit epistemic arguments that show why diversifying science will result in *better science* rather than having diversification be solely a moral obligation.<sup>7</sup> While the above shifts in the epistemology and philosophy of science literatures have paved the way for some of those epistemic arguments to be developed, very little of this literature has explicitly engaged with the details of the social structures, power relations, and other aspects of the ways in which scientific communities generate, test, adopt, and integrate explanations and understanding. In other words, once we recognize that the epistemic achievements of science are social/communal accomplishments, much more attention needs to be paid to the details of science’s social structures—for example, those that have been the focus of standpoint, feminist, and Indigenous epistemologies for some time.

For example, to even be considered within the scientific community’s best explanations or understandings of a phenomenon, the observations, alternative possibilities, and interpretations offered by different ways of knowing (or perspectives) must be taken up by the scientific community and given intellectual authority within that community. In short, the collection of observations, the generation of possible scientific explanations (or hypotheses), the use of inference to the best explanation, and the integration of multiple explanations into an overall understanding of the phenomenon are all complex *social* processes whose *structures* directly promote and limit different ways of explaining and understanding the world. Only by ensuring that these social processes encourage the generation, consideration,

---

<sup>7</sup> While we are focused on the epistemic benefit of diversity in this paper, we also agree with Gardner-Vandy (2024) that the moral obligation is to enhance diversity in STEM because it is a correct action. We add that it is not the *only* way to justify sustained attention to diversity and inclusion within STEM.

and respect of competing (and sometimes conflicting) experiences, explanations, and understanding from traditionally marginalized ways of knowing will these processes be most effective. Therefore, this growing social epistemology of science literature has much to gain by incorporating lessons from long-standing debates within standpoint, feminist, and Indigenous epistemology that have focused on revealing, critiquing, and improving the social structures within which science is practiced. To help bring these literatures into more effective collaboration, we now turn to some of the theoretical lessons from standpoint and feminist epistemology.

### **3. Standpoint and Feminist Epistemology**

#### *3.1. Theoretical Lessons*

One of the most widely accepted contributions of standpoint theories is the notion that those on the margins of knowledge production are uniquely privileged to question the assumptions of status quo processes of knowledge production. Including individuals from the margins in the production of knowledge has the potential to yield more holistic knowledge, deeper ways of understanding, and creative problem-solving strategies (see Collins 1986, 1989, 2000, 2019; Haraway 1988; Harding 1986, 1995, 2004, 2009; D. Smith 1974, 1987). According to Patricia Hill Collins, the embodied experiences of marginalized individuals create an “outsider within” status, whereby such individuals never become fully socialized into the mainstream paradigm of knowledge production and are therefore able to see “thinking as usual as partially organized, partially clear, and contradictory, and may question these existing recipes” (Collins 1986, s27).

However, as standpoint theorists also point out (e.g., see Collins 1986, 1989), survival and success in scientific disciplines often requires a high degree of assimilation to Western ways of knowing. Within sociology, this is evident in the ubiquity of required social theory courses that focus solely on the canon of Marx, Weber, and Durkheim (Fillingim and Rucks-Ahidiana 2021). Although sociology retains space for critical theorizing and critique, as well as for expanding the canon (here recent calls to bring Du Bois into the canon are instructive), learning to theorize from white, Western men is still central to the discipline. Imagining a way to train sociologists without that perspective at the center remains nearly unthinkable. Similar concerns can and have been raised about the teaching of philosophy from its white-male, Eurocentric history and canon. While those with marginalized perspectives and ties to communities not typically considered to be theorists by Western scholars may bring the transformative perspective that Collins describes, in order to be taken seriously within the discipline, these scholars often must conform, disconnect from communities of origin, and otherwise adopt the prioritized Eurocentric way of knowing that scientific disciplines privilege (Collins 2000). Too often, the cost of inclusion within the community that produces and endorses those epistemic

achievements is the setting aside of the very experiences, values, assumptions, methods, and standards that could lead to more robust explanation and understanding within scientific disciplines.

Standpoint theorists also argue that all knowledge (and understanding or wisdom) is socially produced. That is, knowledge is neither created nor advanced through individual actions. Consequently, these theorists argue for a more inclusive process of knowledge production such that marginalized perspectives (which proponents argue are actually more complete standpoints from which to begin any scientific pursuit) are able to influence scientific knowledge production, particularly within academia (Collins 1986, 2000; Harding 1995, 2015). Realizing this kind of intervention requires two interlocking components. The first is that the hierarchy of ways of knowing/understanding needs to be disrupted so that individual scholars may draw on their unique perspectives, rather than being forced to assimilate to the community's existing Western and Eurocentric way of learning and knowing. The second is that different research questions, methodologies, and analyses emerging from a range of perspectives currently bracketed out of scientific inquiry will only gain traction in scientific fields through shifts in the relational processes of scientific inquiry.

### *3.2. Critiques of Value-Neutral Objectivity*

Additional theoretical contributions have come from feminist critiques of the value-free ideal and value-neutral objectivity (Douglas 2009; Intemann 2010; Longino 1990, 2002). Western ways of knowing are typically presumed to be objective and value-neutral—that is, out of relation to the object/subject of study. This view from above (or nowhere) approach places the trained observer in a privileged power position relative to that which is under study. Achieving this privileged position—that is, being accepted within the scientific epistemic community—requires abandoning all ways of knowing that were cultivated prior to scientific training. Moreover, this epistemology of science holds that science's epistemic achievements are provided via processes that require value-neutrality and result in the discovery of objective observer-independent truths. This “value-free ideal” of science and objectivity has long structured the practice and aims of scientific communities (Douglas 2009, chap. 3).

These assumptions about the scientific process are mistaken according to feminist philosophers of science like Helen Longino (1990, 2002), Heather Douglas (2009), and Sandra Harding (1995, 2015). These authors articulate the fragility of this conception of objectivity and the failures of the value-free ideal. In particular, they show that traditional conceptions of objectivity that assume that objective processes require the elimination of values and the guarantee of truth are not only unachievable but also undesirable aims of science (Douglas 2009). In other words, values play

important roles within the scientific process and, thus, should not be eliminated from scientific practice. A better, and achievable, conception of scientific objectivity must focus on the crucial role of *critical interactions* between multiple standpoints, values, and approaches. For example, Longino's work (1990, 2002) focuses on the ways that scientific communities socially construct which claims are accepted via critical interactions *between* conflicting values and assumptions. According to Longino's critical-contextual empiricism, a scientific community is "objective to the degree that it permits transformative criticism" (1990, 76). Transformative criticism is achieved by providing avenues for criticism, establishing shared standards for assessing claims, ensuring the uptake of criticism, and providing equality of intellectual authority among different approaches (Longino 1990, 2002). Harding's (2015) view of strong objectivity further argues that starting research from the lives of women, Indigenous peoples, and other oppressed groups will strengthen standards of objectivity because it will reveal and critique the androcentric biases involved in scientific research that hide behind claims of value neutrality. The crucial point for our purposes is that the work of these scholars moves us away from focusing solely on the objectivity or value-neutrality of individual researchers and toward a conception of objectivity that is produced, maintained and improved by critical engagement among diverse members within larger social structures.

Whereas these authors have focused on how *objectivity* is produced by the social structures of science, the views of explanation and understanding surveyed above show that other epistemic aims of science are likewise products of the value-laden social structures of science. As a result, in order to best accomplish these epistemic aims, we need to pay attention to the ways that those structures enable/restrict the integration of traditionally marginalized ways of knowing, explaining, and understanding within the social structures of science. Collins (2019) is especially instructive on matters of power, making a strong case for the necessity of resistant knowledge projects that not only challenge dominant paradigms but also resist the cooptation of resistant knowledge projects into conventional disciplinary practices (see also Coburn et al. 2013; Foley 2003; Walker 2003). As a corollary, we argue that a wider range of explanations and deeper understanding will be extremely difficult to achieve within such an oppressive structure because the workings of power within it preclude the creativity and innovation that emerge within scientific communities that embrace how *epistemological* diversity could map onto (or grow out of) demographic diversity.

### *3.3. The Shortcomings of Thin Implementations of Diversity*

The interventions suggested by standpoint and feminist epistemologies require a critical mass of demographically (or representationally) diverse people to achieve these epistemic benefits. However, we argue that in-practice attempts to

improve diversity within science and academia have typically focused solely on demographic/representational diversity. This relatively thin conception of diversity, in turn, greatly limits (or obstructs) the effective implementation of the theoretical lessons of standpoint and feminist epistemologies. While many of the epistemic benefits we seek exist at the level of *theory* (outlined above), the inadequate *implementation* (or misapplication) of various conceptions of diversity within science and academia has largely missed the mark and, thus, has largely failed to produce these epistemic payoffs. These attempts to improve diversity have too often been limited to the diversity of individuals across specific factors (i.e., not all identities “count” in the same way in official tallies of diversity) and have too often adopted “add diversity and stir” or additive approaches to diversity rather than an intersectional and social-structural approach. To support this claim, we now provide various examples of thin implementations of standpoint and feminist epistemology to show that *identity/representational diversity is necessary, but not sufficient, for producing these epistemic benefits for scientific inquiry*. While these three examples of thin implementations have several overlapping features, we use them to draw distinct lessons that motivate several of the core components of our alternative (thick) approach.

One example of the insufficient (or thin) implementation of diversity is hiring practices in academia. While many colleges and universities profess an interest in diversifying faculty, the results are typically poor, especially in STEM fields. Often, an institution will hire an individual from a minoritized or underrepresented group to serve as a token of diversity. This individual is then expected to assimilate to the status quo processes of academia’s epistemic communities and to leave their embodied experiences at the door. That is, the institution accepts the premise that adding diversity will improve something, but administrators would be hard pressed to put this in terms of how diversity will improve the ways their academic communities explain and understand the world. In addition, institutions often go no further than the hire to achieve diversity on college campuses and to support diverse faculty. The approach to diversity enacted across many colleges in the United States is one of “add and stir” that merely tracks representational diversity. No structural or cultural changes occur in the doing of science or institutional life, no alterations to the social processes or structures that produce scientific explanations or understandings occur, and the root causes of too few women (or people of other identities) achieving PhDs in science remain unaddressed. Tokenized individuals are expected to enact change simply by virtue of their existence but are also expected to assimilate to a Western way of relating to the production of knowledge and standards of objectivity (as described above). These individuals encounter discrimination, bias, and other negative experiences that undermine careers and push these scientists out (Malcolm-Piqueux 2024). Lindsey Malcolm-Piqueux (2024, 22) notes that a focus on

“underrepresentation alone provides no clear directive on what the causes are, what actions should be taken, the appropriate points of intervention, and who bears the responsibility of acting to redress the issue.” This individual-representational approach undermines the argument from standpoint/feminist theories that the epistemic benefits of diversity occur by virtue of the inclusion of perspectives that do not fully incorporate the status quo assumptions of mainstream knowledge production because individuals hired to improve diversity on campus are not supported or expected to actually do science differently. Such an approach can reinscribe the very factors that lead to a lack of diversity, creating a cyclic problem that limits explanation and understanding as well as the purported equity goals of these institutions. Institutions also tend to adopt the belief that because they hired one person who is not a white man, then the work is done and all subsequent hiring does not need to consider diversity.<sup>8</sup> This approach ignores the heterogeneity within groups and renders a single individual as the token or spokesperson for a group that actually has a diversity of perspectives to bring to the scientific process. This lip service to diversity limits the possibility for *structural* change in the production of scientific knowledge, explanation, and understanding.

Beyond individual campuses, structural limitations exist at the level of disciplines and academia as a whole constraining hiring, supporting, and promotion of those who are not white (see Norman 2024; Sacco 2024). Specifically, even if an individual is able to practice science differently within their institution—e.g., by focusing on unique research questions, using alternative methods for scientific research, or having alternative background assumptions inform their work—the larger scientific disciplines they are expected to take part in often make it difficult for alternative approaches and methods of justification to be accepted for publication, seen as significant contributions to the field, or be taken up in discussions among practitioners of the field.<sup>9</sup>

---

<sup>8</sup> The rise of “cluster hires” in academia are a welcome shift in recognizing that individuals are less likely to be successful without a community and that individual hires will not change institutional culture. Yet, this remains a thin implementation in that the expectation is that some sort of epistemic or institutional benefit will accrue from changes in the individual composition, rather than cultural and structural practices, of an institution.

<sup>9</sup> In addition, faculty from underrepresented groups are routinely expected to provide mentorship and emotional support for students from underrepresented groups that is “emotionally draining and takes significant time away from your own research” (Hirji 2021, 643–44). Moreover, doing this service work reinforces oppressive structures that make it more difficult for underrepresented groups to succeed in their field (Hirji 2021, 644).

All these structural and social challenges combine to make it far from a trivial step from hiring a person from an underrepresented or marginalized group to having their unique way of knowing about the world contribute to the epistemic aims of their chosen field (or academia more generally). Representational diversity at the level of the individual is simply insufficient without also addressing the mistaken value- or perspective-neutral conceptions of objective scientific research imposed by academic institutions, scientific disciplines, and academia as a whole. This example of insufficiently attempting to diversify epistemic communities illustrates the first lesson motivating our positive view: failing to interrogate academic/scientific conceptions of objectivity and rigorous research—e.g., by asking individual researchers to be value-free, set aside their unique ways of knowing, and not draw on their own experiences—results in pressures to assimilate to Western ways of knowing rather than creating spaces for alternative ways of knowing to contribute distinct explanations and understanding.

Another example of an insufficient, thin implementation from outside of academia is that of scientific forestry (Coutinho-Sledge 2015). Forest management has typically occurred through the adoption of scientific principles. According to historian James Scott (1998, 15), the goal of this approach is “to impose upon disorderly nature the neatly arranged constructs of science.” In the United States, this often amounted to a narrow focus on timber production to the detriment of other, more holistic concerns about the forest. Such a perspective is also distinctly masculine and largely white (FAO 2006). In the 1990s, the United States Forest Service (USFS) became the focus of media and legal attention as a result of pressure from environmental groups and a series of Equal Employment Opportunity Commission (EEOC) cases regarding discrimination and harassment against women. The reaction to these criticisms led to attempts to increase the number of women foresters in the USFS and in private forestry (Brown and Harris 2001). Robert T. Perschel, then the northeast regional director of the Forest Guild, argued, “Women are essential to the ideals of preservation of life, nurturance of the earth, and closeness to nature and [the New England branch of the Society of American Foresters] cannot be successful in refining these ideals without major input from women” (1991, 21). The scientific forestry community generally believed that individual women embodied the ideals of environmental stewardship and sustainability that would transform the public perception of forestry. Further, the USFS believed that increasing the number of women would help mitigate allegations of harassment. In practice, women foresters became scapegoats for problems in the USFS as they were accused of having insufficient knowledge about scientific forestry, EEOC claims increased as more women spoke out about harassment on the job, and the organizational culture through which knowledge of the forest was produced and management decisions were made remained intact (Carroll, Freemuth, and Alm 1996; Brown and Harris

2001; Lewis 2005; James 1991). Again, we see that representational diversity at the level of the individual is insufficient if the social and structural limitations imposed by the community are left unaddressed. This example of thin implementation illustrates a second lesson motivating our positive view: representational diversity is insufficient for improving the explanations, understanding, and practice of science if the social-structural power relationships and hierarchies that structure the interactions between community members are left unaddressed.

A third recent example of thin understanding of diversity reiterates that representational diversity is insufficient and illustrates a different challenge to improving the epistemic products of science. Unlike the forestry case that failed to acknowledge the structural interactions between its members, the US National Academies of Science, Engineering, and Medicine (NAEM) recognized the importance of these relationships and created an expert committee to *study* how best to pursue knowledge “coproduction”: processes that seek to jointly create and share knowledge in a way that values diverse perspectives (Mervis and Pérez Ortega 2024). Despite this focus, the committee was disbanded in July 2024, in part because the committee refused to *enact* principles of coproduction of knowledge as advised by Indigenous scholars who were asked to participate (Mervis and Pérez Ortega 2024). Another issue was failing to address Indigenous participants’ calls to address the power dynamics that affect such cocreation projects. The focus on individual-level representational diversity combined with the rejection of structural changes to the epistemic practices of the committee not only limited the ability of the committee to better understand coproduction across knowledges but also led to the dissolution of the committee itself. This is another cautionary tale highlighting additional barriers for translating representational diversity into improved explanations and understandings for the group. As we attempt to diversify the perspectives and ways of knowing represented in scientific projects, it is essential that we practice the work. In addition to challenging value-neutral conceptions of objectivity and identifying the social-structural interactions of scientific practice, the lesson of this thin implementation is that interventions designed to increase the diversity of ways of knowing in science must explicitly adopt practices of cocreation and address the power dynamics involved in communicating between different perspectives.

As noted above, standpoint and feminist theories provide important theoretical insights into how epistemic communities understand the world. But these examples show how implementation of these insights is routinely limited by a thin conception of diversity that is consistently unable to see beyond the individual. Importantly, science is not performed by individuals but via social processes that

occur at places and within larger historical contexts.<sup>10</sup> The theoretical arguments leading to standpoint and feminist theory reviewed above are sound, in our estimation. Moreover, these theories have both been developed in ways that make them more social and attentive to diversity within groups than their original versions (Intemann 2010; Wylie 2003).

Despite this theoretical promise, however, in-practice attempts to diversify STEM fields have been largely ineffective at improving science's explanations and understandings because these thin implementations of diversity have the following flaws:

1. They have sought to focus our attention on individual rather than collective inquiry.
2. They incorrectly assume that individual-level representational diversity is sufficient for ensuring that a standpoint's unique ways of explaining and understanding are considered legitimate within an academic discipline.
3. They assume that changing the composition of the group of producers will change the processes of inquiry without proposing changes to the social structures of explanation and understanding.
4. They fail to enact methods of epistemic cocreation that put distinct ways of knowing into collaborative conversation.

The three examples above illustrate several ways that a focus on individual/representational diversity has driven the implementation of diversity in practice. Not only do these implementation problems ignore heterogeneity and interactions within groups; they also create obstacles for learning from the standpoints of others. In contrast, we argue that the social processes of science must include avenues for individuals from one standpoint to incorporate or find commonality with the assumptions, practices, or knowledge of other standpoints. The actual social structure of scientific inquiry needs to create space for alternative interpretations emerging from the unique embodied knowledge of individuals (Clough 2013) to influence the process and to be picked up by others.

We are not arguing that one individual (e.g., a white man) can adopt the perspective or have the experiences of another individual (e.g., a black woman) and thereby "fix science." Instead, we argue that it is possible for one individual to partially

---

<sup>10</sup> Standpoint theory does, however, suggest a way that the social structure of science ought to be (re)organized. Specifically, standpoint implies that adding individuals from more social categories will improve the knowledge and understanding produced by scientific inquiry.

understand the perspectives of another and to learn (or at least treat as epistemically equivalent) practices stemming from that perspective within communities of reciprocity and cocreation rather than communities marked by extraction, exploitation, and appropriation. Members of one group cannot adopt another member's way of knowing, but those ways of knowing can engage each other in meaningful ways (see Clough 2013; Rouse 2009). No one individual is adopting, understanding, or incorporating all these perspectives. Members can understand and learn practices in the collaborative pursuit of generating and considering novel and wider-ranging hypotheses, explanations, and understanding. Diverse perspectives, experiences, and assumptions are incorporated into a collaborative social process of knowledge production by recognizing the scientific practices that emerge from them (see Barad 2007).

To best achieve the epistemic benefits that stem from diversity of persons in scientific inquiry, there needs to be space where different standpoints can interact within processes of cocreation and respect (rather than siloing and assimilation). This is important not just for updating our conceptions of scientific objectivity (Longino 1990) but also for clarifying how science accomplishes its other epistemic aims such as explanation and understanding.<sup>11</sup> Each member—and their values, identities, experiences, and background assumptions—contributes to the collective possibility space. The general takeaway of the above examples is that scientific explanations and understandings are produced through social interactions situated within larger power structures. The potential epistemic contributions of diverse ways of knowing in the pursuit of more complete (or diverse) explanations and deeper understanding can be (most fully) realized only if we address the complexities of these social structures of science rather than limiting our focus to diversity at the level of individual representation.

---

<sup>11</sup> While this conclusion about the importance of social aspects of science for explanation and understanding is similar to Longino's conclusions about objectivity, the arguments offered here are importantly different from Longino's emphasis on the ways the underdetermination requires values to fill in the gap between theory and evidence. Despite this difference in argumentative focus, however, underdetermination could certainly be used to show the importance of having a diversity of values and background assumptions for diversifying the range of explanations (and evidence) considered. Thanks to an anonymous reviewer for emphasizing this difference.

#### **4. Power of Heterogeneous Ways of Knowing: Indigenous Epistemology and Thick Implementation**

In this section, we lay the foundation for an alternative *thick* implementation of standpoint and feminist epistemology by drawing additional insights from Indigenous (feminist) theories. We then identify several areas of structural intervention in science that we suggest will have substantial benefits to scientific explanation and understanding.

The solution to the failures of the above thin implementations lies in returning to the theoretical heart of standpoint epistemologies. As standpoint *theory* developed it became clear that “standpoints do not automatically arise from occupying a particular social location. They are achieved *only when there is sufficient scrutiny and critical awareness of how power structures shape or limit knowledge in a particular context.*” (Intemann 2010, 785; our emphasis). Current *implementations* of diversity take a surface-level, “add and stir” demographic diversity approach rather than a social epistemic diversity approach, which grows out of demographic diversity only if the perspectives and experiences of demographically diverse scientists *actually hold power within the epistemic communities of science*. Drawing on the lessons of the three examples of thin implementation discussed above, our alternative thick implementation of standpoint and feminist epistemologies requires (1) shifting science education to include a genealogy of objectivity and Western versions of objectivity, (2) updating the way we conceptualize the social structures that produce the epistemic outputs of science, and (3) building communities of science dedicated to resistant and cocreated epistemic projects.

The thick implementation we propose is structural, rather than individual, and requires confronting the practices of science—and the explanations and understandings that derive from it—in the context of power dynamics that privilege certain groups and ways of knowing over others. Effectively diversifying science requires innovation in the social practices of producing scientific explanations and understandings to dismantle hierarchies of ways of knowing so that the epistemic power of a range of knowledge systems can be considered with respect and integrated in meaningful ways. We draw inspiration from and honor lessons from recent Indigenous epistemology that goes beyond the standpoints of individuals and considers a variety of social interventions based on cocreation, reciprocity, and attention to history and place of explanation and understanding production.

##### *4.1. Indigenous Epistemology*

Despite the potential we see in the feminist theories outlined above, there remains room to elaborate on precisely what structural changes are needed within scientific communities to fully realize the epistemic benefits of diversity. Indigenous (feminist) standpoint theories, or I(F)STs, collectively lay out multiple pathways to

envision just how scientific practices can be transformed via attention to how these communities fit within larger structures of power and ongoing processes of settler colonialism (see Bartlett, Marshall, and Marshall 2012; Barker 2019; Black Elk 2016; Cajete 2000; Claw et al. 2018; Foley 2003; Gardner-Vandy and Scalice 2024; Kimmerer 2013; Kovach 2009; Meyer 2001; Moreton-Robinson 2013; Nakata 2007; Simpson 2017; L. Smith 2012).<sup>12</sup> Rather than presenting a positive argument for the importance and power of these standpoints to the production of knowledge or a critique of Western ways of knowing, I(F)ST scholarship provides a guide to *building relationships between* Indigenous and other standpoints in ways that advance the epistemic benefits we seek.

Certainly, I(F)STs have much in common with the theories outlined in section 3. Aileen Moreton-Robinson (Goenpul) identifies this commonality as a shared “understanding that their respective production of knowledge is a site of constant struggle against normative dominant patriarchal conceptual frameworks” (2013, 331). An important distinction lies in the understanding within I(F)STs that white Western conceptions of science (e.g., those advocated by the logical positivists) exists in the context of ongoing systems of colonization. I(F)STs, then, are a struggle against not only patriarchal frameworks but also those of settler colonialism. This requires attention to gender (as called for by feminist standpoint theorists), race (as noted by Black feminist theorists), and also sovereignty and land (hallmarks of Indigenous ways of knowing). In advocating for I(F)STs, Indigenous and settler scholars alike clarify that the social practices of science must change for epistemic benefits to follow from a diverse community of scientists. While this is largely implicit in the theories addressed above, I(F)STs are instructive in clarifying specific changes to be made to the practice of science that will allow the epistemic benefits envisioned by other feminist theorists to be fully realized: namely, that the values of science must be made clear, the responsibilities and commitments of the scientific community to other communities (both human and more-than-human) must be identified and incorporated into practice, and an understanding that cultural assumptions from the broader social context shape scientific practice must be addressed in order to ensure a truly diverse community of scientists. To this last point, I(F)STs add the context of ongoing colonization as a critical structure of power that emphasizes individuals as the bearers of collective knowledge (which supports the notion that adding diverse individuals will produce trickle-up changes to the structure and culture of science) and further emphasize the problematic practice of asking individuals to assimilate into narrowly defined ways of knowing to be accepted within the scientific community. Additionally,

---

<sup>12</sup> We use I(F)ST as an umbrella term including scholarship that self-identifies as standpoint theory but also scholarship that advocates for particularly Indigenous ways of knowing without necessarily using this terminology.

Manulani Aluli Meyer (Kanakanaka Maoli) elaborates on the centrality of *place* that is shared across Indigenous epistemologies. Meyer (2001, 125) notes that “how one knows, indeed, what one prioritizes with regard to this knowing . . . [is] the essence of who we are as Oceanic people. It is a discussion of place and genealogy.” In this respect, Indigenous ways of knowing are not only the result of an individual perspective from the margins of patriarchal society with great potential for improving scientific understanding and explanation. Rather, I(F)STs clarify that a way of knowing is grounded in culture and in place.

I(F)STs collectively also pose an intervention into the social epistemic processes of science by changing our conceptions of who and what “count” as knowledge producers and a recognition that “protocols, or attitudes of how to approach the world, are inseparable from scientific inquiry for some Indigenous peoples” (Whyte, Brewer, and Johnson 2016, 29). Gregory Cajete (Tewa, Santa Clara Pueblo) elaborates, “In Native science, sanction of knowledge through appropriate ritual and tribal society acknowledgement is important, because knowledge of the natural world and how best to relate to it is not just a matter of individual understanding, but is gained and shared for the benefit and perpetuation of community” (Cajete 2000, 72). Both Cajete and Kyle Whyte and his coauthors are making a structural point about the practices of science. The way of knowing and practice of science that emerges from Indigenous worldviews centers relationship and community above the individual. This is in stark contrast to Western approaches to science. In Indigenous ways of knowing, knowledge begins with relationship to the natural world (i.e., land) and is held by and transmitted through communities, not individuals. It is not just the standpoint that diverse individuals bring to scientific practice, but the very practice of science that must be addressed in order to achieve the epistemic benefits diversity can bring. Cajete (2000, 307) puts it this way: “Western science *needs* Native science to examine its prevailing worldview and culture. . . . Until Western science rejects its bias, dialogue with another culture will be problematic. Individual scientists can sometimes see beyond, but as an institution, Western science is caught behind institutional blinkers.” In this way, Indigenous scholars emphasize that changes among individuals are necessary, but insufficient, to realize a shift from a Western conception of knowledge to one that is creative, participatory, diverse, and multifaceted.

This flow from Indigenous worldviews to changes in methodology is shared across Indigenous scholarship on science and epistemology. Examples abound, including Fourth World theory (Ryser, Gilio-Whitaker, and Bruce 2017), two-eyed seeing (Bartlett, Marshall, and Marshall 2012), braiding/weaving (Kimmerer 2013; Hernandez and Spencer 2020; Whyte, Brewer, and Johnson 2016), holographic epistemology/triangulation of meaning (Meyer 2003, 2013), mutual stewardship (Wong 2024), storywork/ceremony (Archibald 2008; Wilson 2008), land-based

learning and knowing (Dei, Karanja, and Erger 2022; Gegeo and Watson-Gegeo 2001), and Native science (Cajete 2000; Black Elk 2016); but these are not exhaustive, and knowledge traditions are culturally and geographically specific. An essential contribution of I(F)STs is not just the rejection of Western objectivity as rooted in systems of patriarchy and Eurocentric values but also an alternative conceptualization of the epistemic practices of science as fundamentally relational, collaborative, and reciprocal with human and nonhuman communities.

I(F)STs suggest that there is a way to bring into relation conventional, normative, European-based ways of knowing with Indigenous ways of knowing in order to do fundamentally better science. The imperative here is to recognize normative approaches to science as a culturally embedded way of knowing, rather than the mold into which all other forms of knowledge must fit. The wisdom of these perspectives is that they do not engage in the power hierarchy that many other standpoint epistemologies emphasize. No perspective is privileged over others. Instead, all perspectives are in relation and have insights to offer. Embedded in this emphasis on relationality, however, is the recognition that the accepted and institutionalized way of scientific knowing are but *one* perspective and could not possibly contain all the possibilities for explanation and understanding alone. This relational approach returns us to our earlier discussion of the social-structural epistemic processes of science. When multiple perspectives—derived from a range of culturally embedded experiences with the constructed and natural world—are able to have equal standing in the process of scientific inquiry, evidence may be viewed more holistically, new evidence may be recognized as relevant, new relationships across evidence may become apparent, and a great range of alternative hypotheses may be generated. This moves scientific practice closer to achieving the epistemic benefits we seek.

Instead of emphasizing a single or particular way of knowing (or perspective), I(F)STs draw attention to the “ethical space of engagement,” the *relationship between* the dominant (read Western, patriarchal white, able-bodied, etc.) paradigm of knowing and every other standpoint, where transformation may occur (Ermine 2007). While it is necessary to recognize this ethical space, it is not sufficient for transformation. Transformation requires recognition of power and the imbalance of power across ethical space, the rejection of Western objectivity as the primary (and value-neutral) position from which explanation and understanding should be achieved and evaluated, and resistance to the assimilation required by oppressive intellectual communities (such as academic disciplines). These are not only theoretical but practical interventions. In laying out specific Indigenous research approaches, I(F)STs provide a framework for changing interactions within scientific communities and collaborations, beginning with a reflexive process of self-examination of science as an institution, in place and in history, to open up the space necessary for multiple

practices of knowledge creation to work together. Ultimately, this will bolster the impacts of diversity on the science that we do, the people who do the science, and the land upon which the science occurs.

In summary, I(F)STs and Indigenous epistemologies, more broadly, are culturally specific, though there are common themes that support our thick implementation of feminist and Indigenous standpoint epistemologies. Borrowing from Margaret Kovach (Nêhiyaw and Saulteaux), who lays out very specific interventions made by Indigenous women's standpoints (2017, 218), Meyer's (2001) careful work on Hawaiian epistemology, Cajete's (2000, 2020) foundational work on Native science, and the other scholars cited in this section, we emphasize five principles that provide an important foundation for the thick implementation of standpoint theories:

1. All knowledge is subjective (i.e., derived from unique experiences that shape what we know, how we know, and the meanings we derive) and holistic (including empirical, experimental, sensing, embodied, and metaphysical possibilities).
2. All knowledge arises from interconnectivity and interdependency and must be cocreated across communities even when they have differing world views.
3. Knowledge comes from the land and is animate and fluid.
4. Right relationships and balance are central to understanding (this includes spiritual approaches).<sup>13</sup>
5. Knowledge arises from a multiplicity of sources, including nonhuman sources.

These principles are similar to, yet remain distinct from those held by other feminist standpoints in that there is a parallel rejection of Western objectivity as disembodied and without relations, resistance to assimilation and oppression of patriarchal white supremacy, and recognizing the centrality of community, reciprocity, coexistence, cooperation, place/land. This multilayered approach attends to specific interactions and structural conditions through which science is accomplished (see Walter et al. 2023; Gardner-Vandy et al. 2021). Starting from this perspective allows for interventions to address power imbalances inherent in the structure of science (and

---

<sup>13</sup> It should be noted that spirituality is central to Indigenous ways of knowing, but spirituality does not hold Western definitions of the term. Instead this is connected to relationships with seven generations in the past and future, to the land, to embodied ways of knowing. It is an alternative to the mind/body split central in Eurocentric ways of knowing.

the incomplete explanations and understandings that emerge from that power imbalance), while also putting forth a positive research program for science that emphasizes the potential of multiple subjectivities for explanation and understanding, recontextualizes these epistemic practices within the relationships between knowledge seekers, and centers the land from which those epistemic achievements emerge. In the remainder of this section we combine these lessons from Indigenous epistemology with the lessons drawn from the examples above to develop the foundation for an alternative thick implementation of standpoint, feminist, and Indigenous epistemology focused on improving the explanations and understandings produced by scientific and academic communities.

#### *4.2. A Social-Structural Conception of Scientific Objectivity*

As we argued in section 3, and as the above discussion of Indigenous epistemologies makes clear, having a diversity of ways of knowing is not sufficient to realize the potential benefits for explanation and understanding emerging from diverse ways of knowing, since the very structure and processes of science undermine the epistemic contributions of those perspectives that are in tension with white, Western ways of knowing. This is because creative generation of hypotheses, consideration of alternative interpretations of data, and investigation of fundamental assumptions are tasks that can only be effectively accomplished by a scientific *community* (rather than by individuals acting in isolation), and the full breadth of diversity must be at the center of this community. These epistemic benefits are further constrained by cultures of scientific inquiry that only (and minimally) account for diverse representation while assuming that people who embody multiple ways of knowing will compartmentalize all but a Eurocentric way of knowing in the pursuit of science. This pressure of assimilation contributes to erasure, invisibility, and hypervisibility. Consequently, we argue that in addition to embracing diverse ways of knowing, the scientific process must be reimagined first by situating scientific inquiry within the social structures that inform the questions, methods, and outcomes of scholarship as well as to the extent that embodied and community specific knowledges shape this reimagining.

As we argued in section 3.3, academia and scientific communities have used an inadequate individual-additive model of diversity that has severely limited the ability to implement the ideas of standpoint and feminist epistemologies. This practice contributes to ongoing centering and elevation of Eurocentric science that incorporates only surface-level understandings of standpoint theories without attention to the many intricate feminist epistemologies that lay plain alternative and, we suggest, better pathways for science to proceed. In practice, this additive approach becomes reductive as the traditional structure of scientific inquiry requires researchers to eliminate the unique ways of knowing derived from their social

experiences and to become detached (if temporarily) from the communities that support these ways of knowing. In order for the unique ways of knowing that are embodied by individuals to have the type of epistemic benefits to scientific explanation and understanding that we desire, we must understand science as situated within structures such as race and gender and then work for changes across that structure rather than only at single points (such as individual hiring decisions in an academic department).

First, following Longino (1990, 2002), we ought to conceive of objectivity and other epistemic aims of science *as the product of a value-laden social process* in which different ways of knowing with conflicting values interact so as to critically evaluate each other's background assumptions, methods, and interpretations of data. Rather than something that can be accomplished by an individual scientist, objectivity is achieved only by subjecting a scientific hypothesis, explanation, or understanding to the critical evaluation of alternative points of view. What is more, this kind of objectivity is actually achievable by scientific practice. While individual researchers cannot set aside their values, background assumptions, or biases, it is possible for the social structures of science to support more effective interaction among alternative ways of knowing to achieve a higher degree of (this social form of) objectivity. Unfortunately, the current social structures of science often stifle this kind of interaction among alternative ways of knowing—especially when research questions, methodologies, or background assumptions of a marginalized way of knowing are in conflict with the status quo (i.e., the Eurocentric perspective).<sup>14</sup> We must recognize that the more effective the interactions between diverse ways of knowing, values, and methods within the social structures of scientific communities, the more objective (or justified) the explanations and understandings produced by scientific communities will be.

Second, following from I(F)STs, realizing the above goal also requires that scientific communities acknowledge and understand the particular culture of science in order to recognize that scientific knowledge within this positivist culture is not universal. While the questions may be shared across many cultures, the framing of the question, the evidence, methods, analysis, and communication of the answers all may differ. The assumption of universality as a corollary to objectivity must be directly addressed and overcome for epistemic benefits to accrue. Further, objectivity itself is understood within I(F)STs to be a unique feature of Western ways of knowing because Indigenous ways of knowing are rooted in place/land. From this perspective, no knowledge can be universal, and claims to objectivity fail to account for the full range

---

<sup>14</sup> While these ways of knowing might be in tension/disagreement in these ways, it should not be taken to mean that they are completely incompatible or inconsistent.

of evidence at hand while continuing processes of colonization that require assimilation into a narrow worldview.

A crucial part of updating this conception of objectivity lies in the motivations for updating the canon of many scientific disciplines. While diversifying syllabi so that students can see researchers who “look like them” is certainly important, there are crucial epistemic benefits of expanding the canon that go beyond this. In particular, rather than taking scientific objectivity as an undiscussed given, we contend that scientific education must include an interrogation of individual-level, value-neutral conceptions of objectivity, consideration of alternative social conceptions of objectivity, and exposure to alternative ways of producing, verifying, and arguing for the adoption of knowledge, explanations, and understanding.<sup>15</sup> Doing so will not only provide a genealogy of different conceptions of objectivity but will clarify the diversity of ways of knowing available and their different strengths (and weaknesses). Further, the foundations of science education ought to include discussions of the ways that diversity of values, perspectives, background assumptions, and methods will make for better science by expanding the range of hypotheses considered and bringing different ways of knowing into conversation in ways that will deepen understanding. Recognizing a wider range of ways of knowing as epistemically legitimate will enable future scientists to recognize the value of incorporating additional inputs into scientific inquiry and suggest methods by which a plurality of ways of knowing might effectively interact.

#### *4.3. Focusing on the Social Structures of the Epistemology of Science*

As we have argued throughout, realizing the epistemic aims we seek requires intentional consideration of the relationships of power foundational to the organizations within which we do science. Unfortunately, the implementation of standpoint/feminist epistemologies has been hampered by a thin understanding of diversity within academic and scientific communities. This thin understanding has led to a set of problems that prevent the type of structural changes that would create space for epistemic diversity to build more complete and innovative explanations and

---

<sup>15</sup> Of course, implementing these educational changes might be challenging in a number of ways given the literature and ideas that science students (and teachers) are currently familiar with. But the ideas are no more “advanced” or “complicated” than the value-neutral, individual conception of scientific objectivity currently taught in these spaces. We suggest that normalizing these discussions of uncertainty, social objectivity, and the social epistemology of science—and not requiring students to “unlearn” other conceptions of science to do so—will make such topics accessible to early science students.

understanding. We identify two key, interrelated problems with the current impact of standpoint epistemologies on scientific knowledge practices:

1. Standpoint has not been implemented in a way that reflects the epistemic claims made by standpoint theorists.
2. To the extent its theoretical imports are recognized, standpoint has been subsumed in institutions in ways that are essentializing and limited to the achievement of a “moral credential,” and the notion that once there is one person of color (of any gender) or a woman (of any racial identity), then the work of DEI is done (Bendick and Nunes 2012; cited in Ray 2019).

To get to the thick implementation that we advocate, a series of “moves” are required to bring the full power and potential of standpoint theories to bear on the social production of explanations and understandings in science (and academia more generally). The most central of these moves is to situate academic departments, educational institutions, and scientific disciplines as racialized and gendered organizations (see Acker 1990, 2006; Ray 2019).<sup>16</sup> As Victor Ray (2019, 27) notes, “In isolation, individual prejudice and racial animus may matter little; but when these are put into practice in connection to organizational processes such as racialized tracking, job-typing, or exclusion, they help shape the larger racial order.” For our purposes here, acknowledging these facts about the constitution of scientific communities shatters the illusion that scientific fields (including practitioners, the questions asked, the means of answering them, etc.) are somehow above, beyond, or outside social structures of race, gender, and other systems of inequality and oppression. Doing so also makes possible a real consideration of the ways that becoming a scientist perpetuates notions of whiteness and cis maleness as capital and privileges those who assimilate to these ways of knowing, while simultaneously disrupting the notion that these ways of knowing are not standpoints themselves.

When we understand science as a social endeavor achieved through specific organizations (here we might think of funding agencies, academic departments, etc.), then we may begin to disentangle the workings of those organizations. As Ray (2019) makes clear in his work, organizations are coercive, yet there is also the possibility of challenge. In addition to moving beyond the individual level of thin implementations, we also must recognize that challenging organizations is insufficiently enacted when it only occurs at a single level of social structure. For example, Barbara Risman (2004) identifies three dimensions through which social structures are reproduced or, by

---

<sup>16</sup> This point has also, of course, been repeatedly made throughout the feminist and standpoint literature we reviewed earlier.

extension, challenged: individual (i.e., socialization, identity, and the construction of self), interactional (i.e., cognitive bias, cultural/behavioral expectations), and institutional (organizational practices, laws, resources, ideologies). At present, in-practice attempts to diversify academia and science have primarily had but a thin impact at the individual level with “moral credentialing” that institutionalizes whiteness by determining who has “access to organizational resources, legitimizing work hierarchies, and expanding White agency” (Ray 2019, 41). We think the above arguments make the case for additional interventions into the interactional and institutional aspects of scientific epistemic communities.

#### *4.4. Resistant Knowledge Projects, Cocreation, and Attention to Place*

We also advocate for interventions that account not only for a diverse community of scientists, but also for an expansion of who may be included under the term “scientist.” Following from Indigenous scholarship, we argue that the communities and places within which science is practiced make vital contributions to the practices of science and, thus, the explanations and understanding that scientific communities produce. Not only does science always occur from distinct perspectives, but scientific facilities (whether these are labs, field stations, observatories, etc.) also exist in a place and with relationships to the land and people of that place, whether they are in the scientific community as traditionally defined or not. Ignoring this has been detrimental to the practice of science in ways that range from legal challenges to direct action halting the construction and operations of these facilities.

While feminists posit that all science is produced from a distinct perspective emerging from the scientist’s position within various, intersecting structures of power (i.e., race, gender, class, sexuality, ability, etc.), Indigenous scholars add that science is always (and must be) done in relationship to ancestors, the land, and future generations. In this respect, science is never done only within the scientific community (i.e., those trained in standard practices in recognized academic settings), nor is it done out of place. Indigenous science recognizes the relationships between the physical world, the human world, and the sacred world (Foley 2003). Norma Wong (Kanaka Maoli and Hakka Chinese) suggests that “humans follow the earth” (2024, 5). This key principle of mutual stewardship requires that science must “begin with and center the needs and desires of the place, the land, the waters, and the beings who are not human” (Wong 2024, 5). A thin implementation of diversity cannot hope to achieve this, yet it is central to all Indigenous epistemologies. In contrast, a thick implementation of these ideas recognizes that the engagement of scientists with communities of place can open possibilities of incorporating more diverse perspectives and evidence from which understanding and explanation can flow.

#### 4.5. A Positive Example of Epistemic Diversity: The Maunakea Stewardship Oversight Authority

In order to illustrate some of these ideas more concretely, we conclude this section with the example of the proposed Thirty Meter Telescope (TMT) and the creation of the Maunakea Stewardship Oversight Authority (MKSOA), which offers insight into the kind of structural and cultural change Indigenous epistemologies can offer scientific communities and help to illustrate some principles of thick implementation.

The construction of the TMT on Maunakea was positioned within the astronomy community as the priority facility for the decade between 2010 and 2020 (Blandford et al. 2010). TMT was not to be the first such observatory on the sacred mauna, but it was to be the largest ground-based telescope. The history of the lease for the summit of Maunakea—the interrelationships between the Government of Hawai‘i, international collaborators, US federal agencies, and numerous academic institutions—is too extensive to cover here (Cuby et al. 2024; Beamer 2020). Importantly, *kia‘i* (Kānaka Maoli protectors) successfully halted construction of TMT in 2019, launching a global movement for the protection of the mauna and drastic changes in the practices of astronomy in relation to Indigenous communities who have been relatives of the land on which these facilities sit since time immemorial.

The creation of the MKSOA, the product of efforts by the Maunakea Working Group, is an attempt to bridge the gap between the astronomy and Indigenous communities in order to put into practice the principles of mutual stewardship (Wong 2024).<sup>17</sup> This work importantly breaks down the perceived dichotomy between science and Indigenous communities/ways of knowing in order to identify shared values and commitments to repair relationships among people and the land, while improving the science that is done. Wong writes, *“When culture and science are coequal and synergistic, the peoples, the future, and the land reap benefits”* (2024, 8; emphasis in original). All of this work emphasizes cocreation and recognizing that communities have something to contribute to the epistemic practices of science (Matsuda 2022). Central to the positive outcomes of the working group and the current efforts of MKSOA is a deeper commitment to diversity than simply having Kānaka Maoli representation. Rather, as Rich Matsuda (2022) points out, *“Building mutual understanding of both traditional Hawaiian knowledge and contemporary*

---

<sup>17</sup> Wong conceptualizes mutual stewardship from a Native Hawaiian perspective in which boundaries between science and culture are dismantled; local participation is cultivated; the land is understood as a living being to whom all decision-makers have a responsibility; and care for land, peoples, and future guide the practices of a scientific community that includes local peoples and the Indigenous knowledges they hold.

science, like astronomy and other fields, with openness and humility provides the opportunity to integrate knowledge, not talk past each other.” Rather than simply bringing different perspectives to the table, this example shows that epistemic benefits occur through structural changes in how science is practiced. This is the basis of the thick implementation of standpoint epistemologies we seek.<sup>18</sup>

Most recently, the MKSOA crafted a horizon story and guiding principles, built on the commonly held Indigenous principle that all decisions must consider impacts seven generations into the future. As Jean-Gabriel Cuby and coauthors write, “For many of the authors of this paper, reaching a consensus on our shared vision of our future using Indigenous principles and wisdom was a first, and very significant achievement. Modest as this achievement may seem to many, we firmly believe that it illustrates how Indigenous knowledge and wisdom can and must find a place in the conduct of our profession” (Cuby et al. 2024, 17). Centering Indigenous ways of knowing in the future planning of MKSOA produced a framing of community astronomy that led to six areas in which community astronomy can be realized via positive impacts:

- Equitable hiring and workforce development
- Local technology development
- Cultural awareness and competence
- Environmental responsibility
- Community engagement
- Expanded scientific approach

The final area is of the utmost importance for our argument regarding the epistemic benefits of diversity in scientific communities. Cuby and coauthors posit that “allowing scientists and scientific inquiry to be rooted in cultural context will not only *support greater scientific advancement* but will make it relevant and a point of pride for the communities in which the science takes place” (Cuby et al. 2024, 20; emphasis ours). Given the nascent state of MKSOA, they cannot say with certainty

---

<sup>18</sup> Additional examples of scientific projects working toward putting these ideas into practice include the Next Generation Event Horizon Telescope (ngEHT) and Cosmic Explorer (CE), a next generation gravitational wave observatory (Daniel et al. 2025). Both projects are employing interdisciplinary collaborations across physics, astronomy, philosophy, sociology, geology, and more to reimagine the process of scientific facilities from conception to decommission. In their efforts toward responsible siting, ngEHT created the History, Philosophy, Culture Working Group, and CE established the Indigenous and Place-based Partnership and Responsible Siting Program (IPPRS).

that this epistemic benefit in the form of greater scientific advancement will occur. Yet, their strong hypothesis that these benefits will occur is important to follow empirically. In this example, epistemic diversity is positioned as “the only way forward” for MKSOA and, as the most significant astronomical site in the world, this creates a model for the discipline of astronomy as a whole (Cuby et al. 2024, 20). The example above represents a sustained intervention in the practices of astronomy by Indigenous community members. This is not the first such action by Indigenous land protectors with respect to the doing of science. What is unique in this example is that the organizing and actions by *kia’i* have inspired a shift in scientific practice at multiple levels, including facilities construction, facilities operations, and funding.<sup>19</sup> We find great hope in this example. While born out of intense conflict, what has emerged is an approach to conducting science that incorporates many of the thick structural elements we identify above. The efforts of community organizing created ripples not only in the scientific community on Maunakea but throughout the discipline of astronomy and the funding agencies that support it. These new models have not supplanted normative practices of science, but are opening possibility space for epistemic diversity to significantly impact the creation of astronomical explanations and understanding. Within astronomy, there is strong movement at all institutional levels to explore a wide range of benefits that can flow from diversifying not only the people but the practices of scientific communities. While it remains unclear precisely what epistemic advances may result from this new perspective, it is understood by those involved in MKSOA that there is a strong promise of epistemic benefits and that the benefit of ending the “dehumanization or segmenting of self that is required to do ‘real science’” has already benefited the astronomers involved (Cuby et al. 2024, 20). This alone suggests that examples such as MKSOA should be supported and followed by those invested in questions of improving scientific understanding.

##### **5. Putting the Pieces Together: Structural Interventions and Future Directions**

Organizational change is key to building space for the epistemic benefits we believe diversity can hold for scientific explanation and understanding. The problem is not simply one of inclusion (which is as far as most scientific institutions have gone in incorporating standpoint and feminist epistemologies). The organizational changes required flow in multiple directions at once. These changes include demographic diversity but cannot stop at the achievement of a moral credential. This change must be thick. “Thick” expands the meaning of diversity into the gaps left by insufficient DEI

---

<sup>19</sup> The National Science Foundation (NSF) has devoted attention to increasing Indigenous participation in STEM through various funding streams and now requires all projects that may impact Tribal Nations to engage in consultation practices in order to obtain NSF funding (NSF 2024, 80).

efforts in a way that is slow, intentional, constant, and nonhierarchical. Thick epistemic diversity seeps into every aspect of organizational and intellectual culture to fundamentally reshape the doing of science.

As we initiate what we hope will lead to a collective imagining of the thick implementation of epistemic diversity, we offer the following conclusions as a starting point:

1. We must grapple with the reality that the epistemic products of science are produced within relations of power. For diversification efforts to make an impact on explanation and understanding, first scientists need to understand that science is necessarily situated in complex power relations. Then, scientists need to learn to accept that their experiences shape their perceptions, observations, explanations, and ultimately the way they understand that which they study.
2. Scientists (and philosophers of science) need to recognize that we cannot separate our epistemic practices from the experiences that have shaped us. This is a motion to refuse the intellectual assimilation that we accept (either fully or under duress) as part of our scientific or academic training.
3. We need to learn to see alongside and in relation with others rather than try to see from their perspectives, while actually engaging with the situated standpoint that we each bring rather than striving for knowledge from nowhere (or individual-level objectivity).
4. From this place of reflexivity, scientific disciplines (and academia) can begin to reorganize with social interactions between diverse ways of knowing/practices of science as the foundation. Specifically, the ways that observations are collected, hypotheses are generated, and explanations and understanding are justified/adopted must be viewed as communal/socialized practices.
5. We should receive insights from perspectives and epistemologies other than our own, when offered, as gifts with reciprocity and accept that science done in community with people with different lived experiences provides a check on our own biases and assumptions such that a broader and more complete understanding is possible. This requires acknowledging that when the scientific community perceives from only one perspective, we are missing every other perspective that is crucial to understanding.

6. Future philosophical theorizing about scientific explanation and understanding ought to more fully engage with projects and communities that are attempting to align multiple epistemic perspectives to produce a wider range of epistemic and social goods.

While we recognize that the above list does not contain all the necessary changes, implementing these changes will put us on the path to recognizing the breadth and depth of the epistemic benefits of diversity in science.

Of course, we agree that demographic diversity in academic departments (students and faculty), funding agencies, editorial boards, and every other position of knowledge gatekeeping is a necessary part of improving epistemic diversity. But there must also be an ideological shift embraced by those gatekeepers that fundamentally rejects the elitism, exploitation, and coercion at the heart of the process by which any of us come to be agents within the epistemic communities. Specifically, with respect to the epistemic aims of explanation and understanding this is essential because, as we argued above, these gatekeeping structures determine which explanations and understandings are considered, tested, and adopted by scientific (and academic) communities. This is the difficult task at hand, but it is crucial for creating a space where a wide range of ways of knowing, ways of doing, and ways of being can shape the future of scientific inquiry.

The interventions we seek are not just in the realm of epistemology. Rather, we are specifically calling for change in the people, practices, and products of science. As Dara Norman, Tim Sacco, and Dorian Russell (2024, 12) write, “Over centuries, humans have been fascinated with the stars, the planets, the Moon, etc., and wanted to know more about what they are and how they have come to be. The desire to gain this knowledge about the Universe and our place in it is not limited to any one group of people in any one place or at any single time—it is a universal desire.” This preface to their volume on inclusion in astronomy is an important touchstone. If the desire for explanation and understanding is universal, science must be careful not to position itself, its limited disciplines, or its particular way of knowing as the one path to understanding the universe and our place within it.

Changing scientific fields in these ways must be a cooperative task. We live in a world in near constant crisis. The recent pandemic has made it abundantly clear that science has central value not just to some lofty epistemic ideals but also to the act of living itself. This does not mean that science is beyond scrutiny. For science to help us all make our lives livable, epistemic diversity becomes imperative. We need a practice of and an organizational structure for science within which it can aid, support, and endorse rather than erase, extract, and exploit—and where the pursuit of explanation

and understanding is situated, relational, and in community rather than a form of elitism that reproduces (if unintentionally) oppressive ideologies.

## References

- Acker, Joan. 1990. "Hierarchies, Jobs, Bodies: A Theory of Gendered Organizations." *Gender & Society* 4 (2): 139–58.
- . 2006. "Inequality Regimes: Gender, Class, and Race in Organizations." *Gender & Society* 20 (4): 441–64.
- Ahmed, Sara. 2012. *On Being Included: Racism and Diversity in Institutional Life*. Durham, NC: Duke University Press.
- Archibald, Jo-ann. 2008. *Indigenous Storywork: Educating the Heart, Mind, Body, and Spirit*. Victoria: University of British Columbia Press.
- Barad, Karen. 2007. *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning*. Durham, NC: Duke University Press.
- Barker, Joanne. 2019. "Confluence: Water as an Analytic of Indigenous Feminisms." *American Indian Culture and Research Journal* 43 (3): 1–40.
- Bartlett, Chery, Murdena Marshall, and Albert Marshall. 2012. "Two-Eyed Seeing and Other Lessons Learned within a Co-learning Journey of Bringing Together Indigenous and Mainstream Knowledges and Ways of Knowing." *Journal of Environmental Studies and Sciences* 2 (August): 331–40.
- Beamer, Kamanamaikalani. 2020. "He Ali'i Ka 'Āina, Ua Mau Kona Ea: Land Is the Chief, Long May She Reign." In *Routledge Handbook of Critical Indigenous Studies*, edited by Brendan Hokowhitu, Aileen Moreton-Robinson, Linda Tuhiwai-Smith, Chris Andersen, and Steve Larkin, 283–94. New York: Routledge.
- Bendick, Marc, Jr. and Ana P. Nunes. 2012. "Developing the Research Basis for Controlling Bias in Hiring." *Journal of Social Issues* 68 (2): 238–62.
- Black Elk, Linda. 2016. "Native Science: Understanding and Respecting Other Ways of Thinking." *Rangelands* 38 (1): 3–4.
- Blandford, Roger D., Martha P. Haynes, John P. Huchra, Marcia J. Rieke, Lynne Hillenbrand, Steven J. Battel, Lars Bildsten, et al. 2010. *New Worlds, New Horizons in Astronomy and Astrophysics*. National Research Council Committee for a Decadal Survey of Astronomy and Astrophysics. Washington, DC: National Academies Press.
- Boyd, Kenneth. 2021. "Group Understanding." *Synthese* 198, no. 7 (July): 6837–58.
- Brown, Greg, and Charles C. Harris. 2001. "A Longitudinal Study of Environmental Attitudes of Women and Gender Diversification in the U.S. Forest Service 1990–1996." *Forest Science* 47 (2): 246–57.
- Cajete, Gregory. 2000. *Native Science: Natural Laws of Interdependence*. Santa Fe, NM: Clear Light.

- . 2020. “Indigenous Science, Climate Change, and Indigenous Community Building: A Framework of Foundational Perspectives for Indigenous Community Resilience and Revitalization.” *Sustainability* 12 (22): article 9569.
- Carroll, Franklin O., John Freemuth, and Les Alm. 1996. “Women Forest Rangers: Revisiting Kaufman’s *The Forest Ranger*.” *Journal of Forestry* 94 (1): 38–41.
- Claw, Katrina G., Matthew Z. Anderson, Rene L. Begay, Krystal S. Tsosie, Keolu Fox, Nanibaa’ A. Garrison, and Summer Internship for Indigenous Peoples in Genomics (SING) Consortium. 2018. “A Framework for Enhancing Ethical Genomic Research with Indigenous Communities.” *Nature Communications* 9 (July 27): article 2957.
- Clough, Sharyn. 2013. “Pragmatism and Embodiment as Resources for Feminist Interventions in Science.” *Contemporary Pragmatism* 10 (2): 121–34.
- Coburn, Elaine, Makere Stewart-Harawira, Aileen Moreton-Robinson, and George Sefa Dai. 2013. “Unspeakable Things: Indigenous Research and Social Sciences.” *Socio*, no. 2: 331–48. <https://doi.org/10.4000/socio.524>.
- Collins, Patricia Hill. 1986. “Learning from the Outsider Within: The Sociological Significance of Black Feminist Thought.” *Social Problems* 33 (6): S14–S32.
- . 1989. “The Social Construction of Black Feminist Thought.” *Signs* 14 (4): 745–73.
- . 2000. *Black Feminist Thought: Knowledge, Consciousness, and the Politics of Empowerment*. 2nd ed. New York: Routledge.
- . 2019. *Intersectionality as Critical Social Theory*. Durham, NC: Duke University Press.
- Cottom, Tressie McMillan. 2019. *Thick: And Other Essays*. New York: New Press.
- Coutinho-Sledge, Piper. 2015. “Feminized Forestry: The Promises and Pitfalls of Change in a Masculine Organization.” *Gender, Work, and Organization* 22 (4): 375–89.
- Cuby, Jean-Gabriel, Christine Matsuda, Rich Matsuda, Andy Adamson, John O’Meara, and Nadine Manset. 2024. “Astronomy’s Relationship with the Lands and Communities of Maunakea.” arXiv preprint. (2024). arXiv:2407.14629.
- Daniel, Kathryn J., Joshua R. Smith, Stefan Ballmer, Warren Bristol, Jennifer C. Driggers, Anamaria Effler, Matthew Evans, et al. 2025. “Criteria for Identifying and Evaluating Locations That Could Potentially Host the Cosmic Explorer Observatories.” *Review of Scientific Instruments* 96 (1): article 014502.
- Dei, George J. Sefa, Wambui Karanja, and Grace Erger. 2022. *Elders’ Cultural Knowledges and the Question of Black/African Indigeneity in Education*. Cham, Switzerland: Springer.
- Delarivière, Sven. 2020. “Collective Understanding: A Conceptual Defense for When Groups Should be Regarded as Epistemic Agents with Understanding.” *Avant* 11 (2): 1–20. <https://doi.org/10.26913/avant.2020.02.01>.

- Douglas, Heather E. 2009. *Science, Policy, and the Value-Free Ideal*. Pittsburgh: University of Pittsburgh Press.
- Dotson, Kristie. 2015. "Inheriting Patricia Hill Collins's *Black Feminist Epistemology*." *Ethnic and Racial Studies* 38 (13): 2322–28.
- Elgin, Catherine Z. 2017. *True Enough*. Cambridge, MA: MIT Press.
- Ermine, Willie. 2007. "The Ethical Space of Engagement." *Indigenous Law Journal* 6 (1): 193–203.
- FAO (Food and Agricultural Organization of the United Nations). 2006. *Time for Action: Changing the Gender Situation in Forestry; Report of the Team of Specialists on Gender and Forestry*. Rome: FAO.
- Filligim, Angela, and Zawadi Rucks-Ahidiana. 2021. "Theory on the Other Side of the Veil: Reckoning with Legacies of Anti-Blackness and Teaching in Social Theory." *American Sociologist* 52 (2): 276–303.
- Foley, Dennis. 2003. "Indigenous Epistemology and Indigenous Standpoint Theory." *Social Alternatives* 22 (1): 44–52.
- Gardner-Vandy, Kathryn G., and Daniella M. Scalice. 2024. "It All Starts with Relationships: Astronomical Collaborations with Indigenous Communities." In *An Astronomical Inclusion Revolution: Advancing Diversity, Equity, and Inclusion in Professional Astronomy and Astrophysics*, edited by Dara Norman, Tim Sacco, and Dorian Russell, 28–36. Bristol: IOP Publishing.
- Gardner-Vandy, Kat, Daniella Scalice, Juan Carlos Chaves, Dominique M. David-Chavez, Kathryn J. Daniel, Eddie Gonzales, Annette Lee, et al. 2021. "Relationships First and Always: A Guide to Collaborations with Indigenous Communities." An EDI Community Paper to the 2020 Planetary Science and Astrobiology Decadal Survey 2023–2032. *Bulletin of the American Astronomical Society* 53 (4). <https://doi.org/10.3847/25c2cfcb.0de1af1a>.
- Geertz, Clifford. 1973. *The Interpretation of Cultures*. New York: Basic Books.
- Gegeo, David Welchman, and Karen Ann Watson-Gegeo. 2001. "'How We Know': Kwarā'ae Rural Villagers Doing Indigenous Epistemology." *Contemporary Pacific* 13 (1): 55–88.
- Grimm, Stephen R. 2006. "Is Understanding a Species of Knowledge?" *British Journal for the Philosophy of Science* 57 (3): 515–35.
- Haraway, Donna. 1988. "Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective." *Feminist Studies* 14 (3): 575–99.
- Harding, Sandra. 1986. *The Science Question in Feminism*. Ithaca, NY: Cornell University Press.
- . 1995. "'Strong Objectivity': A Response to the New Objectivity Question." *Synthese* 104 (3): 331–49.

- . 2004. “Rethinking Standpoint Epistemology: What Is ‘Strong Objectivity’?” In *Feminist Perspectives on Social Research*, edited by Sharlene Nagy Hesse-Biber and Michelle L. Yaiser, 39–64. Oxford University Press: New York.
- . 2009. “Standpoint Theories: Productively Controversial.” *Hypatia* 24 (4):192–200.
- . 2015. *Objectivity and Diversity: Another Logic of Scientific Research*. Chicago: University of Chicago Press.
- Hernandez, Jessica, and Michael S. Spencer. 2020. “Weaving Indigenous Science into Biological Sciences: Culturally Grounding Our Indigenous Scholarship.” *Human Biology* 92 (1): 5–9.
- Hirji, Sukaina. 2021. “Oppressive Double Binds.” *Ethics* 131 (4): 643–69.
- hooks, bell. 1989. “Choosing the Margin as a Space of Radical Openness.” *Framework: The Journal of Cinema and Media*, no. 36: 15–23.
- Intemann, Kristen. 2010. “25 Years of Feminist Empiricism and Standpoint Theory: Where Are We Now?” *Hypatia* 25 (4): 778–96.
- James, Chuck. 1991. “Women in the Forest Service: The Early Years.” *Journal of Forestry* 89 (3): 14–17.
- Khalifa, Kareem. 2017. *Understanding, Explanation, and Scientific Knowledge*. Cambridge: Cambridge University Press.
- Kimmerer, Robin Wall. 2013. *Braiding Sweetgrass: Indigenous Wisdom, Scientific Knowledge, and the Teachings of Plants*. Minneapolis: Milkweed Editions.
- Kovach, Margaret. 2009. *Indigenous Methodologies: Characteristics, Conversations, and Contexts*. Toronto: University of Toronto Press.
- . 2017. “Doing Indigenous Methodologies: A Letter to a Research Class.” In *The Sage Handbook of Qualitative Research*, 5th ed., edited by Norman K. Denzin and Yvonna S. Lincoln, 214–34. Sage Publications.
- Le Bihan, Soazig. 2017. “Enlightening Falsehoods: A Modal View of Scientific Understanding.” In *Explaining Understanding: New Perspectives from Epistemology and Philosophy of Science*, edited by Stephen R. Grimm, Christoph Baumberger, and Sabine Ammon, 111–35. New York: Routledge.
- Lewis, James G. 2005. “The Applicant Is No Gentleman: Women in the Forest Service.” *Journal of Forestry* 105 (5): 259–63.
- Longino, Helen. 1987. “Can There Be a Feminist Science?” *Hypatia* 2 (3): 51–64.
- . 1990. *Science as Social Knowledge*. Princeton, NJ: Princeton University Press.
- . 2002. *The Fate of Knowledge*. Princeton, NJ: Princeton University Press.
- . 2013. *Studying Human Behavior: How Scientists Investigate Aggression and Sexuality*. Chicago: Chicago University Press.
- Malcolm-Piqueux, Lindsey. 2024. “Detecting the Signal Amidst the Noise: Ambient Exclusion as a Barrier to Advancing Diversity in Physics and Astronomy.” In *An Astronomical Inclusion Revolution: Advancing Diversity, Equity, and Inclusion*

- in Professional Astronomy and Astrophysics*, edited by Dara Norman, Tim Sacco, and Dorian Russell, 19–27. Bristol: IOP Publishing.
- Malfatti, Federica Isabella. 2022. “Understanding Phenomena: From Social to Collective?” *Philosophical Issues* 32 (1): 253–67.
- Matsuda, Rich. 2022. “Let’s Brave the Possibilities on Mauna Kea.” *Honolulu Civil Beat*, February 9. <https://www.civilbeat.org/2022/02/lets-brave-the-possibilities-on-mauna-kea/>.
- Mervis, Jeffrey, and Rodrigo Pérez Orega. 2024. “Study on Braiding Indigenous and Western Science Halted.” *Science* 385 (6708): 482–83.
- Meyer, Manulani Aluli. 2001. “Our Own Liberation: Reflections on Hawaiian Epistemology.” *Contemporary Pacific* 13 (1): 124–48.
- . 2003. “Hawaiian Hermeneutics and the Triangulation of Meaning: Gross, Subtle, Causal.” *Social Justice* 30 (4): 54–63.
- . 2013. “Indigenous and Authentic: Hawaiian Epistemology and the Triangulation of Meaning.” In *The Global Intercultural Communication Reader*, edited by Molefi Kete Asante, Yoshitaka Miike, and Jing Yin, chap. 9. New York: Routledge.
- Mitchell, Sandra D. 2009. *Unsimple Truths: Science, Complexity, and Policy*. Chicago: University of Chicago Press.
- . 2012. “Emergence: Logical, Functional and Dynamical.” *Synthese* 185 (2): 171–86.
- Moreton-Robinson, Aileen. 2013. “Towards an Australian Indigenous Women’s Standpoint Theory: A Methodological Tool.” *Australian Feminist Studies* 28 (78): 331–47.
- Morrison, Margaret. 2011. “One phenomenon, many models: Inconsistency and complementarity.” *Studies in History and Philosophy of Science Part A* 42 (2): 342–51.
- . 2015. *Reconstructing Reality: Models, Mathematics, and Simulations*. New York: Oxford University Press.
- Nakata, Martin. 2007. *Disciplining the Savages: Savaging the Disciplines*. Canberra: Aboriginal Studies Press.
- National Science Foundation. 2024. *Proposal and Award Policies and Procedures Guide*. NSF 24-1 (). OMB Control Number 3145-0058. Alexandria, VA: NSF. <https://www.nsf.gov/policies/pappg>.
- Norman, Dara. 2024. “The Scientific Merit of Building and Maintaining a Culture of Inclusion in Astronomy and Astrophysics.” In *An Astronomical Inclusion Revolution: Advancing Diversity, Equity, and Inclusion in Professional Astronomy and Astrophysics*, edited by Dara Norman, Tim Sacco, and Dorian Russell, 97–101. Bristol: IOP Publishing.

- Norman, Dara, Tim Sacco, and Dorian Russell. 2024. Preface to *An Astronomical Inclusion Revolution: Advancing Diversity, Equity, and Inclusion in Professional Astronomy and Astrophysics*, edited by Dara Norman, Tim Sacco, and Dorian Russell, 12–13. Bristol: IOP Publishing.
- Okruhlik, Kathleen. 1994. “Gender and the Biological Sciences.” *Canadian Journal of Philosophy* 20: 21–42.
- Patterson, Ashley, Valerie Kinloch, Tanja Burkhard, Ryann Randall, and Arianna Howard. 2016. “Black Feminist Thought as Methodology: Examining Intergenerational Lived Experiences of Black Women.” *Departures in Critical Qualitative Research* 5 (3): 55–76.
- Perschel, Robert T. 1991. “Pioneering a New Human/Nature Relationship: Report and Recommendations to the New England SAF Concerning a New Mission Statement.” *Journal of Forestry* 89 (4): 18–22. <https://doi.org/10.1093/jof/89.4.18>.
- Potochnik, Angela. 2017. *Idealization and the Aims of Science*. Chicago: University of Chicago Press.
- Ray, Victor. 2019. “A Theory of Racialized Organizations.” *American Sociological Review* 84 (1): 26–53.
- Rice, Collin. 2013. “Moving Beyond Causes: Optimality Models and Scientific Explanation.” *Noûs* 49 (3): 589–615.
- . 2021. *Leveraging Distortions: Explanation, Idealization, and Universality in Science*. Cambridge, MA: MIT Press.
- . 2022. “Scientific Representation and Understanding: A Communal and Dynamical View.” In *Scientific Representation and Understanding: Modeling in the Physical Sciences*, edited by Insa Lawler, Kareem Khalifa, and Elay Shech, 234–51. New York: Routledge.
- Risman, Barbara. 2004. “Gender as a Social Structure: Theory Wrestling with Activism.” *Gender & Society* 18 (4): 429–50.
- Rouse, Joseph. 2009. “Standpoint Theories Reconsidered.” *Hypatia* 24 (4): 200–209.
- Ryser, Rudolph Carl, Dina Gilio-Whitaker, and Heidi G. Bruce. 2017. “Fourth World Theory and Methods of Inquiry.” In *Handbook on Theoretical Perspectives on Indigenous Knowledge Systems in Developing Countries*, edited by Patrick Ngulube, 50–84. Hershey, PA: IGI Global.
- Sacco, Tim. 2024. “How Grantmaking Organizations Can Further DEI Goals.” In *An Astronomical Inclusion Revolution: Advancing Diversity, Equity, and Inclusion in Professional Astronomy and Astrophysics*, edited by Dara Norman, Tim Sacco, and Dorian Russell, 91–96. Bristol: IOP Publishing.
- Scott, James C. 1998. *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed*. New Haven, CT: Yale University Press.

- Simpson, Leanne Betasamosake. 2017. *As We Have Always Done: Indigenous Freedom through Radical Resistance*. Minneapolis: University of Minnesota Press.
- Smith, Dorothy. 1974. "Women's Perspective as a Radical Critique of Sociology." *Sociological Inquiry* 44 (1): 7–13.
- . 1987. *The Everyday World as Problematic: A Feminist Sociology*. Boston: Northeastern University Press.
- Smith, Linda Tuhiwai. 2012. *Decolonizing Methodologies: Research and Indigenous Peoples*. 2nd ed. London: Zed Books].
- Solomon, Miriam. *Social Empiricism*. Cambridge, MA: MIT Press, 2001.
- Stanford, P. Kyle. 2006. *Exceeding Our Grasp: Science, History, and the Problem of Unconceived Alternatives*. Oxford: Oxford University Press.
- Walker, Polly. 2003. "Colonising Research: Academia's Structural Violence Towards Indigenous Peoples." *Social Alternatives*. 22 (3): 37–40.
- Walter, Maggie, Tahu Kukutai, Robert Henry, and Angela A. Gonzales. 2023. "Introduction: Holding the Discipline of Sociology to Account." In *The Oxford Handbook of Indigenous Sociology*, edited by Maggie Walter, Tahu Kukutai, Angela A. Gonzales, and Robert Henry, 1–11. Oxford: Oxford University Press.
- Weisberg, Michael. 2007. Three kinds of idealization. *Journal of Philosophy* 104 (12): 639–59.
- . 2013. *Simulation and Similarity: Using Models to Understand the World*. Oxford: Oxford University Press.
- Whyte, Kyle Powys, Joseph P. Brewer II, and Jay T. Johnson. 2016. "Weaving Indigenous Science, Protocols, and Sustainability Science." *Sustainability Science* 11 (1): 25–32.
- Wilson, Shawn. 2008. *Research Is Ceremony: Indigenous Research Methods*. Black Point, NS: Fernwood Publishing.
- Wong, Norma. 2024. "The Philosophy and Elements of Mutual Stewardship." Hawai'i I Ke Alo Mutual Stewardship Project.
- Woodward, James. 2003. *Making Things Happen: A Theory of Causal Explanation*. Oxford: Oxford University Press.
- Wylie, Alison. 2003. "Why Standpoint Matters." In *Science and Other Cultures: Issues in Philosophies of Science and Technology*, edited by Robert Figueroa and Sandra Harding, 26–48. New York: Routledge.

PIPER SLEDGE is an associate professor of gender and women's studies at the University of Arizona. Her research explores the meanings of gender and race across diverse contexts including the ways that individuals resist and reimagine these meanings through embodiment. Sledge is the author of the award-winning book *Bodies Unbound: Gender Specific Cancer and Biologitimacy*, published with Rutgers

University Press. Sledge also serves as the director of community-based initiatives and research for the Indigenous and Place-based Partnership Program (IPP) of Cosmic Explorer.

COLLIN RICE is an assistant professor of philosophy at Colorado State University. His research focuses on the epistemological and metaphysical issues surrounding scientific explanation and understanding, the positive roles highly idealized models play in scientific research, and the social epistemology of scientific understanding. Major works include his book *Leveraging Distortions: Explanation, Idealization and Universality in Science*, published with MIT Press; “Moving Beyond Causes: Optimality Models and Scientific Explanation” in *Noûs*; “Models Don’t Decompose That Way: A Holistic View of Idealized Models” in *British Journal for the Philosophy of Science*; and “Factive Scientific Understanding without Accurate Representation” in *Biology and Philosophy*.