

ARTICLE

Between the Screens: Brain Imaging, Pornography, and Sex Research

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Abstract

This essay focuses on the use of brain imaging technologies to understand sexual arousal and orgasm and the issues that this practice raises for feminist theories of embodiment, visibility, and gender. In the first section, the paper examines the use of brain imaging technologies to measure the brain's role during sexual arousal and orgasm and its circulation in popular culture, with a particular focus on fMRI and PET technology. The second section examines the interplay between brain imaging technologies as the means of measurement and film pornography as the means of arousal, bringing together scholarship on pornography studies, visual studies, and science and technology studies. By interrogating the technology behind research into the neurology of sexual response and critically examining the use of one representation of sexuality to produce another, the paper investigates how gendered difference is manifested in this research and how the body is produced as a site of intervention.

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Rapid developments in brain imaging technologies since the 1980s have provided researchers a new means to pursue sexual response research, as well as tap into a larger fixation on the brain as the newest frontier of scientific research. Brain imaging technologies can be considered part of what Sawchuk (2000) terms “biotourism,” or “the fantasy that one can voyage into the interior space of the body without intervening in its life processes, with silent footsteps, without leaving a trace” (p. 21). The availability of technologies such as functional magnetic resonance imaging (fMRI) and positron emission tomography (PET) have allowed researchers unprecedented access to the “living” brain. Efforts to understand sexuality and sexual response, in particular, have increasingly focused on understanding the neurological components of sexuality through the use of these technologies. How sexual response is measured and with what reveals not just changes in how sexual response itself is understood and who lays claims to this understanding but also how the body more generally is articulated and produced as a site of intervention. Debates regarding the most effective measurement devices for gauging sexual response are central to the history of sex research. Brain images in particular require a nuanced understanding of visibility and the circulation of images in order to understand effectively their role in scientific knowledge production.¹

Feminist and queer studies scholars have elucidated the limitations and dangers of brain imaging studies purportedly establishing neurological differences based on gender and sexuality. These studies have included critiques of the study of emotion (Bluhm, 2013), sexual orientation (Jordan-Young, 2010), moral cognition (Vidal, 2012), and generated a special issue of *Neuroethics* focusing on studies of sex/gender and two critical anthologies *Neurofeminism* (Ed. Jacobson, 2012) and *Gendered Neurocultures* (Eds. Schmitz & Höppner, 2014). Much of this scholarship draws attention to the bias at work in the assumptions driving research on sex/gender difference, the limitations and flaws in research design, and the questionable leaps in data interpretation. Feminist and queer scholarly concerns are particularly

pronounced in the cases of brain imaging studies purporting to discover neurological differences that seem to confirm already pervasive and harmful stereotypes of marginalized groups.²

As scholars researching the dissemination of medical images have aptly noted, the visualization of “difference” is highly persuasive. As scientific research filters out into mainstream publications intended for non-specialist audiences, the complexity of these images is often radically simplified. The image, rather than an interpretation of a set of data, becomes literal — the brightly colored images of a PET scan, for example, are presented as *pure reflection*. As Anne Beaulieu (2000) argues, brain scans “are presented as though they were photographs, transparently rendering the brain's activity” (p. 46). The image is viewed as faithfully representing what the brain looks like or what it is doing, as if areas of our brain really do light up bright purple when we engage in complex memory or motor tasks, or, in the case of sex research, become sexually aroused. The images “function as visual arguments, serving as powerful proof of the interpretations made” (Beaulieu, 2000, p. 43). Sex research using brain imaging technologies often perpetuate troubling discourses of gender and sexuality, particularly as the research spreads out beyond specialized scholarly circles and into mainstream discourse.

Imaging technologies in sex research have the power to affect people’s lives profoundly, given their potential influence on medical and legal discourses, but their use also raises critical questions regarding embodiment and visibility. Given the rapid advancements in sex research, particularly the contemporary use of brain imaging technologies and pharmaceutical interventions, it is critical to consider what the future holds and what direction science and technology might take us in the near future in the realm of sex. This essay outlines the contemporary focus on the brain as a site of understanding of sexual arousal and orgasm through brain imaging technology, the reliance on film pornography as the arousal stimulant in sex research, and the issues this practice raises for theories of embodiment, visibility, and gender. In the first section, I examine the use of brain imaging technologies to measure

the brain's role during sexual arousal and orgasm and how this research circulates in popular culture, with a particular focus on fMRI and PET technology. While some brain imaging studies of sexual response rely on direct stimulation as the means of arousal by either the subject or a partner, a significant number of studies rely upon film pornography to elicit arousal in research subjects. The second section examines this interplay between brain imaging technologies as the means of measurement and film pornography as the means of arousal, bringing together scholarship on pornography studies, visual studies, and science and technology studies. By interrogating the technology behind research into the neurology of sexual response and critically examining the use of one representation of sexuality to produce another, I demonstrate how gendered difference is manifested in this research and how the body is produced as a site of intervention.

“Much of Her Brain Went Silent”: Brain Imaging and the Production of Difference

Not surprisingly, physiological measurements of sexual arousal began with men. The externality of male genitalia seemed to offer a relatively simple avenue for early sex researchers to measure, record, and interpret male sexual arousal. The desire for physiological measurements grew from mistrust of self-report — particularly self-reporting in stigmatized areas of sexuality that subjects would be likely to report falsely such as pedophilia, and most notably, sexual orientation. The desire to find an accurate means of measuring female sexual arousal followed quickly on the heels of research on men but proved far more difficult for researchers. Erection and ejaculation are viewed as reliable indices of male sexual arousal and orgasm whereas female sexual response lacks such universally accepted indicators. While women exhibit certain physiological responses such as increased blood pressure and heart rate during sexual arousal, these indicators are not specific to a sexual context; women may experience increased blood pressure and heart rate in response to fear, non-sexual physical exertion, and anxiety.

Researchers needed a physiological measurement that functions as a clear indicator of *sexual* response, creating what Dussauge (2013) calls an "epistemological anxiety of specificity" (p. 134) in sexual response research.

Most of the initial developments around the measurement of female sexual arousal mapped the male model of arousal onto women through a focus on vaginal blood flow. Just as erection (a result of increased blood flow) is viewed as the primary indicator of male arousal, vaginal blood flow is a commonly used barometer of female sexual arousal (Mulhall, 2004). Part of this focus is a direct result of the development of erectile dysfunction (ED) medications for men; researchers and pharmaceutical companies were eager to determine how vaginal blood flow relates to sexual arousal in women and determine whether these drugs could be an effective treatment for female sexual dysfunction.³ However, researchers hoping to demonstrate the effectiveness of interventions for women modeled on the vascular approach have encountered outright failure as well as contradictory data in which the "objective" data fails to match the subjective reports of female research subjects. The brain, while a longstanding interest of some sex researchers, became a veritable obsession for researchers hoping to overcome the obstacles outlined above, particularly as ED drugs proved ineffective with women. Advancements in brain imaging technologies, particularly fMRI and PET, have dramatically influenced sex researchers hoping to overcome the limitations of other devices, particularly as they seem to allow us to understand the cognitive dimensions of sexual response and enable direct comparison between men and women.

Both fMRI and PET are used to capture data on the brain in action, detecting levels of cerebral blood oxygenation in the case of fMRI and using radioactive tracers to measure regional cerebral blood flow in PET. Both technologies offer "a solution to the problem of how to obtain useful information about biochemical processes taking place in relatively inaccessible sections of living organisms" (Dumit, 2004, p. 27). Scholars

have pointed to the tenuousness of what these technologies actually measure and the assumptions driving their interpretation. First, what the technologies measure is taken to have a direct correspondence to neural activity; in the case of fMRI, "a one-to-one correspondence between hemodynamic changes (the BOLD signal) and neuronal activity" is assumed (Shiffman, 2015, p. 60). Second, a key assumption guiding the use of these technologies is that the level of activity in a certain region of the brain is a barometer for how involved that region is during a given task or event. As Bluhm (2013) highlights in her critical analysis of the use of brain imaging to study gender differences in emotion, the assumption driving the research is that more activity signals more emotion, despite a plenitude of evidence suggesting that this is not always the case (pp. 874-875).

Scholars have also drawn attention to the assumptions embedded in processes of subject selection for both imaging studies. Selecting individuals for study based on predetermined criteria involves selecting *for* the variable being studied and selecting *against* possible intervening variables. Dumit explains,

"Subject selection defines a concept of the normal human being in the form of an ideal (super)normal. Abnormal categories, such as mental illness, are likewise normed as ideals. This process takes types of humans (or the generalized human as a type) as given, not to be discovered through the experiment but only to be correlated with brain activity" (p. 68).

The process of subject selection then assumes not just an idealized "normal," but also an idealized "abnormal." While the images presented, particularly in mainstream non-scholarly publications, appear to "discover" abnormality, Beaulieu explains that this is far from the case, "There are no 'blind' imaging studies where the neurological, psychological and medical status of the subjects have not been assessed prior to the scanning. In imaging settings, the label is known before the scanning begins; popular accounts show the images as providing the label" (2000, p. 47). Whether the study concerns schizophrenia or sexual

dysfunction, the label is already in place. Both Jordan-Young (2010) and Dussauge (2013) offer cogent critiques of subject selection practices in studies attempting to understand possible neurological differences between heterosexuals and homosexuals. How sexual orientation is defined varies widely across studies, or "one's scientist's heterosexuals are another scientist's homosexuals," and these categorical decisions often fluctuate in ways that shore up researchers' theories of neurological components of sexual orientation, producing a sort of "scientific gerrymandering" to produce expected results (Jordan-Young, 2010, p. 168). Subject exclusion practices also create an "idealized homosexual and heterosexual desire," (Dussauge, 2013, p. 128) and thus an idealized homosexual and heterosexual subject, producing the "super" subjects that Dumit cautions against.

Subject selection practices that produce "ideal (super)normal" and "(super)abnormal" research subjects go hand in hand with imaging technologies' relationship to the production of difference. Fitsch (2012) argues that the statistical mapping in fMRI is "always already a project to install a norm" and represents "visualized knowledge of a normative and categorizing regime" (p. 282). Similarly, one of Dumit's key arguments regarding PET technology is that embedded into the very rationale and mechanism of the technology is a focus on difference; PET can be thought of as a "difference engine." He argues, "PET scans are far better suited to show differences and abnormalities than they are to show that someone is normal or that there are no significant differences between groups" (Dumit, 2004, p. 12).

The PET process involves injecting radioactive molecules into a research subject and tracking their decay with the scanning apparatus. "The scanner," as Dumit explains, "must properly collect the data, and then a computer must algorithmically reconstruct the data into a three-dimensional map of activity, based on assumptions about the scanner and brain activity. The result is a dataset keyed to the individual's brain activity, a brainset" (p. 59). The brainset is "normalized" using "MRI data and digital brain atlases." The last stage of the PET process, making data

presentable, produces the images we are accustomed to seeing as representative of medical imaging technologies such as PET. "At the heart of this process," Dumit argues, "is a common, standard, and often encouraged practice of selecting extreme images" (pp. 59-60). The process of image manipulation emphasizes some differences and commonalities between different brains and suppresses others. Because PET images function as visual arguments, using "extreme images" makes these arguments all the more persuasive. However, the practice, particularly as it filters out to lay audiences, often leads to grossly simplified understandings of complex brain processes. Even the use of bright colors indicating particularly active brain regions visually implies that each region is a discrete, isolated entity as opposed to a dynamic part of an interdependent whole. The PET images that appear in both academic and mainstream publications are then compound representations of a series of normative assumptions, the result of a myriad of design and implementation decisions predicated on demarcating "normal" and "abnormal." Researchers also have a vested interest in highlighting difference in part because of the "publication bias" (Bluhm, 2013, p. 876) operating in the domain of academic publishing wherein research purporting to find a difference between men and women, for example, is far more likely to be published than research finding none. This can lead to an "overemphasis on positive findings and a loss of null results" (Rippon et al., 2014, p. 9), suggesting consensus where there is still significant debate.

The presentation of dramatic differences is particularly pronounced in sex research and has a marked impact on the public perception of sexual and gender difference, notions of sexual "health" and parameters of normality/abnormality. The oversimplification of medical imaging data in the media and its limitations is not solely the responsibility of journalists looking for splashy headlines; researchers are just as likely to dramatize results and to draw on deeply ingrained assumptions about gender and sexuality in the interpretation of their findings.

In order to demonstrate how researchers and the mass media co-

produce troubling narratives of sexual differences, it is helpful to take a detailed look at one representative study in particular. Gert Holstege and a team of researchers from the University of Groningen used PET to measure regional cerebral blood flow in women during four states: rest, clitoral stimulation, simulation of orgasm, and orgasm. During the clitoral stimulation phase, each woman was stimulated by her male partner. During the “simulation” phase, participants were asked to perform “voluntary repetitive contractions of hip, buttock, abdominal and pelvic floor muscles in a rhythmic ‘orgasm-like’ fashion, while receiving stimulation to the clitoris” (Georgiadis, 2006, p. 3306). The team’s presentations, and subsequent publications, provoked a tremendous amount of media attention, particularly in connection with two related claims: one, that certain areas of the brain *deactivate* during orgasm in women, and two, that there are distinct differences in brain activation during orgasm versus “simulation.” The team’s findings garnered attention from print and web media such as *The Daily Mail*, *BBC News*, *Times Online*, *New Scientist*, *The Independent*, and *The Guardian*. Headlines included “If She’s Thinking, She’s Faking,” “Women fall into ‘trance’ during orgasm,” “There’s no faking it,” and “Good sex really is mind-blowing for women.” One publication began by stating, “Ladies, you may be able to fool your lover, but you cannot fool the machine” (Witz, 2003).

The *BBC News* online article, with the headline “Scan spots women faking orgasm,” includes two images of colorized PET scans. One image’s caption reads “Tell tale brain activity in a fake orgasm,” the other image’s caption reads “Genuine orgasm: less brain activity” (Roberts, 2005). These images, along with quotes from Holstege himself, function as guarantees of scientific authority. No background on PET is given in the article, in fact, the technology used is never mentioned specifically — the subjects in the study are described as simply being placed in a “scanner.” Thus, the images themselves function as a substitute for the totality of the PET measurement process. Other than the oversimplified captions, the reader is given no information regarding how these images

are derived or what, and who, they represent. For example, the images are just as likely to be composites, or averages, of multiple scans from multiple women, representing not one individual woman's brain during orgasm and during simulation, but rather the averages of multiple women during each stage. More importantly, colorization schemes have the effect of dramatizing difference in troubling ways.⁴ The first image, that of the "faked" orgasm, contains two separate spots, richly colored in yellows, oranges, and reds. The rest of the image is a uniform grayish blue, suggesting that no activity is occurring in the brain other than in these two isolated regions. In the second image, representing "real" orgasm, one of these spots completely disappears. The visual argument then encourages the dramatic interpretation that "much of a [woman's] brain goes silent" during orgasm (Portner, 2009).

The images and their media uptake are not the only source of dramatic interpretation. Holstege himself declared at the 2005 meeting of the European Society of Human Reproduction and Embryology, "At the moment of orgasm, women do not have any emotional feelings" (Portner, 2009, p. 31). Given that the team found deactivation in women in regions of the brain that researchers believe control fear and anxiety, suggesting that women need to "let go" of these emotions during orgasm, Holstege's advice to men is, "When you want to make love to a woman, you must give her the feeling of being protected" (Roberts, 2008). Holstege also links the deactivation of fear to the benefits of alcohol. "Alcohol brings down fear levels. Everyone knows if you give alcohol to women it is easier" (Meikle, 2005). Given research suggesting that alcohol consumption may actually lower sensitivity, decrease vaginal lubrication, and inhibit orgasm in women, as well as the troubling association between alcohol consumption and sexual assault, it is unclear what the "it" is that Holstege is referring to here. Holstege's interpretations of the PET data fit neatly into traditional gender roles and heteronormative scripts of seduction that situate women as in need of convincing by male sexual partners tasked with initiating sexual action and overcoming women's resistance.

The Pornographic Brain

In May 2009, *Scientific American Mind* published a special issue entitled “Your Sexual Brain.” In addition to articles on the “sexual brain” of animals, sex offenders and gay men, Martin Portner’s piece “The Orgasmic Mind” provides an overview of contemporary brain research into human orgasm with a significant focus on Holstege and his team’s research. In this case, it is not so much Portner’s discussion of this research that I want to focus on, but rather, I want to draw attention to the opening image that accompanies the piece. The article opens with a full-page image featuring a woman’s head in shadowed profile with fireworks emanating outside the lower frame, with bursts of explosion appearing deep within the recesses of her brain and continuing in a fantastical upsweep of hair. The bright colors of the fireworks and the shadowy figure of the woman mimic the brain images the authors profiles. The woman herself is but a backdrop for the bright bursts of energy. This opening image bears a strange resemblance to another familiar visualization of women’s orgasm — Gerard Damiano’s hardcore pornographic film *Deep Throat* (1972). In the film, Linda Lovelace’s character is desperately seeking sexual fulfillment. As she describes to a friend, her sexual experiences are wanting; she desires “bells ringing, dams bursting, bombs going off, something.” After discovering that her clitoris is located at the back of her throat, Linda finds a very willing male doctor to help her test out this new discovery. It is determined that Lovelace requires “deep throat” in order to experience the heights of sexual pleasure. At the end of the film, she finally finds her fulfillment in the act of “deep throat.”

The culminating “deep throat” scene is interspersed with footage of rockets launching, bombs bursting, and bells ringing as she performs oral sex on her male counterpart. These cuts stand in for Lovelace’s pleasure and grow increasingly more rapid as the male recipient of the “deep throat” approaches climax and finally ejaculates. Fireworks, and other explosive phenomena as a metaphor for orgasm are well-worn

tropes. So why make a comparison between two such seemingly disparate types of representation: one, a digital image in a contemporary science magazine, the other, a pornographic film sequence from the 1970s? The comparison is apt precisely because these representations overlap in ways far beyond simply a shared reliance on convenient metaphors for female orgasm. Sex research on sexual response require means of stimulation — arousal and orgasm must be brought forth in research participants in order to be measured. While some studies like Holstege's develop research designs that allow for self-stimulation or stimulation by a partner, the majority of sex research relies on film pornography in order to elicit sexual response. What makes this practice such a fascinating site of analysis with regard to the use of pornography in brain imaging studies is the body's positioning between two forms of visualization. There is a complex interplay of screens involved in most sexual response research. One visual representation of orgasm (pornography) is screened and used to manufacture another (the brain scan image). The question becomes: What happens to the body positioned between these two screens?

The use of visual stimuli is a longstanding and common practice within sex research, driven both by experimental limitations as well as the assumption that human beings are significantly attuned to and stimulated, sexually and otherwise, by visual stimuli. Studies rarely provide much detail regarding the actual content of the film pornography used, however. Park et al. (2001) and Maravilla et al. (2000) simply state that an "erotic film video" (p. 74) and a "sexually explicit stimulus segment" (p. 918) were used respectively. Arnou et al. (2002) describes the erotic video used as depicting "rear entry intercourse, intercourse with the female in the superior position, fellatio and sexual intercourse with the male in the superior position" (p. 1016). Zhu et al. (2010) notes, "All five erotic video clips were selected from commercial adult films containing consensual sexual interactions between one man and one woman, of which two were non-intercourse (petting) and three were vaginal intercourse scenes" (p. 280). Film titles, production companies,

year of release, and detailed descriptions of the film actors involved in the selected clips in terms of race, ethnicity, and age are absent from the descriptions. Sexual response research on men is typically quite vague regarding the content of the visual stimuli used, perpetuating the notion that men will respond to most anything that is sexually explicit. Research on women's sexual response as well as research comparing men and women's sexual response tends to be much more forthcoming with detailed explanations of the content of the video images. This practice derives from the idea, borne out by some research in this area, that women respond differently to sexually explicit material than men and to different types of stimuli, as well as criticisms that pornography objectifies women.⁵

Key selection criteria in sexual response research using visual stimuli include the requirement that participants be responsive to sexually explicit imagery more generally in order “to ensure that visual sexual stimuli would be effective” (Stoléru et al., 1999, p. 4-5). Lack of responsiveness to sexually explicit imagery is coded as a conflicting variable that could throw off the data; responsiveness is coded as “normal”—the normal human brain is one that *responds*.⁶ Indeed, as Dussauge points out, as soon as participant responsiveness to visual stimuli is established, the specificity of the arousal stimulus seems to drop out of the analysis in most sexual response research. Drawing on Sara Ahmed's work on queer phenomenology, Dussauge argues that this disappearance strips sexual arousal of its “towardsness,” or the “specificity of our relations to the objects of sexual desire.” (Dussauge, 2015, p. 449). This is further compounded by the practice of subtraction in brain imaging research:

Subtraction entails imaging subjects performing a mixed sequence of two different tasks that are (supposedly) separated by a single cognitive element, ending up with two different time series that can be compared to verify whether the activity in the region of interest was different between the two tasks. Once performed, the image of the “simpler” task is subtracted from the complex one, creating

a difference image that (ideally) has isolated an area of increased or decreased activation. That area is considered to be the seat of the additional cognitive element separating the two tasks.

(Shifferman, 2015, p. 63)

In the case of sexual response research using visual stimuli, researchers go to great lengths to isolate what they hope to be the specifically "sexual" component of the stimuli. This is accomplished by showing research subjects a range of neutral and control stimuli designed to establish a baseline and to provoke emotional, but non-sexual, responses. Documentary films, sports clips, humorous episodes, and videos of people talking are examples of control stimuli used in sexual response research. In order to isolate the neurological response to the sexually explicit video, the control stimuli response is subtracted from the sexually explicit stimuli response, with the assumption being that the difference will capture the specifically *sexual* response elicited in the subject. Or, as Dussauge puts it, "What counts as sexuality is thus defined as much by what does not count as sexual pleasure/desire" (2013, p. 133). This practice of subtraction in brain imaging further strips sexual response of its "towardsness" in that what is captured is not so much a response to a specific stimulus, but a remainder between a presumptively non-sexual stimulus and a sexual stimulus. The implication, of course, is that what is isolated is sexual response at its most basic, a response that is universal regardless of the particular stimulus.

Debates concerning the selection of visual stimuli within sex research, particularly regarding women, in many ways rehearses longstanding debates within feminist theories of representation addressing issues of spectatorship, identification, and objectification. Linda Williams's work has systematically engaged both the horror genre and pornography, linking them through her explication of "body genres." A body genre is one that depicts "the spectacle of the body caught in the grip of intense sensation or emotion" through a "focus on what could probably best be called a form of ecstasy [...] a quality of uncontrollable

convulsion or spasm—of the body ‘beside itself’ with sexual pleasure, fear and terror” (Williams, 1991, p. 4). Body genres not only depict these “uncontrollable convulsion[s] or spasm[s]” on screen, but also seek to elicit them in their audiences — the success of these genres is often measured by the degree to which the audience sensation mimics what is seen on the screen.” In a strange way, brain imaging technology offers a perspective on the pleasure women, and men, take in pornography, translating the genre’s ability to elicit “uncontrollable convulsion or spasm” into data. Barbara Maria Stafford (1996) describes PET scanners as “provid[ing] portraits of the brain caught in the act of thought” (p. 24). In the case of sex research, medical imaging technologies provide images of the brain “caught in the act” of pleasure. Pleasure is no longer dependent on “subjective” affirmations nor limited to meanings read off the body, but rather read *into* the body to such depths that the body recedes from view. Just as Damiano’s camera leaves the scene of climax in *Deep Throat*, relying on stock footage of bombs bursting and rockets launching to signify pleasure, brains imaging leaves the “scene” of the body. Not only is pleasure reduced to a disembodied head, but the head itself is stripped of its fleshiness. The use of pornography in brain imaging studies positions the body *between* two forms of visualization. One visual representation of sexual response (film pornography) is used to manufacture another (a brain image).

Just as the prerequisite skill of a male adult film actor is his ability to perform on cue, participants in brain imaging sex research must be able to synchronize their performance with the demands and limitations of the technology. The radioactive tracers used in PET scanning, for example, often have short half-lives, requiring that data be acquired within a finite window of time. The oxygen tracer used in Holstege and his team’s study has a half-life of only two minutes, necessitating that the subject “reach orgasm in the first minute after tracer injection” (Georgiadis et al., 2006, p. 3306) during the orgasmic phase of the research. “Six orgasms were ill-timed” and, therefore, not included in the analysis (p. 3308). Thus, the orgasms represented in brain imaging

research are those that synch with the temporal limitations of the technology. Williams argues that the temporality of fantasy structuring pornography is a “utopian fantasy of perfect temporal coincidence”; the representation of pleasure is “on time!” (Williams, 1991, p. 11). A variety of tactics are used in adult film to give the appearance of “perfect temporal coincidence,” particularly in regard to male orgasm. Shots are edited together to provide the appearance of seamless temporal continuity, often “the money shot” is filmed separately from the sexual acts displayed, and occasionally, other actors are called in to perform “the money shot” in cases where the original actor cannot. Similarly, the “directors” in medical imaging sex research cue the performance, requiring temporal coincidence in order for the representation to be captured so that it can be successfully reproduced for its intended audience. The action of the filmic body is translated into the immobility of the subject’s body inside the scanner, which is then translated into the action implied in the bright bursts of neurological activity, or temporal shift from activity to inactivity in the case of regions of the brain “shutting down” during orgasm, depicted in brain scans.

Both pornographic film representations of orgasm and brain scans of orgasm rely upon the “on time!” delivery of a perfectly synchronized body in tune with the apparatus. Unlike pornographic film, however, brain imaging offers up these “on time!” moments in their isolation — as *moments*. Pornographic film may secure temporal sequencing through the delivery of perfectly timed moments of climax, but they do so from *within* the very logic of a temporal sequence, however manufactured it may be. Medical imaging delivers these moments in their isolation. Vivian Sobchack’s (2004) discussion of temporality in relation to photography is useful:

The photograph freezes and preserves the homogeneous and irreversible *momentum* of this temporal stream into the abstracted, atomized, and essentialized time of a *moment*. [...] [T]he photograph constructs a space one can hold and look at, but in its conversion to an object to behold that space becomes

paradoxically thin, insubstantial, and opaque. It keeps the lived body out even as it may imaginatively catalyze — in the parallel but dynamically temporalized space of memory and desire — an animated drama. (pp. 144-145)

While medical images are not photographs in the traditional sense, they do appear in the pages of journals, magazines, and newspapers as photographs and often function and circulate through a photographic register. The brain scan of orgasm presents the “animated drama” of orgasm as an “abstracted, atomized and essentialized time of a *moment*,” collapsing multiple temporalities. Just as multiple temporalities are made to appear as one continuous temporal sequence in pornographic film, oftentimes even incorporating the temporalities of multiple actors to appear as one, the brain scans we typically encounter collapse *multiple* brains, and therefore multiple temporalities, into one image. Thus, the *moment* is, in fact, several — what we often see is not one moment of one orgasm of one body, but multiple moments, multiple orgasms, multiple bodies. Individual bodies are folded into, collapsed, reduced, and dispersed into an image of pure abstraction, an idealized image of orgasm; “electrobricolage” at its finest (Mitchell, 1992, p. 7). In the case of sex research, the body’s position between two screens — the screen of pornography and the screen of medical imaging — renders it more transponder than flesh and blood. The “uncontrollable convulsion or spasm” of the film image is transferred through the body and captured as its digital output and image. The brain becomes the penultimate, yet strangely disembodied and passive, seat of orgasm.

The Future is Coming

The drive to “capture” orgasm has often gone hand in hand with the desire to manufacture it in increasingly complex and sophisticated ways. With the rapid advancement in sex research, particularly the contemporary use of brain imaging technologies and pharmaceutical interventions, it is critical to consider what the future holds and what

direction science and technology might take us in the near future in the realm of sex.

Given the strange interplay between pornography and the brain in the science of orgasm, it is helpful to consider a film that explicitly interrogates what might happen if science, technology, and pornography should continue to merge. What are pornography and science's possible futures? Shu Lea Cheang's film *I.K.U.* (2000), a "Japanese Sci-Fi Porn Feature," blends the genres of science fiction and pornography, interrogating the possible futures of sex and technology's entanglement. The film's narrative follows Reiko, a replicant initially built to assist humans in colonizing space, but who now works alongside other replicants as an I.K.U. Coder for the Genom Corporation. Genom Corporation, "a worldwide leader in the field of digital desire entertainment," uses I.K.U. Coders to collect "ecstasy data" through sexual contact with humans. Once Reiko's "Biomatic Disk" is full, I.K.U. Runners are dispatched to retrieve the data via penetration with a dildo-shaped device. This data is then sold as data chips to the public in vending machines and at convenience stores, allowing users to experience "sexual excitement without physical friction" by "sending pleasure signals directly to the brain."

Cheang's future vision is a world where corporations battle one another for control over the domain of sex and "business controls personal pleasure," provoking questions of the human along the way (*I.K.U. The Movie*, n.d.). Indeed, the film, released in 2000, comes at the tail end of a decade's worth of Donna Haraway-inspired cyborg theory, activism, and art (Haraway, 1991). *I.K.U.* offers a version of the possibilities and limitations of imagining cyborg revolutions — their possibilities for opening up classic binaries, such as nature/culture, human/machine, human/animal, and individual/collective, as well as the limitations inherent in depending upon technologies born from military, state, and corporate ambitions. *I.K.U.*, Eve Oishi (2007) argues, "articulates the insistent tension produced by trying to conjure a future, a narrative of social justice and change, within a system founded on

corporate and governmental control” (p. 33). The desire to maximize pleasure is, in this case, bound up with the corporate ambitions of Genom just as recent advances in pharmaceutical treatments for sexual dysfunction and pleasure enhancement arise from and are disseminated by profit-driven companies.

Yet, unlike other science fiction films and their imaginings of rather bleak sexual futures in which corporations and governments conspire to control populations via highly regulated, disembodied pleasure, *I.K.U.* does not fall prey to a back-to-nature resolution — itself also a fantasy. There is no nostalgic "man out of time" as in Woody Allen's film *Sleeper* (1972) and Marco Brambilla's *Demolition Man* (1993), in which the protagonists long for a different future in the form of a return to good, old-fashioned (heterosexual) intercourse. Nor does *I.K.U.* share the oversimplified sense of alarm and paranoia of the film *Brainstorm* (1983) in which a team of scientists develop the means to record people's experiences, allowing people to re-experience moments in their past or partake in those of others. The dangerous possibilities of this "Brainstorm" technology first becomes evident when one of the team members becomes obsessed with a recording of someone else's sexual encounter; not content to merely encounter the experience as is, the team member creates a loop of one section of the tape, the moment of climax. The man views the tape endlessly and enters a coma-like state, suffering from an overload of sexual stimulation requiring extensive rehabilitation. Whereas *Sleeper* and *Demolition Man* humorously highlight the limits technology places upon a mythology of natural pleasure, *Brainstorm* underscores the dissolution of limits that technology may bring to pleasure. In this case, the technoscientific overwhelms, taking us beyond our limits, beyond the body's bounds.⁷ *Brainstorm* provokes the question, not of what a body *can* do, but rather, what can a body *sustainably* do?

While sharing many of the same themes with *Brainstorm*, particularly the provocation of being able to experience the pleasure of another via a recorded neurological experience, *I.K.U.* complicates the

assessment of both our technoscientific future and present. Braidotti (2002) argues, "[Contemporary] science fiction...is the defamiliarization of the 'here and now', rather than dreams of possible futures," (p. 184). It is in this register that Cheang's work operates, in part through her use of both the genre conventions of hardcore pornography and common thematics in science fiction that challenge the limitations of a two-sex model of biological sex, heteronormative figurations of pleasure, and the divisions among nature/culture/machine. Cheang's use of the conventions of hardcore pornography alongside her interrogation of the increasing encroachment of corporate, technoscientific interventions provokes questions that prevent simplistic nostalgia for a return to a mythologized past when sex and sexual pleasure were "pure," while also not letting the question of power slip from our view.

If the technology in Cheang's vision seems close at hand, her fantasy of a dissolution of binary sex and gender seems a far stretch from the focus of most contemporary sex research in which shoring up the differences between men and women seems as central as ever. Brain imaging seems to sidestep morphological difference between male and female bodies through a reduction of sexual response to neurological processes, offering the seductive possibility of directly comparing and contrasting men and women's orgasms. The production of gender difference is often at the heart of sex research using brain imaging technologies, particularly in its circulation in mainstream media, with serious ramifications for broader understandings of sex, gender, and sexuality. While feminist and queer scholars should remain wary of researchers' claims to find gendered neurological differences in sexual response via brain imaging, that does not mean that difference should be dismissed out of hand. As Wilson (2004) argues, "It is parochial to expect that sexualities circulate only in non-biological realms, that they could be contained to cultural domains, or that they could be arrested at the cell membrane or synaptic gap" (p. 61). Indeed, my concern with brain imaging research on sexual response is less a dismissal of the technologies themselves, or a repudiation that neurological differences

exists between brains, but rather a concern with the flattening of sexuality into neurological function and the continued production of bias-driven research in the domain of sex difference that insists on perpetuating assumptions and generating interpretative leaps that confirm already existing ideas about gender, sexuality, and embodiment. It may be necessary to heed Jordan-Young and Rumiati's (2012) advice on future research in this area that "a more sophisticated and ethical approach to understanding sex/gender in the brain and behavior will require the somewhat paradoxical strategy of turning away from sex/gender differences in our search" (p. 305). What variables are we missing when we incessantly turn back to gender, or sexual orientation, as the only difference that matters? As numerous scholars have pointed out, despite the growing body of research using brain imaging to study sexual response, we still know very little about the characteristics we think we are observing when we sift through the data. For example, as Jordan-Young and Rumiati (2012) and Vidal (2012) demonstrate, neurological difference does not necessarily indicate a hardwired difference, as is so often assumed, but may arise from the very social and contextual domain that is so often obscured by the research design itself. Given the vastly different worlds men and women often occupy in almost every conceivable contextual domain, it is "utterly predictable that we would observe group-level differences between men and women in various cognitive functions" (Jordan-Young & Rumiati, p. 312). So, rather than the perception that feminist scholars are "anti-difference" (Roy, 2016) in the context of neuroscience, it may just be that we find claims to have "discovered" difference thoroughly uninteresting in their obviousness. More importantly, the assumption that neurological difference indicates hardwiring reinforces the idea that the brain (and by extension bodily materiality) is static, rather than itself a site of flux and transformation.

The drive to understand the brain through medical imaging technology, as I have suggested, is intimately bound up with the desire on the part of researchers to develop effective means to identify the causes of sexual dysfunction and potential remedies, as well as maximize

sexual pleasure for a broad population. The brain becomes an idealized site of intervention, the place where sexuality truly resides, and attempts to remedy sexual dysfunction become focused on the manipulation of the brain's functioning. Our contemporary focus on brain imaging and the neurology of sexual functioning to capture the subjective "feeling" of arousal and orgasm, as well as the extensive use of film pornography as the arousal mechanism in sex research, opens up the possibility envisioned in both *Brainstorm* and *I.K.U.* that what we may want most is to experience not the height of our own sexual pleasure, but someone else's. The reduction of sexual response that results in our attempt to find comparable forms of measurements across bodies may actually flatten and restrain the very differences these studies so often presume to find. The multitude of data omitted in any given imaging study — the ill-timed orgasms, the physiological indicators that do not neatly coincide with one another, the subjective assessments of the participants themselves that do not match the physiological indicators, and the arousal that is brought forth as a response to control stimuli — all these responses simply vanish in our efforts to "drill down" (Jordan-Young, p. 155) to a singular response. What drives the search for techno/pharmacological interventions into sexual response, the hunt to understand how orgasm is experienced at the neurological level, and the use of film pornography in sex research may be yet another instance of wanting difference, of wanting an(other) — the perfectly "on time!" other of film pornography, an(other) morphology with different capacities than our own, or even that other version of ourselves who is idealized as someone who was once or is soon to be. Whatever the fantasy driving the search, what we find in the neurological answer of the brain scan is likely to be, not difference, but only more of the same.

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Notes

¹ For an overview of the history of debates regarding measurement technologies and sex research, see Waidzunus & Epstein (2015).

² For excellent reviews of the history of feminist critiques of neuroscience, see Kaiser and Dussauge (2015) and Roy (2016).

³ See Loe (2004) for an outstanding history of Viagra and the codification of erectile dysfunction as a disorder. See Tiefer (2006) and Fishman (2004) for analyses of the relationship between sex research and the pharmaceutical industry.

⁴ For an excellent visual argument regarding the problems in colorization schemes, see Brian Murphy's set of images reproduced in Dumit (2004), Plate 12. For Dumit's discussion of Murphy's images, see p. 94-95.

⁵ See E. Laan et al. (1994), Mosher & Mclan (1994), and Rupp & Wallen (2008). For evolutionary perspectives arguing that men are "pre-wired" to respond to visual sexual stimuli more than women, see Malamuth (1996). Interestingly, the idea that men are more responsive to sexually explicit stimuli contradicts the widely publicized findings of Meredith Chivers (2004) who found that men are "category specific" in their response to visual stimuli (i.e. heterosexual men respond only to stimuli featuring women) and that women are much more fluid in their response, becoming aroused by a broad range of sexual visual stimuli.

⁶ This is particularly pronounced in the widely debated work of Reiger et al. (2005) who used self-identified bisexual men's lack of genital response to sexually explicit visual stimuli featuring two women, and their heightened response to stimuli featuring two men, as evidence that male bisexuality does not really exist as sexual orientation. See Jordan-Young (2010) and Waidzunus & Epstein (2015) for an excellent critique of this research.

⁷ A contemporary example of such a threat might include the set of issues that has accompanied pharmaceutical treatments for erectile dysfunction, particularly Viagra. The widespread dissemination of Viagra has been accompanied by reports of its abuse as a recreational drug and its potentially life-threatening side effects. The warning that accompanies

advertisements for ED drugs also signifies the possibility that its effects may overwhelm the limitations of the body — “In the rare event of an erection lasting more than 4 hours, seek immediate medical help to avoid long-term injury.” (See <http://www.viagra.com/>)

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Bio

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