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Scientific Reforms, Feminist Interventions, and the Politics of Knowing: An Auto-ethnography of a Feminist Neuroscientist

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Abstract

Feminist science studies scholars have documented the historical and cultural contingency of scientific knowledge production. It follows that political and social activism has impacted the practice of science today; however, little has been done to examine the current cultures of science in light of feminist critiques and activism. In this article, I argue that, although critiques have changed the cultures of science both directly and indirectly, fundamental epistemological questions have largely been ignored and neutralized through these policy reforms. I provide an auto-ethnography of my doctoral work in a neuroscience program to a) demonstrate how the culture of science has incorporated critiques into its practices and b) identify how we might use these changes in scientific practices to advance feminist science agendas. I critically analyze three areas in current scientific

practice in which I see obstacles and opportunities: 1) research ethics, 2) diversity of research subjects and scientists, and 3) identification of a project's significance for funding. I argue that an understanding of the complicated and changing cultures of science is necessary for future feminist interventions into the sciences that directly challenge science's claim to epistemic authority.

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Introduction

Much feminist science studies work starts from the idea that science is historically and culturally contingent (Haraway 1988 ; Longino 1990 ; Schiebinger 1993 ; Spanier 1995 ; Harding 2001 ; Subramaniam 2009 ; Richardson 2010). Accordingly, if we posit that feminism has changed our broader culture, it must also have impacted science. I argue that although political dissent has changed science, these changes have been largely superficial. Rather than presenting fundamental challenges to the theoretical foundation of scientific knowledge production, these changes have added new formal procedures to scientific practice, particularly in biological sciences. These changes have not successfully challenged the ideal of attaining pure objectivity through scientific research. In this paper, I demonstrate how science's flexibility in enacting superficial changes in response to critique protects and potentially strengthens its claim to epistemological authority. However, I also argue that these changes have opened up spaces that we can, should, and must exploit to create fundamentally different sciences. I identify scientific reforms that have created new language and ideas that can potentially be used to push for more radical change.

The questions I pose about science parallel feminists' challenge, in the US, to contend with claims of a postfeminist, postracial society. The rhetoric of equality, diversity, and justice used in mainstream discourse and the histories of successful women's-rights and civil-rights movements are heralded as national victories, thereby rendering unintelligible fundamental anticapitalist, anti-imperialist critiques by feminist and antiracist movements. The cooptation of social justice ideas makes it increasingly difficult to point to continuing systematic injustices such as health disparities, disparities in the criminal justice system, increased border control and anti-immigrant policies, employment discrimination, and inequitable pay. I argue there is a similar (yet particular) post-social-justice-politics ethos in effect in the sciences. The question in regard to science is how to interject critiques into a field that claims an investment in increasing diversity, public participation, and transparency.

Feminist science studies scholars have argued that we need not only push for scientists to change their practices but for feminists to engage more with scientific knowledge production, acknowledging the realities of current scientific practice in order to craft relevant, effective critiques (Subramaniam 2009 ; Roy 2012). I offer the politics of enfranchisement as an example of how specificity and nuance can impact the intelligibility of a call for change. Arguing that women and people of color should have the right to vote seems outdated and illogical to a large segment of the population because there are no laws that explicitly exclude women and/or people of color from voting. However, laws disproportionately affect people of color thereby leading to imprisonment and the stripping of voting

rights. Additionally, hours that polling places are open and laws about proving one's identification limit the ability of some groups of people to vote more than others. The depth of the argument that segments of the population remain disenfranchised lies in a critique of color-blind politics and constructions of "citizenship" and "rights." In the realm of science, if feminist critiques continue to focus on the problems with genetic reductionism while the field of genetics is engaging in multiple gene-environment and epigenetics research, our critiques sound outdated. It would be difficult to find any geneticist who would argue that there are individual genes "for" specific traits. This does not mean that genetic reductionism is not theoretically underlying much research. As with the voting example, more specified critiques are necessary.

One way to create more relevant critiques is to better understand cultures of science. This essay uses an auto-ethnographic method to add to our understanding of scientific cultures in light of at least forty years of feminist science studies scholarship. David Hess argues that those conducting good ethnographies in science and technology studies should develop "near native competence in the technical aspects of the science and technology involved" (Hess 2001 , 239). He adds that researchers should "develop ways of intervening in their field sites as citizen-researchers and of making their competence applicable to policy problems" (Hess 2001 , 239). Based on these criteria, feminist science studies scholars trained as scientists are perfectly positioned to undertake a critical ethnography of their own work in which they attempted to make change from within the sciences.

The method of auto-ethnography is both challenging and unique because researchers subject "themselves and their most intimate surroundings to the same forms of critical analysis as they would any other" (Meneley and Young 2005 , 2). Although some feminist scientists before me have undertaken this challenge (for example, Roy 2004), too few of us have shared these critical insights from "on the ground." Here I add to this literature by critically analyzing my own training as a neuroscientist mapping a pathway for future feminist interventions from within the sciences.

On the Functional Organization of Plantarflexion Muscles

I use my doctoral research project for analysis in this paper. In this project I aimed to determine whether plantarflexion, downward motion of one's foot, could be accomplished using multiple combinations of muscles. My first goal was to identify the roles of individual muscles during plantarflexion, and my ultimate objective was to model how different muscles could compensate for the loss of use of one or more muscles. I attempted to temporarily disable a single muscle through the use of electrical stimulation and predict the new muscle-activation pattern. All of my experiments used human subjects. The typical protocol was to record the movement using force sensors and muscle-activation patterns during and after the subject completed a plantarflexion exercise using electromyography (EMG) and magnetic resonance imaging (MRI), respectively. I compared movements and muscle patterns during a variety of interventions, including changes to exercise intensity and intentional muscle fatigue.

Other work in our lab focused on the functional organization of muscles; that is, we studied whether entire muscles must be activated uniformly or whether subsections of muscles could be activated

during a movement. Helen Longino has argued that although science is a social process that allows for competing theories to be put forth and debated, without a critical approach to challenge dominant cultural ideas, mainstream ideas will prevail in this race for the “truth” (Longino 1990 ; 2002). Using this insight, I used our research questions, which I saw as debates over the definitions and boundaries of muscles, to frame my analysis. I applied an interdisciplinary analysis to understand the historical and cultural contingencies of the scientific knowledge we produced. I was not interested in finding the “truth” about the unit we call a muscle but rather in understanding what was at stake in defining the unit of a muscle. Through my contextualization I recalled a long history of debates demonstrating that the unit of movement-generation changed over time based on prevailing social theories. For example, the prevalence of a theory of animal spirits creating movement in the body paralleled social beliefs about religion at the time. This allowed me to ask how contemporary social ideas influence how we understand the boundaries of muscles, specifically scientific theories of normalization and their relationship to theories of disability.

Three concepts in current scientific practice proved to be productive for raising feminist-inspired questions: 1) ethics, 2) diversity, and 3) project significance. I focus on these three concepts because they represent major areas of concern for feminists: specifically, how science is done (ethics), who can do science and on whom (diversity), and why science should be done (significance). Despite the seeming resonance with feminist concerns, feminists and scientists have not been in conversation on all of these topics equally. The incorporation of study-participant and scientist-diversity initiatives responds directly to feminist critique (Dresser 1992 ; Rosser 2012). Research ethics and project significance respond to broader political calls for more transparency and accountability (Tuana 2010). Much feminist thought has focused on how research ethics, particularly bioethics, may be used to address feminist concerns (Wolf 1996 ; Tong 1997 ; Scully, Baldwin-Ragaven, and Fitzpatrick 2010 ; Tuana 2010 ; Roy 2012). However, the practice of identifying project significance has largely been ignored by feminists and other philosophers of science (Tuana 2010).

Spaces for Feminist Interventions

Ethics

Colloquially, ethics describes how we act in the world (collectively and individually), as well as our expectations for how we and others should act. Arguably, there is an ethics involved every time someone makes a decision regarding how to act; however, ethics in science is largely relegated to formal procedures. It is a common myth in science that ethics became necessary only after the Nazi experiments during World War II, and its implementation is meant to protect subjects against unethical research such as the US Public Health Service's Syphilis Study famously conducted with Tuskegee University.

The formulation of ethics as a response to research abuses and individual ethical dilemmas assumes that the everyday practice of science is ethically neutral. Instead, as James Thomas argues (Thomas 2008), we must integrate ethics into the daily practice of science. This is limited by a continued belief in the ideal of a value-free, purely objective science. Adhering to an ideal of pure objectivity means that ethics is constrained to weighing the risks and benefits of finding the “truth” through research and what

one should not do to “bias” a sample, experiment, results, and their dissemination (Kourany 2010). If scientists heeded Haraway's call to become accountable through a new kind of objectivity in which “we might become answerable for what we learn how to see” (Haraway 1988 , 583) what kind of ethics practices would result? If we assume greater agency in creating scientific truths, many more ethical choices must be made, such as how research questions are determined, how results are determined and disseminated, and how to assess the effects of scientific research on individuals and communities (Harding 1991 ; Roy 2004).

Bioethics has been a successful site for feminist intervention (Rehmann-Sutter 2010). Feminist bioethicists have challenged the philosophical underpinnings of the field, questioning the idea of universal principles and risk/benefit analyses, asking who makes ethics decisions and how women and other marginalized groups are affected by the field (Wolf 1996 ; Tong 1997 ; Scully, Baldwin-Ragaven, and Fitzpatrick 2010). Although theories from these bioethicists can be useful for more basic researchers, they have focused largely on health-care and biomedical research, creating a need for translation. This translation must include linking feminist critiques of objectivity with feminist proposals for increased public participation, transparency, and accountability. Recent theorists have proposed that beginning with a rejection of value-neutrality in the sciences, philosophers of science (particularly feminists) can be useful in developing a more ethically engaged science community (Douglas 2009 ; Kourany 2010 ; Tuana 2010). Although ample feminist scholarship exists to ground new ethical practices in the sciences, how the boundaries of science can be pushed to make use of these theories remains a challenge.

The IRB (institutional review board) process is the primary way that researchers with human subjects engage with ethics. Scientists and nonscientists have criticized the IRB, though often for different reasons (Heimer and Petty 2010 ; Stark 2012). Scientists complain of the bureaucracy that delays completion of important research (Heimer and Petty 2010). Others have suggested that the IRB process serves as a rubber stamp for scientific research more concerned with protecting the legal interests of the institution than the interests of human subjects (Stark 2012). The inefficiency of the IRB, whether intentional or unintentional, reinforces the oppositional relationship between working scientists and ethical issues.

However, some of the foundational values of the IRB represent great potential. An IRB is mandated to include academic scientists, nonscientists, and members of the public, although my experience suggests that the members of the public are often former academic scientists. This is a possible entry point for advocating a more democratic, publicly accountable scientific process.

The process also represents an opportunity for dialogue between researchers and IRB members. Unfortunately, this dialogue is often one of learning the necessary procedures to pass the gatekeepers (the IRB board), rather than one of genuine interest in creating the most ethical project. I use the process of submitting my own consent forms as an example. Like many others, my proposal was returned for revisions following its initial submission. The reasons for denial included the absence of a line for the exact time of signing, omission of ads announcing the study, failure to use a new HIPAA template, and a need to simplify the consent-form language. Annoyed at the delay, my feeling of us (researchers) against them (the IRB) intensified. The IRB is seen as synonymous with ethics, so this opposition is effectively between research and ethics. I changed the vocabulary of the consent form to match an eighth-grade level using Microsoft Word's implementation of the Flesch–Kincaid scale.

Examples of changes included “approximately” to “about,” “investigate” to “see,” and “complete” to “do.” I removed some details describing the research goals but included additional details explaining how “standard” the procedures were. The simplified consent form appeared to me to be even more vague, resulting in greater distance between the researchers and the “participants.” This is in accord with a broader move to describe science in “lay” terms and to explain science to the “public” through simplified media accounts. This model of scientific literacy, in which the public is not expected to be able to critically engage and truly participate in scientific research, has been critiqued for legitimizing science as usual (Weinstein 2010). Alternative practices that incorporate what Weinstein termed “critical science literacy” (for example, Roth and Barton 2004) require greater democratic participation from research subjects and must include social-justice goals.

In my lab we referred to informed consent as a “process” rather than simply a form: an ethics intervention along the same lines as using “participants” in place of “subjects.” Informed consent was included in our research protocol even in published work. These changes in language did not necessarily reflect changes in the way ethics were incorporated into the “process.” We never held a group meeting to discuss what we meant by an informed consent “process” or by research “participants.” Most of the informed-consent process was carried out by an assistant who was not included in the theoretical work of the lab such as the creation of new projects or preparation of publications. We might use this language (for example, participants, process) to stimulate new conversations about how to truly make informed consent a process or more effectively establish a participatory role for research “participants.”

As I neared completion of my doctoral work, I shared with my committee my decision to take a nontraditional career path, moving toward the field of ethics. Overall, they were not only supportive of my continuing with a new career path but also of incorporating my “interest” in ethics into the text of my dissertation; however, this support was not unanimous. Interestingly, the most politically left-leaning committee member emphatically said I could not discuss “ethics.” Other committee members reflected a variety of supportive positions. One committee member had no problem with including ethics as long as it was restricted to appropriate domains (for example, the IRB process, the protection of human subjects, and subject diversity). A third committee member indicated that I could explore these ideas in my unpublished dissertation but not in published work, presumably because it would be outside the realm of legitimate scientific research. A fourth member suggested that a historical evaluation in the introduction would be acceptable. These comments show that my committee members considered the analysis of my data and scientific results separately from my contextual work regarding ethics. I wanted to do just the opposite; to show how the historical and ethical contexts informed the questions we asked and the results we found. Historical context and ethical questions were not variables that could be controlled out. I aimed to show that the science and context were intrinsically inseparable. I was left wondering whether my left-leaning committee member was most keenly aware of the political stakes and the potential for destabilizing scientific epistemology through my approach. For him, mixing politics and science raised a red flag causing the strict boundaries of acceptable scientific inquiry to be identified.

The views expressed in this meeting are useful for feminist science scholars to be aware of as we think about ways to transform scientific practice. Scientists are often more open than we might think to interdisciplinary or novel approaches to scientific research; however, without a clear critique of

scientific objectivity, our intentions may not be intelligible to a scientific audience. Intentionally or not, some scientists will accept novel ideas as long they are nonthreatening, but will react strongly against challenges to scientific epistemology.

Many continue to see ethics as a means of effecting positive changes in science (for example, Kourany 2010 ; Roy 2012). Nancy Tuana argues that it is strategic to enter through ethics at a time when expanded ethics education is being mandated by the major funding agencies (NIH, National Science Foundation) (Tuana 2010). I agree. What I argue here is that many opportunities exist to use the language and even structures of ethics that are already in place. We should imagine new ways to support ethical research by drawing on concepts from feminist science studies, such as contestations and reinventions of objectivity, as well as democratic, participatory science.

Diversity

Although diversity is sometimes incorporated within ethics in the sciences, I analyze diversity separately because decisions are not generally isolated to ethics departments and instead are handled directly by working scientists. Hiring committees and admissions committees consider diversity, scientists have formed groups to increase the number of women in the sciences, and lead scientists report racial and gender representation in studies directly to funding agencies. Although abuses of research subjects fall squarely in the realm of ethics, discussions about the recruitment of diverse subject populations often happen without regard to historical ethics abuses of those same “diverse” groups in research (Epstein 2008).

Diversity among research subjects and diversity among scientists are typically dealt with separately; however, the same word and concept are used. Therefore, I address them together. Despite compelling arguments that each has epistemic value, the regulations for each are based on valuing equality. In recruiting diverse groups of scientists, the goal is to create equality in job opportunities. In recruiting diverse groups of research subjects, the assumption is that biological differences among populations may lead to differences in research outcomes, broadening the implications of the results and thereby promoting equality in health knowledge. Discussions of epistemology and methodology are largely missing in these conversations. For instance, how has scientific knowledge production contributed to the creation of “diversity” among research subjects (Schiebinger 1993 ; Fausto-Sterling 2000 ; Epstein 2008 ; Gravlee 2009)? Are certain subject positions “better” for producing scientific knowledge and why (Haraway 1988 ; Harding 1991 ; Fehr 2011)?

Diversity of Scientists

Diversity initiatives in the sciences, led primarily by women scientists, have been somewhat successful in increasing gender diversity (Rosser 2012). However, critical feminist scholarship has insisted on more than simply creating gender equality in science jobs and patents. Early feminist science studies scholars challenged male-dominated fields of science based largely on their own experiences. Several were trained as scientists themselves (for example, Ruth Bleier, Anne Fausto-Sterling, Evelyn Fox Keller, Evelyn Hammonds, Donna Haraway, Ruth Hubbard), and expressed the relationships among the lack of women in the sciences, the culture in the labs, and the content that was produced. As I add my story to those of others who have more recently struggled with how and whether to hold onto the dual identities of feminist and scientist (for example, Subramaniam 1998 ; Wayne 2000 ; Lostroh

2001 ; Moran and Belcastro 2003 ; Roy 2004), I reflect on what has changed over the past several decades.

Ruth Bleier's last public speech reflected on a “decade of feminist critiques in the natural sciences” (Leavitt and Gordon 1988). She suggested that science resisted feminist criticism because this criticism challenged its core belief in positivism. Moreover, she asserted that science was powerful enough that the field was not obliged to listen to feminists. I argue that the first part of her argument remains intact. Science resists true engagement with feminist critique as a self-protective measure against challenges to the core beliefs of scientific epistemology. However, the voice of feminism is powerful enough that it can no longer be completely ignored by the sciences. How and by whom feminism is defined is still up for debate.

The most significant change since Bleier's speech is the growth of communities of feminist science studies scholars and feminist scientists. Although not handed to us in our graduate classes, feminist science theory is available if we look. This is evident not only in my own experience, but in other recent narratives, such as Banu Subramaniam's ability to complete a certificate in Women's Studies while completing her PhD, and Deboleena Roy's account of finding Bonnie Spanier's *Im/partial science* at a bookstore as a graduate student (Subramaniam 1998 ; Spanier 1995 ; Roy 2004). This is not to obscure the degree to which the “contradiction” between being a feminist and scientist largely remains (Subramaniam 1998), and the number of scientists who identify as feminists seems to be growing more slowly than the number of women in the sciences (for example, Ginorio, Marshall, and Breckenridge 2000 .)

Universities, government agencies, and private industries have all incorporated diversity goals into their missions. As in the private sector, diversity has been effectively used as a new marketing plan. In this way, the use of “diversity” is similar to the uses of “ethics.” Not only does this use fall short of creating real change, it also serves to “wash” over other problems within the institution of science.

Women outnumbered men in my graduate program, and racial diversity was openly discussed as a priority during the admissions process; however, only about ten percent of the faculty were women and none were African-American. My experience was that the program's intentional commitment to creating an environment suitable for recruiting and retaining women and people from under-represented racial minorities was, in practice, done on a case-by-case basis.

Diversity initiatives often parallel ethics regulations, creating check-off boxes rather than changing the hiring processes and work environment. One year, my graduate program enrolled a class of only women because only female students accepted admission. The next year some students complained that we needed to improve gender diversity in the next class to ensure male representation. This argument can only make sense when diversity initiatives are not intended to challenge a larger system of unjust raced and gendered power.

Although early feminist science studies literature spanned research on gender diversity in the sciences and critiques of scientific knowledge production, by the 1990s these areas of research had become more disparate than connected (Longino and Hammonds 1990 ; Hammonds and Subramaniam 2003 ; Subramaniam 2009 ; Richardson 2010). Those interested in increasing the number of women in the sciences found some success in liberal diversity initiatives as feminist science studies as a field centered more on philosophical questions of knowledge production. Those of us trained as

scientists understand these issues as necessarily entangled, seeing the separation, as Subramaniam notes (2009), as a “profound loss.” This loss is not about a missed opportunity for collaboration but about whether either of these now separate goals of increasing diversity and challenging scientific epistemology can succeed without making connections with each other. For example, social and scientific arguments cyclically reinforce each other so that as long as there is a lack of diversity in the sciences, new scientific research will continue to look for and “prove” the naturalness of sex differences, producing the rationale for a continued lack of diversity (Hubbard 1990 ; Spanier 1995 ; Fausto-Sterling 2000 ; Jordan-Young 2010).

Is there an epistemic benefit to a diverse scientist population? An affirmative answer challenges the idea of absolute neutrality. Feminists have critically addressed how social location impacts knowledge production. Standpoint epistemologies have been debated and revised over the last several decades, with consensus around the importance of marginalized voices producing knowledge along with a rejection of a simplistic model of social location determining the knowledge produced (Harding 2004). Carla Fehr points to several structural barriers limiting situational diversity (diversity of social locations of scientists), resulting in epistemological diversity, such that marginalized scientists may fear sharing alternative points of view because of their position, or, if they do share these points of view, fearing not being taken as seriously due to gender and/or racial bias (Fehr 2011). Clearly, simple diversity initiatives will not automatically create a more just science.

Diversity of Human Subjects

Institutional mandates to increase diversity of human subjects was the result of feminist scientists' and bioethicists' critiques in the 1980s and 1990s (Eckman 1998 ; Epstein 2008 ; for example, Dresser 1992). This example is particularly interesting because it represents a feminist intervention that was “successful.” Its success has been questioned due to its ahistorical approach to the subject of women and minorities in research, seemingly ignoring research abuses of people of color, in particular women, as well as a long history of scientific racism (Eckman 1998 ; Epstein 2008). Without a more complex analysis of the inclusion of research subjects, there is a danger of reifying concepts of natural, immutable differences between socially salient groups. This is not to discount what may be biologically “real” differences that could be identified to lessen health disparities. Feminists and others have argued that there is a difference between biological and innate, showing that social factors such as sexism and racism themselves can create biologically different social groups (Hubbard 1990 ; Fausto-Sterling 2005 ; Gravlee 2009). Although some in public health and medicine argue for diverse populations to tease out racism and other social reasons for biological differences, basic science research does not allow for such social factors. In fact, when I tried to cite public-health research about racism potentially causing biological differences, each of my committee members questioned it and asked whether I meant “race” or another factor such as exercise or nutrition. This boundary needs to be further examined and pushed.

All of my experiments involved human subjects. In one, the project was half complete when we realized we had not enrolled any African-American subjects. The lone African-American person in our lab was asked to put up signs in areas that would promote the recruitment of black people. When we needed to report sex/gender and race/ethnicity data at the end of that study, we sat around, trying to remember what each person looked like and discussing which categories they fit into. In another, we recruited

subjects through an online solicitation to students and enrolled the first nine subjects who responded, all of whom were male. These experiences led me to question what the actual regulations were, how they were enforced, and why researchers seem to be either uninformed or disinterested in adhering to them. For example, we reported the diversity data back to our funding agencies, but it did not appear in our published work and there was no follow-up from the funding agencies or our university IRB. This inconsistency is one reason that hierarchical accountability does not work. Although I thought there was something wrong with the lack of diversity in our subject populations, I still felt uneasy about reaching out to under-represented groups and about constantly counting in an effort to achieve perfect demographics. This is an example of the need for conversations about rules and regulations in order to foster more thoughtful change.

In the introduction to my dissertation, I cited feminist science studies and bioethics literature to discuss the agreed-upon topic of “diversity.” I titled the section “Inclusion/Exclusion Criteria and Subject Recruitment” as a subsection in “Study Design”:

Numerous studies have used an exclusively male cohort of subjects to examine “normal” muscle function; comparatively few have used an entirely female cohort. This asymmetry demonstrates that male bodies, and more specifically white male bodies, are often considered to be “normal.” To avoid reproducing this norm, samples should be diverse. At the same time, we must recognize and consider that people from non-dominant (oppressed) groups have been used for research that has been both dangerous to the individual subjects and invoked to legitimate discriminatory categories. (Giordano 2008 , 22)

I continued with a brief discussion of scientific studies (particularly anatomical studies) that have looked for differences between socially relevant groups, noting that such studies continue. I suggested that decisions about exclusion and inclusion in experiments are not simple and should be discussed by researchers on a case-by-case basis (rather than determined universally through legislation or by bioethicists). I argued that these choices impact our experimental set-up, our results, and that our experiments have real consequences on people's lives. My committee members found this section interesting and appreciated the call for us to be more involved in conversations about ethics. I mention this because it illustrates that many researchers are genuinely interested in creating knowledge that is beneficial to society.

Instead of “sneaking” feminist science studies into projects, we should be direct as to its purpose. I primed readers of my dissertation on the framework of feminist science studies that I was using to evaluate my work. Scientists often use figures and diagrams to explain concepts. Figure 1 shows my visual representation of competing visions of the relationship between science and culture, along with the ideal of objectivity that is central to dominant scientific practice. I used this diagram with my text to further question the relationship among scientists, the subject matter we study, and the broader culture(s). The view of science as one from above or what Haraway has called the “god-trick” (Haraway 1988) to explain our world is presented in contrast to an idea of science in which science—the scientists and the experimental subjects—is fully integrated into culture(s). The idea that the

cultures in which one is situated affect the scientific knowledge one can produce seemed to be eye-opening for my colleagues. This model makes it clear that both the diversity of scientists and the diversity of research subjects impact “science.”

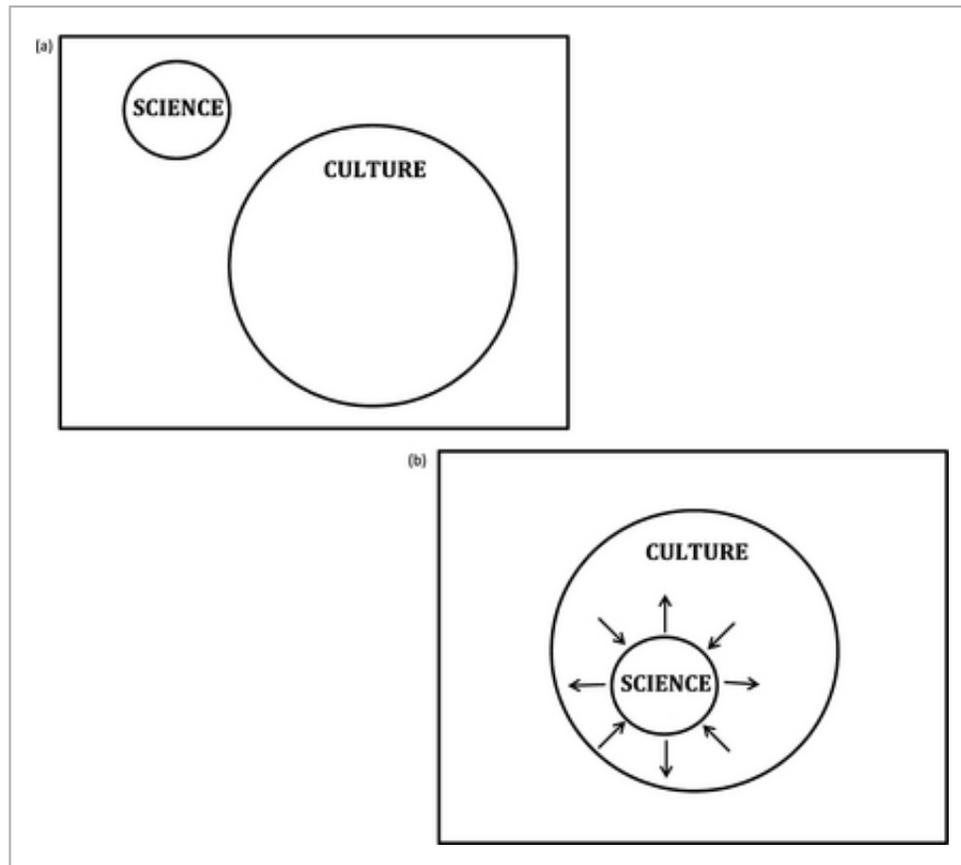


Figure 1.

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The relationship between science and culture. (a) Scientific knowledge has often been represented as wholly distinct from the larger culture in which it is produced. (b) A more sophisticated understanding of how knowledge is produced and evaluated would see science as part of culture both influencing and being shaped by its assumptions and preoccupations.

Significance

The practice of evaluating the significance of a scientific project represents another opportunity for feminist interventions. Scientists must explain a project's societal significance to receive government funding. Even proposals for basic research must describe potential translational benefits, even if those benefits are distant dreams. Priority areas for biological research are increasingly influenced by the activity of patient-advocacy groups (Dresser [1999](#) ; Brower [2005](#) ; Best [2012](#)). Although some lament the supposed loss of basic research for the sake of curiosity, accounts of scientific history suggest that scientific research has long been funded for military, public health, or medical progress (Harding [2001](#)).

Although the success of HIV/AIDS activists in calling attention to a stigmatized and marginalized population has been credited for beginning the trend of patient-advocacy groups affecting biomedical research (Epstein 1996 ; Dresser 1999), this model does not require a social-justice-based redistribution of research priorities. Feminist bioethicist Rebecca Dresser raised concerns about how patient advocacy was and could negatively affect marginalized populations, arguing for greater ethical deliberation by government officials and advocacy groups to create a more fair system of public participation (Dresser 1999). Based on a study of the National Institutes of Health (NIH) funding of fifty-three diseases from 1989 to 2007, Rachel Best suggests that patient advocacy resulted in increases in funding for certain diseases while other diseases lost funding, resulting in a redistribution that lessened funding for diseases that affect primarily women and minorities (Best 2012). Feminist objectives will not necessarily be met with any democratic process (Intemann 2011).

In assessing a feminist methodology developed by Bonnie Spanier (Spanier 1995), Deboleena Roy argues that beginning with the “Origins of the Problematics” and “Purpose of Inquiry” is counter to the ideal of objectivity traditionally required in the sciences (Roy 2004). As I have argued throughout this paper, I agree that the ideal of objectivity limits the translatability of feminist epistemologies to the sciences. However, the critique that scientists do not acknowledge the purpose of the research ignores the funding process. We must examine the ways in which demands for public funding have opened spaces for acknowledgment of the purpose of research. Feminists and other philosophers of science have largely ignored the declaration of purpose in funding opportunities (Tuana 2010). Nancy Tuana is a notable exception in calling attention to the opportunity for philosophers of science to impact funding agencies' criteria and their evaluation (Tuana 2010).

In the “Significance” section of NIH grant applications, the applicant(s) explains why the work is important, addressing both the relationship between the project and societal priorities and the significance of the project to the field of study. The most common approach is to choose research questions and then determine the justification for funding. In this model, the same research is sometimes proposed with changes in the significance section to reflect current funding priorities. Feminist and other critiques of this model suggest reversing the approach, so that research questions are determined based on the needs of targeted communities (for example, community-based participatory research [Wallerstein and Duran 2008]). Institutionalizing this type of model would require a major restructuring. Most individual researchers are unable to devote the time required to truly include nonscientific communities. This inability results in part from current structures, which not only do not provide support for this kind of research but also devalue it because of a perceived lack of objectivity.

My dissertation project was funded for three years through the National Institutes of Health (NIH) Ruth L. Kirschstein National Research Service Award (NRSA). I summed up the significance of my project for my NRSA application as follows:

Clearly the results from our study will not only improve our understanding of how and where normal neural controls of movement are generated but may also lead us to suggest ways in which this knowledge could be used to help patients. Perhaps there is a way to artificially or with a different kind of training tap into the redundancy at the muscular level and allow patients to more effectively regain function. Our protocols or variations of our

protocols may be able to be employed in these ways in rehabilitation.

My original motivation in choosing this topic was to solve what has been called a “degrees of freedom” problem. The large number of “parts” in the neuromuscular systems (for example, muscles, joints, and neurons) suggests that the same task could be performed using multiple combinations of parts (redundancy). The scientific interest is in understanding how our bodies choose what combinations of these parts to use in creating movement.

I did not know for which patients this research could be helpful (as evidenced by the vague reference to patients who could “regain function”). This broad category was meant to encompass anyone with muscle dysfunction. The many steps between answering my research question and helping patients were never clear. Nevertheless, I was awarded the fellowship based on my first application. The decision was based on other factors as well such as my potential for success and my lab's ability to provide resources; however, I use this example to highlight the potential use of significance to address community needs or at least to push researchers to be more thorough in their assessments of proposed work.

During this project, my focus grew narrower. Simply showing that multiple patterns were possible would not suffice; the goal was to be able to predict this redundancy, presumably to be able to control it. I tried to determine which movements were performed by which individual leg muscles to create a testable model that could predict the redundancy I planned to discover. I believe that my most significant finding does have a potential impact for people with disabilities: I identified substantial variability between individual study subjects and reported it. The design of the experiment was not intended to measure variability but to look for the “normal” movements produced by activating individual muscles; however, it was not possible to average the data for individual muscles. I explained the significance of this in my dissertation and pushed for more recognition and research into variability in a subsequent peer-reviewed publication (Giordano, Segal, and Abelew **2009**). Access to feminist theories allowed me to view my data in new ways and to produce a different scientific result.

This result (that there is variation among humans) is not novel for many, particularly those in feminist disability studies. Rosemarie Garland-Thomson challenged a strict medical model of disability, arguing that disability should be viewed as “human variation rather than essential inferiority” (Garland-Thomson **2005** , 1567). How could I have used this idea to design a more effective research project? This brings us back to the question of how we determine which research questions to ask in the first place.

For me, this question came directly from a local disability activist after a program on feminism, disability, and social justice at the local (one of the few remaining) feminist bookstore. Upon being asked what I do for work, I explained I was completing a doctorate in neuroscience, studying the coordination of leg muscles. The activist followed up with, “How can this help people with disabilities?” It was at this moment that I realized I could create a research path informed by community members who worked on disability activism. This was the impetus for analyzing my dissertation work using theories from feminist science studies. It inspired me to search for an interdisciplinary postdoctoral research position that would allow me to undertake further education in disability studies and create a project with disability scholars and neuroscientists.

I did not succeed in my search for this interdisciplinary postdoctoral research position. I discovered new institutional obstacles during one of the most promising interviews, with a researcher who headed a lab with over a million dollars of equipment, at a school that also housed a disability studies program with strong ties to feminism and the local disability activist community. His research focused on ways for people with quadriplegia to regain the ability to walk. When I stated my intention to use the priorities of the “patient” population to direct my research questions, his response surprised me. He told me there had already been studies into what “patients” wanted and walking was not the top priority. He explained that he couldn't change his focus because the funding was for walking. My subsequent search of the literature found “Targeting Recovery: Priorities of the Spinal Cord-Injured Population” (Anderson 2004), which may have been the study he was referring to. A survey of 681 people with spinal cord injuries found that regaining the ability to walk was not the top priority for most people in the group (Anderson 2004). This work suggests that the priorities of affected populations may not match funding and cultural assumptions about dis/ability. We must acknowledge that it is not simple to determine the needs of a “community” and then change research directions accordingly. In addition to funding and epistemic obstacles preventing scientists from working on community-based research agendas, questions arise regarding how to identify communities and how their needs should be assessed.

My experience indicates an opening for transforming science into a more democratic, justice-oriented practice by leveraging ideas that are already fundamental to funding procedures to promote community-driven science. The fear of biased research remains a major obstacle to community-driven research. Feminist science studies can play a key role in overcoming this obstacle by asserting the impossibility of reaching “absolute neutrality” in science (Harding 2001).

From Scientific Reforms to Feminist Science

Science is resistant to critiques that challenge its epistemic authority. Feminists and other philosophers of science have had consensus for many decades on the fallacy of the myth of value-neutrality (Haraway 1988; Hubbard 1990; Harding 1991; Douglas 2009; Subramaniam 2009; Kourany 2010). Science has superficially addressed certain public concerns about the ethics of its practices, the inclusion of diverse populations, and its role in supporting societal good. Through my doctoral research project, I found that examining the boundaries of muscles was not about discovering the “truth” about this body matter but rather allowed me to identify the tightly patrolled borders of science. I found that “ethics” must be narrowly defined to keep it outside of the daily practice of science, that “diversity” initiatives must not ask questions about how populations are defined or how who does science impacts the knowledge produced, and that the societal “significance” of a project must match funding priorities set by those representing dominant interests.

For feminists interested in engaging with science, I argue through this paper we must directly challenge the idea of objectivity. Although this may seem to be an old claim because feminists have identified science's basis in the ideal of pure objectivity as a problem for decades, I argue it remains intact in the sciences. Therefore, attempts to incorporate scientific data into feminist projects or to diversify the sciences will continue not only to leave the ideal of pure objectivity intact but potentially to strengthen it. Science has and will use the existence of reform measures and its ability to modify prevailing scientific truths to defend its ability to discover the “truth.” There is ample feminist research

that connects issues of ethics, diversity, and significance to a new way of producing knowledge. Feminist science studies scholars have long suggested that we intentionally create scientific knowledges that address social inequalities and create a more just world (Rose 1983 ; Longino 1990 ; Harding 1991 ; Kourany 2010 ; Richardson 2010 ; Tuana 2010). Interconnected struggles by feminist, disability, queer, and reproductive-justice activists have demanded control over our own bodies and our own environments through the creation of our own knowledge. Feminist scientists must incorporate these ideas into their work and challenge the acceptable boundaries of science within the sciences. Additionally, we need more work such as this analysis to provide feminist scientists with resources for how to enact changes from within the sciences. I argue we can use ethics (how), diversity (who), and project significance (why) to create a new way to create knowledge only if we base our interventions in feminist critiques of scientific epistemology.

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References

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