Gender, Race, and Science: A *Feminista* Analysis of Women of Color in Science

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Abstract

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Gender, Race, and Science: A Feminista *Analysis of Women of Color in Science* is a methodological intervention that expands the boundaries of Feminist Science Studies to include the experiences of women of color scientists and to continue the resistance against persistent racialized gender ideologies within the field. In this dissertation, I propose a revision of the field I call "*Feminista* Science Studies." In the introduction, I map out a methodology which integrates decolonial historical case study methodology, feminist cultural and spatial studies, and US Third World feminist theories. I then apply my *Feminista* analytic to three cases. In each case, I use María Lugones' theory of fragmentation, multiplicity, and curdling to analyze the relationship between the socially marked bodies of women of color scientists to the epistemological paradigms in which they worked. The first case, on zoologist Roger Arliner Young (1899-1964), uses intersectionality and queer of color theory to push beyond the single-axis accounts by situating Young's individual experience in the context of the US Eugenics

movement and Jim Crow segregation. In the second case, I argue that physicist Chien-Shiung Wu's (1912-1997) research threatened foundational values within Modern Science and, magnified by Cold War era anxieties, her exoticized Asian female body was perceived as disruptive to the militarized space of the nuclear laboratory. In my third case, I use border theory to analyze how Sor Juana Inés de la Cruz (1648-1695) laid claim to the right to produce knowledge about nature, as a woman, by articulating an epistemology of *mestizaje*. In the conclusion, I make three claims based on these cases: 1) Women of color are positioned in opposition to modern Western science through the association of their bodies with a primitive and wild form of nature in our cultural scientific imaginary. 2) The strategies employed by these women of color for survival and success in science represent a form of oppositional differential consciousness in the service of scientific knowledge production. 3) The epistemological paradigms in which these women operated shape their experience by regulating their ability to conform and resist the social norms of science.

TABLE OF CONTENTS

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DEDICATION

This dissertation is dedicated to my abuelita Emperatríz Cardona Díaz and my grandmother Constance Eleanor Zink who each had the strength and courage to make their lives their own, as independent women.

Chapter One
Introduction: Toward a *Feminista* Science Studies Theory and Method

Gender, Race, and Science: A Feminista Analysis of Women of Color in Science is a methodological intervention that seeks to expand the boundaries of Feminist Science Studies to include the history of women of color scientists and to continue the resistance against persistent racialized gender ideologies within the field. This research began as a quest to understand the historical roots of my own experiences of marginalization within the laboratory. As a young person, I had a passion and talent for science and mathematics. After many years committed to studying, and then practicing science professionally, I was rapidly promoted into leadership positions in the laboratory. However, this early success did not lead to my being respected as a scientist by many of my professors, managers, and peers. I suspected that my experience was related to the historical inequalities women and people of color have faced in gaining access to the sciences, but I did not have the vocabulary or background knowledge to articulate these ideas. As I familiarized myself with the field of Science and Technology Studies, and its emphasis on the coproduction of scientific knowledge with social power, the theories I read on subjugated knowledges in the subfield of Feminist Science Studies (FSS) resonated with my experiences of marginalization. Though I did not see women of color scientists represented in this body of scholarship, I learned that my experiences were indeed rooted in historical inequities but were also deeply epistemological. In the years-long process of defining this dissertation and articulating it to others, I came to understand that my project is not only about the epistemological roots of inequities in science, but is also a manifestation of those epistemological conflicts. That is, the epistemologies required to make knowledge about the

history of women of color in science do not neatly fit within the traditional methodological boundaries of the discipline of history—they require a new method that is both intersectional and interdisciplinary. As such, in both the content and its form, my research addresses how deeply entwined Western scientific epistemological questions are to the historical inequalities experienced by women of color in science.

In this chapter, I develop and detail a "*Feminista* Science Studies" methodology which integrates comparative historical case study methods, feminist cultural studies of science, and US Third World feminist theories.[1] First, I outline the epistemological, methodological, and theoretical obstacles which have prevented a comprehensive study of women of color scientists within the history of science and feminist science studies. Then, I propose a new *Feminista* Science Studies methodology, which centers the contributions and experiences of women of color within these fields. In the following chapters, I apply my *Feminista* analytic to three comparative historical case studies: Roger Arliner Young (1899-1964), Chien-Shiung Wu (1912-1997), and Sor Juana Inés de la Cruz (1648-1695). Taken together, these cases demonstrate how individual women of color have negotiated scientific institutional spaces and work toward two principle goals: 1) to make visible the ways in which women of color and our bodies have been symbolically and epistemologically positioned in opposition to rational/scientific thought in Modern Western science; and 2) to read history for the strategies used by women of color to

[1] I use the term "US Third World" feminism to designate a particular theoretical formation which has emerged among women in the United States who have a shared experience of racial and imperialist oppression. It acknowledges the coexistence of "First" and "Third" worlds and thus troubles those categorizations. It is also meant to call up the complex interchange of liberatory ideologies between women of color in the US and social movements in the so-called "Third World."

succeed in spaces in which we were "never meant to survive."[2] These cases demonstrate how the symbolic association between black and brown female bodies with primitive, untamed nature structures how women of color are perceived and participate in science individually, institutionally, and epistemologically.

Problem Analysis

> *All psychologists who have studied the intelligence of women, as well as poets and novelists, recognize today that they represent the most inferior forms of human evolution and that they are closer to children and savages than to an adult, civilized man. ... Without doubt there exist some distinguished women, very superior to the average man, but they are as exceptional as the birth of any monstrosity, as, for example, of a gorilla with two heads; consequently we may neglect them entirely. (Gustav LeBon, 1879)*[3]

In 1879, French social scientist Gustav LeBon articulated the deep conceptual interconnections between race, gender, and scientific reason. For him, women and people of color (savages) were both closer to the animals in the great chain of being. And though he acknowledge the existence of intelligent women, by his logic they were so rare they need not be accounted for by the social sciences. The quote above demonstrates the way in which, during LeBon's time, the intellectual potentials of people of color and white women were measured in relation to one another in an endless cycle of circular, so-called "logic" wherein the "average man" was by definition white. Not only was the average intellectual worth of white women and all people of color presumed to be lower than the "average man," those Others too exceptional in their intellect to be ignored, were easily cast aside as inconsequential anomalies or made a spectacle as monstrosities. LeBon's insistence that "distinguished" women were so

[2] Lorde, "A Litany for Survival"; Sands, "Never Meant to Survive: A Black Woman's Journey."
[3] Quoted in Kaplan and Rogers, "Race and Gender Fallacies," 70.

exceptional that they, as a class, may be completely disregarded from any social scientific discussion of intelligence is a correlate of the concept of "outliers" which developed with the emergence of social statistics at the end of the nineteenth century. The logic of statistical significance contained an unstated assumption embedded within it—that statistical significance translates to social scientific relevance. This move towards probabilistic understandings of both nature and society represents a dramatic departure from the Early Modern scientific paradigms under which exceptional or rare cases, examples, or specimens had been epistemologically privileged.[4]

The logic of statistical significance continues to have implications for the history of science. Scholars of both the history of science and intellectual history have traditionally concerned themselves with the lives and work of those who were deemed intellectually exceptional. However, following LeBon's logic, our studies would be limited to the intellectually exceptional "average man," coded white. Leaving aside the intellectual work and products of white women and people of color as mere random occurrences was justified by their presumed social scientific irrelevance. In other words, the exceptional white man was deemed statistically insignificant with respect to his intellect but highly relevant to us as social researchers, while exceptional Others (female/non-white) were not considered statistically significant *or* socially relevant.

Anti-racist and feminist scholars have, for decades now, insisted that people of color and white women are not insignificant but highly relevant to intellectual history and the history of science. Feminist science studies scholars have documented the experiences, contributions,

[4] Findlen, *Possessing Nature: Museums, Collecting, and Scientific Culture in Early Modern Italy*.

and epistemologies of white women in science.[5] Historians of the African American experience have made similar advances with respect to the history of African American men in science. [6] Based on the success of such scholarship, it might seem that we have cast off LeBon's now obviously racist, sexist social science ideology of significance. But the dearth of scholarship on women of color as scientific actors (scientists), rather than as objects of science, indicates otherwise.[7] Women of color in science—whose bodies, lives, and work reside at the intersections of race, gender, and science—for the most part, remain obscured in that place of "insignificance" to which Gustav LeBon relegated them.

Despite an epistemological tradition of privileging the position of the socially subjugated within the field, the history of women of color scientists is a topic that has been grossly understudied by FSS scholars.[8] Given the rejection of LeBon-like ideologies within FSS, why do women of color remain understudied? I argue women of color scientists, as subjects of social inquiry, exist at the intersection of fields, methods, and theories. What Chela Sandoval has called the "apartheid of academic knowledges" still separates feminist science studies scholars methodologically from intersectional analytics that would help to make women of color visible in our scholarship.[9] Furthermore, FSS is burdened by the legacies of racism in its methodologies of origin—sociology and history. Despite efforts to resist within these disciplines, even

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[5] Rossiter, *Women Scientists in America: Struggles and Strategies to 1940*; Alic, *Hypatia's Heritage*; Schiebinger, *The Mind Has No Sex?*; Haraway, *Primate Visions*; Schiebinger, *Nature's Body*; Rossiter, *Women Scientists in America: Before Affirmative Action, 1940-1972*. See also the countless biographies of white women and men of color scientists.

[6] Bedini, *The Life of Benjamin Banneker*; Bedini, "Peter Hill, the First African American Clockmaker"; Manning, *Black Apollo of Science*; Timmermans, "A Black Technician and Blue Babies". See also numerous biographies of George Washington Carver.

[7] Ginorio et al., "Absent from Social Sciences Research: Ethnic Minority Participation in Science."

[8] Haraway, "Situated Knowledges"; Harding, *The Science Question in Feminism*.

[9] Sandoval, *Methodology of the Oppressed*, 4.

qualitative or historical analyses are subject to the logic of statistical significance that prevents the study of small, marginalized groups. In the next two sections I elaborate on the theoretical and methodological obstacles that inhibit our ability to make meaningful knowledge relevant to the lives of those we study.

Methodological Obstacles

US Third World feminists have expressed concern about producing social scientific scholarship which reinforces imperialist narratives or that may mislead policy makers and the public. For example, bell hooks argues that historians and sociologists have been responsible for perpetuating the myth of Black matriarchy and the stereotype of the aggressive, emasculating Black woman. The results of sociological studies of the Black family in the 1960s were not confined to academia, but had a direct impact on public policy set by a Congress informed by the Moynihan Report.[10] Sociological studies of Black families, such as the Moynihan Report, were aimed at casting Black women as pathogenic to the Black community.[11] The reproduction of racist/sexist narratives in social science scholarship are both ethical and methodological problems.

From a methodological perspective, the application of the logic of statistical significance to the study of women of color scientists is problematic because it is designed to ensure robust knowledge about *averages* rather than rare or exceptional groups or individuals like scientists of color, who have overcome the social, cultural, and institutional barriers to their participation

[10] hooks, *Ain't I a Woman*, 71–82, 104.
[11] Ibid., 71–80; Collins, *Black Feminist Thought*.

in the knowledge production process.[12] Quantitative statistical methods privilege the study of larger, "statistically significant" samples because smaller samples may not be representative of the "average" member of the population. If the sample size is too small, social statisticians have less mathematical certainty about the generalizability of the results to the population in question. A second reason social scientists prefer large sample sizes is that small samples lead to mathematically weak causal links between variables.[13] To use the logic of statistics to study a group which is by definition *not* average makes little sense within this framework.

Sociologist, Tukufu Zuberi, has shown that social statistics emerged as part of a project of racial stratification in the late nineteenth century and early twentieth century.[14] In the case of women of color scientists, the logic of statistical significance embedded in social science methods works to hide the accomplishments, and indeed, the existence of women scientists of color. As "outliers," women of color scientists challenge the original racial stratification project of social statistics by showing that women and men of color have equal intellectual potential to white women and men. In the current historical moment, it works to the advantage of the racial stratification project that scientists of color are deemed "insignificant" by the logic of statistics. In fact, sociologist Carole Marks cites statistical insignificance as one of several rationales which lead to the erasure of racism from the current sociological narrative of race.[15] Thus, research conducted from an anti-racist political position is often at odds with the logic of social statistics, making such research difficult under the current epistemological paradigm.

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[12] Price and Evans, "N-of-1 Randomized Controlled Trials(n-of-1 Trials)," 227.
[13] Abell, "Causality and Low-Frequency Complex Events"; Harding, "The Method Question"; Mahoney, "Strategies of Causal Inference in Small-N Analysis."
[14] Tukufu Zuberi argues that Francis Galton, "the father of social statistics," developed his methodologies "as part of his racial theory of eugenics." p. 33 Zuberi, *Thicker Than Blood*, xviii, 30, 33.
[15] Marks, "White Logic, White Methods," 53, 57.

Unfortunately, qualitative social science methods are as burdened by their racist pasts as quantitative or statistical social science methods. Roderick Ferguson points to ethnography as a qualitative extension of the early twentieth-century social scientific project of sanctioning racial stratification. According to Ferguson, the success of ethnography was initially reinforced by its ability to reproduce the hegemonic racial beliefs of the time.[16] Patricia Hill Collins has argued that these racist tendencies in social science are driven by assumptions that are built into the core of sociological inquiry. First, Collins argues that sociology assumes that "dichotomous oppositional thinking is natural and normal." And, because sociology tacitly accepts the notion that "white males are more worthy of study because they are more fully human than everyone else," Black women have routinely been cast as less than human in sociological research.[17] The concerns articulated by hooks, Ferguson, and Collins are as much about the epistemology of social science, as they are about the liberatory potential of the knowledge they create. In the case of women of color scientists, it is unethical to perpetuate the historical erasure of women of color in the history and sociology of science. In basic social scientific terms it is not beneficent and it does harm by replicating the marginalization of women of color in science and denying young people access to their histories.

Many of problems cited above are rooted in the positivist, objectivist commitments of both qualitative and quantitative sociological research. Collins has been particularly critical of objectivism. She contends that traditional sociological definitions of "objectivity" prevent (Black female) sociologists from utilizing what she argues should be epistemological advantages that

[16] Ferguson, *Aberrations in Black*, 76.
[17] Collins, "Learning from the Outsider Within," S27.

accompany "outsiderness" in the academy.[18] But objectivism is not only oppressive to the researcher. Ferguson has also argued that through its commitment to objectivity, ethnography serves to establish a hierarchy between the researcher and the researched and thus reinforces white heteropatriarchy.[19] Methods which operate under an assumption of a dichotomous relationship between women of color and white masculinity or rationality will fail to produce antiracist knowledge about women of color in science.

Like qualitative sociology, historical methods have several apparent epistemological and ethical advantages, but are far from unproblematic when applied to the study of women of color scientists. Historian Emma Pérez argues that it is not just the individual social scientist who has kept Chicanas out of historical narratives. Pérez finds that chronology traps history in a teleological linearity that obscures continuities across time, the simultaneity of social worlds, and the coexistence of possible futures in time.[20] Furthermore, Pérez argues that the nationalist, universalist, progressivist politics that form the foundation of the discipline of history are at odds with feminist antiracist scholarship which seeks to decolonize history. Traditional definitions of what constitutes an archive also preserve imperialist historical narratives which exclude women of color.[21] These legacies, which burden the social sciences with epistemological commitments to the logic of statistical significance and positivism, have prevented a comprehensive study and analysis of women of color scientists.

[18] Ibid., S15.
[19] Ferguson, *Aberrations in Black*, 77.
[20] Pérez, *The Decolonial Imaginary*.
[21] Ibid.

Theoretical Obstacles

In addition to numerous methodological obstacles, there are several theoretical challenges that must be overcome, as well. In this section, I will argue that the historical development of Science and Technology Studies (STS) narrowed the scope of the field such that the lived experiences of scientists from socially marginalized groups (white women and women of color, alike) lie outside the mainstream boundaries of the field. Second, because of the narrow scope of STS, the study of scientists from marginalized social groups has been left to education scholars and sometimes even scientists themselves.[22] Scholarship that comes from the discipline of education centers on the educational experiences of students of science rather than the experiences of scientists once they have completed their education. While efforts made by those from within the sciences are laudable, such studies are conducted by researchers without training in social science research ethics. [23] Furthermore, studies done by scientists are often conducted under a positivist/statistical framework or are biographical, with little analysis of the social meaning of lived experience. Given the anti-positivist theoretical framework at the core of STS, research done about the participation of people of color in science, technology, engineering, and mathematics (STEM) from an educational or positivist perspective reinforces the notion that this kind of study is outside the scope of the field of science studies. Unfortunately, studies done in the field of education or by scientists themselves have not fully elucidated the problem precisely because they lack the theoretical framing that STS has to offer.

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[22] Nelson, Brammer, and Rhoads, "A National Analysis of Minorities in Science and Engineering Faculties at Research Universities"; Jordan, *Sisters in Science*.
[23] Ginorio, "When N< 1 or 2."

In his 1997 survey of the field, David J. Hess identified four varieties of science studies, noting that feminist contributions have been made throughout: 1) The history and philosophy of science; 2) Institutional sociology of science; 3) Sociology of scientific knowledge (SSK); and 4) Critical and cultural studies of science.[24] Like many fields, STS developed differently in the US and Europe. Hess notes that in the United States, science studies emerged from organizational sociology which treated science as just another job among many. Institutional sociology of science was not concerned with how science produced power by sanctioning certain knowledge production processes, but rather with how power operates through the social structures within the institutions of science. But, the US variety of institutional sociology of science was quickly subordinated to SSK which developed from and in conversation with the sociology, history, and the philosophy of science in Europe and the United Kingdom. The methods used within SSK are informed primarily by sociology and history and its scope is defined by philosophy, which is concerned with the production of scientific knowledge, or the content of science. SSK scholars argued that the "theories, methods, design choices and other technical aspects of science and technology"[25] were missing from institutional sociologies of science. SSK scholars insisted that to understand the social importance of science as an institution, the system which gave it political power—sanctioned forms of authoritative knowledge production—had to be the focus of social scientific research. As such, the greatest strength of SSK approaches has been the emphasis on social context and the construction of scientific knowledge, something which US approaches to the sociology of institutions of science have neglected.[26] However, since SSK has

[24] Hess, *Science Studies: An Advanced Introduction*.
[25] Ibid., 81.
[26] Ibid., 52.

become the dominant paradigm in science and technology studies in both the US and Europe, the privileging of the content of science over its institutions has had the unfortunate effect of reinforcing a key component of the SSK critique—the fallacious notion that scientific knowledge is detached and independent of the people who create it, that it does not matter *who* is doing science.

Of course, feminist science studies scholars have argued that institutions, and the kind of people who have access to or are excluded from them, are of critical importance.[27] Indeed, FSS scholars have enriched our understandings of 1) how gender shapes the culture and politics of science and vice versa,[28] *and* 2) how scientific understandings of gender regulate or limit women's engagement with the scientific endeavor.[29] While these studies represent a tremendous advancement within mainstream STS, they focused primarily on white European and American women. It seems that women of color are yet again left out by the notion that "all the women are white, all the Blacks are men."[30] Race has not been left untouched by STS scholars either.[31] STS analyses of race, however, fit within the established SSK disciplinary boundaries—they use history and sociology as their methods and focus on the production of scientific knowledge. While these studies have made important contributions to our understanding of scientific racism and the unethical/unjust scientific abuses perpetrated against communities of color, they do not deal with racialized individuals as scientific actors

[27] Haraway, *Primate Visions*; Schiebinger, *The Mind Has No Sex?*; Findlen, "A Forgotten Newtonian: Women and Science in the Italian Provinces"; Rossiter, *Women Scientists in America: Struggles and Strategies to 1940*; Rossiter, *Women Scientists in America: Before Affirmative Action, 1940-1972*; Traweek, *Beamtimes and Lifetimes*.
[28] Harding, *Whose Science?*; Keller, "The Gender/Science System"; Longino, "Can There Be A Feminist Science?".
[29] Haraway, *Primate Visions*; Schiebinger, *Nature's Body*; Schiebinger, *The Mind Has No Sex?*; Wylie, "The Engendering of Archaeology Refiguring Feminist Science Studies."
[30] Hull, Bell Scott, and Smith, *But Some of Us Are Brave*.
[31] Fujimura, Duster, and Rajagopalan, "Special Issue on Race, Genomics, and Biomedicine"; Gould, *The Mismeasure of Man*; Haraway, *Primate Visions*.

with full scientific subjectivity. When scientists of color are studied, they are typically men.[32] Though important, feminist and anti-racist interventions in SSK remain marginalized within the field and have not been successful at creating knowledge about how women of color gain access to and authority within scientific institutions.

The study of women of color scientists requires the use of theoretical frameworks like intersectionality. Frameworks that originated among women of color are better positioned to resist the epistemologies which have written women of color out of the history of science. Women of color in FSS, like Evelynn Hammonds, have insisted that intersectionality is relevant to the social studies of science and to the experiences of women of color scientists. In her 1986 interview with poet and filmmaker Aimee Sands, Hammonds describes the way race and gender shaped her experience as a physics student at MIT. When Sands asked Hammonds which was more of a problem for her, racism or sexism, Hammonds articulated the inseparable nature of race and gender central to Black feminist thought.[33]

> They are not separate. Because they aren't separate in me. I am always black and female. I can't say 'well, that was just a sexist remark' without wondering would he have made the same sexist remark to a white woman. So, does that make it a racist, sexist remark? You know, I don't know. And that takes a lot of energy to be constantly trying to figure out which one it is. I don't do that anymore, I just take it as, you know, somebody has issues about me. And who I am in the world. Me being Black, female and wanting to do science and being taken seriously. That's it.[34]

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[32] Bedini, *The life of Benjamin Banneker*; Bedini, "Peter Hill, the first African American clockmaker"; Manning, *Black Apollo of science*; Timmermans, "A Black Technician and Blue Babies." See also numerous biographies of George Washington Carver.

[33] See the following for other articulations of intersectionality within US Third World feminist theories: Crenshaw et al., "Part Six: The Intersection of Race and Gender"; Collins, *Black Feminist Thought*; hooks, *Ain't I a Woman*; Hull, Bell Scott, and Smith, *But Some of Us Are Brave*; Moraga and Anzaldúa, *This Bridge Called My Back*.

[34] Sands, "Never Meant to Survive: A Black Woman's Journey," 248 [Emphasis original].

In another interview, seventeen years later, Evelynn Hammonds and FSS scholar Banu Subramaniam wonder if white FSS scholars have assumed that research about issues of gender and science applies equally to race, and thus no additional research dedicated to race is necessary. Weary of her position as a token woman of color in FSS, Hammonds calls for more theorizing about women of color in science.[35]

The lives and experiences of women of color scientists remain under-studied because the social sciences—as they are constructed now—are not epistemologically suited to the task, because the rise of SSK has led to an emphasis in STS on the production of authoritative scientific knowledge, and because mainstream and FSS uses single-axis analyses that leave women of color in this methodological blind spot. I propose an end to the apartheid of academic knowledges that separates US Third World feminist theories from the history of science and feminist science studies. I propose a revision of the field which will integrate the theories, such as intersectionality, with historical methods and feminist cultural studies of science. I call this new method "*Feminista"* science studies. In the next section I map out the *Feminista* Science Studies methodology which will frame this dissertation project.

A Solution: *Feminista* Science Studies

A new feminist science studies, not tied to positivist or single-axis theoretical frameworks, is needed to allow us to privilege social relevance over statistical significance. A specifically *feminista* science studies is needed to write a history of women of color in science without replicating the racist/sexist narratives which position women of color in opposition to rational/scientific thought. Grace Hong has argued that, "to avoid complying with racism,

[35] Hammonds and Subramaniam, "A Conversation on Feminist Science Studies."

objectivity must be refused for an anti-racist stance."[36] Feminists of color have opposed objectivity in their scholarship by, as Patricia Hill Collins urged, "learn[ing] to trust [our] own personal and cultural biographies as significant sources of knowledge."[37] This is a radical move that undermines the Cartesian subject. While US Third World feminists have consciously "refused" this objectivist stance, we have also been denied it. Cindy Cruz asks, "How do we reconfigure ourselves as witnesses when our observations of poverty and oppression include the communities of our families?"[38] Cruz argues that brown women who seek to testify as scientific witnesses *and* as members of traditionally objectified communities become "disruptive to the canon" and "provoke the custodians of normality and objectivity."[39] In this way, not only is it undesirable to assimilate from an anti-racist perspective, but it is also nearly impossible within the bounds of hegemonic social science.

To resist the impulse to universalize and decontextualize, the case studies presented in this dissertation draw on methods from US Third World feminist theorists. Using an explicitly US Third World feminist analytical lens, this project builds upon the traditional set of critical methodologies—social constructionism, subjugated knowledges, and scientific realism—employed by feminist science studies scholars such as Londa Schiebinger, Donna Haraway, and Sharon Traweek. *Feminista* Science Studies uses several additional strategies to create a history that takes women of color seriously as scientific actors. While preserving the analytical importance of the content of scientific knowledge production, inquiry in this study is driven by what Danish social theorist, Bent Flyvbjerg has called "value-rational" questions that seek to

[36] Hong, *The Ruptures of American Capital*, 50.
[37] Collins, "Learning from the Outsider Within," S29.
[38] Cruz, "Toward an Epistemology of a Brown Body," 65.
[39] Ibid., 62.

understand how power works on and through individuals and institutions.[40] Objectivist accounts of the history of women of color scientists in this study are avoided by 1) using philosopher María Lugones' theoretical framework of fragmentation and multiplicity, which connects the epistemic values of science with the embodied experiences of women of color scientists, and 2) employing case-based cultural studies methods, such as close reading and spatial analysis. Each case is analyzed using US Third World feminist theories which allow for a multiplicity of categories, meanings, and social worlds. In this way, *Feminista* Science Studies is more than a recovery project, reclaiming the history of women of color in science, but also makes knowledge about the way gender, race, and science operate as complex and interlocking social norms in the lived experiences of women of color scientists.

Phronesis: Practical Research Ethics

The critical component of *Feminista* Science Studies is an ethical imperative to produce research accountable to its subjects. While science studies scholars adhere to the "do no harm" maxim, feminists and other critics of the social sciences have called for an ethics which requires that knowledge actually "do good." Much feminist science studies scholarship rests on this ethical commitment to social justice, as well. Bent Flyvbjerg's application of Aristotle's ethic of "Phronesis," lies at the intersection of ethics and epistemology.[41] Flyvbjerg defines phronetic social science as a "more practical, intellectual activity aimed at clarifying problems, risks, and possibilities we face as humans and societies, and at contributing to social and political

[40] Flyvbjerg, *Making Social Science Matter*, 53–65. For Flyvbjerg value-rationality is the use of reason to advance social values or ethics. That is a more ethical or just society is the ends toward which reason and rationality work. In the tradition of Aristotle, Weber, and Foucault, Flyvbjerg offers value-rationality as an alternative to instrumental-rationality which uses reason as a means to advance goals unrelated to social justice.
[41] "Practical understanding; wisdom, prudence; sound judgement.""Phronesis, N."

praxis."[42] He argues that to create practical knowledge, the social sciences must shift away from the natural sciences as our epistemological and ethical model and toward a "practical ethics" infused with Foucauldian power analytics. [43]

In the context of this study, practical ethics require accountability to the women of color whose lives I use to generate knowledge about the complex interrelations between gender, race, and science. As I described in the previous section, certain epistemological commitments in the social sciences can work against creating socially just knowledge. Ethics are not separate from methodologies or epistemologies. Scholars such as Emma Pérez have critiqued the commitment to chronology in the discipline of history as a legacy of imperialism. For example, a chronological telling of the story of Roger Arliner Young bookends her scientific successes with her subordination to her male mentor and teacher, at the beginning, and her commitment to the Mississippi State Asylum, at the end. Chronology makes it difficult to appreciate Young's contributions, her scientific subjectivity, and her agency. This is unjust to both the memory of Roger Arliner Young and to the many women and girls of color who will locate their histories in hers. However, if we start Young's story in the middle, and begin with her contributions to zoology at the international level, we are forced to take her seriously as a scientific actor. A commitment to phronetic social science, the decolonial historical methods articulated by US Third World feminist historians like Hammonds and Pérez, complement cultural studies analytics, and work in opposition to social science methods that have traditionally left women of color out of the history of science.

[42] Flyvbjerg, *Making Social Science Matter*, 4.
[43] Ibid., 110–112.

Flyvbjerg urges social scientists to use phronesis to reframe not just their epistemologies, but the very questions that guide their research. He argues that to "make social science matter" we must center our work around the following "value-rational" questions we see echoed by many feminist science studies scholars: "(1) Where are we going?;" "(2) Is this desirable?;" "(3) What should be done?;" and finally, "Who gains and who loses; by which mechanisms of power?"[44] Questions such as these applied to a history of women of color scientists incorporate gender and race, as intersecting and interlocking categories with science, into the traditional science studies power analytics.

Comparative Historical Case Studies

In order to disrupt objectivism and the oppressive logic of statistical significance and create rich contextual knowledge about women of color scientists, *Feminista* Science Studies is case-based. Deep contextualization has been identified by both US Third World feminist theorists and feminist science studies scholars as an alternative to the positivist/relativist debate.[45] Patricia Hill Collins contends that neither relativism nor positivist/objectivist epistemological frameworks recognize "the importance of specific location in influencing groups' knowledge claims, the power inequities among groups that produce subjugated knowledges, and the strengths and limitations of partial perspective."[46] According to Collins, Afrocentric feminist thought privileges partial, contextual knowledge:

> Those ideas that are validated as true by African-American women, African-American men, Latina lesbians, Asian-American women, Puerto Rican men, and other groups with distinctive standpoints, with each group using the epistemological approaches growing from its unique standpoint, thus becomes the most 'objective' truth. Each speaks from

[44] Ibid., 60.
[45] Collins, *Black Feminist Thought*; Haraway, "Situated Knowledges."
[46] Collins, *Black Feminist Thought*, 235.

> its own standpoint and shares its own partial, situated knowledge. But because each group perceives its own truth is partial, its knowledge is unfinished. … [47]

Under this epistemological framework, "Truth" is determined by a method that is neither relativistic nor positivist, because it is *both*. Truth is the sum total of our individual standpoints; the common thread that run through each of our experiences. Thus, a comparative analysis of individual historical case studies will approximate the integration across multiple standpoints Collins calls for and allow specific contextualized knowledge to become generalizable. My use of multiple cases allows me to analyze the experiences several women of color in science and identify the "common threads" that runs through each to create generalizable knowledge that is inherently specific, partial, and contextual, but never universal. Preserving the value of generalizability without compromising contextualism, ensures that women of color scientists, to whom I am accountable and who are trained in a positivist paradigm, have epistemological access to this study.

Theoretical Framework: Fragmentation and Multiplicity

Feminista science studies needs a theoretical framework which places the epistemology of science in relation to the body. Philosopher María Lugones offers just such a framework in her 1994 article "Purity, Impurity, and Separation." In particular, I will draw from six inter-related concepts detailed by Lugones: transparency, thickness, fragmentation, multiplicity, separation, and curdling. I will outline these here as they are foundational to each of the case studies in this dissertation. Lugones argues we live in a "monophilic" culture that privileges purity, homogeneity, unity, and universality.[48] For Lugones, purity, and the related concepts of

[47] Ibid., 236.
[48] These are also the core values of Modern science.

unity and homogeneity, are an assumption or "fiction." The social world is, mixed, heterogeneous, and multiple. This has explicitly epistemological dimensions. According to Lugones, the concept of purity constructs

> a vantage point from which unified wholes, totalities, can be captured. It generates the construction of a subject who can occupy such a vantage point. … The vantage point is privileged, simple, one-dimensional. …it is otherworldly, as ideal as its occupant, the ideal observer… [who] must himself be pure, unified, and simple so as to occupy the vantage point and perceive unity amid multiplicity.[49]

For Lugones the logic of purity and unity is the foundation of both the unified or Cartesian subject and the Western scientific concept of objectivity. Though we all occupy multiple subject positions, individual members of society are normed for purity. However, the bodies of some subjects are marked as multiple and impure such as "women, the poor, the colored, the queer," while other bodies are not. [50] Lugones calls marked subject positions "thick" and unmarked subject positions "transparent." [51] Thick individuals, who by virtue of their marked multiplicity cannot "occupy the privileged vantage point," are at an epistemological disadvantage.[52] They can only be the objects of observation, never the subject-observers.

Because unity carries great epistemic privilege, Lugones argues that those with transparent, unmarked identities have incentive to deny their multiplicity. By replacing his multiple identities with one "pure" fragment, the transparent subject can claim to occupy a subject position that is unencumbered by culture, politics, or history. Lugones calls this process "fragmentation." Transparent subjects do this by feigning unity, or "passing" as pure. For Lugones, fragmentation is a performance. Furthermore, transparent subjects can increase their

[49] Lugones, "Purity, Impurity, and Separation," 464–465.
[50] Ibid., 467.
[51] Ibid., 474.
[52] Ibid., 465.

epistemic privilege through self-discipline and conformance to norms, and gain access to the "observatory," to systems of knowledge and truth production. Because thick subjects cannot easily perform unity, some choose to embrace their multiplicity. Multiplicity is the opposite of fragmentation. It is the act of claiming one's multiple identities. [53] Multiplicity, however, threatens to expose the unity performed by fragmented subjects. Lugones describes the strategies that the fragmented subject uses to keep that threat at bay:

> He shuns impurity, ambiguity, multiplicity as they threaten his own fiction. The enormity of the threat keeps him from understanding it. So, the lover of purity remains ignorant of his own impurity, and thus the threat of all impurity remains significantly uncontained. … He can only attempt to control indirectly, through the complex incoherence of affirming and denying impurity, training the impure into its 'parts' and at the same time separating from it, erecting sturdy barriers both around himself and between the fiction "parts" of impure beings.[54]

According to Lugones, the Western proclivity for unity forces those who occupy multiply marked subject positions to choose either the fragmentation of those identities or to live with their multiplicity and sacrifice the epistemological privileges that accompany the fragmented fiction of the unified subject.

In order to ground her theory of fragmentation in the familiar, Lugones uses an extended metaphor based on her embodied experience of curdling and separation in the process of making homemade mayonnaise. Like mayonnaise, we are all composed of multiple identities which, once combined, are mixed and emulsified and can never be completely separated into the pure starting ingredients again. Lugones defines two kinds of fragmentation or splitting. The first form of fragmentation she calls "split/separation." This kind of fragmentation separates identities presumed to be incongruent and replaces the whole with

[53] Ibid., 467.
[54] Ibid., 467–468.

just one of its parts. Split/separation is the process by which a subject feigns unity and gains epistemic privilege. The second form of fragmentation Lugones names "split/curdling." When making mayonnaise, curdling occurs when the ingredients begin to separate. But curdling is messy. Lugones explains that "when [mayonnaise] separates, you are left with yolky oil and oily yolk."[55] That is, fragmentation has occurred, but the parts are impure, and not fully separated. Lugones finds great liberatory potential in curdling. Curdling can be a strategy for multiply marked individuals to gain epistemic privilege while embracing their multiplicity. The logic of curdling is useful in this study because it offers a way to read specific strategies used by women of color for epistemological gain.[56] In each of the cases presented in this dissertation I will use the concepts of fragmentation and multiplicity to frame the strategies used by these women of color to gain access to the sciences.

Feminista *Cultural Studies of Science*

In addition to the theoretical framework of fragmentation and multiplicity described above, I use cultural studies reading practices and spatial analytics make sense of the lived experiences of women of color in science. The cases analyzed here demonstrate that women of color in science use what Chela Sandoval calls "oppositional differential consciousness" to navigate their numerous social realities and move from the social margins to the center of scientific power/knowledge.[57] Sandoval's theory of "differential consciousness" is drawn from various survival strategies articulated by feminists of color using diverse terminologies such as "'*la conciencia de la mestiza*', 'trickster consciousness,' 'masquerade,' 'eccentric subjectivity,'

[55] Ibid., 459.
[56] Ong, "Body Projects of Young Women of Color in Physics: Intersections of Gender, Race and Science."
[57] Sandoval, *Methodology of the Oppressed*.

'situated knowledges,' 'schizophrenia,' '*la facultad*,' 'signifyin',' 'the outsider/within,' 'strategic essentialism,' '*differance*,' '*rasquache*,' 'performativity,' 'coatlicue,' and 'the third meaning.'"[58] She argues that, for women of color, these are "ways of life,"[59] and are "misrecognized and underanalyzed by readers.[60] Sandoval notes that people who utilize differential consciousness possess "art-form knowledges" which are "not easily scientized or narrativized, for they are in constant flux, in continual revolution."[61] This consciousness allows individuals to negotiate and manage the multiplicity of worlds we occupy and the often contradictory identities that arise within them using several strategies.[62] Bent Flyvbjerg calls this kind of knowledge "embodied expertise" which he argues operates unhindered by reductive, rational processes and thus cannot be studied through traditional scientific methods which, by definition, privilege rationality. Instead, he argues that "where science does not reach, art, literature, and narrative often help us comprehend the reality in which we live."[63] The cultural studies analytics used by scholars like Evelynn Hammonds, Chela Sandoval, and Emma Pérez, and the spatial analytics of Mary Pat Brady allows this study to reach where traditional objectivist social science methods cannot—into the embodied expertise of women of color in science.

Hegemonic explanatory models which reduce the under-participation of women of color in science to structuralist pipeline metaphors, or individualize it with arguments about socialization or aptitude, leave the production and circulation of cultural images and

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[58] Ibid., 68–69 [Emphasis Added].
[59] Ibid., 58–62.
[60] Ibid., 171.
[61] Ibid., 199 n. 12.
[62] Ong, "Body Projects of Young Women of Color in Physics: Intersections of Gender, Race and Science"; Timmermans, "A Black Technician and Blue Babies". While neither of these scholars use the term "differential consciousness," the experiences and strategies they document are consistent with Sandoval's theory.
[63] Flyvbjerg, *Making Social Science Matter*, 18.

assumptions about the scientific capabilities of women of color unexamined. While the foundations of quantitative, qualitative, and historical social science rest on the already intelligible racialized/gendered "Other," cultural studies methods are designed to interrogate the social imagination that constructs social scientific Otherness. In this way, cultural studies methods also help to resist reproducing racist/sexist narratives within the cases presented here. In the traditions of Donna Haraway and Londa Schiebinger, *Feminista* science studies interrogate the cultural imagery about gender and science that operates in and through both institutions and individuals. An excellent model for alternatives to positivist and relativistic explanations of the under participation of (white) women in science is Mary Barbercheck's analysis of advertisements in *Science.* Barbercheck identifies two explanatory models for the underrepresentation of women in science. The first, the "deficit model," identifies the "structural barriers—legal, political, and social—that exist or existed in the social systems of science" as the origin of the problem of underrepresentation.[64] The second, "difference model," however "assumes that there are fundamental differences in the outlook and goals of men and women …. They are innate or the result of gender-role socialization and cultural values."[65] Barbercheck finds these two models problematic because they "take an either/or approach in that either obstacles are imposed on individuals by a system that constrains their choices or individuals place constraints on themselves that aggregate to social patterns."[66] What's more, neither of these models has fully explained the persistent under-participation of

[64] Barbercheck, "Mixed Messages: Men and Women in Advertisements in Science," 117.
[65] Ibid.
[66] Ibid., 118.

women, especially at the highest levels, in the face of numerous intervention programs designed to rectify the problem.

Barbercheck suggests a third explanatory model which she argues will "account [for] the force of stereotypes, gender schemas, and images that surround us but do not seem to have the direct or concrete power to shape an individual's choices."[67] Using feminist cultural studies methodology, Barbercheck explores the powerful cultural norms expressed in advertising imagery that reflect and construct both the individual and institutional obstacles to women's participation in science. According to Barbercheck, metaphors, representations, and archetypes create a shared cultural understanding of who is and is not a scientist. This kind of analysis gets at what Michel Foucault called the "capillary" form of power—the diffuse, unlocalized forms of oppressive gender ideologies which work on and through individual bodies, but which have no seat, no single, identifiable source for their power.[68] Cultural studies methodology is precisely what is absent from studies which use the deficit and difference explanatory models that have thus far been the principal approaches available to study women of color in science.[69] *Feminista* Science Studies will combine cultural studies of science methods, like Barbercheck's, with intersectional analytics to create a history of women of color in science.

Cultural studies methods are also useful when traditional historical methods break down because traditional archives are scarce or do not exist. For example, in her discussion of the invisibility of non-normative Black female sexualities in queer studies, historian of science

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[67] Ibid.
[68] Foucault, *Power/Knowledge*, 39.
[69] One notable exception is Ong, "Body Projects of Young Women of Color in Physics: Intersections of Gender, Race and Science."

Evelynn Hammonds demonstrates one way cultural studies reading practices can be used to create alternative archives. Using the metaphor of a black hole, which she borrows from Michelle Wallace, Hammonds proposes a solution to the problem of invisibility. A black hole is not a void but rather a space so densely packed with matter that its gravity lets nothing escape, not even light. This renders it "invisible." Relying on her background in physics, Hammonds explains how to detect a black hole:

> One finds a visible apparently 'normal' star in close orbit with another body such as a black hole, which is not seen optically. The existence of the black hole is inferred from the fact that the visible star is in orbit and its shape is distorted in some way … Therefore, the identification of a black hole requires the use of sensitive detectors of energy and distortion. In the case of black female sexualities, this implies that we need to develop reading strategies that allow us to make visible the distorting and productive effects these sexualities produce in relation to more visible sexualities.[70]

The "technology" needed to make the invisible visible within the social world, is a set of intersectional reading practices. I locate that technology in US Third World feminist theory. With respect to Black women's sexuality, Hammonds asks her readers to consider:

> What methodologies are available to read and understand this perceived void and gauge its direct and indirect effects on that which is visible? Conversely, how does the structure of what is visible, namely white female sexualities, shape those not-absent-though-not-present black female sexualities which … cannot be separated or understood in isolation from one another?[71]

Following Grace Hong's argument that "woman of color feminism is not a reified subject position but a reading practice, a 'way of making sense of' that reveals the contradictions of the racialized and gendered state," reading for the distortions, silences, contradictions, and discontinuities is one way to create an archive of information where none seemed to exist.[72]

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[70] Hammonds, "Black (W)holes and the Geometry of Black Female Sexuality.," 139.
[71] Ibid., 130–131 [Emphasis Added].
[72] Hong, *The Ruptures of American Capital*, x.

By examining the effects of the presence of women of color scientists on their more visible counterparts, white women and men scientists, I create a new archive *and* generate insights about the relationships between gender, race, and science. For example, in Chapter Two, I show how Roger Arliner Young manifests as a distortion, like a misshapen star orbiting a black hole, in the story of her much more visible mentor, African-American biologist, Ernest Everett Just. The distortion she creates in Just's life is reflected in his ability to juggle a multitude of tasks and responsibilities, without compromise. Young's unseen teaching labor, for instance, enabled Just to maintain his position of power as the head of the biology department at Howard University, even while abroad for extended periods conducting research. The benefits of this reading strategy are twofold. First, it expands the archive of information available for analysis. Second, reading for these distortions generates knowledge about the way gender roles construct the division of labor in historically Black scientific institutions.

Chela Sandoval's notion of differential consciousness is also useful in identifying strategies women of color scientists used to survive and succeed in social environments hostile to their presence. Sandoval defines differential consciousness as "a strategy of oppositional ideology that functions on an altogether different register. ... [it] is the expression of the new subject position [that] permits functioning with, yet beyond, the demands of dominant ideology."[73] Patricia Hill Collins has called this consciousness the "outsider within."[74] The differential consciousness used by women of color to function "with, yet beyond," as an insider/outsider within scientific institutions is easily misread as erratic or contradictory

[73] Sandoval, *Methodology of the Oppressed*, 44.
[74] Collins, "Learning from the Outsider Within."

behavior by their contemporaries and historians alike. When read through a US Third World feminist lens, however, these contradictions come into sharp focus. For example, despite much evidence to the contrary, at the end of her career, Chien-Shiung Wu claimed never to have experienced discrimination. However, I argue that her assertion is a sign of both differential consciousness and curdling that allowed her to operate with, yet beyond the culture and epistemology of physics. Wu feigned the unity necessary to preserve her epistemological privilege as a scientist by distancing herself from the experiences of discrimination which marked her as multiplicitous. Such contradictions are evidence of the strategic use of various ideologies for the purpose of survival. In conjunction with Hammonds' strategy of reading for the influence of the invisible on the visible, identifying the manifestations of differential consciousness in their lives and careers allows me to make sense of the survival strategies utilized by women of color in science.

I also draw on the "reading practices" employed by Chicana feminist and historian, Emma Pérez. For Pérez, a decolonized historical epistemology "trace[s] repetition, the manner in which rhetoric is repeated to serve similar kinds of purposes,"[75] allowing us to connect the past to the present moment without creating teleological narratives. These "repetitions of rhetoric" can demonstrate continuities across time periods. Identifying continuities, allows me to make sense of the past while preserving the messiness of its emergence within the contemporary moment. It is only after we identify these repetitions and continuities that we can move beyond them. Pérez also describes another kind of repetition she calls "doubling." Doubling occurs when hegemonic discourses are co-opted by the socially marginalized for

[75] Pérez, *The Decolonial Imaginary*, 55.

liberatory purposes.[76] I examine doubling of hegemonic rhetorics in each of my case studies. For example, in Chapter Four, I demonstrate how Sor Juana doubled rational/scientific, sexist, and religious rhetorics. When Sor Juana found herself in trouble with church authorities, she routinely doubled the logic of sexism by feigning womanly ignorance in order to assert her right to study. Sor Juana strategically deployed such rhetorics to argue for women's intellectual equality and lay claim to the right to produce knowledge about nature.

Finally, I will utilize what I call *feminista* spatial analytics, such as border theory to analyze the productive power of space in each of my cases. These theories place the body *in* space and examine how the body is constructed and given social meaning through space. Mary Pat Brady, a Chicana literary scholar, argues that power is encoded in spatial relations and that space is both productive of power and produced by power.[77] For example, she asserts that,

> Crucial to this understanding of the production of space is its bodily instantiation. If the production of space is a highly social process, then it is a process that has an effect on the formation of subjectivity, identity, sociality, and physicality in myriad ways. Taking the performativity of space seriously means understanding that categories such as gender, race, and sexuality are not only discursively constructed but spatially enacted and created as well.[78]

Feminista spatial analyses facilitate investigations of the production of identities and meanings within and through spaces by allowing us to move beyond the limits of discursive analyses. Somewhat like Foucauldian "power/knowledge", Brady's reading of space in border literature might be called "power/space". As such, power/space produces subjectivities.[79] Power/space works through a temporal encoding of the border which, depending on her assignment to one

[76] Pérez, *The Decolonial Imaginary*.
[77] "Wu, Chien-Shiung," 7.
[78] Brady, *Extinct Lands, Temporal Geographies*, 8.
[79] "Wu, Chien-Shiung," 11.

side or another, marks that subject as Modern or as a relic of the past. Through the "naturalization" of space, these subjectivities are naturalized making them invisible and unnamable.[80] Brady asserts that the productive power of the border is challenged in Chicana feminist literature in stories of border trickery or double-crossing, through resistance of the temporal geography, and by calling into question the ways in which the border "authorizes" certain subjectivities. I will employ spatial analysis as another form of cultural studies reading practice which examines the ways in which borders and temporal geographies figure in the experiences of women of color scientists. For example, for Sor Juana the choir grate, which separated the monastery from the cathedral acted as a border that regulated her social and scientific worlds.

In this study, I expand the archive of information about women of color scientists by examining several kinds of cultural images. I examine the symbolic relationship between the bodies of women of color and nature. I analyze the way racialized gendered archetypes, such as the Black matriarch, Sapphire, and Dragon Lady, shaped the lived experiences of women of color scientists and the stories told about them. I interrogate the coding of "scientist" as white and male in each of my cases. I read for the distortions of the unseen in the lives of the visible, differential consciousness, fragmentation and multiplicity, repetition, and doubling in each of my cases. And finally, I use *feminista* spatial analytics to examine the productive power of space in the lives and work of each of my cases.

[80] Ibid., 7.

Feminista *Science Studies Defined*

Feminista Science Studies uses an interdisciplinary and intersectional lens to study the interconnections between gender, race, and the scientific endeavor. It works "with, yet beyond" traditional social science methodologies by privileging partial, contextual knowledge through the use of comparative case studies.[81] Cultural studies reading practices and spatial analytics are used to make sense of the production and circulation of controlling imagery about the relationship between women of color and scientific knowledge production. Spatial analytics are used to generate knowledge about how power works through spatial inscriptions to construct scientific subjectivities. It takes women of color seriously as scientific actors by examining both the institutions within which they worked and the content of the scientific knowledge they produced. Finally, *Feminista* Science Studies is ethically accountable to the socially marginalized for both the process and products of the knowledge it generates.

Outline of Dissertation

In the following chapters I apply the *Feminista* Science Studies methodology outlined here to the analysis of three cases. In Chapter Two, I use my *Feminista* analytic to push beyond the single-axis accounts the life of Roger Arliner Young (1899-1964), the first African American woman to earn a doctorate in zoology. This intersectional analysis allows me to situate Young's individual experience in the context of the US eugenics movement and Jim Crow era racism and sexism within the laboratory. Young, who worked with pioneer Black scientist Ernest Everett Just, made internationally recognized contributions before she had even attained the level of doctorate, but in the last years of her life she voluntarily committed herself to the Mississippi

[81] Sandoval, *Methodology of the Oppressed*, 44.

State Asylum. Unfortunately, most of her biographies fall back on racist/sexist narratives of Black womanhood that pathologize Black women's sexuality to explain Young's life trajectory. Such stereotypes are shaped by the symbolic association between Black women's bodies and primitive nature, sex, and heritable pathologies of the body and mind. Though her biographers attributed the decline of her career to dependence on Just, in fact, Young was black-listed from university teaching positions for her activism and union organizing. The logic of eugenics which cast Young as unfit scientifically left its imprint on the narratives of her life and shaped her options for resistance by limiting her ability to fragment.

In Chapter Three, I use a cultural studies approach to analyze the way physicist, Chien-Shiung Wu's Asian female body marked her as an anachronistic and mysterious "destroyer of worlds" five years before her colleague Robert Oppenheimer popularized those words. Wu is notable for her work on the Manhattan Project and for having designed the 1957 experiment that disproved the "law of conservation of parity"—that subatomic particles decay symmetrically. The law of parity was more than a false assumption, however. Symmetry, uniformity, simplicity, and elegance are core aesthetic values within Western scientific culture. By demonstrating that sub-atomic particles decay in a non-uniform way, Wu's research threatened some of the most foundational values within Modern science. In a profile that appeared in the *New York Post* in 1959, Wu was described as "small and modest" yet "powerful enough to do what armies can never accomplish: she helped *destroy a law of nature*."[82] The awe expressed in the *Post* demonstrates that the presence of Wu's foreign, Asian female body was perceived as disruptive to the militarized space of the nuclear laboratory. Wu used

[82] "Wu, Chien-Shiung" Current Biography, 1959.

fragmentation and curdling to maintain her epistemological privilege by manipulating stereotypes of Asian femininity to conform to the aesthetic of elegance within the culture of physics.

In Chapter Four, I analyze how seventeenth-century Mexican nun, poet, and natural philosopher, Sor Juana Inés de la Cruz, laid claim to the right to produce knowledge about nature by articulating an epistemology of *mestizaje*. Using border theory, I demonstrate how Sor Juana managed spatial relations to create a place from which she could produce knowledge about nature. The choir grate, which separates the cloister from the cathedral, acted as border and is what made Sor Juana's intellectual life possible. Due to the porosity of the grate, she was able to extend her social and intellectual worlds beyond the walls of the convent. From behind the choir grate, Sor Juana developed a strategy of doubling rational/scientific, sexist, religious discourses which allowed her to justify her "border-crossing," a metaphysical transgression of the vow of enclosure, to Inquisition-era church authorities. However, the symbolic association of women's bodies with nature marked her as an object with no claim to scientific subjectivity. To liberate her mind from her gendered body, and put her natural philosophy on equal epistemological footing with the men of her age, Sor Juana doubled the epistemology of disembodiment—separation of the mind and the body—proposed by contemporary philosophers like Descartes. However, she also expressed in her letters and poems a profound preference for embodied knowledge production. I argue that in the epistemological and cultural context of colonial Mexico, Sor Juana articulated an epistemology that allowed her to use the best of the various epistemological paradigms at her disposal.

In the final chapter, I draw connections between each of the cases. I make three claims based on my analysis of these cases: 1) While the symbolic association of women's bodies with nature marks all women as objects, limiting their claim to scientific subjectivity, women of color and white women are not marked in the same ways. Women of color are positioned in opposition to modern Western science through the association of their bodies with wild, primitive, destructive, and deficient forms of nature in the scientific cultural imaginary. 2) To the extent that these associations reinforce racial dichotomies which cast women of color as subhuman irrational beings, with little capacity for the "higher reasoning" skills required for a scientific career, the strategies for survival and success in scientific institutions employed by women of color represent a form of oppositional differential consciousness in the service of scientific knowledge production. 3) The epistemological paradigms in which these women operated shape their experience by regulating their ability to conform and resist to the social norms of science. Finally, through these cases this study disrupts the logic of "statistical significance" by revealing the social and historical relevance of the experiences and contributions of women of color in the history of science.

Chapter Two
Doing Science from the Back of the Bus:
Science, Eugenics, and Jim Crow in the Life of Roger Arliner Young

> *"You seem to be making a deliberate effort to keep me from doing any research while in residence in your department. This type of thing is so averse to a true scientific or real university spirit that for a long time I have tried not to believe that it is the correct expression of your sincere attitude." —Roger Arliner Young to Ernest Everett Just, May 6, 1935*[83]

What was most revolutionary about Roger Arliner Young (1899-1964) and her career was her very presence in scientific spaces as a Black woman, from the working class, at the height of the eugenics movement during the Jim Crow Era.[84] Young was the first African American woman to earn a doctorate in zoology (1940). The daughter of a coal miner and a housekeeper, Young moved through multiple social worlds—from the highly segregated world of the Jim Crow South, and the Black middle- and professional-class societies of Washington, D.C. and Durham, to the elite white world of the biological sciences. Using state-of-the-art facilities and high-tech equipment, she conducted summer research at both Woods Hole Marine Biological Laboratory (MBL) and Hopkins Marine Laboratory in the 1920s and 1930s alongside the leading scholars in her field. Her research on the effects of electromagnetic radiation, such as X-Rays and UV light, on paramecium and sea urchin eggs, though well cited, did not change scientific paradigms.[85] But, her research did advance science in between its revolutions. Young's research was a part of what Thomas Kuhn called "normal science."[86]

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[83] Young to Just, May 6, 1935.

[84] Young signed many of her letters R. Arliner Young, as such I will refer to her as Arliner Young throughout this chapter.

[85] Young, "On the Excretory Apparatus in Paramecium"; Heilbrunn and Young, "The Action of Ultra-Violet Rays on Arbacia Egg Protoplasm"; Heilbrunn and Young, "Indirect Effects of Radiation on Sea Urchin Eggs"; Young, "The

Even today Young's experiences resonate with many women of color in academy, in both the sciences and other disciplines. The challenges she faced included job instability and discrimination, poverty, lack of access to adequate health care, and a violently racist and sexist culture. In particular, she struggled to incorporate her commitment to her non-scientific, working-class community outside the university with the elite racial uplift agenda, of which she was a part, within the university. Constrained by white supremacy, the class politics of the African American communities in Washington, DC and Durham, North Carolina, and the lack of a tenure system in historically Black colleges and universities (HBCUs) ultimately pushed Young out of her community, and further isolated her from the research resources she needed to continue her career. Though she achieved internationally recognized success for her research on the effects of X-rays on paramecium before she had even attained the level of doctorate, Young's story has been used as a "cautionary tale" for women of color in science.[87] To be sure, her story may give pause to women of color in science—she died alone and penniless.

However, I argue that Young's story should be read as a cautionary tale for historians of science and feminist science studies scholars, as well. The biographical histories of Young's life and work, have neglected to use intersectional methods. As a result they have left one or the other of her identities, as an African American woman, unexplored. In what follows, I unpack the construction of Young as a tragic figure through an intersectional reading of the biographies written by Wini Warren and Kenneth Manning, as they are among the most detailed and

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Effects of Roentgen Irradiation on Cleavage and Early Development in the Annelid, Chaetopterus Pergamentaceus"; Costello and Young, "The Mechanism of Membrane Elevation in the Egg of Nereis"; Young, "The Indirect Effects of Roentgen Rays on Certain Marine Eggs."

[86] Kuhn, *The Structure of Scientific Revolutions*.

[87] Warren, "Roger Arliner Young: A Cautionary Tale."

represent the most original scholarly work.[88] I employ the *feminista* science studies methodology I outlined in the previous chapter to "make sense" of Manning and Warren's historical representation of Young. I re-construct a narrative that takes Young seriously as a scientific actor by adding new archival evidence and reinterpreting old sources. Using *feminista* cultural studies of science methodologies, like Evelynn Hammonds' strategy of reading for Black (w)holes, I examine the distortions in the lives of those around Young.[89] I use María Lugones' framework of fragmentation/multiplicity to show how Young's resistance was constrained by the epistemology of the field in which she worked.[90] And, I draw out the strategies Young used to manage her multiple identities across her social worlds by applying Chela Sandoval's analytic of differential consciousness.[91] Young's story illustrates the difficulty of re-constructing a history of science that includes women of color and demonstrates that such a history requires both the creation of alternative archives to make the unseen visible, and deep historical, social, and political contextualization. Furthermore, Young's story makes evident the intricate nexus between science, eugenics, and African American class politics during the Jim Crow era that can only be seen in its full complexity when we examine the life of someone who walked in each world. Through an analysis of Young's biographies and a reconstruction of the story, we can expand our knowledge about the way that what Stephan Timmermans has called "racial meanings" are produced in scientific spaces.[92]

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[88] Ibid.; Manning, "Roger Arliner Young, Scientist"; Other biographies of Young include: Diaz, "Young, Roger Arliner (1889-1964)"; Hammonds, "Young, Roger Arliner (1889-1964)"; Spangenburg and Moser, "Young, Roger Arliner."
[89] Hammonds, "Black (W)holes and the Geometry of Black Female Sexuality."
[90] Lugones, "Purity, Impurity, and Separation."
[91] Sandoval, *Methodology of the Oppressed*.
[92] Timmermans, "A Black Technician and Blue Babies," 223.

The "Cautionary Tale"[93]

Arliner Young first appeared as a minor character in African American historian Kenneth Manning's 1983 biography of Ernest Everett Just, *Black Apollo of Science*. Later, in 1989, Manning compiled what he had uncovered about her into a cohesive five-page biography which was published in a special issue of *SAGE* dedicated to Black women's contributions to science and technology. In 1999, Wini Warren built on Manning's work and included Arliner Young in her encyclopedia, *Black Women Scientists in the United States.* Both Manning and Warren portrayed Young as a tragic figure whose tumultuous career started at Howard University and ended when she voluntarily committed herself to the Mississippi Mental Asylum in the early 1960s.[94] Young died several years later of unknown causes.[95]

Because Young's story was initially told through Just's, the resulting narrative is deeply intertwined with his and leaves Young with little scientific agency of her own. These biographies are also teleological. They accept the final outcome of Young's life as inevitable and try to understand the events that led up to her fall from scientific glory. Manning and Warren take the rumors and negative performance reviews that plagued Young's career at face value rather than looking at them as clues about the context in which Young operated. In this section I offer an analysis of the historical construction of Young by Manning and Warren. I show how each of their analyses rests on assumptions about Black women that derive from the political contexts in which they were developed.

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[93] This section is a revised and expanded version of my contribution to Clark, Díaz, and González, "Intersectionality in Context from the Perspective of Feminists in the Americas: Three Cases for the Specificity of Intersectionality."
[94] Warren, "Roger Arliner Young: A Cautionary Tale," 299.
[95] According to life span data, Young's life was close to the average life span of black women born in 1900. Rogers and Glover, *United States Life Tables 1890, 1901, 1910, and 1901-1910.*

A close examination of the sources used for Manning's biography of Young reveals two things. First, he added no additional sources beyond those included in his 1983 study of Ernest Everett Just.[96] Second, Manning makes numerous claims and conjectures about Young that he does not (perhaps cannot) support with archival evidence. This indicates that Manning may have felt there was no need to deepen his research on Young for the *SAGE* biography, that what he had uncovered incidentally, as part of his research on Just was adequate to write Young's her story because she was only of secondary importance to an African American history of science in comparison to Just. But, his sources indicate that his research was not sufficient to explain the trajectory of her life in two different ways. First, there are factual gaps such the reason for her move to Texas. Second, there are "perceived" gaps. Manning manages both the factual and perceived gaps by citing recognizable racial/gender stereotypes to connect disparate elements in Young's story. These are elements of the story that Manning is unable to reconcile with his understanding of Black womanhood or scientific subjectivity. In this way, stereotypes are used to resolve conflicts between Young's Black female body and Manning's image of a scientist as an authoritative producer of knowledge about the natural world.

Manning paints Young simultaneously as a "genius" in her own right and intellectually, as well as professionally, dependent on Just. In one paragraph he acknowledges Young as a pioneer and points out that Just referred to her as a "genius."[97] In the next, he paints Young as catty, jealous, and incapable, while Just is consistently portrayed as a benevolent and tolerant

[96] Note: The biography published in SAGE did not contain any references to primary sources. I carefully compared the passages pertaining to Young in the 1983 biography of Just to the SAGE article and found that majority of the 1989 piece was copied directly from the earlier version. The fact that Manning did not provide any sources for the SAGE biography forces us to conclude that he did no additional research.

[97] Manning, "Roger Arliner Young, Scientist," 4.

mentor. Manning undermines his own assertion that Young "had the potential to be, like [Just], a leader in the field of biology," by detailing her grades (Bs and Cs), implying that they did not indicate the innate scientific talent a true "genius" would possess. That Manning mentions Young's intellect suggests that he was unable to reconcile Young's intelligence with his assumptions about the scientific abilities of Black women. The result is a representation that echoes both the racist stereotype of the dull "negro" and the sexist stereotype of the "simple" woman, each of which are inconsistent with a fact Manning himself cites—Young, as sole author of her 1924 paper "On the Excretory Apparatus in *Paramecium,"* was recognized internationally for her achievements, and not only by Just.[98]

Despite his claim that "Young was anything but docile,"[99] in Manning's narrative Young is portrayed as entirely dependent on Just. According to Manning, Just recruited Young, found money for her studies, connected her with mentors at the University of Chicago and Woods Hole, gave her a research topic, and provided her with teaching opportunities. Manning even goes so far as to suggest that Young failed her qualifying exams because Just was out of the country and unable to provide her with what he refers to as "symbolic support." Without her mentor, he argues, "she was unable to answer the simplest questions."[100] In Manning's story, Young becomes a body through which Just worked and by extension what success she attained symbolically belonged to him. This image of Young as lost without Just stands in stark contrast to the woman who "was accepted … readily at Woods Hole," and who sought to "expand her academic horizons" by pursuing her doctorate at the University of Chicago, both places outside

[98] Ibid.; Young, "On the Excretory Apparatus in Paramecium."
[99] Manning, "Roger Arliner Young, Scientist," 5.
[100] Ibid., 4.

of Just's immediate sphere of influence.[101] Manning also fails to critically reflect on the fact that it was not until after her falling out with Just and subsequent firing from Howard that she actually passed her exams and earned her doctorate from the University of Pennsylvania. Instead, Manning denies Young's agency in her career, and even in her *voluntary* commitment, by describing her using words like "mental problems," "loss of control," and "vulnerable," ultimately concluding that "She was clearly not, however, in a condition to *do* much for herself."[102] Thus, even in her most active decisions, Manning portrays Young as helpless which denies her agency and full subjectivity.

In Manning's story, Young's success at the international level could not be explained exclusively by her meaningful contribution to her field, because of his perception that she was scientifically dependent on Just. Manning looked to Just to explain how Young could have attained such success. That Just might have supported Young because she was a promising young scientist, does not fit with Manning's understanding of Black womanhood. In the absence of evidence about why Just might have put so much effort into Young's career that supported his preconceptions, Manning speculates that Just's interest in Young was not only scientific but also sexual. Though he acknowledges that he does not present evidence to support his claims, his allusion to an affair between Young and Just frames the rest of the story.

Manning uses several conflicting stereotypes of Black female sexuality to describe Young's behavior. For example, he implies that Young was a race traitor as he presumes that jealously led her to betray Just and report his "affairs with white women in Europe" to his

[101] Ibid.
[102] Ibid., 7 [Emphasis added].

colleagues at Woods Hole. Noting that "such a revelation was sure death professionally, and often literally, for an American Black man—and Young knew it," Manning misplaces the responsibility for violence toward Black men by blaming Young, rather than institutionalized racism and segregation, while overlooking other reasons Young may have reported him.[103] Though, I found no sources which indicate Young's reasons, it is possible that Just made unwanted, harassing sexual advances toward Young, and that his extramarital affairs prompted her action. Or, perhaps, having spent time with his wife during summers at Woods Hole, Young found Just's infidelity reprehensible. Instead of exploring other possibilities, Manning not only highlights what he sees as Young's sexually transgressive behavior but he also expresses common anxieties about female-bodied sexuality being disruptive to scientific spaces. Londa Schiebinger has argued that from ancient times well into the modern period "the very presence of women had been thought to disrupt serious intellectual endeavor." Schiebinger ties the disruptive threat women represented directly to female sexuality, noting that "until late into the nineteenth century celibacy was required of all faculty" at Oxford and Cambridge.[104] By layering the threat of lynching over Just's "professional" death, Manning illustrates how Black female sexuality is seen as even more dangerous than white femininity in the laboratory.

To emphasize Young's nonconformity to gender norms, Manning highlights her status as an unmarried, childless, professional woman in the following passage: "... she continued to experience financial troubles: she owed a lot of money, had to support her mother on a tiny salary, and was beginning to feel—as a single woman—that she had better start preparing for

[103] Ibid., 5.
[104] Schiebinger, *The Mind Has No Sex?*, 151.

her own retirement."[105] By setting Young's marital status inside dashes, he calls attention to this aspect of Young's identity and ranks it above the other identities he mentions, that of professional and caregiver. This allows him to tacitly cite a deviant sexuality that is either heterosexuality uncontained by marriage (which he explicitly mentions), or homosexuality (which he leaves as a silent insinuation). However, Young's role as a caretaker for her mother and her strong identification with her through her fears of illness, which Manning cites using Young's own words, prevent him from fully casting Young as an emasculating Sapphire. This secondary image of the asexual "mammy" jars against his charge that she "began to act the jealous woman."[106] As Patricia Hill Collins argues, controlling images of Black women, such as those used by Manning, carry oppressive power and "are designed to make racism, sexism, and poverty appear to be natural, normal, and an inevitable part of everyday life.[107] These images operate in precisely this manner in the Young's story, making her experiences of marginalization unremarkable and, at the same time, unnamable.

Manning's telling of Young's story is a case study in the relevance of theories of intersecting or interlocking oppressions and identities to historical analyses, even when documenting conflicts or collaborations between men and women of color. Manning's biography is loaded with positive potential but laden by his negative representations of Young. According to sociologist of science Willie Pearson, historical biographies of Black scientists have had a positive influence on the selection of science careers among African American

[105] Manning, "Roger Arliner Young, Scientist," 6.
[106] Ibid., 5.
[107] Collins, *Black Feminist Thought*, 68.

chemists.[108] This means that historians of science who, like Manning, conduct publicly accessible research on the history of African American scientists have the opportunity to encourage young Black students to see science as a viable career path for themselves. As Patricia Hill Collins notes, there is power in symbolic representation: "As part of a generalized ideology of domination, these controlling images of Black womanhood take on special meaning because the authority to define these symbols is a major instrument of power."[109] While Manning's biography is important because it made the contributions of a woman of color scientist visible in a field where women of color are grossly understudied, it inadvertently reproduced damaging representations of Black women as simultaneously aggressive, emasculating, and dependent.

In Wini Warren's telling of the story, it is the sexism that Arliner Young faced that is foregrounded. Young is used as a "Cautionary Tale" but that caution is one of sexism rather than racism. Warren, unfortunately, only adds a few sources to the story. She challenges Manning's allusion to a possible affair between Young and Just in a footnote, but his narrative of dependence still structures the biography. Warren argues that "Young was never really able to outgrow her dependence on her mentor—as all young scholars and scientist must eventually do if they are to blossom in their own right."[110] She does not consider how racism might have played a role in, for example, Young's estrangement from her colleagues and mentors at Woods Hole during the 1940s. Nor does Warren attribute the fact that Young's employment difficulties were due in part to the strict segregation which limited her career to HBCUs. For example,

[108] Pearson, *Beyond Small Numbers*.
[109] Collins, *Black Feminist Thought*, 68.
[110] Warren, "Roger Arliner Young: A Cautionary Tale," 293.

citing Manning, she recounts Just's falling out with his mentor, Frank R. Lillie, and the community of scientists at Woods Hole in 1930 at which he is reported to have said publically: "I have received more in the way of fraternity and assistance in my one year at the Kaiser-Wilhelm-Institut than in all my other years at Woods Hole put together."[111] Warren does not name racism as the source of Just's frustrations, as Manning does, nor does she note this episode took place just months after Young failed her exams under Lillie. Instead, she implies that Just's falling out might have influenced the feelings of the MBL community toward Young, overlooking the six years of collaborative work Young did following Just's break with Woods Hole. The narrative of dependence that Manning established keeps Young's story centered on Just and, as such, obscures the racial dynamics at work. Despite the facts that Young's primary mentor was a Black scientist and that she worked at Howard University, a historically Black university, Young's race cannot be ignored.

Warren also denies Young's claim to scientific subjectivity. For example, Warren implies that Just chose to recruit Young for reasons other than her aptitude for science. Warren points out, "Marguerite Thomas Williams, a science major who was far more qualified for the position than Young, graduated in the same year, and obtained a position at Miner Teachers College, also in Washington, D.C. Whatever the reason for Just's interest in Young, he was clearly her mentor and she blossomed as a scientist under his tutelage."[112] Though she includes an entry on Williams in her encyclopedia, she neglects to note that Williams was a geologist and not a

[111] Manning, *Black Apollo of Science*, 194.
[112] Warren, "Roger Arliner Young: A Cautionary Tale," 288–289.

zoologist or biologist.[113] Neither does Warren consider that Williams might not have wanted the position. Warren dismisses Manning's theory of an affair, but continues to question Young's qualifications for the job.

Both Manning and Warren have expressed commitments to challenging stereotypes which obscure the work of Black scientists. Manning has demonstrated throughout his career that he is committed to challenging stereotypes of Blackness which have historically precluded Black scientific subjectivity. His own history as a Black South Carolinian born in 1947, means that he was both generationally and geographically situated to have been deeply and personally influenced by the Civil Rights movement. Manning is currently a tenured professor in the Science and Technology Studies department at MIT. He has been actively involved in MIT initiatives to recruit and retain both under-represented students and faculty, sometimes in very public and controversial ways.[114] It is clear from the record of his activities at MIT that Manning is committed to academic institutional equality as a key part of the Civil Rights agenda. In fact, in his 1998 article "Science and Opportunity," which appeared in *Science*, the premier scientific journal in the United States, Manning frames his essay, indeed his entire project, against a statement made in 1913 by then editor and owner of *Science*, J. McKeen Cattell: "There is not a single mulatto who has done creditable scientific work."[115] As a Black historian best known for his biography of Just, we must see in Manning a commitment to an anti-racist re-accounting of the history of science. Yet, in the process of revising that history to acknowledge Black male

[113] Warren, *Black Women Scientists in the United States*, 267–268.
[114] Chomsky et al., "A Plea for Fairness at MIT"; Kwan, "Prof. Begins Hunger Strike, Says Racism Cost Him His Tenure"; Sherely, "A Second Plea for Help to End Racism at MIT"; "Prof. Sherley's Press Release."
[115] Manning, "Science and Opportunity," 1037.

scientific subjectivity, he reinscribes racially specific sexist ideologies and norms which deny such subjectivity to Black women.

The problem with Manning's biography is inherently methodological. Because he did not operate within an intersectional framework, he did not consider the specificity of Arliner Young's subject position or the intersecting oppressions that Young faced as a Black woman. Nor did he consider the ways in which Just, as a man, was privileged relative to Young. By considering only her Blackness and not how her gender modified that racialization, making it different than the Blackness of his primary historical subject, Ernest Everett Just, Manning inadvertently created a story laden with sexist representations of Black womanhood. The story works because the stereotypes were both familiar and invisible to his readers.[116] That is, Manning was able to piece together a short biography including a (hi)story of an affair between Arliner Young and her mentor without documentary evidence and avoid jeopardizing his scholarly credibility, because we all already know the story through stereotypes. While it is really Young who has become invisible, it is the stereotypes of Black womanhood, naturalized through their reiteration as historical fact, that go unseen and blur the distinction between fact and fantasy, story and history. And, as Collins argues, these naturalized stereotypes are "essential to the political economy of domination."[117] In this case they reinforce the notion that "all the Blacks are men," through the benevolent image of Ernest Everett Just, and work to elevate the status of the Black male scientist at the expense of the Black female scientist.

[116] Manning, "Roger Arliner Young, Scientist," 4.
[117] Collins, *Black Feminist Thought*, 67.

Ultimately, Warren's construction of Young is shaped by the notion of Universal Sisterhood which is often a defining feature of First World feminisms. Within feminist organizing, feminists of color have struggled to have the particularities of their oppression as raced and classed women acknowledged and fully supported by white feminists. In the "second wave" women's liberation movement, they found white feminists' notion of universal sisterhood oppressive and offensive. According to Elizabeth Spelman, a white ally who has worked closely with María Lugones, the problem with universal sisterhood is that it is concerned only with the oppression that women experience *as* women. The notion of sisterhood rests on two assumptions—women share a common oppression as women and, as the root of all other forms of domination, gender oppression is the most important.[118] In Warren's work, she attempts to right the record by creating a biographical encyclopedia of Black women scientists, however, in the case of Young, she only considers the influence of sexism and not racism. By neglecting to account for racism in Young's history, Warren perpetuates the erasure of women of color, as people of color, from the narrative of the history of science. Though Warren writes that she has considered her own subject position as a white woman in relation to Black women scientists in a very short author's note at the end of the introduction of the book, her biography of Young does not demonstrate her understanding of the multiplicity of oppressions or the differences that exist among women. Warren claims:

> I have spent some time considering the thoughts expressed by Peter Novick on historical separatism in 'Every Group Its Own Historian.' I have discussed the issue at a number of symposia attended by women scientists of color in the last six years, and have also talked at length about it with the women I have interviewed, who generally expressed

[118] Spelman, *Inessential Woman*.

> satisfaction that someone was (finally) interested in studying Black women scientists. … I hope my effort will spur further research in this area.[119]

Through her reference to Novick, Warren argues that a white woman should be able to write a history of Black women because African American history is American history. And, while I agree with this statement on its surface, Warren's work demonstrates that writing anti-racist, feminist histories of women of color is not simply about identity; it is also about methodology. If Warren had used the analytic of intersectionality in her work, she would have been able to provide a narrative that included gender and race as well as sexism and racism as analytics for understanding the experiences of Black women scientists. Unfortunately, her analytic of universal sisterhood results in a representation of Young as dependent on Just—a tragic victim of deracinated sexism within the institution of science.

Both Manning and Warren's biographies of Roger Arliner Young are important milestones on the path to creating a history of science which includes women of color. As Warren indicated in her introduction, it is just these kinds of mini-biographies that are need to inspire further research into the history of women of color in science.[120] Yet, these histories of Arliner Young demonstrate that in order to write more complete histories of science it is not enough to simply add women of color. If we accept Young as a scientific actor with full subjectivity, and look beyond the single-axis narratives of white women and Black men in science, new questions emerge. While Manning and Warren asked how someone who wound up in an asylum ever managed to publish a single-author paper in one of the world's most prestigious scientific journals, I will ask how such an promising scientist was left with so few

[119] Warren, "Roger Arliner Young: A Cautionary Tale," xvi.
[120] Warren, *Black Women Scientists in the United States*, xvii.

resources at the end of her life. How connected was Young to her community outside the laboratory? Did she receive help from people outside the academy? If not, why not? Might Young have sought shelter rather than, or in addition to, treatment in the asylum? How might the specificity of her racialized gender have affected her colleagues' willingness to support her in the face of rumors and allegations? Might Young's complaints about Just at Howard have been about something other than jealousy or scorn? In the context of the eugenics movement, which was strongly supported by many of her white scientific colleagues, is it possible that Young internalized failures that were structural in nature and understood them as personal/mental failings? In what ways did Young resist oppression? What strategies did she use to survive? In the following sections I will explore these questions as I analyze "the production of racial meanings and prejudices" using intersectional and cultural studies methodologies.[121] I argue that an account of Young's scientific career must consider her position as a single, professional, Black woman who lived in the Jim Crow South at the height of the eugenics movement.

Gender and Historically Black Colleges and Universities

In this section, I will examine the ways in which gender and class, in addition to race, shaped Young's experience and limited her options for resistance differently than Black men in science like Just. While it may appear to Manning and Warren that Young's career went downhill without Just's support because she was either dependent or incompetent, other more political factors led to the decline of her career. First, I want to establish that Young was an independent scientific actor worthy of consideration separate from Just. Young was the sole

[121] Timmermans, "A Black Technician and Blue Babies," 223.

author of the 1924 publication that put her on the map. It appeared in the "Discussion and Correspondence" section of *Science*, the premier scientific publishing venue in the United States. The section typically featured cutting edge research not yet ready for publication as an article, but innovative enough to be noteworthy. Furthermore, as a general science journal, which publishes research from across the natural science disciplines, research published in *Science* must be broadly important. The fact that Young's work appeared in *Science* is a testament to its quality and relevance. Her two other co-authored papers were published in discipline-specific journals. Young was second author on these, while her future advisor at the University of Pennsylvania, Louis V. Heilbrunn, was first. It is also important to note, that she never co-authored a paper with Just. Whether this is because she never collaborated with him as a co-researcher, or because she was never acknowledged as a co-researcher is not known. Given the number of years they worked together and how much she assisted him with other work, it seems doubtful that they never collaborated. Young also presented papers at Woods Hole on three occasions, in 1938 as sole author.[122] Young had an active research life in which she collaborated with at least two scientists, other than Just, at the MBL and completed several research projects independently, as well. Though Young did fail her exams at the University of Chicago while Just was out of the country and unable to provide her with what Manning referred to as his "symbolic support," it wasn't until after she ended her professional association with Just that she completed her doctorate.

[122] Heilbrunn and Young, "Cell Hormones and X-Ray Effects on Arbacia Eggs"; Costello and Young, "The Mechanism of Membrane Elevation in the Egg of Nereis"; Young, "The Effects of Roentgen Irradiation on Cleavage and Early Development in the Annelid, Chaetopterus Pergamentaceus."

In order to create a narrative of Young's life that takes her seriously as a scientific actor, I situate Young's failed first attempt to earn her doctorate at the University of Chicago in 1930 in the political context of Historically Black Colleges and Universities (HBCUs) and re-interpret several primary sources used by Manning. Using US Third World feminist reading practices, such as Evelynn Hammonds' search for the distortions caused by Black (w)holes, and María Lugones' framework of fragmentation and multiplicity, I show that Young was overburdened by responsibilities that were placed on her by Just and Howard University. Howard University was the country's leading institution of higher education for African Americans during Young's career. Howard's mission was intertwined with racial uplift ideology which charged HBCUs with educating what W. E. B. Du Bois called the "The Talented Tenth." However, funding was scarce and Howard's facilities were woefully inadequate.[123] So, Howard turned to the federal government for support. In fact, in 1932, Young and Just's research was cited in a congressional report as justification for continued funding of Howard.[124] And, in an effort to attract the attention of potential funders like the Rockefellers and the Julius Rosenwald Fund, Howard sought to raise its profile as a competitive research university and justify its importance as more than a teaching institution for the Black elite.[125] To secure and sustain such funding Howard required highly-qualified research faculty, actively engaged in research. But, given the racism prevalent in the leading research universities, where were they to find such highly trained Black faculty? For the most part, they trained themselves.[126] Promising students like Young were groomed through post baccalaureate education and close research with more advanced

[123] Williams, *In Search of the Talented Tenth*.
[124] "Howard Research Is Cited in Report."
[125] Manning, "The Role of Foundation Support for Black Scientists"; Williams, *In Search of the Talented Tenth*.
[126] Just to Curtis, March 25, 1931.

scholars. Inevitably, as the American university system became more standardized and professionalized, Howard had to ensure that faculty received doctorates. This meant building relationships with faculty who were committed to the development of Black institutions of higher education at major research Universities, such as the University of Chicago, and institutions like the Woods Hole Marine Biological Laboratory. It was under these conditions that Young went to the University of Chicago. There was a lot at stake in Young's successful completion of the doctorate, both for her as an individual, and also for the success of Howard's mission.

In 1929, while Just was busy doing his part to raise the profile of Howard by conducting research in Europe, Young took over his leadership responsibilities. While acting as zoology department head, Young made arrangements with the General Education Board (GEB) for funding to work with Frank R. Lillie, Just's former mentor. She began her graduate work at the University of Chicago starting in the autumn of 1929. In her handwritten letter to Lillie, she wrote,

> I have my problem fairly well in hand, but should like to do some more experimental work on it for purpose of clarifying points in the description.… I should appreciate a conference with you and should like your criticisms before attempting to complete the problem.… I should appreciate your advice since my work at Chicago will be with you. Dr. Johnson and I are anxious to get all details settled as soon as is convenient. May I have your decision at an early date?[127]

She wrote with the voice of someone proactive, confident, and ready to impress her new advisor. In March, Lillie responded that he was unfamiliar with her research. And yet, he too expressed confidence in her abilities, saying "I do not know exactly what you are working at but

[127] Young to Lillie, February 20, 1929.

I feel sure that you are far enough advanced to get to work independently."[128] Though Just was still in Europe, Howard University approved a sabbatical for Young to begin her coursework.[129]

Young sat for her qualifying exams on January 10th, 1930, just months after starting the program. But, unfortunately, she failed to meet Lillie's standards. The day after the exam, Lillie drafted a letter to tell her she was "not yet ready for admission to candidacy for the degree of Doctor of Philosophy."[130] On January 12th, a telegram arrived from Louis V. Heilbrunn, a biologist with whom Young had worked at Woods Hole. Heilbrunn asked Lillie, a day too late, to confer with a third party, Dr. Libbie Hyman, "before making a final decision about Miss Young."[131] But, the decision had already been made, and communicated to Young. By the 15th, Lillie had notified the president of Howard University, Mordecai Johnson, of Young's status.[132] In an undated handwritten letter, likely written in January of 1930, Young explained the situation to Lillie.

> The trouble is that for two years I've tried to keep going under responsibilities that were not wholly mine but were not shared and the weight of it has simply worn me out. I forced myself on so long that I automatically accepted arrangement for the examination which I knew the first of last August I would fail unless there was some relief. Instead of relief the situation has become worse since I've come here. It is not exactly an outside thing—it does concern my work at Howard—if I took an examination a month from now under the same conditions I'd more than likely do worse. I could go on as long as there was any hope of satisfying Dr. Just by getting the degree before my return, I can keep on trying, but now that I've made that impossible I think I would gain more and create less embarrassment by giving up the whole thing for a while at least[133]

[128] Lillie to Young, March 20, 1929.
[129] "Howard Professors Get Leave to Study."
[130] Lillie to Young, January 11, 1930.
[131] Heilbrunn to Lillie, January 12, 1930.
[132] Lillie to Young, January 11, 1930.
[133] Young to Lillie, January 1930.

Young wrote this letter in the context of extreme institutional pressure to succeed, not only for her own sake, but for the sake of Howard University, and perhaps all Black institutions of higher education. In order to explain to Lillie what had happened, Young had to walk a very fine line. Because of the racialized institutional relationship between the University of Chicago and Howard, and the personal relationship between Lillie and Just, Young was reluctant to directly name the true source of the problem. The ambiguities in Young's phrasing "it is not *exactly* an outside thing" indicate that she was aware of the power dynamics in play. But, because they did not take into account the full range of power relations which defined this communication and Young's ambiguity, both her contemporaries and her biographers mistook what she felt were institutional problems for personal problems.

Manning and Warren interpreted the circumstances surrounding Young's failure at the University of Chicago and the 1930 letter to Lillie as early signs of mental instability. The white men with whom Young interacted also described her difficulty, with varying degrees of sympathy, as "mental."[134] In another frequently cited remark at the end of the letter, Young apologized to Lillie for not communicating with him in person and explained that "I seem to have lost my grip all around."[135] While Manning and Warren cite this as evidence of her mental and emotional state, I argue that Young was not referring to losing her grip on reality, but rather losing her grip on the numerous balls she was juggling.[136] Using Evelynn Hammonds' strategy of reading for the effect of the invisible on those who are more visible, as astronomers do when searching for black holes, we can see numerous distortions in the 1930 letter which

[134] Heilbrunn to Lillie, January 12, 1930; Allee to Lillie, January 28, 1930; Lillie to Johnson, January 15, 1930.
[135] Young to Lillie, January 1930.
[136] Warren, *Black Women Scientists in the United States*, 290; Manning, "Roger Arliner Young, Scientist," 5.

indicate the presence of something unseen. Though Young acknowledged she was unable to recall information she knew very well, the passage above demonstrates that she externalized the problem and did not conceive of it as "mental." In stressing that her poor performance on the exam "does concern my work at Howard," Young attempted to communicate that the problem was not personal in nature, but instead related to conflicts between her doctoral work and her responsibilities to Just and the Department of Zoology at Howard. Indeed, she said outright that the problem began two years before (1928) when she became burdened with "responsibilities that were not wholly mine but were not shared." It was at that time that she began to take on responsibilities for Just within the department of zoology at Howard.

In fact, Young delayed her doctoral work at the University of Chicago twice. In 1927, she did not receive the letter notifying her of a fellowship award from the GEB in time to begin course work. The notification had been delayed because it had not been forwarded to Woods Hole where she was conducting summer research. The next year, Young was required to delay enrollment in the program again. This time, in a letter to the GEB, she explained she could not take the fellowship in 1928 because "it was not convenient from the financial side but more than that, it would have interfered with departmental plans."[137] At the GEB, officers communicated directly with Mordecai Johnson regarding their disappointment about the delay. They learned that, "President Johnson seems to think that *Just could not get along without her* this year..."[138] During this time period, Just was at his most academically productive, publishing

[137] Young to Thorkelson, January 28, 1929.
[138] Jackson to Thorkelson, September 15, 1928, [Emphasis Added].

twenty articles between 1928 and 1931.[139] Surely, he could not have been so productive without a significant amount of invisible and unrecognized administrative, teaching, and scientific support. Young provided that unseen labor. It seems that Just was supportive of Young's educational pursuits precisely because he needed an assistant. In a 1925 letter seeking funding for Young's graduate education, Just explained to Abraham Flexner at the GEB, that he had difficulty retaining men within the biological sciences because medicine was a much more lucrative profession. He felt that, while it was rewarding to participate in the training of future physicians, he "… must also have *competent help*." And, he added, "This I can get better from a woman perhaps than a man because the lure of medicine is not so strong."[140] Young was brought in specifically to assist Just with *his* career. As such, her education was necessary to create and sustain a gendered division of labor within the department of zoology at Howard. Initially Young might have provided this assistance willingly, but by January of 1930, her support of Just came at the expense of her own progress and reputation.

Young's reluctance to clearly and fully name the problem may have stemmed from a fear of airing the "dirty laundry" of internal politics. It would be crucial to her, Just's, and Howard's future funding that they not seem like an amateur operation to a wealthy, well-connected, and supportive white scientist.[141] Furthermore, administrative and teaching responsibilities have long been feminized as reproductive work within academe. In particular, the academic "housekeeping" associated with leading a department would have been

[139] Lovell, Jr., "In Memoriam: The First Springarn Medalist," 395.
[140] Just to Flexner, September 28, 1925, [Emphasis Added].
[141] Lillie was married to Frances Crane who was a member of a wealthy family. Because of her marriage to Lillie, the Cranes provided extensive financial support to the Marine Biological Laboratory at Woods Hole. Watterson, "The Striking Influence of the Leadership, Research, and Teaching of Frank R. Lillie (1870-1947) in Zoology, Embryology and Other Biological Sciences."

racialized, as well. As a Black woman, Young would have been expected to take on these duties quietly, invisibly, and without complaint, as a Black maid in a white man's house was expected to provide reproductive labor and remain invisible. While, she wanted Lillie to know that her failure was not a result of a lack of aptitude or a lack of respect for the time he had invested in her, she did not seem to feel comfortable bringing to light exactly how much of Just's slack she was picking up, especially given that Just was also a former student of Lillie. In any case, when read with the political, economic, and social context of Howard's racial uplift mission, Young's letter to Lillie in 1930 demonstrates that she did not fail her preliminary exams because she was incapable or dependent. Instead, Young's failure was the result of the invisible labor of support she was expected perform for Just and for the race.

Within María Lugones' framework of fragmentation and multiplicity, Young's letter to Lillie constitutes an unsuccessful attempt at fragmentation. According to Lugones in order to appear unified, and gain epistemological privilege by positioning themselves outside the reach of social and cultural influence, subjects fragment their multiple identities. Young knew that calling attention to the gendered division of labor or the racialized power dynamics which defined her institutional relationship with Lillie would only serve to emphasize her multiplicity, difference, and nonconformity to the racial and gender norms of science. She simultaneously alluded to the institutional causes of her failure while attempting down play their influence. Her ambivalence had the devastating effect of facilitating Lillie's prejudices about Black women's inferiority which led him to conclude that her problems were personal, rather than structural. Young was caught in a double-bind. If she clearly identified the institutional arrangements which led to her overwork, she risked jeopardizing the relationships between the University of

Chicago and Howard which were crucial to supporting her graduate work. On the other hand, if she took personal responsibility, she would appear incapable. Because Young's subject position was "thick"—she was visibly marked by multiple non-dominant identities—she was unable to successfully achieve the fiction of unity. However, it is important to note that, though her fragmentation was not successful, it is still an indication of differential consciousness, an attempt to negotiate the multiple social worlds through which she moved.

Though Just was also a member of a marked group, as a man he was freer to complain openly to his funders about his administrative and teaching responsibilities because his masculinity allowed him to position himself above such reproductive work.[142] For example, in a 1931 letter to the National Research Council reporting his progress for the year as a Julius Rosenwald Fellow, Just noted that "Practically all of my time during the past six months has been given over to a group of four graduate students and the four other members of the teaching staff who are in engaged in research."[143] Though in the preceding pages of the report, Just outlined various research activities at Woods Hole and abroad, he felt compelled to justify a sudden slowdown in his research which followed Young's failure at the University of Chicago. Just explained the difficulty he had balancing his teaching responsibilities with his research, lamenting that "On the whole, the research program has suffered."[144] Though Just expressed ambivalence about working with graduate students who he felt did not "have the best records as undergraduates," he articulated a firm commitment to improving the rigor of the

[142] Manning, "The Role of Foundation Support for Black Scientists," 234.
[143] Just to Curtis, March 25, 1931, 3.
[144] Ibid., 5.

undergraduate zoology program at Howard.[145] For him, acknowledging the difficulties of managing a research career at a teaching institution reinforced his conformity to gender norms. It was also means to an end. He concluded his report with a request for additional support, explaining that, "If it were possible for me to have the feeling of security which would come from an indefinite tenure, this would result in removal of a mental hazard."[146] Ultimately, Just argued that this state of affairs was justification for a more permanent source of funding from the National Research Council. For Just, complaining about institutional burdens and articulating them within the framework of professionalization had the potential to benefit his career and Howard University's financial status.

Race, Science, and Eugenics: "Heredity sets the limits"

In the preceding section I argued that Arliner Young's failure at the University of Chicago must be situated within the context of the politics of HBCUs. However, to understand the trajectory of Young's career, we must also situate her as a Black woman within the racial and gender climate of the biological sciences during the first half of the twentieth century. Young was educated in the biological sciences at a time when eugenics dominated scientific debates. As the theory of evolution gained traction, understandings of heredity as a process of natural and artificial selection emerged in the form of the new science of genetics. Anxieties that natural selection was not sufficient to ensure human biological progress developed as colonial powers began to lose their grip on colonized territories and peoples. While these fears were by no means confined to scientists, biologists proposed eugenics as a legitimate field of research.

[145] Ibid., 3.
[146] Ibid., 5.

Howard University had no official program of study in eugenics. However, in the early 1920s Ernest Everett Just and the leadership at the university expressed an interest in establishing such program to the Eugenics Record Office.[147]

As an undergraduate, and later as a graduate student, Arliner Young would very likely have been immersed in a biological education which defined members of her race as "inferior" stock. Eugenic ideologies appeared in biology textbooks at just about the time that Young started her undergraduate work at Howard. By the time she began to study biology with Just in the early 1920s, these ideologies were reflected in numerous high school and college level biology textbooks.[148] Students who read these books were given an introduction to eugenicist ideology in the context of the biological sciences and genetics. For example, in *A Textbook of General Biology,* William Martin Smallwood defined eugenics as "the application of the laws of heredity to man, especially emphasizing the beneficial results of good mating."[149] But the authors of such books did not limit themselves to the mechanics of biological heredity. Many of them made direct observations about human social problems.

The eugenicist narrative in biology textbooks held that social and moral interventions led to overbreeding of inferior or unfit "stocks" of human beings.[150] For example, in a highly propagandistic chapter of the 1922 introductory college textbook, *General Biology,* Lewis M.

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[147] Dorr, *Segregation's Science*, 298–299.
[148] To gain a sense of the eugenic and racial ideologies to which Young may have been exposed in her biology courses, I have surveyed several biology textbooks published between 1914 and 1922. These are available in electronic form through textbookhistory.com and books.google.com: Abbot, *The Elementary Principles of General Biology*; Smallwood, *A Textbook of Biology*; Burlingame et al., *General Biology*; Menge, *General and Professional Biology*; Woodruff, *Foundations of Biology*.
[149] Smallwood, *A Textbook of Biology*, 279.
[150] Abbot, *The Elementary Principles of General Biology*, 240–241; Burlingame et al., *General Biology*, 525.

Terman argued that "The intellectually superior families are no longer reproducing as rapidly as formerly, and their rate of reproduction has fallen far below that of the socially incompetent."[151] In another text, *The Elementary Principles of General Biology,* James Frances Abbott, observed that:

> Man, in contrast to the rest of organized nature, largely controls his environment instead of being controlled by it. Nature's eliminations are frequently nullified by his altruism. In preserving his "unfit," however, he is imposing a very heavy burden of support on the fit and normal members of the race. … The superior classes; the cream of the race, are not continuing their heritage, and were it not for constant reinforcement from the 'lower' grades of society, the so-called intellectual element would soon be self-exterminated.[152]

Biologists worried that by allowing social mores to interfere with natural selection superior humans would be over-run by the inferior and that human evolution would stall. Terman offered a solution to this problem advocating a structural program of both positive and negative eugenics:

> … the desirability of adopting legal measures to prevent the feeble-minded from reproducing is self-evident. Many states have laws designed to accomplish this, but unfortunately they are rarely enforced against the higher grades of defectives. Sterilization of the unfit has gained little headway. However, the reduction of the number of defectives is only a small part of the problem of Eugenics. Elimination of all the feeble-minded would not raise the average level of intelligence in the general population to more than a barely noticeable extent, and it is the improvement of our entire population that counts in the long run. Still more important is the adoption of eugenic measures which will increase the number of intellectual and moral geniuses.[153]

Biology students, like Young, were taught that "superior" stock could not match the rates of reproduction of "inferior" stock, primarily because of moral aversion to behaviors that were acceptable in the animal world. Somewhat counter intuitively, eugenicists advocated further human intervention and selection to ensure progress in human evolution through good

[151] Burlingame et al., *General Biology*, 525.
[152] Abbot, *The Elementary Principles of General Biology*, 240–241.
[153] Burlingame et al., *General Biology*, 527–528.

breeding. A campaign of forced sterilization targeted primarily at women of color and disabled women emerged out of such thinking.

Though much of the eugenicist rhetoric in biology textbooks centered on mental "defects" and intellect, the notion of "good mating" was also highly racialized. While lower class, Southern and Eastern European whites were considered by eugenicists to be of inferior stocks, their primary eugenic concerns among these groups emphasized mental "defects" such as feeblemindedness, epilepsy, and alcoholism, which were all tied to criminality, pauperism, and sexual deviance.[154] Nonwhite people, particularly those of Black African descent, were considered on the whole to be inferior to whites. Terman stated that: "Probably not more than ten or 15% of American Negroes equal or exceed in intelligence the average white. The intelligence of the average Negro is vastly inferior to that of the average white, and the mulatto occupies a position about midway between."[155] The textbook authors cautioned students about the dangers of unchecked immigration and miscegenation. Terman warned: "No nation can afford to overlook the danger that the average quality of its germplasm may gradually deteriorate as a result of unrestricted immigration."[156] It is important to note that the science of eugenics was not uncontroversial and, even in highly propagandistic texts, there was an acknowledgement of the role of "nurture," environment, or education. For example, Terman noted that "one has only to compare the Negroes in America with their 'cousins' in Africa to see what an immense difference education can make."[157] According to the eugenicist narrative, it

[154] Ibid., 527; Smallwood, *A Textbook of Biology*, 278.
[155] Burlingame et al., *General Biology*, 526.
[156] Ibid., 527.
[157] Ibid., 528.

would be extremely rare for an African American to have the intellectual capacity for any kind of career in science.

The rhetoric of eugenics in biology textbooks was highly gendered, as well. While men were implored to take active responsibility for their "mating," women were the primary targets of discourses of sterilization.[158] Assuming a male readership, Terman urged his readers to have "regard for the quality of his descendants [and] of course avoid mating into a racial or family stock which is inferior to his own, even if it is not characterized by outright defect."[159] By casting men as the guardians of human biological progress—breeders in the Mendelian, agricultural sense—women/females/mothers are relegated to the traditional passive reproductive role. For example, Abbott cited a study which claimed that "twenty-five percent of the mothers in Great Britain *produce* fifty percent of the next generation."[160] Women were often rhetorically positioned as vectors of heritable defects, such as feeble-mindedness. In their textbooks Abbott and Smallwood referenced Henry Goddard's 1912 study, *The Kallikak Family: A Study in the Heredity of Feeblemindedness,* which purported to compare and contrast the offspring of a man of "good English ancestry" with two different women. In *A Textbook of Biology,* Smallwood noted that "The descendants of the same father and the normal and the defective mother have been studied, as they lived in the city and country and the same marked discrepancy obtained."[161] Abbot described the same man as having "mated temporarily with a feebleminded woman" but later "[marrying] a woman of good heredity."[162] In each case, the

[158] Dorr, *Segregation's Science*, 117, 132.
[159] Burlingame et al., *General Biology*, 527.
[160] Abbot, *The Elementary Principles of General Biology*, 241 [Emphasis Added].
[161] Smallwood, *A Textbook of Biology*, 278–279.
[162] Abbot, *The Elementary Principles of General Biology*, 521–522.

textbook authors attach the notion of defectiveness to the woman. While the man is responsible for ensuring good breeding, it is not he who is the carrier of hereditary defects. Undoubtedly the authors of these texts, and their eugenicist contemporaries would have believed that men were capable of passing on hereditary defects, but it is significant that they chose an example which conformed to social norms of female passivity and pathology to present to their students who, unlike Young, they presumed to be white and male.

The world of the biological sciences was littered with scientists who subscribed to eugenicist ideologies during the early part of Young's career. For example, one of the positive reviewers of her 1924 *Science* publication was Lorande Loss Woodruff, biologist and author of *Foundations of Biology*, a more balanced, but still thoroughly eugenicist introductory textbook.[163] Though Woodruff acknowledged the important role of "social heredity," his textbook instructed students that, "we cannot doubt, knowing what we know of the genetic constitution of organisms, that from the standpoint of permanent advance racial rather than individual the path to progress is through EUGENICS, the science of being well born."[164] Woodruff concluded that human progress would ultimately come through good breeding rather than education or social uplift. Young had other, more direct, encounters with eugenicists, both Black and white, in her scientific career. Thomas Wyatt Turner, a member of the Howard Biology faculty while Young was both a student and instructor there in the 1910s, 1920s, and 1930s was a proponent of racial uplift eugenics. Turner studied genetics with Charles Davenport, a leader of the American eugenics movement. Historian Gregory Dorr

[163] Manning, "Roger Arliner Young, Scientist," 4.
[164] Woodruff, *Foundations of Biology*, 297 [Emphasis original].

describes Turner's ideology as "'accommodationist' eugenics" which "rejected mainline eugenicists' racism but accepted their class biases, aligning Black and white eugenicists over fitness, while acknowledging the unfitness of some Blacks and whites."[165] Turner's eugenics were thoroughly steeped in the class politics of the Black elite. He did not offer any courses at Howard exclusively focused on eugenics. He did, however, incorporate eugenic ideas into his courses on "Sex hygiene," "Biology and Education," "The History of Life," and "Biology 106."[166] As his coworker at Howard, Young surely encountered his ideology. Even Young's doctoral supervisor, Frank R. Lillie at the University of Chicago was a part of the eugenics movement as a member of the American Eugenics Society. Lillie was also actively engaged in scientific research which supported the project of Eugenics. In fact, Lillie's research was cited by Abbott Smallwood in his chapter on heredity in *A Textbook of Biology*.[167] Lillie was also involved in a project with the National Research Council's Committee for Research on Problems of Sex through he which sought to establish "biological basis of behavior."[168]

Young would have been exposed to a scientistic, biologized understanding of the social position of African-Americans from outside of academia, as well. While many of the Black intelligentsia did not conceive of racial uplift in eugenic, or even biological terms, some Black elites promoted a version of eugenics that insisted on equality across the races but not necessarily within them.[169] This brand of "equality" eugenics emphasized racial uplift through

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[165] Dorr, *Segregation's Science*, 104.
[166] Ibid., 100, 104.
[167] Smallwood, *A Textbook of Biology*, 280.
[168] Frank R. Lillie in Glenn E. Bugos, "Managing Cooperative Research and Borderland Science in the National Research Council, 1922-1942," *Historical Studies in the Physical and Biological Sciences* 20, no. 1 (January 1, 1989): 7.
[169] Dorr, *Segregation's Science*, 98–104; Hasian, Jr., *The Rhetoric of Eugenics in Anglo-American Thought*, 51–70.

both positive eugenics—strategic breeding of superior stock—and social improvement through education across class lines. For example, social scientist Albert Sidney Beckham, who occasionally published in *Crisis* in the 1920s, argued that

> The future problems of the Negro will be the elimination of the unfit and the perpetuation of the fit. Eugenics applied to the Negro will be a successful experiment. If the Negro is to come into his full capacities he must not be afraid to experiment. He must see how the facts of modern science can contribute to his progress.[170]

Black eugenicists like Beckham, shared white eugenicists concerns with "fitness," but rejected the notion that this had anything to do with race. For them, the elevation of social standing required the use of both education and eugenics. Outside of academia, Black eugenics often drew from older forms of hereditarian thinking such as Lamarckism rather than Mendelism or Darwinism.[171] That is, Black eugenics was informed by the notion that traits acquired through education or environment in the lifetime of one generation were passed on to subsequent generations and thus *became* biological traits. As such, efforts centered on education and hygiene, especially among children, and were biologized. A shift to a more individualistic form of racial uplift was justified as necessary for group progress.[172]

Black eugenics was a project of hereditarian racial uplift that sought to improve the social status of the current generation with the aim of biologically passing on elevated status to the next generation. Non-scientists endorsed this strategy, as well. For example, musician and

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[170] Beckham quoted in Hasian, Jr., *The Rhetoric of Eugenics in Anglo-American Thought*, 65.

[171] Lamarckism postulated that changes in species over time occurred by the inheritance of the acquired characteristics of the previous generation. Mendelism traced heredity of specific unit traits, such as eye color, and was later supported by the discovery of chromosomes. Darwin's theory of natural selection posited that individual organisms with random traits that lead to more successful reading or survival would eventually outnumber less fit organisms.

[172] Smith, "Childhood, the Body, and Race Performance," 807 Though Smith finds that the individualism that defined conduct literature in this period "chafes again the elite uplift ethos," I would argue that through understanding their discursive connection to Lamarckism and eugenics we can see that the two are completely compatible ideologies.

performer, Azalia Hackley published a guide to comportment for young Black girls, *The Colored Girl Beautiful,* in 1916, the same year Arliner Young began her education at Howard University. Hackley's book does not reference the biological theories of Lamarck but is nevertheless an excellent illustration of the discursive influence of Lamarckism and eugenics in Black racial uplift discourses. Hackley encouraged Black girls to feel proud of their African heritage and describes "kinky hair" under the framework of evolution:

> 'Kinky' hair is neither a disgraceful nor a shameful heredity. It is an honorable legacy from Africa. A kind Mother Nature protected her children from the torrid sun which kept the oils and waxes in a fluid state or else the hair would have dried up. The chemical action of the atmosphere caused a shrinking into spirals which further protected the uncovered heads from scorching.[173]

But, Hackley went on to describe how kinky hair could be improved in Lamarckian terms. She informed her young readers that "constant care of the hair will cause an improved condition of the *texture which will in time be inherited*."[174] By Hackley's logic, disciplining the body, in this case hair, could alter physical traits passed on from one generation to the next, allowing for overall improvement of the race. Hackley did not confine herself to prescriptions about the physical body. She also described proper behavior for Black girls as a part of racial uplift in eugenicist terms. For example she addressed the stereotype of loudness and talkativeness describing them as a "spot":

> Talkativeness is another "Spot," and a sign of lost control. In public places, especially, it is a sign of ill breeding and bad taste. Good breeding should always keep a woman from loud talk. We must remove the stigma of loudness and coarseness that now rests upon the race.[175]

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[173] Hackley, *The Colored Girl Beautiful*, 36–37 [footnote].
[174] Ibid., 37 [Footnote; Emphasis Added].
[175] Ibid., 47.

Here, the term breeding has an ambiguous double-meaning that alludes to both education and biological heredity. Hackley urged Black girls to conform to white upper-class norms of beauty and submissive femininity through bodily and behavioral self-discipline which would lead to both biological and social uplift for the race.

Though Hackley encouraged her young readers to aspire to the elite values of white womanhood, she acknowledged the working-class reality for most Black girls. In her chapter entitled "The Colored Working Girl Beautiful" Hackley outlined the responsibilities that Black working women, like Arliner Young, carried for the race: "A colored working girl is a racial trust. Her race burden is a heavy one. Her speech, actions and diligence constitute the measure by which the whole race is judged." Finally, Hackley provided guidance for working Black girls who found themselves socially isolated from other "well-bred" individuals or encountered obstacles to their progress:

> She should not push or try to climb; she should bide her time. In the meantime she might improve herself; she might study the piano, elocution or singing, and prepare for the day when opportunity will open the long-closed social door.[176]

Hackley suggested that girls who encountered resistance to their personal and professional goals should avoid ambition and instead turn inward and focus on their individual development. Aggression and competitiveness, even in the service of the race, would be seen as a "spot." For her it was far better to bide ones time, rather than complain or become demanding. While there is no evidence that Young ever read *The Colored Girl Beautiful,* it provides a specific example of the eugenic discourses to which she would have been exposed outside of academe. In her professional life, Young was immersed in a culture which conceptualized social problems

[176] Ibid., 157.

such as poverty, racism, and sexism, as biologically determined. Even within HBCUs and the Black community, the epistemology of eugenics influenced some articulations of the racial uplift project. And, in many ways, the ideology of eugenics was the lens through which professional achievements would be read by both her contemporaries and historians, like Manning and Warren who continued to use the trope of "fitness" to frame their narratives of Young's life.

The Scientific Sterilization of Roger Arliner Young

In one of the most propagandistic textbooks circulating while Young was still an undergraduate, *General Biology*, Lewis M. Terman asserted that "heredity sets the limits" for individual human achievement.[177] The idea at the core of eugenics, that the intellectual capacities of individuals were determined by biology, defined Young's interactions with her mentors and advisors in the biological sciences. To the extent that graduate education is a form of intellectual reproduction, Lillie's refusal to work with Young after she failed her qualifying exams at the University of Chicago can be seen as a form of professional sterilization. Later, as Just pushed her out of Howard, he too distanced himself from Young's academic genealogy. And, decades later, when Kenneth Manning and Wini Warren retold Young's story, they reproduced the eugenicist discourse of fitness in their narratives of intellectual dependence.

Lillie's epistemological commitments to deterministic and hereditarian ideology shaped his interactions with Young. Though he acted swiftly in notifying Young of her failure, instead of waiting to confer with other interested parties such as Louis V. Heilbrunn and Libbie Hyman, his

[177] Burlingame et al., *General Biology*, 529 [Emphasis original].

initial assessment was to reserve judgment and to allow her to continue with her education at Chicago. In his letter to Mordicai Johnson, President of Howard University, after Young failed her preliminary exams he quite gently explained:

> I am sure she has not been able to do herself justice and our part we, of course, have not been able to find out what her *natural capacity* and degree of training may be. The situation is therefore in a way prejudiced. Nevertheless, it is rather probable that Miss Young may not be *able* to satisfy the requirements for the degree of doctor of philosophy.
>
> I want to say that we all have the greatest respect for Miss Young's character and intelligence and that we are hoping that she will overcome her present nervous state and show us what she really can do.[178]

Though Lillie was cautious about jumping to conclusions about Young's abilities, he expressed a deep ambivalence about her intelligence and her "natural capacity" for scientific work. In fact, the nature versus nurture debate, of which he was a part, is reflected in the distinction he makes between her natural capacity and "degree of training." Young's Black female body made her capabilities suspect according to the eugenic hereditarian logic in which Lillie was invested. Though he allowed that her environment may have been a factor in her failure to meet his standards, like the authors of the textbooks cited above Lillie's inclination was to favor nature over nurture—he prepared Johnson for the likelihood that, as a Black woman, Young would turn out to be to be lacking in "natural" scientific ability.

It is unlikely that Lillie received Young's letter explaining her situation before he sent his much more forgiving assessment of the situation to Mordecai Johnson in January. By May, when he began to describe her problems in explicitly eugenic terms of fitness, he most certainly would have received Young's explanation. However, in the months following Young's

[178] Lillie to Johnson, January 15, 1930, [Emphasis Added].

disappointing performance, Lillie shifted from his generous conceptualization of her problem as the result of a "nervous state." Amongst his notes of a telephone conversation with Mordecai Johnson about their plans for Young's return to Howard and the future of her funding he scribbled "unfit mental condition" and ambiguously referred to her "difficulties" but seemed to see them as natural rather than institutional.[179] Either Lillie did not pick up on Young's allusions to her overwhelming responsibilities at Howard, or he did not find them a valid excuse for her failure to meet his standards.

One of Young's classmates at Howard, Zora Neale Hurston, famously described the social status of Black women as "mules of the world."[180] If constructions of Black women as tireless workers, responsible for the least desirable orders of reproductive labor had any influence on Lillie, and they very probably did, he would have expected Young to be able to handle the load placed on her as easily as a beast of burden. In Lillie's eyes, Young's struggle to manage institutional overwork would have been yet another sign of her professional scientific unfitness. By August, Lillie's tone about her scientific potential had changed radically. He wrote to Young explaining that she was expected to return to Howard in the Autumn of 1930 rather than continue her studies with him at the University of Chicago:

> I am informed that Howard University expects you back next year and that they have no funds to continue your scholarship for further studies outside. As matters stand in the department *there is no reason to expect, even if you remained, that you would be admitted to examination again*—quite certainly not this year. It is therefore clear to me that you should not remain in Chicago. My memory is that when I left in June you were to send me account of your work within two weeks. Your failure to do so indicates a

[179] Lillie, May 20, 1930.
[180] Hurston, *Their Eyes Were Watching God*; Warren notes that Hurston was a classmate of Young and Marguerite Thomas Williams who all graduated in 1923. Warren, *Black Women Scientists in the United States*, 268 (note 4).

> continuation of the difficulties that have prevented you from doing satisfactory work with us, and therefore *I cannot continue to be in any sense responsible for your work.*[181]

Now, Lillie was ruthless in his assessment of Young. No longer open-minded about the circumstances surrounding her failure, the eugenic rhetoric of "fitness" resolved his ambivalence about her abilities. He had "no reason" to believe she could pass the exam a second time around. And, though it was unrelated to her performance as a student, Lillie wrote a note at the bottom of the carbon copy of the letter: "Memo: written after consultation with Miss Hyman. Miss H. has been lending money." Hyman, the first white woman to earn a doctorate in zoology in the US and faculty and the University of Chicago, notably, was Jewish. Lillie's note hints at an aversion to money lending and has an air of anti-Semitism. As a more advanced scholar, marginalized by gender and Jewish heritage, Hyman, sympathetic to Young's plight, was likely trying to help a younger woman with fewer resources. However, as though it were further evidence of her inability to perform, the loan seems to have triggered Lillie's class biases and confirmed his concerns about Young's fitness for academic life. For Lillie, Young's performance on the exam, her inability to juggle institutional burdens or her finances had made the limits, which racial and mental heredity had set for her, crystal clear to him.

Lilllie's turn away from Young can be understood as a flat refusal to allow "defective" offspring to breed, just as Terman encouraged his student readers to do in *General Biology*. Lillie simply could not allow "inferior" stock, like he perceived Young to be, to impede the progress of the sciences which were reserved for society's best and brightest. Though Lillie had demonstrated a commitment to the advancement of "superior" African American men like

[181] Lillie to Young, August 20, 1930, [Emphasis Added].

Ernest Everett Just, who he had mentored years before, he was influenced by the sexist double-standard that targeted women for forced sterilization. Like Just, Young was a member of an "inferior" race seeking advancement. But, for Lillie it was Young's sex, in addition to her race, that made her difficulties in Chicago appear to be the result of some kind of innate defect. And according to the sexist logic of eugenicist thought, unlike Just, Young represented a danger to the future of scientific progress because she risked passing on undesirable traits both biologically and intellectually. In Lillie's estimation, the only "responsible" thing for him to do was to cut institutional ties with her, disconnecting himself, and his name, from Young's academic pedigree. By refusing to participate in the scholarly reproduction of a mentally and intellectually "unfit" student, Lillie was performing a kind of academic eugenics to ensure the continued progress of science.

Young understood her problems as institutional, or in the terms of biology, environmental. She tried, unsuccessfully to allude to the institutional burdens that were placed on her as a Black woman. But, she was limited by the rhetoric of racial uplift which regulated what could and could not be said to outsiders about the problems within her community. At Howard, she was immersed in a culture that placed intense pressure for the progress of the race on the "talented tenth," at the top of the social hierarchy. Though she had begun life as the daughter of a coal miner and day laborer, through her education at Howard, she had significantly improved her class status and position within the community. Young was, in Azalia Hackley's words, a "racial trust. … Her speech, actions and diligence constitute[d] the measure

by which the whole race is judged."[182] She would have been expected to conform to the norms of upper-class white femininity Hackley outlined for the Black women of Young's generation. When she encountered obstacles and challenges in her path up the social ladder, instead of complaining loudly, "she should bide her time … and prepare for the day when opportunity will open the long-closed social door."[183] To have explicitly named the factors that contributed to her poor performance on the exam would have confirmed existing prejudices about the behavior of Black women. Young would have recognized the risk that naming the institutional burdens which led to her failure might have closed social doors affecting Just, her classmates, and those who came after her seeking graduate education with Lillie. How she handled her failure could have implications for the racial uplift project.

Young encountered a eugenic response from Just, as well, in the years that followed her failure in Chicago. Not only had she let him, Howard, and their funders down, she had let the race down. Like Lillie, Just pursued a kind of scientific sterilization against Young. He scheduled her to teach poorly-attended or elective classes at odd times of the day. The fact that resources were scarce at Howard proved a convenient justification for denying her and her students basic equipment and supplies for laboratories, causing her frustration and embarrassment. Just blocked Young's access to the scientific equipment she needed to advance her research. He delayed confirming space at Woods Hole and suddenly found himself too busy to provide Young with the scholarly feedback on her latest research she was used to from her mentor.[184] Unlike Lillie, Just's attack on Young's scientific career was protracted and took place over the course of

[182] Hackley, *The Colored Girl Beautiful*, 156.
[183] Ibid., 157.
[184] Young to Just, February 28, 1935; Young to Just, March 19, 1935; Young to Just, May 6, 1935; Young to Just, June 3, 1935; Just to Young, February 8, 1936; Young to Just, June 2, 1936.

years. He sent her curt, condescending memos creating a paper trail that painted Young as disruptive to the smooth operation of teaching and research at Howard. Though he seemed bent on pushing her out, Just continued to need her labor. In the meantime, he made a clear case against her to the deans. When the opportunity finally presented itself in 1936, Just fired her.

Young's response to Just's attempts to prevent her from continuing her scientific career was quite different to her handling of Lillie. Where she might have felt constrained by the need to present a united front to Lillie, she felt no such inhibition in her interactions with Just. She repeatedly responded sharply and swiftly to his condescension and various attempts to shame her into submission. At Howard there was no imperative to present a united front to an outside observer. When Just overrode her authority on a grading decision with respect to one of her students,[185] she immediately pointed out that her judgment had not been too harsh, but in fact had been lenient given that the student had violated one of Just's departmental rules. After correcting him on the facts of the matter she feistily asked: "What is your disposition now?"[186] In a dense letter written in May of 1935 Young directly addressed Just's apparent hostility toward her detailing her grievances with him. She explained her disappointment that he had obstructed both her ability to meet the needs of her students and the advancement of her research. Addressing excuses he made about not having the time to provide feedback on a paper she was writing, Young reminded him that she had been trying to make an appointment with him for six weeks. Cuttingly, she remarked: "You seem to be making a deliberate effort to

[185] Just to Young, February 5, 1935.
[186] Young to Just, February 5, 1935.

keep me from doing any research work while in residence in your department. This type of thing is so averse to a true scientific or real university spirit that for a long time I have tried not to believe that it is the correct expression of your sincere attitude."[187] Because of his treatment of her, Young felt "justified" in requesting that he assist her with funding a trip to Woods Hole for the summer. If he was not going to look out for her, as her mentor, she would just have to look out for herself by asking for what she needed, directly. In the intra-racial context of Howard University, Young did not need to follow Azalia Hackley's guidelines for Black women because she did not risk reaffirming stereotypes to outsiders. However, Young's resistance against Just's efforts to marginalize her, marked a direct challenge to the Black elite's expectation that Black women conform to the norms of white femininity, passive submission to masculine authority.

Young's different responses to Lillie and Just's racist/sexist assessments of her scientific abilities demonstrates what Chela Sandoval has called differential consciousness. In Chapter One, I outlined Sandoval's theory which argues that women of color master the rules which regulate the multiple social worlds through which they must move in order to use them for their own survival. Young used her knowledge of the rules that governed the very different social spaces of Howard University and the University of Chicago to assess what options for survival and resistance were available to her. In Chicago, Young's options were highly constrained by her allegiance to Howard's racial uplift project. At Howard she was freer to actively, even loudly, resist what she felt was unjust treatment. One manifestation of Young's differential consciousness is her use of what María Lugones calls fragmentation and multiplicity.

[187] Young to Just, May 6, 1935.

At Chicago, in the context of Lillie's eugenicist ideology, she had little other choice but to attempt to fragment her identity—to split off and hide her marked gender and race—in order to position herself as intellectually worthy of Lillie's efforts. As a Black woman Young occupied multiple marked subject positions and thus was unable to transparently fragment her identities in order to perform unity for Lillie. At Howard, Young did not have to fragment herself. Instead, she chose multiplicity by insisting that Just treat her with respect regardless of her outsider identity as a woman. In fact, after she left Howard and finished her doctorate, it seems that Young used multiplicity quite regularly, as I will discuss in the next section.

Young's Social World outside the Laboratory

Manning and Warren's stories of Young's life provide little description of her activities after she left Howard. They note that she earned her doctorate from the University of Pennsylvania in 1940, working with her colleague from Woods Hole, Louis V. Heilbrunn. And they report that she worked at North Carolina College for Negroes (NCC) before moving to Texas in the 1950s and committing herself the Mississippi State Asylum in the early 1960s. Both Manning and Warren rely on Young's 1955 letter to Dr. Peter Murray, written from Waco, to construct a narrative of the 25 years of her life after she severed ties with Just. Unfortunately, the letter explained little of her history during the 1940s. Perhaps because Manning perceived Young to be a minor character in Ernest Everett Just's story, he did not take Young seriously as a historical and scientific actor and locate additional archival sources about her life after she severed ties with Just. Warren's biography of Young added few additional primary sources

beyond those cited by Manning.[188] Thus, apart from Young's letter to Murray, which is located in the Howard University archive, Manning had little evidence to draw from. Based on the letter to Murray, Manning asserts that after leaving Durham, Young's "nomadic existence stemmed in part from the mental problems that ultimately overwhelmed her."[189] Warren concludes that the death of Young's mother in 1953 "hastened her emotional breakdown."[190] Both Warren and Manning extend their narratives of dependence, marked by the eugenicist rhetoric of mental fitness, well beyond the time Young worked with Just to make sense of the final years of her life.

If we take Young seriously as a historical actor, however, there is ample evidence to reconstruct a history of Young's life during the 1940s, after she left Howard, and to explain why she left North Carolina. Faculty records from North Carolina College for Negroes indicate that when Young started her job there in 1941, she moved into the vibrant Hayti District where she and her mother rented a house.[191] According to Durham city directories, the very next year they moved several streets away, within in the Hayti District. That same year, 1942, she began her leadership role as head of the biology department at Shaw University. Though she was now commuting about eight miles, each way, on segregated buses to Raleigh, she did not move from Durham in any of the subsequent years.[192] Her willingness to commute for the five years she worked at Shaw, before returning to NCC in 1947, indicates she had a strong connection to

[188] Given that Young was just one of more than 100 Black women scientists included in her encyclopedia, it is probably not reasonable to expect that she would have had the resources to identify and utilize the numerous archives necessary to examine Young's life after Howard.
[189] Manning, "Roger Arliner Young, Scientist," 6.
[190] Warren, *Black Women Scientists in the United States*, 291.
[191] "Faculty Record."
[192] *Hill's Durham City Directory*. Young is listed in the Durham city directory from 1941-1949.

the community in the Hayti District of Durham. City directory records also show that in 1953, two years before she wrote Dr. Murray, Young was working at Bishop College in Marshall, Texas.[193] Until recently it was not known why Young left her community in Durham, and moved to Texas. Thanks to the work of historian Christina Greene, in her book about the history of Black women's involvement in the Civil Rights movement in Durham, *Our Separate Ways*, we now have a better picture of what led to Young's employment instability and why she was forced to reach out to Murray for help in 1955.[194]

Greene's history documents Black women's involvement in the Durham National Association for the Advancement of Colored People (NAACP) during the 1940s. One of those women was none other than Roger Arliner Young.[195] Greene notes that Young was chair of the biology department at Shaw University, but otherwise does not engage with any of the history of science literature about Young. She does not cite Manning or Warren's biographies of Young.[196] Just as Manning and Warren were ignorant of this period in Young's life, Greene was unaware of her contributions to science. Greene's work, however, provides the missing link in Young's story and helps us make better sense of the events that occurred in the later part of her life. According to Greene, Arliner Young was, like many residents of Durham, inspired by the 1944 murder of a young Black man, Pfc. Booker T. Spicely.[197] Spicely was shot in broad daylight

[193] *The Mullin-Kille and Demmer Co. Marshall Texas Con Survey City Directory*.
[194] Greene, *Our Separate Ways*.
[195] Greene refers to Young as Arline. This is undoubtedly due to the fact that Arliner's name was frequently misspelled in newspapers, census records, and other historical documents.
[196] I do not fault Greene for this, she is a Civil Rights historian and not a historian of science. Her sources would not have given her any reason to dig further into Young's scientific career.
[197] Greene, *Our Separate Ways*, 21.

by a white bus driver after refusing to move to the back of the bus.[198] Given that she was a regular rider of segregated buses between the Hayti District and Shaw University, Spicely's murder was likely very meaningful to Young. That year, she joined the Durham National Association for the Advancement of Colored People (NAACP) and was elected secretary of the chapter.[199] Young also joined the board of directors of the Harriet Tubman Young Women's Christian Association (YWCA) and was elected to chair. She became the director of the youth choir at the well-known Hayti District White Rock Baptist Church during that time as well.[200]

Liberated from the narrative of dependence, a wealth of archival evidence emerges, primarily because Young was so active in the various communities of which she was a part. Though Warren notes that Young "participated actively in the [Howard] Glee Club, the Young Women's Christian Association, and the Howard University Players" and cites her desire to do future "service work," Manning mentions little of her activities outside of science. However, Young appeared relatively frequently on the society pages of Black newspapers from 1916 until the mid-1940s. Young had been engaged in her community long before she moved to Durham. When she was seventeen, she attended a religious revival and visited family members and friends in McDonald, Pennsylvania.[201] In 1926, she participated in a "musical song and dance … for ex-servicemen in the Red Cross building."[202] Later, in 1932, after she was denied candidacy in the doctoral program at the University of Chicago, she attended a ball with other members of the Washington DC Black elite. She performed with the Dunbar Players, a drama troupe

[198] Ibid., 18–21.
[199] Ibid., 22.
[200] Ibid., 242 (note 78).
[201] Redd, "McDonald, PA."
[202] "Under the Capitol Dome."

associated with Howard University in 1934.[203] In 1942, she hosted a wedding shower and in 1943 participated in another in Durham.[204] That Young appeared with such frequency in the society pages is a demonstration of her high level of activity in her communities, but is also an indication of her class status. Though she came from a "humble" background, through her education at Howard she had elevated her class status significantly, at least within the Black community, like many others who attended college there.[205]

Young was also active in women's issues, particularly in academia. As president of the Women's Faculty Club at Howard University, Young had the opportunity to meet Eleanor Roosevelt in 1935. She participated as master of ceremonies for Roosevelt's speech to the group about recent "social, political and economic changes … in world history."[206] While completing her doctorate, she was a keynote speaker at a widely publicized homemaking institute hosted at Bennett College, a historically Black women's college in Greensboro, North Carolina. Young was portrayed as a leader among African-American women in no less than nine announcements about the event in Black newspapers.[207] Citing her credentials as a "graduate student" and former "Howard University faculty" one paper outlined her speech:

> Using as her subject, "research as a basic factor in consumer education," Miss Young gave an historical account of man's research efforts in behalf of a wider diffusion of knowledge to the consumer that he may live a fuller and more serviceable life. The work of Madame Curie, Louis Pasteur, Koch the discoverer of microbes, was pointed out as

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[203] "Dunbar Players Offer Three Plays Saturday."
[204] "Durham Society: Personals ..."; "Miss Edythe A. Parham And Rev. Kearns In Beautiful Wedding Ceremony Here At Pine Street Presbyterian Church."
[205] Williams, *In Search of the Talented Tenth*.
[206] "First Lady Talks To Howard U. Club."
[207] "Home Making Institute To Be Held at Bennett"; "Noted Economic Authorities to Visit Bennett"; "Home Making Institute At Bennett To Begin"; "Bennett To Hold Home Making Institution"; "Bennett Institute Starts February 18"; "Series of Events Planned for Week at Bennett College"; "Bennett Ready For Annual Home Making Institute"; "Bennett Institute Speakers"; "Consumers' Institute Is Held At Bennett College."

> distinct assets to the consumer today. At the conclusion of the address, Miss Young showed slides of the Marine laboratories located at Woods Hole, Mass. where some of the world's most eminent scientists work.[208]

Young was also mentioned in several newspaper announcements about goings on at HBCUs.[209] Her graduation from the University of Pennsylvania and academic achievements were covered by the Philadelphia *Afro American,* in 1940.[210] In 1941, Young hosted another educational event for the NCC branch of the National Association of College Women with a local authority from the North Carolina Department of Mental Hygiene who spoke about various mental diseases, disorders, and maladjustments.[211]

After completing her doctorate in 1940, despite her failure at Chicago and her falling out with Just, it was clear that Young had become a respected teacher and scholar, and that many people valued her authority, knowledge, and expertise. Her negative experiences at Chicago and at Howard, became the backdrop against which she judged her new surroundings which she described as "very much pleasanter" and where she "found cooperation and a wholesome atmosphere."[212] Now that she was beyond Just's influence, she settled into her new community and found increased success. Perhaps, this change of status gave her a greater sense of confidence in her abilities and affirmed her long held belief that she deserved to be treated with respect. However, Young was cut-off from the resources she would need to continue her career in research. So, she turned much of her energy to the work that needed to be done in her community. When Young became activated within the Civil Rights movement, after the

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[208] "Consumers' Institute Is Held At Bennett College."
[209] "Howard Professors Get Leave to Study"; "Howard Research Is Cited in Report"; "Make Changes In Howard University's Personnel"; "Dr. J. E. Shepard Announces 1940 Faculty."
[210] "One Gets Ph.D.; 2 Receive M.A. at Pennsylvania."
[211] "Dr. James Watson Speaks To College Women In Durham."
[212] Young to Hanson, February 22, 1943; Young to Hanson, May 10, 1944.

Spicely murder, she quickly rose to leadership positions with the organizations central to the movement.

According to Christina Greene, Young soon found herself in conflict with the Black leadership of Durham, which was dominated by an older generation of wealthy Black businessmen. Perhaps having had time to reflect on her experiences at Chicago and Howard, in Durham Young shed whatever allegiance she still had to the racial uplift strategy espoused by the Black elite in Washington DC and at Howard. The respect she had earned in the preceding twenty years, may have allowed her to more freely embrace her multiple identities, including her working-class background. In the wake of the Spicely murder, Young was frustrated that the Black elite of Durham were reluctant to take a more aggressive stance against white power in the city.[213] She felt that something had to be done about the racial injustice in her community and for Young the shooting of Spicely was evidence that the old strategies were not working. Collaborating with Ella Baker at the national headquarters of the NAACP, Young challenged the entrenched leadership within the Hayti District. Her struggle became two-fold. Through the NAACP she was fighting to end the Jim Crow laws that maintained strict segregation and she was fighting an old guard of elite Black businessmen who she felt were more interested in preserving what little power they had attained in Durham than in fighting for the advancement of working-class Black people, like Spicely, who regularly rode on segregated buses.

As an extension of her renewed commitment to the working-class, Young also became actively involved in labor rights at this time. She began to collaborate with the American

[213] Greene, *Our Separate Ways*, 22.

Federation of Labor (AFL) and the Tobacco Workers International Union (TWIU). Struggling to make ends meet herself, Young even joined the payroll of the TWIU. While working full-time at Shaw University as the head of the biology department, she traveled all over North Carolina to register voters and recruit workers. Young was even arrested for refusing to move to the back of the bus on one of her early morning trips to organize workers in 1946.[214] As part of an effort to prevent passage of the Taft-Hartley Act, Young sent a telegram to North Carolina Senator, Josiah Bailey, on behalf of "8763 voters members of AFL NAACP and other organizations who urge you to vote against anti labor legislations."[215] Bailey responded that "Labor leaders have too much power which they are using to the detriment of the workers themselves as well as the rest of the country. They are themselves destroying what President Roosevelt described as labor's gains."[216] Young may have agreed with Bailey to a certain extent. As her allegiance to the working-class grew, she became increasingly dissatisfied with what she saw as "undemocratic" leadership in both the NAACP and the TWIU.

Perhaps Young found more radical potential in her students as she also brought the struggle for civil and labor rights to the NCC campus. She had been working with Durham youth through the White Rock Church youth choir and the NAACP for several years, but in 1947, after having moved back from Shaw, Young helped establish a chapter of the NAACP at NCC. Greene notes that, "One student leader hailed Arline [sic] Young's leadership, describing her as 'a real fighter and worker' who had 'made many personal sacrifices in the interest of the N.A.A.C.P.' Young's 'fighting spirit' was also indispensable in establishing a statewide NAACP youth

[214] Young, "Weekly Report - July 6, 1946" Tobacco Workers International Union, 1946.
[215] Young to Bailey, n.d 1946.
[216] Bailey to Young, May 30, 1946.

council."[217] Even though she was struggling financially, Young was so committed to student organizing, she contribute some of her own money to help students attend an NAACP conference at Tuskegee.[218] Young was respected by student activists, and her support of students at NCC, led to increased student organizing across North Carolina and the South.

Given Young's history of civic engagement, Green's documentation of her activism with the NAACP, AFL, TWIU, YWCA, and White Rock church is not surprising. These were simply an extension of her history of community leadership. Young's election to president of the Howard Women's Faculty Club, secretary of the Durham NAACP, and chair of the board of directors of the Durham YWCA, all show that she was respected, particularly among Black women, as a leader and community organizer. But her negative experiences at Howard as a new member of the Black intelligentsia, seem to have profoundly influenced her politics—she no longer trusted the racial uplift strategies of the Black elite. Just as Lillie and Just had turned their back on her, Young turned her back on elite values and returned to her working-class roots. Young's increasing frustration was grounded in her commitment to the working-class. Her activism with respect to race, through the NAACP; class, through the AFL and TWIU; and gender, through the YWCA is a sign of her conscious embrace of her multiplicity. Young's actions, if not her words, expressed awareness of the intersectionality of identities and oppressions that she, and other members of her community, experienced. Young's was not a single-issue politics. But, she was not alone her criticism of the older generation of leaders in the Hayti District. Greene notes that Young was one of several younger "radical" leaders agitating in the community. However, as a

[217] Greene, *Our Separate Ways*, 25.
[218] Ibid., 244 (note 89).

professor and researcher, Young's actions stood out. In her work with community organizations, as in her work with Just, Young made her opinions and assessments known. She had every reason to expect that her opinions about the leadership of the NAACP and the TWIU would be respected. However, after approaching the Washington DC leadership of the TWIU about her concerns with the democratic process within the union, she was eventually fired. Though she was cast out of the unions, Greene notes that Young was black-listed for her labor organizing activism. It seems that for the old-guard of Black businessmen, who still held power within North Carolina HBCUs, her challenges to their authority and strategy combined with her facilitation of labor activism at the NCC campus, were too much to tolerate. Without an adequate tenure system in HBCUs, Young's activist work was not protected as academic freedom, and thus threatened her livelihood. Ultimately Young's rejection of fragmentation through her insistence that the Civil Rights agenda in Durham include multiple categories—race, gender, *and* class—compromised her epistemological privilege by further limiting her access to the institutions in which she had spent her entire career. No longer employable in North Carolina, and perhaps at HBCUs in other states were under the influence of the Durham elite, Young was forced to move more than a thousand miles to find work within academia.

"I've driven myself for 25 years."[219]

Kenneth Manning and Wini Warren explained the arc of Young's career, from promising young zoologist to helpless mental health patient, as a result of mental instability and dependence on her mentor, Ernest Everett Just. However, as I showed above, the story is significantly more complicated. What mental strain Young experienced, I have argued, must be

[219] Young to Murray, March 1, 1955.

situated in the context of the immense pressures of racial uplift that HBCUs like Howard faced. In the 1920s and 1930s, Young was suffering from institutional overwork. In the 1940s, Young embraced a politics of multiplicity and worked as an activist for women's, civil, and labor rights which resulted in retaliation and led to what Manning called her "nomadic existence," placing further strain on both her finances and her health.[220] It was Arliner Young's union activism, and her embrace of multiplicity, that led to her employment instability and not mental problems. Though Manning and Warren have interpreted her 1955 letter to former Howard colleague, a white medical doctor named Peter Murray, as evidence that her crisis continued for decades after her failure at Chicago, I argue that the letter shows evidence of differential consciousness. That is, though Young may have internalized some of the rhetoric of eugenics (mental fitness), it is also possible that she was utilizing that rhetoric to appeal to Murray's charitable nature. In this sense, it may have been a strategy of "doubling," using the dominant narrative about Black women and their mental capacities, to get what she needed from him—access to medical care.

Anti-union sentiments and the power of the Black elite, which was fully intertwined with the leadership of HBCUs in North Carolina, drove Young from her community in the Hayti District and led her to seek employment far away in Texas. Records from the University of Pennsylvania show that between 1948 and 1962, her transcripts were issued, presumably for job applications, a total of six times. Young had no savings, having spent nearly 30 years providing support for her mother, herself, and her research. The cumulative effect of the

[220] Manning, "Roger Arliner Young, Scientist," 6.

gender wage gap had also taken its toll.[221] Her conflict with Just also had negative financial consequences. Young had been paid about $2500 a year at Howard, but in North Carolina her salary dropped by $700 dollars per year. At that time, in the midst of her activist work, Young felt that the drop was worth it given that she found Shaw University "so very much pleasanter."[222] The drop in salary might also explain why Young was willing to take a paid position with the TWIU while working full time at Shaw University. Even in the 1940s she had begun to worry about her financial future. In 1944, she wrote to Frank Hanson, a fellow zoologist she had met at Woods Hole years before and an officer at the General Education Board. She explained her financial situation to Hanson:

> I am still paying for the third year's [tuition at the University of Pennsylvania], trying to buy a home for my mother and have not been able to put aside <u>anything</u> for retirement.
>
> I received a raise of $20 dollars per month this year (and an extra class) am promised a small raise next year — but haven't been able to buy one baby war bond. I'm not complaining — I know this is a church school. I am forced to look forward to preparation for old age, nevertheless.[223]

By 1953, after her mother's death, Young no longer had to worry about caring for her mother but still had not a penny to her name and no children to care for her when she reached old age. When her mother died, she lost her only family. Now, disconnected from the various communities of which she had become an integral part, Young had few resources.

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[221] For example, in 1929 Young's fellowship was for $1200 dollars, out of which she had to pay her tuition at the University of Chicago, laboratory fees at Woods Hole, and support herself and her mother. Her colleague Percy Barnes, who had equivalent education and experience to her was awarded an $1800 dollar fellowship the same year from the General Education Board at the request of Mordecai Johnson, president of Howard University. Johnson to General Education Board, September 19, 1929.

[222] Young to Hanson, February 22, 1943; See also: Young to Hanson, May 10, 1944.

[223] Young to Hanson, May 10, 1944, [Emphasis original].

In 1955, Young's letter to Peter Murray expressed both financial and emotional distress. Though it may seem that in this dark moment, Young accepted the notion that "heredity set the limits" for her, I argue that her letter to Murray is a sign of differential consciousness. Young described her situation to Murray in the hereditarian terms which dominated the biological sciences, especially during the period in which she was receiving her education and most actively conducting research.

> Mama passed in '53. *She lost reasoning power. I am terrifically afraid I'm going the same way* with the difference that I have spent so much in school and moving that I not only have no funds, no insurance and a rapidly increasing inability to sew a seam, read a page, write, sleep, remember. There were no jobs at this time of year. I feel that my brain is like a (switch) sign board with some wire reversed and now the bulbs are going out one by one.[224]

She expressed concerns to Murray that she would inherit what she perceived as mental difficulties from her mother. And, she subtly tied her fears of genetic determinism to her employment difficulties by juxtaposing concerns about her health with her work, carefully switching the narrative from one to the other and back again. It is difficult not to read Young's letter to Murray as authentically desperate when she explains to Murray "I am so scared I'm numb." However, because Manning and Warren accepted, perhaps unintentionally, the eugenic rhetoric of Black women's biological and mental inferiority they were unable to interrogate the racial and gender politics which also shaped Young's plea. As a result the eugenic framework Young used to structure her letter to Murray carried over into their narratives of dependence and mental decline.

[224] Young to Murray, March 1, 1955, [Emphasis Added].

To avoid replicating such destructive narratives, the racial and gender politics in which Young wrote the letter, must be accounted for. This requires the use of *feminista* reading practices which can reveal strategies of resistance. Given Young's past experience admitting her struggles to Lillie, she would have been cognizant of the way that her narrative of her situation would be read differently across the social worlds of Black and white, male and female. Young was surely aware that her union organizing had led to her being black-listed, yet she choose not to explain it to Murray in those terms. Perhaps, playing to her audience, an elite white man, she decided to play "dumb." She summarized her employment situation to Murray this way, instead:

> I have lost three jobs in a row. In Nov. after 2 months I had lost the job here at Paul Quinn. The reasons are never quite clear to me and in each case I've had the legal technicality on my side which means nothing. … I haven't been criticized on the teaching, but I can only teach college biology. I seemed never to get in the related sciences.[225]

I suggest that in her letter to Murray, Young deployed her differential consciousness to "function with, yet beyond, the demands of dominant ideology," just as she had done in her communications to Lillie decades earlier.[226] Perhaps fear that if Murray knew of her union-organizing days, he would be reluctant to help her, led her to omit the fact that her situation was the result of having been black-listed. Or maybe, having been trained at the height of the eugenics movement, Young reasoned that medicalizing her difficulties, and linking them to some heritable defect, might gain Murray's sympathies as a doctor. It is possible that Young was using what historian Emma Pérez calls "doubling," which is the strategic use of a dominant narrative, in this case the biological inferiority of Black women, in order to get what she felt she

[225] Young to Murray, March 1, 1955.
[226] Sandoval, *Methodology of the Oppressed*, 44.

needed—health care.[227] That is, Young used stereotypes of Black women's inferiority to make herself intelligible to Murray, and gain his sympathy for her plight. However, it is also possible that, despite her rejection of many of the values in which she was immersed during the early years of her career, she may have internalized the rhetoric of eugenics. That Young had been directly involved in discussions of mental hygiene while in North Carolina also indicates that she may have understood her own difficulties in eugenic terms.

Regardless of her internal motivations for framing the letter to Murray in the way she did, she actively sought help during this time. But, in the context of the Jim Crow south, there would have been few resources for Young to turn to for support. She explained to Murray:

> I have no money for medical care. No relatives and a deep fear of the institutions down here. I've read in the paper that they are inadequate for whites. I have a little three-hour job which I know the priest gave me as a rescue because I have nothing. It ends in May—Kindergarden [sic]. I'm not Catholic—can expect nothing more from this very poor mission.[228]

Here she points to the structural problems that have shaped her crisis. She identifies her financial and family situations in the context of Southern poverty, and hints at the Jim Crow segregation that placed the few community resources out of her reach when she writes that local institutions "are inadequate for whites." Just days after writing Murray, she wrote to the General Education Board asking them to apprise her of any teaching positions for which she might be qualified. By this time her old contact there, Frank Hanson, had passed away and was no longer able to share his connections.[229] It is possible that, though Young had no family, she asked friends outside of academia for help during this time as well, but that records of such

[227] Pérez, *The Decolonial Imaginary*.
[228] Young to Murray, March 1, 1955.
[229] Young to General Education Board, March 5, 1955.

communications are lost precisely because they were of a personal rather than professional nature. Even so, as a leader within her community, it is also possible that Young either felt uncomfortable asking less fortunate extended family and friends for help *or* that they simply were not in a position to provide it. In an attempt to help herself, Young visited two psychiatrists in Galveston with mixed results. But, she feared that pursuing treatment in Texas would compromise her employability. She wrote to Murray, "I know Dr. Pete I shouldn't even send this letter but I don't want to go to anyone in Waco and confirm a rumor that the Pres. Frank Veal has apparently disseminated here to the effect that I'm 'off.'"[230] Because she desperately needed work, she asked Murray in New York, far removed from the rumor mills of Waco, Texas for help.

It important to allow for the messy possibility that Young's letter to Murray represented a complex combination of authentic desperation, internalization of eugenic discourses, *and* a strategic effort to negotiate for help from Murray in the terms to which he would be most open. While I reject the eugenic rhetoric which frames Manning and Warren's narratives, the interaction between biological and social forces at work should be acknowledged as real factors in Young's story. For example, it is possible that Young's mother suffered from some form of dementia as she aged. And, though we now believe such conditions are sometimes heritable, as a scientist, the idea of losing her ability to reason would have been particularly disturbing to Young. However, Young had long been suffering from damage to her eyes because of her exposure to UV light and X-rays through her research during the 1920s and 1930s.[231] In North

[230] Young to Murray, March 1, 1955.
[231] Manning, "Roger Arliner Young, Scientist," 5.

Carolina she complained to colleagues of headaches, which she attributed to long bumpy bus rides, but may also have been related to the damage to her eyes.[232] If she had been assisting Just with his research, too, she would have been exposed to much more than the average scientist. As such, her lifelong health problems were likely exacerbated by the gendered division of scientific labor, which burdened women with the reproductive administrative and teaching labor critical to running a laboratory. Young's worry about her ability to "sew a seam" indicates that she may have feared she would have to resort to the kind of manual labor to which many Black women had been relegated by a dominant group that saw such labor as the limit of their ability. But, Young was also quite likely suffering from exhaustion after years of overwork, discrimination, and struggle.

Paul Murray replied to Young's letter a month later telling her he could get her in to see some doctors in New York, free of charge, if she could somehow pay her way there.[233] It is not known if she made it to New York, or if she received treatment. However, in 1960, Young found work at Jackson State University as a professor of science. Though she is listed in the course catalogue for 1961-1963, and pictured in a 1962 year book, Manning reports that at some point during these years, Young voluntarily committed herself to the Mississippi State Mental Asylum and was released on December 21, 1962.[234] After her release, Young started a position at Southern University, in New Orleans, where she rented an apartment in a new building for $65 dollars per month.[235] By June she was having difficulty paying her rent and was sued by the

[232] Young, "Weekly Report - July 6, 1946."
[233] Murray to Young, April 5, 1955.
[234] Manning, "Roger Arliner Young, Scientist," 7.
[235] "1709 St. Andrews St."

property manager. She was sued again in July and September of 1964 for non-payment of her rent.[236] On November 9, 1964, Young died at Charity Hospital in New Orleans.[237]

By the early 1960s, Young may have had no other options for survival. She was suffering through long-term employment instability due to several factors. Strict segregation in the South and racism and sexism in the North, prevented her from seeking employment outside of HBCUs. Tenure was difficult to come by in HBCUs because of a lack of long-term stable funding. And, without the protection of tenure, Young's engagement with the class politics within the Black community resulted in her being black-listed in Durham, where she had been rooted in the 1940s. Second, Young was suffering from poverty that was, in part due to her employment problems. Furthermore, given the wide-spread poverty in the South, she may have had no help within her community to which she could turn in her times of trouble. But, her financial crisis was also the result of the cumulative effect of the gender wage gap. Third, as primary care-giver for her elderly mother, she was working a "double-shift." For many years she worked during the day to support herself financially only to start another shift when she returned home for the evening to care for her mother. Fourth, the gendered division of scientific labor led to overwork and exhaustion as she shouldered institutional burdens which held Black women responsible for the academic reproductive labor as part of the racial uplift project HBCUs faced. Finally, like many African Americans in the South, Young had little to no access to adequate health care to treat her headaches and eye strain. In her 1955 letter Young asked Peter Murray,

[236] "Decisions, Judge Gonzales, Judge Wingerter, Acting"; "First City Court Suits Filed"; "First City Court Suits Filed Docket I"; "Decisions, Judge Gonzales, Judge Wingerter, Acting"; "First City Court Suits Filed Docket I"; "Decisions, Judge Gonzales, Judge Wingerter, Acting."
[237] "Deaths."

"What can I do? I've driven myself for 25 years."[238] Given the years she spent juggling her career, her community commitments, caring for her mother, shouldering the burden of administrative work for Just, and resisting pervasive sexism, classism, and racism at every step, by the 1950s and 1960s Young was plain worn out. However, far from the helpless dependent in no "condition to *do* much for herself" that Kenneth Manning and Wini Warren portrayed her to be, she was an active agent in her scientific career, within her community, and ultimately with respect to her health. [239] She utilized differential consciousness, with limited success, as a survival strategy in every situation she encountered by using strategies of fragmentation, multiplicity and doubling.

Conclusion

Arliner Young's story resonates with the experience of many women of color in academia. The challenges Young faced were, and still are, shared by many women of color academics, intellectuals, and artists, making her story broadly relevant to scholars interested in women of color intellectual history beyond the history of science. Though the narratives of her dependence on Just and her mental unfitness have, until now, been shaped by the eugenic ideology which defined the biological sciences during her most active research period, I have shown here that Young was neither dependent on Just nor a passive victim of mental instability. Rather, she was an active agent in her own life and resisted oppression wherever she could. Young used her differential consciousness to manage both the stress of being a "racial trust" for the sciences at Howard and the resistance she encountered among white colleagues,

[238] Young to Murray, March 1, 1955.
[239] Manning, "Roger Arliner Young, Scientist," 7 [Emphasis added].

like Frank R. Lillie. With limited success, Young attempted to present herself as unified, rather than multiple, through the fragmentation of her identities. In her interactions with white men like Lille, she was unable to achieve fragmentation because her body was inscribed with multiple marked socially defined identities, each of which fit into the eugenicist rhetoric of genetic inferiority. In combination with the strict segregation which relegated Young to HBCUs that were grossly underequipped to provide adequate resources for her research, Young's inability to transparently fragment led to a metaphorical sterilization which compromised her epistemological privilege within the field of zoology. Young's experiences at Howard and the University of Chicago led her to mistrust the racial uplift strategy which required Black women to emulate the values of submissiveness that defined upper-class white femininity. Later, when she embraced multiplicity in Durham, and advocated for Black working-class and women's rights by helping students at NCC organize, she became embroiled in the class politics of the Black community. In order to limit the significant amount of influence Young had earned in Durham, the old-guard of elite Black businessmen pushed her out of North Carolina by blacklisting her. In a dire financial situation and suffering from the long term effects of UV exposure, Young may have used a strategy of doubling rhetoric which positioned Black women as biologically inferior to appeal to Doctor Peter Murray's sensibilities as a sympathetic but elite white doctor. Finally, though she was pushed out of scientific research, and out of her community, Young was an active agent in her life by taking charge of her healthcare and voluntarily committing herself to the Mississippi State Asylum.

The dramatic story of Arliner Young has been offered up by scholars like Wini Warren as a "chilling example of how much could go wrong when a woman entered the loftier reaches of

the scientific professions."[240] Using the story of Roger Arliner Young, I have illustrated what can happen when scholars do not use an intersectional methodology, despite the fact that their politics may be feminist and/or anti-racist. This problem is inherently methodological. Without intersectionality, historical narratives are as likely to reproduce racist/sexist narratives as any other social science methodology. To avoid this requires several things. First, we must take women of color seriously as scientific and historical actors worthy of study in their own right. Second, we must employ reading practices that are designed to register the subtleties of resistance within oppressed groups. Reading for differential consciousness, fragmentation, multiplicity, and doubling have enabled me to reconstruct a narrative of Young's life which is liberated from the controlling images of Black womanhood which framed Manning and Warren's biographies. To get at the "production of racial meaning," and avoid replicating structures and ideologies of dominance, any truly anti-racist feminist re-accounting of the history of science must also be informed by intersectional methodologies such as those from U.S. third world feminists like Evelynn Hammonds, Patricia Hill Collins, María Lugones, and Grace Hong, to name just a few.[241] These methodologies are better suited to uncovering the ways that bodies which are both racialized and gendered are imagined to be less authoritative producers of scientific knowledge and are denied access to the most privileged sites of knowledge production in Western society. Third, we must examine the multiple social worlds through which women of color move to gain a fuller picture of their lives and the ways that various categories of social oppression shape their experiences. In the case of Arliner Young, neither her Blackness nor her gender can be ignored. That is, intersectionality is useful in this

[240] Warren, "Roger Arliner Young: A Cautionary Tale," 287.
[241] Timmermans, "A Black Technician and Blue Babies," 223.

case, not only because the theory originates from the demographic I am studying, women of color, but because it constitutes sound methodological and political practice.

Producing a more complete history of women of color in science, like Arliner Young, is not only important as a reclamation. Through stories like hers we gain a better understanding of the inter-relatedness of what might traditionally be considered separate fields within history. In tracing Young's life both inside and outside of the academy, I have shown the intricate ways in which, during the early 20th Century, the biological sciences were entwined with eugenics, the politics of Black higher education, the Civil Rights and labor movements, and the class divisions within African American communities. Furthermore, I have advanced the social justice goals to which scholars, like Manning and Warren, are committed a step further by allowing us to make sense of Young without erasing any of the multiple parts of her identity.

Chapter Three
Chien-Shiung Wu:
Uncertainty, Asymmetry, and Elegance

> *"Proof that science is not limited by sex or race is the work of Dr. Chien-Shiung Wu, brilliant young Chinese girl who handles some of the powerful atom 'guns' in the University of California radiation laboratory at Berkeley. She already has won international recognition for prying into the nuclear 'hearts of atoms.' Dr. Wu does not look like a serious-minded scientist. Petite and 'easy on the eyes,' she nonetheless is preparing to dedicate the rest of her life to laboratory research."*[242]*–1941, Los Angeles Times*

> *"There is only one thing worse than coming home from the laboratory to a sink full of dirty dishes, and that is not going to laboratory at all."*[243]*–Chien-Shiung Wu*

In 1941, the *Home Magazine* of *The Los Angeles Times* ran a short piece about a "young Chinese girl" who smashed atoms at Berkeley in its regular column reporting science news and curiosities.[244] The story, about nuclear physicist Chien-Shiung Wu (1912–1997)—who had already earned her doctorate and was 30 years old—accompanied other human interest science stories about chicken egg production, radical weight loss and cosmetic surgery, spider traps, and the importance of vitamins. Within our current cultural milieu it is difficult to understand how Chien-Shiung Wu, as a Chinese immigrant woman, could have seemed not to be a "serious-minded scientist." Though the stereotype of Asian Americans as the "model" scientific minority now occupies a primary place in our cultural imagination, in 1941 it was rare to see Chinese or Chinese Americans among the United States professional class. It was even rarer to see Chinese or Chinese American women due to restrictive immigration laws. At that

[242] Barton, "Everyday Science."
[243] Zong, "Nobel Prize Winners and Dr. Chien-Shiung Wu," 4.
[244] Barton, "Everyday Science."

time, Chinese immigrant men in the US were primarily laborers. Pervasive stereotypes associated Chinese women with prostitution due to the fact that around the turn of the twentieth century, Chinese women were often trafficked to the US for sex work. In fact, not until 1965, when immigration laws changed, did large numbers of professional class Chinese men and women immigrate to the US.[245] This change in immigration law, in combination with the visibility of scientists like Wu, and her collaborators Tsung-Dao Lee and Chen Ning Yang, contributed to the construction of Asian Americans as model scientific minorities. By the 1970s, the older stereotype of the Chinese laundryman was replaced by the now familiar stereotype of the science nerd. During the course of Wu's career, her position as a marked outsider in the science lab shifted dramatically. In the 1930s and 1940s, Asian men and women did not occupy a prominent place within the US scientific imaginary, and thus Wu was seen as exotic. But, by the time she was ready to retire, she was claimed by both the physics community and Chinese Americans alike as an ordinary model minority.

In selecting cases for this study, I was initially reluctant to select an immigrant woman of color, like Chien-Shiung Wu, who was born and educated in China. My apprehension was rooted in the methodological requirements of *feminista* science studies which demands deep contextualization. I am not a China scholar and thus cannot do justice to the political and historical context of Wu's youth. However, I decided to proceed with Wu because the category "Woman of Color" in the United States is immensely diverse. Under the "Women of Color" political umbrella are many first generation immigrant women who, as Jacqui Alexander and Chandra Mohanty famously described, "…were not born women of color, but became women

[245] Shah, *Dragon Ladies*, xii–xix.

of color here," due to the "peculiar brand of U.S. North American racism and its constricted boundaries of race."[246] It is, in part, the connection between women of color born in the United States and our immigrant foremothers that makes US Third World feminism distinct from other First World feminisms. Our connection to the colonizing force of Westernization experienced by women, like Chien-Shiung Wu, informs our critique of imperialism in Western epistemologies.[247] In this chapter, I focus on representations of Wu in the United States, as an immigrant woman of color. Though there is no evidence that Chien-Shiung Wu identified as a "woman of color," the story of her life, in the US, is marked by experiences of racism and sexism. Furthermore, her responses to those experiences demonstrate a sophisticated use of various strategies that typify differential consciousness.

This study of Chien-Shiung Wu builds on feminist science studies literature, such as Sharon Traweek's *Beamtimes and Lifetimes*, which establish physics as an important scientific sub-culture that has "maintained a special hold on the American imagination."[248] Because physics has such a key place in our cultural imaginary, the relationship between physics, mass culture, and representations of women of color is particularly important to create a *feminista* science studies. Thus, in this chapter I present an analysis of representations of Wu in popular and scientific media, autobiographies of the scientists she worked with, and her own first person narratives about her life and scientific work. Representations of Wu demonstrate the way in which the bodies of women of color are often positioned as disruptive in relation to

[246] Alexander and Mohanty, *Feminist Genealogies, Colonial Legacies, Democratic Futures*, xiv.
[247] I want to stress that it is not only immigrant women of color who have had such experiences, but that *in addition* to the internally colonized people of color in the United States, immigrant women of color also inform US Third World feminist critiques.
[248] Traweek, *Beamtimes and Lifetimes*, 1.

science. In popular and scientific representations of Wu, anxieties about her destructive potential were expressed with respect to several things. First, her paradigm changing science challenged one of the most fundamental aesthetic values within physics, symmetry. Second, in the context of the militarized physics laboratory and at the height of the Cold War, Wu's Chinese female body was a reminder of both the destructive power of nuclear science and the ideological conflict with communist countries such as Russia, Cuba, and Wu's native China. Third, as a woman in science Wu was implicated in active public debates about the suitability of professional careers for married mothers. Wu's life and work demonstrate the deep interconnections between the culture and aesthetic values of physics, xenophobia in the context of the Cold War, and anxieties about the social implications of "meaningful" work for women outside the home during the mid-twentieth century.

To make sense of representations of Wu in various media, I use María Lugones' framework of fragmentation, multiplicity, and curdling which I introduced in Chapter One and applied to Arliner Young in the previous chapter. In the world of physics, Wu was understood through the positivist logic of purity, which perceives multiplicity as a non-unified, epistemologically impoverished subject position. As such, Wu's multiplicity—gender, race, and nationality—could, in Lugones' words, "neither be seen nor understood."[249] I show that in order to make sense of Wu, her peers and the popular press used several rhetorical strategies to fragment her into intelligible, pure parts which were then simultaneously denied existence and constructed as separate from the culture of physics. Social and scientific anxieties about Chien-Shiung Wu were mitigated by reading her through familiar stereotypes of Asian

[249] Lugones, "Purity, Impurity, and Separation," 468.

femininity. Those stereotypes were then assimilated and domesticated making her appear less foreign and more familiar to white Western people.

I also use the framework of fragmentation to analyze the strategies that Wu used to navigate these discourses, assert her scientific agency, and preserve the privilege she gained within the scientific community. In contrast to Arliner Young, Wu had many more options for positioning herself in an epistemologically privileged position, including what Lugones has called "curdling," the ability to embrace multiply while appearing, to those who use the logic of purity, to be fragmented into pure parts.[250] Though Wu experienced both racism and sexism, because she was an expert in nuclear physics at the beginning of World War II (WWII), she was not excluded from teaching and conducting research in elite universities as Young was. Unlike Young, she was not a "racial trust" held responsible for undoing hundreds of years of violent oppression. Furthermore, her career was not marked by the epistemology of fitness that plagued Young's graduate education. Instead, a set of aesthetic values within physics—certainty, symmetry, and elegance—shaped the ways in which she fit into her field. Young's epistemological privilege was compromised because she was unable to present herself as unified by fragmenting her multiple identities as a Black woman in the context of the biological sciences at the height of the eugenics movement. However, I argue that Wu because was able to use certain aspects of her gendered and racialized body to conform to the aesthetics of physics, she was able to use "curdling" as an epistemological survival strategy for most of her career.

[250] Ibid., 460.

In addition to Lugones' framework, I will use the metaphors of uncertainty and asymmetry to create an analytical link between the social and scientific anxieties Wu provoked. In 1957, Wu led a collaborative and cutting edge experiment, conducted with a team of researchers at the National Bureau of Standards (NBS) that demonstrated that radioactive atoms emit electrons asymmetrically. The experiment disproved the so-called law of conservation of parity, also called symmetry. The non-conservation of parity was a major paradigm shift in the twentieth century, second only to the "Uncertainty Principle." The introduction of statistical uncertainty through probabilistic approaches to describing phenomena at the sub-atomic level was exceedingly difficult for many physicists to accept. For example, though Albert Einstein's own theories led to the development of the "Uncertainty Principle," he was never satisfied with the idea and famously quipped "God does not play dice."[251] To add insult to injury, thirty years later the cherished aesthetic value of symmetry was also abolished by Wu and her team. These major changes occurred because experimental physicists generated more precise data about the sub-atomic world when they applied new technologies to physical phenomena. Theoretical physicists were challenged to generate new explanations for the unexpected results. The introduction of uncertainty and asymmetry were particularly troubling to physicists because historically the science of physics has been conceived of as a divine calling.[252] For example, Sharon Traweek has argued that for many physicists, "'the book of nature' is the manifestation of God's purposes," and as such, "experimentalists want to see themselves as the decoders, or at most as the ghostwriters, of a story whose original author is nature. Theorists want to see the data produced by

[251] "Albert Einstein."
[252] Wertheim, *Pythagoras's Trousers*; Noble, *A World Without Women*.

experimentalists with the help of the machines as a text directly authored by nature."[253] When certainty and symmetry were undermined, physicists' vision of their science as a window to God's creation was threatened. Chien-Shiung Wu had a hand in demonstrating that symmetry was an assumption, and as such her work provoked anxieties within the physics community that were related not only to epistemology by also to spirituality. These scientific anxieties emerged alongside the geopolitical and social anxieties Wu represented. For this reason, I have chosen to frame the anxieties about Wu's multiplicity as "uncertainty" and the uneven, and sometimes unjust, resolution of those uncertainties through fragmentation as "asymmetries."

Scientific and Social Uncertainties

Non-Conservation of Parity and the Aesthetic of Symmetry

The experiment for which Chien-Shiung Wu is most famous confirmed the non-conservation of parity in β-decay. The news of Wu's experiment rocked the world of physics, made the front page of *The New York Times*, and earned Wu's colleagues, who developed the theory she tested, a Nobel Prize. Though Wu was widely honored for her contributions to physics, I show that her multiply marked body posed a threat to the culture of unity that defines physics. In addition to the anxieties her experiment produced, physicists and the public were also uncertain about how to reconcile the perceived incongruity between Wu's foreign, Asian, female body with the aesthetic and professional worlds of nuclear physics. Before I detail those anxieties in the next section, I provide an in-depth description of the experiment and its relationship to the aesthetic values of physics.

[253] Traweek, *Beamtimes and Lifetimes*, 160.

Wu's experiment was designed to determine whether or not parity was conserved in β-decay. β-decay occurs when an electron is emitted from an atom during radioactive decay. It represents what physicists call a "weak" interaction and differs from the other three kinds of forces (strong, electromagnetic, and gravitational). Wu's experiment pertained only to parity in "weak" interactions. The theory of parity was described using several metaphors to make it more accessible for lay people. One simple explanation, given at the time of the Wu experiment in *The New York Times*, was that "the parity law of physics states that for any atomic or nuclear system no new physical consequence or law should result from the construction of a new system, different from the original by being a mirror twin."[254] When Columbia University announced the discovery in a press release, they used a different metaphor—handedness—to explain the concept of parity: "two worlds, one based on a left-handed system and one based upon a right-handed system, have the same laws of physics."[255] If these statements were true for weak interactions, parity was said to be "conserved." The conservation of parity was almost universally accepted as true, though it had never been proven.

However, experimental data involving a recently discovered (1947) sub-atomic particle called a "K-meson" presented a challenge to the conservation of parity. Wu explained the problem in a 1981 autobiography: "Why did two newly discovered atomic particles called K-mesons, with the same mass and other properties, produce different particles when they decayed?"[256] Physicists identified these different particles, which were emitted at different rates, with the Greek letters τ and θ and described the problem as the "Tau-Theta Puzzle." In

[254] "The Meaning of Parity."
[255] "Text of Columbia Report."
[256] Wu, "Chien Shiung Wu," 69.

grappling with the problem, almost no one considered that the solution would involve a violation of parity. It was unimaginable that the universe could be asymmetrical. Wu explained in another first person narrative of the discovery that:

> People not only took it for granted that parity was conserved in all interactions, but this untested notion was also used to discourage others from doing any experiments to test, much less challenge, the validity of this concept. I was told by Dr. M. Morita, who joined our group in October, 1956, that this actually happened at an international conference in Japan in 1955.[257]

The concept of symmetry and parity were normative aesthetics in the culture of physics. But Wu's colleague, Tsung-Dao Lee (1926), and his collaborator Chen Ning Yang (1922), decided to tackle the problem anyway. After consulting with Wu, who was already an established expert on β-decay, Lee and Yang completed a literature review and began theorizing a solution to the τ – θ puzzle that involved a violation of the conservation of parity. Based on their conversation with Wu, the experimentalist, Lee and Yang proposed several possibilities to test their theory that parity is not conserved in weak interactions. They would need to establish non-conservation of parity experimentally for their solution to the τ – θ puzzle to be viable.

After Lee and Yang published their theory, some of the most celebrated physicists scoffed at their proposal that parity was not conserved.[258] When the results of the experiments were publicized, Nobel Prize winning physicist, Wolfgang Pauli described his reaction to the Lee and Yang proposal in a letter to Wu: "I considered it merely as a mathematical play, and as a matter of fact, I did not believe in it when I read the paper of Yang and Lee."[259] Wu had also been skeptical about the proposition, but decided to jump on testing the theory with the one

[257] Wu, "Discovery Story I: One Researcher's Account," 102.
[258] Lee and Yang, "Question of Parity Conservation in Weak Interactions."
[259] Pauli quoted in Wu, "Discovery Story I: One Researcher's Account," 122 [Emphasis Original].

experiment that had not already been tried.[260] She later explained, "This was a golden opportunity for a β-decay physicist to perform a crucial test, and how could I let it pass?"[261] The science of Wu's experiment was quite complicated and she explained it to lay audiences many times throughout her career, so I will allow her to explain it here:

> The test was to take radioactive cobalt 60, place it in a magnetic field, supercool it, and watch where its electrons went. It was a rather simple experiment in conception, but we had to use an ultra-low-temperature facility to perform the experiment and only one or two existed in this country at that time. …
>
> The behavior of the cobalt nucleus was proven to be left-handed and the law of parity, which is derived from left-right symmetry, could not hold. I did the experiment two or three times with different conditions and they all showed the same thing.[262]

Wu's experiment, which she conducted with a team of scientists at the National Bureau of Standards' low temperature laboratory in Washington DC, had demonstrated that the fundamental value of symmetry or parity, was in fact an assumption.[263] The discovery was announced at a press conference at Columbia University on January 15, 1957. Lee and Yang's solution to the $\tau - \theta$ puzzle was validated. Later that year they were awarded the Nobel Prize for their theory. The results of Wu's experiment were quickly confirmed with other kinds of weak particle interactions, leaving many scientists in the physics community dumb-struck.[264]

Non-conservation of parity was a deeply disturbing proposition for many physicists. Wu, herself, had difficulty believing it. Years later she described her reaction to her findings, "After the discovery I couldn't sleep for about two weeks. Why should the Lord want to tell this secret

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[260] Zhu, "Chien-Shiung Wu," 189–190.
[261] Wu, "Discovery Story I: One Researcher's Account," 104.
[262] Wu, "Chien Shiung Wu," 69.
[263] The researchers at the NBS were: Ernest Ambler, Raymond W. Hayward, Dale D. Hoppes, Ralph P. Hudson
[264] Wu et al., "Experimental Test of Parity Conservation in Beta Decay"; Garwin, Lederman, and Weinrich, "Observations of the Failure of Conservation of Parity and Charge Conjugation in Meson Decays"; Friedman and Telegdi, "Nuclear Emulsion Evidence for Parity Nonconservation in the Decay Chain $\pi \rightarrow \mu \rightarrow e$."

through me?"[265] Wu shared the vision of physics as a religious quest and resolved this spiritual crisis for herself by reaffirming her commitment to scientific skepticism. She noted that the overthrow of parity "taught us the lesson never to take the so called self-evident laws for granted."[266] Wolfgang Pauli was similarly shaken at a spiritual level. He explained in a letter to Wu, "What shocks me is not the fact that God is just left-handed, but the fact that in spite of this, he exhibits himself as left/right symmetric when he expresses himself strongly. In short, the real problem now is why the strong interactions are left/right symmetric."[267] Pauli's anxiety was increased by what he observed to be a second level of asymmetry—that not all the fundamental forces showed asymmetry. Then chair of the physics department at Columbia, Isidor Rabi, described the discovery of parity non-conservation as having "shattered the base" of theoretical physics.[268] The *Science News Letter*, reported that the experiment "cracked wide open," the "whole body of theoretical physics."[269] Given that, as physicist Anthony Zee has argued, "symmetry [is] the unifying aesthetic viewpoint through which fundamental physicists look at nature," it is no wonder that the results of the Wu experiment were viewed as destructive by her fellow physicists.[270]

Anxieties about the overthrow of parity also emerged in the press coverage of the event. While many publications described the event as having "upset" or "disproved" the conservation of parity, some described the Wu experiment in explicitly destructive terms. For

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[265] Wu, "Chien Shiung Wu," 70.
[266] Ibid.
[267] Pauli quoted in Wu, "'Subtleties and Surprises': The Contribution of β Decay to an Understanding of the Weak Interaction," 44.
[268] Schmeck, "Basic Concept in Physics."
[269] "New Atomic Matter Laws."
[270] Zee, *Fearful Symmetry*, xi.

example, *The New York Times* described the experiment as having "shatter[ed] a fundamental concept,"[271] while *Time* magazine titled their article on the event, "Death of a Law."[272] *The New York Herald Tribune* used the words "shattered," "destroyed," and "in tatters," to describe the aftermath of the experiment. This text accompanied a photo of Wu dressed in her *cheongsam*, and appeared on the front page of the paper creating a symbolic link between destruction and Wu's Asian female body, which I discuss in more detail in the next section.[273] In other cases, the experiment was described, instead, as having resolved the maddening Tau-Theta Puzzle, and thus having brought order rather than chaos to physics. The day after the discovery was announced, *The New York Times* ran a piece which described the frustration physicists felt at finding an increasing number of sub-atomic particles, "instead of only three well behaved entities." The author explained in vivid terms that, "The subatomic world of physics became a veritable 'jungle' inhabited by all manner of strange 'beasts'—a nightmare to both theoretical and experimental physicists who had hoped to build an orderly universe out of a very few, possibly even only one, elemental cosmic building blocks." Nature represented something wild and in need of taming. Strangely, in this description, physicists are not cast as objective observers of Nature, but as orderly builders, frustrated with their raw materials' chaotic behavior. In this construction, a solution that would allow physicists more order at the expense of symmetry did not seem like such a scary proposition. The author explained that "… physicists now feel confident that they have at last found a way out of the present 'cosmic jungle.'"[274] Regardless of whether one saw the Wu experiment as having brought order, or as having

[271] Schmeck, "Basic Concept in Physics."
[272] "Death of a Law."
[273] Ubell, "Physics 'Principle' Wrong."
[274] "Appearance and Reality."

introduced even more chaos into the science of physics, there was intense feeling about the tension between the wildness of nature and the physicists' desire for order. Wu was implicated as a key figure in that struggle. And, as I show below, because of her multiply marked identities, there was a great deal of uncertainty about her destructive potential as woman physicist and as a Chinese immigrant.

Gender, Race, Nation, and Class

Though Chien-Shiung Wu was accepted as a "serious-minded" scientist, in the context of a popular and scientific culture that privileged unity/fragmentation, there were considerable anxieties expressed in the popular press, and by her fellow scientists, about Wu's seemingly contradictory multiple identities. These uncertainties were fueled by the symbolic link created between Wu and destruction during the parity event. In this section, I examine the deep ambivalence about the meaning of gender, race, nationality, and class in scientific spaces through representations of Wu. Passages like the one that appeared in *The Los Angeles Times* in 1941*,* illustrate that uncertainties about Wu revolved around her multiple, marked social identities. During WWII, anti-Asian sentiment increased dramatically resulting in the internment of Japanese Americans. The US alliance with China during the War did little to undo decades of prejudice that had resulted in immigration restrictions against Chinese people. And, American ignorance and orientalism made few distinctions between the many ethnicities and nationalities among Asian people. As I mentioned above, Chinese and other Asians immigrants were associated with working class, dirty jobs and were considered unclean and unhealthy by many white Americans. After WWII, political, social, and scientific anxieties related to the Cold War, increased with respect to Wu's non-normative gender, race, and nationality. In fact, Wu,

Lee, and Yang all seemed to provoke anxieties and awe with respect to their foreignness and professionalism. It was difficult for their colleagues and writers in the popular press to reconcile the apparent contradiction between Eastern "traditionalism" and Western Modernism which was presumed to coexist in the bodies of Lee, Yang, and Wu. However, because Chinese immigrant women were often associated with prostitution in the white American cultural imaginary, unlike Lee and Yang, Wu's Asian female body would have provoked anxieties about everything from morality and cleanliness to national security and nuclear annihilation in the context of mid-twentieth-century American science. [275]

The ambivalence about Lee, Yang, and Wu's national origins is seen clearly in popular press coverage of the 1957 parity experiment and subsequent Nobel Prize. The three scientists were almost always identified as Chinese early in the narratives of their work.[276] Their heritage may have been evident by their names, but the attention drawn to their status as foreigners illustrates a xenophobic social anxiety about their Otherness. For example, in a 1957 article about the experiment in *Time,* Lee and Yang were almost immediately identified as Chinese, but not as immigrants. When Wu was introduced in the story, she too was identified as Chinese, though she had been naturalized as a US citizen in 1954. In explaining how Lee and Yang came to challenge the assumption that parity is conserved, the author observed that: "Most physicists tried vainly to solve the Tau-Theta Puzzle in a way that preserved parity. *Showing less*

[275] Shah, *Dragon Ladies*, xii–xix.

[276] Schmeck, "Basic Concept in Physics," 24; "Death of a Law," 59; "New Atomic Matter Laws," 51; Associated Press, "Chinese-Born Scientists At Princeton Honored"; Associated Press, "Chinese Scientists Given Nobel Award"; Asbury, "952 At Princeton Receive Degrees"; "Notables Get Degrees at Princeton Ceremony"; Roosevelt, "Meet Your Scientists"; "Award Given to Professor"; "Chinese-Born Physicist Given Award by University Women"; "1959 Achievement Award Won by Woman Physicist"; Wershba, "Daily Closeup: Dr. Chien Shiung Wu Prize-Winning Nuclear Physicist"; "Physicist Named Woman of Year"; "Queen of Physics"; "Columbia Physicist to Get Award"; "NAS Awards," 50.

respect for scientific propriety, Drs. Lee and Yang suggested last summer at Brookhaven that perhaps the trouble lay not with the K mesons [τ and θ] but with parity itself."[277] Instead of framing Lee and Yang's work as critical or creative thinking, the author attributes their discovery to a deficit. By identifying Lee, Yang, and Wu as Chinese foreigners rather than immigrants, the author discursively connects their lack of "respect for scientific propriety" with their nationality.

Border theory, one of the key analytics of *feminista* science studies, is useful to make sense of the perceived incongruities that Wu, Lee, and Yang embodied, whether they were identified as foreigners or immigrants. Chicana feminist, Mary Pat Brady, has argued that "the effects of modernity's structural separation of space and time into a dialectic that encourages a linear narrative of national development: nations emerge along a linear spatial-temporal continuum that begins with feudalism and ends with cosmopolitan modernity."[278] The spatial-temporal border separating China from the United States was constructed such that China was positioned as a feudal, traditional, Eastern society while the US was thoroughly cosmopolitan and modern. When Lee, Yang, and Wu immigrated, they each crossed the temporal border between China and the US, and as such were temporally marked. This is clearly illustrated in a *Newsweek* article about Wu detailing her participation in the parity experiment:

> Surrounded by atomic particle machines and other complicated gadgetry in her basement laboratory at Columbia University's Pupin Building, Mme. Chien-Shiung Wu *looks like an anachronism*. In a high necked *cheong-sam*, her hair plaited in a bun, she retains the old Chinese attributes of a well brought up woman—demure, serene, and, the cliché is inescapable, with a certain inscrutability. Yet her crucial experiments on the elusive particles at the heart of the atom have so stirred her colleagues that the Nobel

[277] "Death of a Law," 59 [Emphasis Added].
[278] Brady, *Extinct Lands, Temporal Geographies*, 50.

> Prize winner Emilio Segrè of the University of California at Berkeley hailed the 50-year-old experimentalist as "the reigning queen of nuclear physics."[279]

Wu's body was inscribed with the signs of Eastern traditionalism and Asian femininity which resulted from her border-crossing into a space of Western, scientific Modernity. In Mary Pat Brady's words, for Wu, "Crossing the border … involve[d] crossing from one temporality to another."[280] For the author of the *Newsweek* article, the marks of an "Old World" Eastern civilization on the edge of extinction jarred against the high-tech modern world of nuclear physics. By positioning Wu as both out of place and out of time within the laboratory, the way the reader's attention was drawn to Wu's status as an immigrant.

Even other Chinese immigrants, such as physicist Anthony Zee, seemed to see Wu through the lens of temporal discord. For example in 1986, Zee interviewed Wu for his book, *Fearful Symmetry*, which examined the aesthetic of symmetry in physics. Zee anticipated that his readers would perceive Wu as out of place in science by insisting that "Madame Wu belies completely whatever stereotypic image one may have of a leading experimental nuclear physicist."[281] Rather than representing Wu as "out of place" in the nuclear laboratory, he positioned her as being "out of time," when he wondered, "how did a girl born almost during the Manchu dynasty, into a feudal and male-dominated society come to be known as the 'reigning queen of experimental nuclear physics,' and become the first woman president of the American Physical Society?"[282] Though Zee had the training to understand just how revolutionary Wu's science was, merit alone was not enough to overcome his perception that

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[279] "Queen of Physics," 92 [Emphasis Added].
[280] Brady, *Extinct Lands, Temporal Geographies*, 50.
[281] Zee, *Fearful Symmetry*, 291.
[282] Ibid.

she was out of time. The clash between Wu's femininity, "backwards" Eastern traditionalism, and modern science created uncertainty about her achievements. Despite the fact that Zee argues that "the Ultimate Designer wants both unity and diversity," he finds Wu's social and temporal multiplicity unintelligible. To make sense of her and resolve the time distortion her border-crossing created, Zee identifies Wu's father's involvement with Westernization efforts in China as a way to bring Wu forward and constitute her as a modern subject.[283]

Zee was not the only writer to contemplate the ostensible impossibility of Wu's success. In 1980, Estelle Gilson, who interviewed Wu for a feature in *Columbia*, the university's magazine, also questioned "how did this petite, soft-spoken woman who was born in China on the threshold of its revolution, and who spent the first 20 years of her life there, achieve a major career in American physics?"[284] Gilson, too, identified Wu's immigration as an act of temporal border-crossing. And, like Zee, Gilson linked Asian femininity and Wu's female body with the temporal distortion surrounding her The perceived coexistence of old and new, pre-modern and modern, Eastern and Western in Wu's female body—her dress, hairstyle, facial features, physical size, and mannerisms—simultaneously marked her as multiple/non-unified and made her a spectacle. In these moments, Wu was re-converted from a scientific subject into a scientific object, while simultaneously publicizing and celebrating her scientific accomplishments.

As a woman in the laboratory, Wu was perceived as out of place; as a Chinese immigrant, she was out of time. Her multiplicity made her unintelligible to the public and many

[283] Ibid., 213.
[284] Gilson, "Subtleties and Surprises," 8.

of her peers. The strange, "anachronistic" image of a Chinese immigrant woman working in a nuclear laboratory was fantastic and frightening at the same time. In the popular and scientific press, Wu's multiplicity was resolved through rhetorics which fragmented her into more pure, intelligible parts. The image of the Dragon Lady, now widely circulating through the American cultural imaginary, provided a way of making sense of Wu and other professional or powerful Asian women.[285] Wu's dissertation advisor at Berkeley, Nobel Prize winner Emilio Segrè, described her to *Newsweek* in 1963 as a "slave driver." He added, "She is the image of the militant woman so well known in Chinese literature as either empress or mother."[286] However, in the context of the Cold War, and the growing military-industrial-scientific complex, the militancy associated with the Dragon Lady only added to the uncertainty about Wu. As a Dragon Lady, Wu was a visual reminder of the militarized ideological conflict between capitalist and communist states racing to amass nuclear arms and threatening the world with destruction.

However, the image of the Dragon Lady was also a way to exert control over Wu. For example, in her short biography of Wu, Sharon McGrayne notes that some students actually referred to Wu as "The Dragon Lady."[287] Using this stereotype would have allowed white men to challenge her high standards and authority over them as students, which they may have seen as an assault on their social privilege. Thus, the Dragon Lady represents not only a challenge to Wu's authority as a woman, but also xenophobia and racism. It is important to note that several

[285] Sonia Shah locates the origin of the moniker in the *New York Times*' use of the phrase "dragon lady" to describe Tsu-hsi, empress of China just before Wu's birth, *Dragon Ladies,* xiv. However, in her biography of Wu, Sharon McGrayne notes that "Dragon Lady" also referred to a comic strip character, "modeled after the imperious wife of General Chiang Kai-shek," *Nobel Prize Women in Science*, 270.
[286] Emilio Segre quoted in "Queen of Physics," 92.
[287] McGrayne, *Nobel Prize Women in Science*, 270.

of Wu's students have addressed that accusation and said that Wu's individual students never called her "The Dragon Lady" because on the contrary, she was a demanding but caring teacher.[288] As in Segrè's description above, however, the available stereotypes of Asian femininity were restricted to emasculating Dragon Lady or caring mother. The specter of the Dragon Lady forced Wu to be acutely aware of her image and behavior, and as such, it was what Patricia Hill Collins has called a "controlling image."[289]

Unfortunately, even historians have fallen into the representational trap of the Dragon Lady. In 1986, Robert Crease and Charles Mann narrate the parity experiment through the lens of the Dragon Lady without ever using the term:

> Wu had been the first to hear about Lee and Yang's work, and was the first to consider testing it. For months she and her husband, Chia-Liu Yuan, had planned to visit the Far East on the 20th anniversary of their exodus from China. With passage booked on the *Queen Elizabeth*, *Wu abruptly canceled and left her spouse to make the sentimental journey alone. She wanted to start an experiment before anyone else realized the paper's importance.* By the beginning of June, three weeks before Lee and Yang were ready to submit the paper, Wu was already lining up her collaborators.[290]

In this passage, Crease and Mann cast Wu as heartless for forcing her husband to go on the trip alone, and as cutthroat for wanting to achieve primacy and credit, which were her sole forms of scientific currency as an experimentalist. As we know, Wu had been consulted in the early phases of Lee and Yang's work as an expert in the area of β-decay.[291] As such, she was involved in their theorizing and literature review process. It was reasonable that she would be interested in following up their conversations with experimental work of such importance. Many men in

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[288] Ibid.
[289] Collins, "Mammies, Matriarchs, and Other Controlling Images."
[290] Crease and Mann, *The Second Creation*, 207 [Emphasis Added].
[291] Wu, "Discovery Story I: One Researcher's Account," 101–104; Lee, "Reminiscences," 162–163; Garwin and Lederman, "History of Parity Violation Experiment"; Zhu, "Chien-Shiung Wu."

physics also sacrificed family time for the thrill of discovery. But for, Wu, the same activities were read through her Asian female body as characteristic of a "Dragon Lady."

Through the figure of the Dragon Lady, Wu was read as a militant, emasculating threat to the hegemonic gender norms of American science in the context of the Cold War and Chinese communism. Nothing manifests this anxiety better than a feature about Wu that appeared in the *New York Post* in 1959. The piece described Wu's contribution to the parity experiment this way:

> Dr. Wu, a professor of physics at Columbia University, has helped widen that pinpoint of knowledge. She is small, demure, almost childlike. Every once in a while, her hand flies up to cover her laughter in a modest manner.
>
> And yet, this small, modest woman, was powerful enough to do what armies can never accomplish: she helped destroy a law of nature. And laws of nature, by their very definition, should be constant, continuous, immutable, indestructible.[292]

Five years before her former Berkeley teacher, Robert Oppenheimer, described the atomic bomb as a "destroyer of worlds," Wu's was discursively marked in a similar way. The awe expressed in the *Post* demonstrates that the presence of Wu's foreign, Asian, female body was perceived as disruptive to the militarized space of the nuclear laboratory. Furthermore, the description of Wu's destructive power was placed in relation to military power, indicating that her presence may have magnified by fears about the destruction of Nature in the context of Cold War era anxieties of nuclear annihilation. But uncertainties about Wu were also explicitly connected to her multiplicity and through the author's racialized and gendered description of

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[292] Wershba, "Daily Closeup: Dr. Chien Shiung Wu Prize-Winning Nuclear Physicist"; It is an interesting reflection of the shifting Cold War anxieties between 1959 and 1962, that when this article was edited and reproduced just three years later, Wershba tempered his description of Wu's accomplishment: "She is also a woman who was powerful enough to do what armies can never accomplish; *she challenged an axiom and repealed* a 'law of nature.'"Wershba, "Closeup: Nuclear Physicist" [Emphasis Added].

Wu through familiar stereotypes of submissive Asian femininity. Thus, discourse about Wu as the Dragon Lady simultaneously expressed xenophobic anxieties about the foreign female body, fears about the relationship between science and nuclear annihilation, and uncertainties about racial/gender multiplicity in scientific spaces.

Women's Place is in the Laboratory?

Chien-Shiung Wu was frequently asked about her work as woman in science. Debate about the suitability of professional work for middle-class women had been circulating in both the popular and scientific spheres since the end of Second World War. The manpower shortages that arose during the Second World War opened the door to technical and professional work for both white women and people of color. The issue of "womanpower," in particular, was discussed extensively. The WWII War Manpower Commission "specifically recommended that women be admitted on an equal basis with men into the engineering, science and management courses sponsored by the Federal government."[293] The enormous contributions made by physics during WWII, through the Manhattan Project's development of the atomic bomb, led to increased federal funding of basic scientific research in universities as such research had been proven invaluable to national defense. The communist threat in Korea during the early 1950s gave rise to fears of a protracted drain of brainpower from US educational institutions should the need to implement a military draft arise.[294] By October of 1957, when the first *Sputnik* was launched, the concern about manpower shortages expanded from simply recovering from the drain of WWII and the Korean Conflict to keeping up with the

[293] National Manpower Council (U.S.), *Womanpower*, 149.
[294] Rabinowitch, "Scientific Womanpower," 34.

scientific output of the Soviet Union. The *Sputniks* made it apparent to the government, scientific community, and public that something had to be done and, as during WWII, women were called to duty. How did Wu, as an immigrant from a country in which communists had recently gained control (1949), fit into such discourse? In this section, I will describe a third set of uncertainties about Wu as a woman in science, beginning with the general concerns about women in science that emerged during her career.

Beginning right after World War II, and throughout Wu's career, there was active discussion about the need for women's participation in science within the physics community. In 1948, an article appeared in *Physics Today* written by a physics professor, Walter C. Michels at Bryn Mawr College. Michels described his initial reservations about teaching physics to women and his subsequent surprise at his students' abilities and interest in the subject. Addressing concerns about the supposed masculinizing effects of scientific study, Michels assured his readers by way of an anecdote:

> Of the students I have known, one of the most successful in this respect was a very attractive blonde who could meet colleagues, male or female, with a sharp critical mind but who, on a social occasion, gave a convincing performance of being without a brain. I later had the opportunity to observe her in a laboratory job and was pleased to find that she could carry out the same division there, in spite of the fact that she spent many evenings with her daytime colleagues. Neither she nor they suffered from this procedure, or seemed to resent it in any way.[295]

Here Michels praised his student for her ability to fragment; she split off her femininity in the laboratory, and split off her scientist identity in social settings. According to Michels, it was possible for women to have careers in physics and maintain their sexual subordination to men, so long as they mastered this "division" of identities. His story assured men that there was no

[295] Michels, "Women in Physics," 18.

need worry about the hegemonic gendered social order being overthrown by "manish" female physicists. Michels addressed other common misgivings about careers for women in physics. Using an informal survey of his former students he argued that women do "continue professional work for a long enough time to justify the effort spent on them."[296] His students had successfully returned to careers in physics after giving birth. Based on the experiences of his students, Michels concludes, "the success of the women physicists I have known convinces me that much of the feeling against women in both academic and industrial laboratories results only from prejudice."[297] Furthermore, he observed "a tendency toward the continued use of women in those laboratories where the ice has once been broken—with no apparent disrupting affect." [298] Though Michels maintained that the sexual subordination of women to men would not be disturbed by women's careers in physics, he did challenge the gendered division of labor within the laboratory. He argued that such subordination was "a waste of some of the country's brains and it is the job of every academic or industrial laboratory that deals with women to encourage them to more independent work." [299] Finally, pointing to what he saw as successful integration of women into scientific work, during the recent war, Michels encouraged continued efforts in that regard. Wu would have to face precisely the kinds of attitudes and assumptions Michels addressed.

But, not everyone was comfortable with the overthrow of the gendered division of scientific labor. In 1951, the editor of *Bulletin of the Atomic Scientists*, biophysicist Eugene

[296] Ibid.
[297] Ibid., 19.
[298] Ibid.
[299] Ibid.

Rabinowitch, wrote an editorial calling for increased participation in science by women.[300] While the article reflected the progressive views Rabinowitch's journal frequently expressed, it also demonstrated an underlying desire to preserve the American social order. Responding to concerns that the conflict in Korea would result in a draft and divert scientists and engineers away from their critical tasks, Rabinowitch's suggestion was to draft women, who could not be drafted into the army, into science careers. "There is in this country one—and only one—large reservoir of potential scientific, medical, and engineering 'manpower,' which is as yet almost entirely untapped: the American women," he declared, overlooking other obvious groups.[301] Furthermore, to keep pace with Soviet scientific achievements, Rabinowitch argued women would need to stay in their scientific professions even after the conflict in Korea was resolved. However, he clarified to his readers that this call for scientific womanpower was not intended to turn the gendered division of labor on its head. "We are concerned, however, not with top achievements or positions of leadership but with the innumerable jobs to be done in hospitals, laboratories, and industrial shops . . . ."[302] In contrast to Michels' plea just three years before, for Rabinowitch, scientific womanpower was needed to address the shortage of workers available to do what amounted to scientific women's work. Women trained in science were to continue in positions subordinate to men.

By 1959, after the launches of two *Sputniks*, Dr. Alan T. Waterman, a physicist and director of the National Science Foundation (NSF), communicated a womanpower policy to the American Association for the Advancement of Science couched in the language of Cold War

[300] Rossiter, *Women Scientists in America: Before Affirmative Action, 1940-1972*, 51–52.
[301] Rabinowitch, "Scientific Womanpower," 34.
[302] Ibid.

manpower shortages.[303] Waterman argued that women had shown themselves to be capable, despite the barriers they had encountered to professional life. Waterman suggested that socialization had led to a situation in which girls were not encouraged to pursue their intellectual interests. However, he went on to limit the various ways that women could make careers in science:

> . . . indexing, abstracting, and technical editing . . .tasks that a women can perform during the time she is at home . . . Teaching is also a possibility for the woman scientist who would like to resume work as her children grow older . . . the woman research scientist . . . possibly as a member of a husband-and-wife team, devotes herself to creative research of the highest order.[304]

Waterman and the NSF echoed Rabinowitch's qualification of scientific womanpower nearly a decade later. Scientific womanpower was to be limited to the less desirable, lower-order work while work of the "highest order" was carefully placed in relationship to the woman scientist's husband. Specifically, scientific womanpower was to remain subordinate to scientific manpower. In general, despite the scientific exigencies of the Cold War, uncertainties about women in science expressed by men in physics related to the preservation of the gendered social order which subordinated women to men in the laboratory and in the social world beyond its walls through marriage and motherhood. As a married mother, Chien-Shiung Wu would have had to manage all the concerns expressed by physicists like Michels, Rabinowitch, and Waterman.

These discourses also occurred in the public sphere where anxieties about the gendered division of labor were expressed. Wu was featured as an example of "American women [who]

[303] Waterman, "Scientific Womanpower - A Neglected Resource," 207.
[304] Ibid., 211–212.

hold high scientific rank" in a 1958 *Parade* magazine insert.[305] The article, "Wanted: More Phyllis Webers," by Alice Leopold, included very little information about Wu. But, it immediately followed another piece, by Lloyd Shearer about a woman engineer, Phyllis Weber, who worked on the US satellite program while also being a wife and mother. This article provides an excellent example of the Cold War scientific womanpower discourses described above and situates Wu within them. Shearer's piece described Weber's career through her domestic life, highlighting her femininity and heterosexuality in the context of the scientific labor she performed. Shearer and Leopold's articles called for more women like Phyllis Weber to take up scientific careers and provided several suggestions for social and institutional changes that would allow women to participate more fully in the scientific endeavor. Though the articles argued for women's intellectual equality with men, Shearer's piece narrated Weber's story around her children and her husband. Shearer reassured the reader that,

> The Webers appear to be leading a happy, well-adjusted life. Phyllis evidently accepts the traditional wifely role. She doesn't want to become a great scientist at this point. Her existence is not shot through with driving ambition. She works because she thinks it will help the family, lighten her husband's financial load and make her a more fulfilled woman.[306]

Phyllis Weber's work as an engineer was framed as secondary to family life and is evidence of the double shift required of women who worked in the paid labor force. The piece also addressed social concerns about the masculinizing effects of scientific work on women. For example, Shearer cites Weber's caution about the potential for inversion of hegemonic gender roles when, like Wu, a wife and mother was also a full-time scientific worker. Weber cast doubt

[305] Shearer, "Meet Phyllis Weber."
[306] Ibid., 9.

on Michels' assertion that women can work in the lab and still feign "brainlessness" in their relationships with men:

> Today, many husbands come home to critical judgments from ambitious careerwives. These wives are ambitious or aggressive because they are in many cases competing against men in their daytime jobs. They find it very difficult to suddenly become submissive and passive when they get home in front of their husbands. This is a very great danger that calls for tact, maturity, and diplomacy *upon the part of the wife.* And sometimes when you've had a real tough day at the plant, it's not so easy being tactful and gentle with your husband.[307]

For Weber, it was imperative that women resume their passive roles with respect to their husbands, once at home. Her call for "tact, maturity, and diplomacy" placed the responsibility for the maintenance of the gender system on women by dictating that scientific women fragment their complex identities and perform feminine submission and nurturing motherliness while at home. Women's aggressive and ambitious behaviors, required in the culture of science, were to be split off and subordinated in favor of femininity at home.

Finally, Weber and Shearer connected scientific woman power to the ideological conflict with Russia. Weber was quoted as saying "and once the American woman starts to concentrate on science, the Russians had better watch out."[308] The message was that women in science should not seek glory but to support their country by providing scientific womanpower and to support their family, particularly their husbands, by way of becoming happier, more fulfilled wives. And in this way, the call for scientific womanpower was linked with the xenophobia embedded in anti-communist Cold War discourses. Though Wu was held up as an exemplar, in the context of mid-century American capitalist nationalism, she was most certainly not what

[307] Ibid., 9 [Emphasis Added].
[308] Ibid., 9.

most advocates of scientific womanpower had in mind. She could not and would not fit the pattern set by Phyllis Weber as a woman engaged in scientific women's work, simply to provide labor. Instead, Wu was involved in paradigm changing science that brought her a great deal of notoriety, much more than her physicist husband, Chia-liu Yuan, ever received. Wu fit her family life into physics and not the other way around. Rather than give up her career at Columbia to be near Yuan, her husband, who worked at Brookhaven National Laboratory, he commuted to be with her on the weekends. Wu's son, Vincent was cared for by a live-in nanny as a young child and was sent to boarding school when he was older.[309] In fact, Wu argued vociferously against the gender ideology which Lloyd Shearer, through Phyllis Weber, articulated in the *Parade* piece.

Women in science did not stay silent on these issues, themselves. In 1964, a group of undergraduates at MIT held a symposium called *Women and the Scientific Professions* to discuss the problems they faced both socially and within the institution of science. One of the keynote speakers was psychologist, Bruno Bettelheim. News coverage of the conference indicated that Bettelheim's address "sparked widespread disagreement between him and the other speakers as well as the undergraduate delegates."[310] Chien-Shiung Wu was among the panelists asked to respond to his speech. As I will discuss in the next sections, Bettelheim's presentation would profoundly influence Wu's feminism. For the rest of her life she argued

[309] McGrayne, *Nobel Prize Women in Science*, 266; Wu, "Chien Shiung Wu," 71.
[310] Parsons, "Women in Sciences Spar at Conclave."

against him. Bettelheim's presentation centered, not on the scientific demands of the Cold War, but rather on scientific work's "intrinsic" importance to the researcher.[311]

In addressing the topic, "The commitment required of a woman entering a scientific profession," Bettelheim, a psychologist, stuck to the familiar ground of feeling. His arguments were essentialist and dualistic and represented the psychoanalytic perspective; Bettelheim argued that women brought with them feminine feelings toward their work while men approached work with masculine feelings. He conceded that there was a spectrum of femininity and masculinity that crosses sex lines, but insisted that, in general, women were more "womanly" than men. [312] In particular, Bettelheim understood sex differences through Western imperialism, describing a woman's approach to science as "a womanly embracing of her tasks rather than a masculine conquering of them."[313] He asserted that these different feelings toward work would not change the outcome of scientific research, but that the different feelings of women needed accommodation within the institution of science. Bettelheim suggested that without careful thinking about women's feelings in regard to work, those who advocated for increased participation by women risked alienating women and defeating their own purposes.[314]

Though in many respects Bettelheim was more progressive than the physicists Michaels, Rabinowitch, or Waterman, he was very much rooted in heterosexual married domesticity as the proper social arrangement between women and men. He argued that, "… any woman's

[311] Mattfeld and Van Aken, *Women and the Scientific Professions: M.I.T. Symposium on American Women in Science and Engineering*, 8–9.
[312] Ibid., 4.
[313] Ibid., 7.
[314] Ibid., 5.

most important commitment is to be a woman. Such commitment should embrace all the activities of her life: her life as a wife and mother, her work in the laboratory or research Institute, her role in society."[315] Later in the speech he stated even more strongly the priority of marriage and motherhood over scientific research: "as much as women want to be good scientists or engineers, they want *first and foremost* to be womanly companions of men and to be mothers."[316] Bettelheim historicized middle-class marriage and argued that work and family need not be incompatible. He made several suggestions that he felt would allow women to balance their desire to work with their duties as wives and mothers: "shorter working hours for the mothers of young children, work close to their home, excellent professional care for their children during the first four and later six hours these women would spend at work away from home, and ready availability of the mother to her children in the event of emergency."[317] Women were not released from these "womanly" duties, only accommodated. And, as Chien-Shiung Wu pointed out, Bettelheim did not encourage men to take on more of the responsibilities of home and family.[318] I describe Wu's feminism and response to Bettelheim in more detail in the final section.

In this section, I have outlined the various social uncertainties that defined the climate in which Chien-Shiung Wu worked. There was considerable anxiety about the science she was involved because it challenged the aesthetics of physics and because it was linked with the dangers of nuclearism. The marks of Eastern traditionalism inscribed on Wu's body also provoked anxieties as she occupied Modern scientific spaces. As a Chinese immigrant she

[315] Ibid., 6.
[316] Ibid., 15 [Emphasis Added].
[317] Ibid., 15.
[318] Ibid., 47.

represented a potential threat in the context of both WWII and Cold War xenophobia. Finally, as a woman in science, her presence in the laboratory triggered scientific, social scientific and popular fears about the appropriateness of scientific work for women. These uncertainties revolved around the potential challenge to the social subordination of women, the gendered division of scientific labor, and the maintenance of heterosexual domesticity and motherhood. In the next section I analyze the discursive strategies used to resolve these uncertainties and outline the historical factors that led to Wu's acceptance as a "serious-minded" scientist.

Asymmetries: Making Sense of Chien-Shiung Wu

> *There is one further symmetry that I feel would be recognized in an award to Chien-Shiung Wu, and that is the fact that she is a woman. In science, sexual parity is certainly not conserved—a fact that is to be greatly regretted—but I feel that any time this asymmetry can be at least partially compensated for, a service to humanity as a whole has been rendered.*[319]–Douglas Hofstadter

In 1991, Douglas Hofstadter wrote to the Royal Swedish Academy of Science on behalf of his late father, Nobel Laureate in physics Robert Hofstadter, who believed very strongly that Chien-Shiung Wu deserved to win the prize for her work on the non-conservation of parity experiment. Drawing a parallel between symmetry in the physical world and gender parity in the sciences, Hofstadter attempted to draw the attention of Swedish Royal Academy of Science to the social injustices in the awards process. I extend this metaphor here. In the previous section, I described the uncertainties expressed in the press and by Wu's colleagues about her multiple marked identities as they related to her science, to the geopolitical climate, and social anxieties about changes to the gendered social order. In this section, I describe how the

[319] Letter from Douglass Hofstadter to the Royal Swedish Academy of Sciences (1991), quoted in Zhu, "Chien-Shiung Wu," 426.

resolution of these uncertainties produced asymmetries which manifested as social injustices, such as Wu's exclusion from the Nobel award for the non-conservation of parity discovery.

As a person who embodied multiple marked identities, Wu threatened to expose the fiction of the unified subject that the notion of objectivity rests upon. Because Wu's multiplicity was unintelligible to many observers, stereotypes of Asian femininity, such as the Dragon Lady, offered convenient tropes to fragment her into recognizable pieces. But, as a "Dragon Lady" in the nuclear lab, Wu threatened both the epistemological and social privilege of white male physicists. In order to contain Wu's multiplicity, and allay fears about her destructive potential to science and the American social order, several rhetorical strategies were used to make her less threatening. In this section I elaborate on the asymmetries that resulted from the social and scientific uncertainties that Wu provoked. I explain why her fellow scientists and the popular press went to such lengths to make sense of Wu rather than simply relegating her to obscurity. Then, I analyze the rhetorical strategies used to fragment Wu's multiplicity and reshape her under the logic of purity. María Lugones argues that fragmentation "reduces multiplicity through abstraction [and] categorization."[320] These strategies deployed stereotypes of Asian femininity to categorize Wu's marked identities and re-form them as evidence of her conformance to the scientific aesthetic values of simplicity, elegance, beauty, and symmetry. Wu's fragmentation resulted in uneven, contradictory, and "asymmetrical" representations of her. The strategies employed to mitigate Wu's racial otherness and neutralize her image as a scientist emphasized her conformance to both Eastern and Western gender norms and heterosexual domesticity.

[320] Lugones, "Purity, Impurity, and Separation," 464.

Unlike Arliner Young, the scientific community could not easily ignore Chien-Shiung Wu. First, Wu had significantly more cultural and material capital than did Young. She had the complete support and encouragement of her parents in choosing to pursue advanced education in physics. Her father, Wu Zhongyi, was both a revolutionary and a feminist. He was active in the movement to democratize, modernize, and Westernize China. And for him, as for many others who shared his political commitments, women's equality was a core aspect of modernization. Wu Zhongyi started a girls' school in their town, Liu Ho, which Chien-Shiung attended. When she graduated and moved on to high school and then college, Wu Zhongyi continued to ensure that she had access to the materials she needed to study.[321] When, Chien-Shiung decided to pursue graduate work in physics, which she could not do in China, her wealthy uncle provided her with the financial means to do so. Wu arrived in the US with funding of her own, something neither Sor Juana nor Young had, which created a measure of freedom and privilege.[322] However, it is important to note that just one year after starting her doctoral work at Berkeley, the Japanese invasion of China effectively cut her off from family support. Wu was able to obtain funding from Berkeley after the Japanese Invasion, but she was unable to communicate with her parents or siblings for more than ten years following the event.[323] Even then, the Cold War prevented her from freely returning to China until 1973. After the communist takeover in 1949, her father warned her she risked being forced to stay in China if she returned and encouraged her and Yuan to stay in the US.[324] By the time she was finally

[321] McGrayne, *Nobel Prize Women in Science*, 254–278.
[322] Ibid.
[323] Heilbron, *Lawrence and His Laboratory*, 223.
[324] McGrayne, *Nobel Prize Women in Science*, 266.

able to visit China, all of her immediate family members had died.[325] Political conflicts at the global scale deeply shaped Wu's experience and limited her access to both cultural and material resources. Nevertheless, without the initial financial support from family she would not have been able to start graduate work.

The second reason Wu was more difficult to ignore than Young was that Wu's education in nuclear physics and the timing of her graduation from Berkeley positioned her to contribute scientific knowledge that was considered highly valuable with respect to World War II and the Cold War. Though Wu had initially planned to study at the University of Michigan, after arriving in San Francisco in 1936, and touring the physics laboratory at Berkeley, she decided to stay in California. Wu explained this change of plans in her own personal narrative in different ways at different times. She claims to have wanted to stay at Berkeley because she wanted to be immersed in US culture. And, because there were fewer Chinese students at Berkeley than at Michigan, she chose to stay in California.[326] The other explanation she frequently gave was that the gender politics at Berkeley were more favorable than at Michigan, where the student union building was not open to women.[327] Wu consistently denied insinuations that she stayed in Berkeley to be close to her future husband, Chia-liu Yuan, who she met almost immediately after her arrival.[328] But there was another very good reason to stay at Berkeley. There, she would be able to work with some of the world's most celebrated and eminent physicists, Ernest Lawrence, Robert Oppenheimer, and Emilio Segrè. Lawrence had just earned fame for having invented the cyclotron and was awarded a Nobel Prize for that work while Wu was a graduate

[325] Reynolds, *American Women Scientists*, 117.
[326] Lubkin, "The First Lady of Physics," 53.
[327] McGrayne, *Nobel Prize Women in Science*, 260.
[328] Ibid., 259.

student at Berkeley. Thus, when Wu arrived in the US, Berkeley was at the beginning of what she later described as a "golden age" of physics research.[329] Nuclear physics was still quite new and Berkeley physicists were leading the field. In addition to the air of excitement at Berkeley, there was also a sense of urgency about the importance of nuclear physics research as the world marched toward its second global war.

While Wu was a student at Berkeley, the conflict that was to become World War II escalated. The semester she began her studies at Berkeley, Germany and Italy signed the Axis treaty. In 1937, her second year, Japan also signed on with the Axis powers and invaded China. When Wu graduated with her doctorate, in 1940, the Allies had already taken the first steps toward creating nuclear weaponry. Physicists were instrumental in pushing forward that agenda. Many European physicists, who had fled persecution by the Nazis, were deeply worried that the Germans were developing an atomic weapon.[330] In the months following Wu's graduation, physicists were mobilized to conduct military research into nuclear fission. Though Wu had wanted to stay at Berkeley and conduct research, and Ernest Lawrence advocated for her, the university prohibited the hiring of foreigners, including a Canadian researcher and Wu's own advisor, Emilio Segrè, who was Italian.[331] Wu's options were also limited by gender. She found it difficult to find employment anywhere but women's colleges.[332] So, she left research for a teaching position at Smith College. Before long, the accelerating scale of the Manhattan Project had drained the top research universities of physicists. With the help of Lawrence, Wu

[329] Wu, "Chien Shiung Wu," 68.
[330] Howes, *Their Day in the Sun*, 8.
[331] Heilbron, *Lawrence and His Laboratory*, 522.
[332] Rossiter notes that many women feared relegation to women's colleges during this period, Rossiter, *Women Scientists in America: Before Affirmative Action, 1940-1972*, 70.

was offered research positions at eight leading universities. Wu eagerly returned to the world of research, taking a job at Princeton, at a time when women were not even admitted to take classes there.[333] Finally, she was recruited to work at Columbia University on the Manhattan Project. While working on defense research, Wu made improvements to Geiger counter technology and advised scientists at Hanford on gaseous diffusion Uranium purification.[334] After the war, Wu stayed on as a researcher, instructor, and then as an assistant professor at Columbia University, where she spent the rest of her career. Without the urgent need for physicists, and specifically the need for physicists with her particular expertise, Wu might have spent her career confined to women's colleges and universities, where research facilities were extremely limited, just as Young was confined to HBCUs. But in the context of the "brain drain" and manpower shortages during WWII, the physics community was forced to reconcile the perceived incongruity between "serious-minded" scientific research and Wu's race, gender, and nationality. The urgent need for defense research combined with the perceived shortage of scientists created a climate in which Wu could not be simply turned away for being unintelligible. As such, it became imperative to make sense of Wu through strategies of fragmentation.

Within the physics community, Wu's acceptance was probably facilitated by two additional factors. First, Wu was working in a field that had a history of recent trailblazing women like Marie Curie, Lise Meitner, and Irene Joliot-Curie. Furthermore, because of the War, the physics community in the United States was diverse with respect to nationality. Some of the

[333] McGrayne, *Nobel Prize Women in Science*, 265.
[334] Ibid.; Howes, *Their Day in the Sun*, 45–46.

most recognizable figures in American physics—Albert Einstein, Enrico Fermi, Edward Teller—were foreigners who had fled persecution by the Nazis. As a result of this diversity and the experiences of persecution, which were rooted in Hitler's eugenicist ideology, Wu joined a decidedly more progressive community of physicists in the 1940s than Young had encountered among biological scientists, just a decade earlier. It is likely that these political factors contributed to the physics community's ability to take Wu seriously.

As I argued above, Wu's multiple identities threatened to undermine the epistemological assumption of unity at the root of scientific objectivity within physics. Worse, the experiment which proved the non-conservation of symmetry challenged one of the most fundamental aesthetics in physics. Though her colleagues, like Wolfgang Pauli, were deeply shaken by the discovery, they could not ignore it. In order to reconcile the non-conservation of parity with the cherished value of symmetry, many of Wu's colleagues fragmented her by emphasizing her conformance, both scientifically and personally, to the other aesthetic values of the community. For example, one of Wu's colleagues, Polykarp Kusch, quoted in *Newsweek* in 1962, described Wu's experiments as "designed with great elegance and have, by virtue of their elegance, a high esthetic quality.'"[335] The magazine described Wu's experiments as "works of art." In 2006, nuclear physicist and former student of Wu, Noèmie Benczer-Koller, wrote a short biography of her which appeared in *Out of the Shadows: Contributions of Twentieth-Century Women to Physics*. Benczer-Koller described Wu's "exquisite evaluative sense" and sophistication with experimental equipment. [336] According to her, Wu also had "utter care for

[335] "Queen of Physics," 95.
[336] Byers and Williams, *Out of the Shadows*, 279.

precision and reproducibility," which, though not aesthetic values, are nonetheless deeply valued by experimentalists.[337] Benczer-Koller also described Wu's β-decay experiment as "beautiful." [338] Lorella M. Jones, a high energy physicist, wrote a mini-biography of Wu for *Women of Science: Righting the Record* in which she described the parity experiment as "timely, intricate, and clean."[339] And, Anthony Zee wrote that Wu's approach to experiment was "characterized by a meticulous care and a stylish simplicity that some of her colleagues have described as feminine."[340] Here, Zee acknowledges one of the other anxieties about Wu's presence in the laboratory—the masculinization of women scientists—and addresses it by linking the aesthetic values of physics to the value of female femininity. Commentators have also noted the ways in which these aesthetics carried over to Wu's persona. For example, Benczer-Koller observed that, "Beauty and aesthetics were major ingredients of her work, of her demeanor, of her relationships with friends and of her home."[341] In this way, Wu's multiplicity was fragmented and the aesthetic values of physics were made to represent Wu's whole persona. I am not arguing here that Wu's work was not beautiful, only that emphasizing her conformance to other aesthetic values of science—elegance, simplicity, beauty—made her invalidation of symmetry less threatening to the overall aesthetic values of physics.

Wu, herself, expressed appreciation for the values of symmetry, elegance, and simplicity in the natural world. In an autobiography written in 1981, Wu described her science in explicitly aesthetic terms:

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[337] Ibid., 274.
[338] Ibid., 276.
[339] Kass-Simon, Farnes, and Nash, *Women of Science*, 206.
[340] Zee, *Fearful Symmetry*, 33.
[341] Byers and Williams, *Out of the Shadows*, 279.

> Every experiment, if it comes out beautifully, I'm always excited. I remember once I was doing an experiment late in the night, four o'clock in the morning, and something was not right. … Then it came out exactly as I expected and I couldn't believe it. It seemed that the electrons know better than I. That's the kind of joy one frequently experiences in experimentation. I don't know how to convey it to people. It is esthetic and fantastic![342]

Wu's passion for physics came from what she perceived as its beauty, and in that beauty she found joy. In 1962, she described her aesthetic vision of nature to *Newsweek*: "One hopes that nature possesses an order that one may aspire to comprehend. When we arrive at an understanding, we shall marvel at how neatly all the elementary particles fit into the great scheme."[343] Again we see an almost spiritual devotion to order in nature. Though the results of the parity experiment were difficult to accept, even for her, she accepted them and speculated that, perhaps, "in place of parity conservation, there may be a deeper symmetry connecting, for the first time, space and electric charge."[344] In 1976, Wu wrote a report in her capacity as president of the American Physical Society about recent advances in physics. At that time, she remarked "nature seems to be more mischievous than we imagine."[345] For Wu, the puzzle of physics was to locate the "deeper symmetry" and learn nature's playful ways.

Outside the physics community, the anxieties caused by Wu's multiplicity, as a Chinese immigrant woman in the space of the laboratory, were mitigated using four rhetorical strategies of fragmentation—infantilization, gentrification,[346] exoticization, and domestication. Each of these strategies emphasized one part of the numerous ostensibly contradictory,

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[342] Gilbert and Moore, *Particular Passions*, 71.
[343] "Queen of Physics," 95.
[344] "Wu, Chien-Shiung."
[345] Wu, "The State of US Physics—1976."
[346] I am using the word "gentrification" in a broader sense than is usual. When I refer to gentrification here, I mean to signal a discursive process by which Wu's class status is emphasized as elevated relative to then familiar stereotypes of Chinese immigrants as working-class laborers.

confusing, or unintelligible components of Wu's identity that was familiar, normative, and unifying to represent Wu as a whole. For example, as we have already seen in some quotations above, Wu was infantilized when she was described as a girl or as physically small.[347] As a discursive strategy, infantilization calls up the subordinate position of women to men, and fits Wu into that framework encouraging the reader to ignore any contradictions such as her actual age. Despite the fact that she was an adult, describing Wu as a "girl" fragmented her into familiar, unified pieces, made her seem less threatening, and reduced the potential damage she could inflict as a militant, emasculating "Dragon Lady" to both hegemonic masculinity and to Nature itself. This strategy was often reinforced by emphasizing Wu's small body. In fact, the *New York Post* took the edge off Wu's destructive scientific accomplishments by describing her as "small, demure, almost childlike." [348] And, in the *Schenectady Gazette*, Edith Roosevelt described Wu as "a tiny Chinese woman in a white laboratory coat busily writing formulas on the blackboard."[349] Even one of Wu's students, John McClaughry, later described her as "a tiny birdlike woman."[350] In other cases, Wu's destructive potential was mitigated by linking her to stereotypes about submissive "Oriental" femininity. For example, the *New York Post* described how "her hands fly up to cover her laughter in a modest manner," [351] while *Newsweek* emphasized that Wu "…still retain[ed] the modesty and shyness of the little girl from Liu Ho …."[352] While, Wu does appear to have been a small-sized person, the repeated emphasis on her bodily smallness reinforced her infantilization. Infantilizing and exoticizing Wu, allowed her to

[347] Barton, "Everyday Science"; Zee, *Fearful Symmetry*, 291; Gilson, "Subtleties and Surprises," 8.
[348] Wershba, "Daily Closeup: Dr. Chien Shiung Wu Prize-Winning Nuclear Physicist."
[349] Roosevelt, "Meet Your Scientists."
[350] McClaughry quoted in Reynolds, *American Women Scientists*, 117.
[351] Wershba, "Daily Closeup: Dr. Chien Shiung Wu Prize-Winning Nuclear Physicist."
[352] "Queen of Physics."

be reimagined through less threatening stereotypes of Asian femininity. Thus, the writers of these pieces remade Wu in ways they felt would be more intelligible, familiar, and less foreign to their readers, who were assumed to be white Americans. This move was fragmenting and reductive, but moderated the threat which her multiplicity posed.

Another strategy used to make Wu appear less intimidating, but which created asymmetries in her narrative, was to domesticate her by highlighting her heterosexuality in addition to her girlish smallness. For example, Edith Roosevelt took this tack in her piece on Wu: "… university life was not all studies for the *little Chinese girl* who loved life and fun as well is science. With her mischievous twinkle in her dark eyes and her warm personality, Dr. Wu found many friends. Many young men asked her to dinner, the movies or a college dance."[353] By normalizing Wu within hegemonic white middle-class femininity and heterosexuality, Wu, the foreign nuclear physicist, was domesticated. The reader was led to conclude that despite her multiplicitous appearance, underneath her lab coat, Wu was as innocuous as the average "girl next door." The United Press also normalized Wu through heterosexual domesticity and motherhood in an article entitled, "'Smartest Woman Physicist' Also Rattles Pots and Pans," which appeared on women's interest pages in February of 1957. The author of the piece argued that, in addition to her laboratory smarts, Wu "also is pretty expert at domestic science."[354] The article identified Wu as "Chinese-born" and declared:

> To meet and talk with Dr. Wu, you'd hardly suspect that her dainty frame cloaks a giant mind. She is no more than five feet tall, slim, and pretty with the dark eyes and olive skin of her race. No 'ivory tower' scientist, she can discuss recipes as readily as

[353] Roosevelt, "Meet Your Scientists," [Emphasis Added].
[354] United Press, "'Smartest Woman Physicist'."

> equations, and classes herself and 'average type' of housewife. I apologized during our talk for my ignorance of physics. 'My dear,' she smiled, 'none of us knows much.'[355]

Here the author used multiple strategies to fragment Wu into a non-threatening white-middle class American feminine mold. She infantilized Wu, exoticizes her, and finally domesticates her within the context of heterosexual marriage. Using these strategies in combination was effective but creates a jarring asymmetry or distortion in the definition of "housewife." As a full-time physicist, it was hard to keep Wu from bursting out of the rhetorical restraints the author places on her. In an attempt to resolve this contradiction, the author explained, "the Yuans (she uses her maiden name professionally) live in an apartment only a block from the Columbia University campus. Dr. Wu said since her husband gets home only for weekends, she puts off most of her cooking until then."[356] After providing a more detailed description of the science that Wu and her husband did, the article noted that they are US citizens. Fragmenting Wu by domesticating her in this second sense served to reassure the presumably female readers of the article of Wu's sameness after having wandered uncomfortably into the world of nuclear physics.

Many articles about Wu, particularly those that appeared in women's interest sections, follow the strategy of softening Wu's scientific accomplishments by immediately situating her in the context of heterosexual motherhood and married life.

> Dr. Wu's experiments disproving the 'parity law' have been termed the 'solution to the number one riddle of atomic and nuclear physics.' She is married to a physicist, Dr. Luke Chia-liu Yuan, and is the mother of one child.[357]

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[355] Ibid.
[356] Ibid.
[357] "Award Given to Professor."

> Dr. Wu told the national AAUW convention that the overthrow of the parity law … 'involves not just the addition of new information, but the continuous revision of old knowledge. It is the courage to doubt what has long been established and the incessant search for its verification and proof that pushes the wheel of science forward.' Dr. Wu … is married to a physicist and is the mother of a child…[358]
>
> When two fellow Chinese physicists suggested the 'no parity theory,' Dr. Wu devised a painstaking proof of their assumption. Dr. Wu is married to a physicist, Dr. Luke Chia-liu Yuan, and is the mother of one child.[359]
>
> Convention delegates heard Dr. Clark describe the contributions and discoveries that have earned Dr. Wu the right to be called 'the world's foremost woman in experimental physics.' Dr. Wu is married to a physicist, Dr. Luke Chia-liu Yuan, and is the mother of a child."[360]

Time after time, Wu's science and her achievements were made less intimidating by marking her conformance to social expectation of marriage and motherhood. The immediate mention of family after the descriptions of her scientific accomplishments is an indication that her heterosexual domesticity and motherhood were viewed as accomplishments, as well. These aspects of Wu's identity, which were simply parts, fragments of her life, were made to represent her as a whole. These constructions of Wu as an ordinary wife and mother were not limited to the popular press. Even Wu's mentor, Emilio Segrè had described her as a nurturing mother figure, a foil to the slave-driving "militant" Chinese woman.[361] Though the Dragon Lady was, perhaps a more unifying stereotype through which to read Wu, in the context of the Cold War, her emasculating militancy was threatening. For many writers, it was much preferable to fragment Wu and read her as a heterosexual, feminine mother, who just happened to also be a scientist.

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[358] "Chinese-Born Physicist Given Award by University Women."
[359] "1959 Achievement Award Won by Woman Physicist."
[360] "Achievement Award Announced by AAUW."
[361] Segrè, *From X-Rays to Quarks*, 260.

Another strategy, gentrification, was also used to neutralize the potentially threatening effects of the Dragon Lady. Chien-Shiung Wu is consistently referred to as "Madame Wu" in both contemporary and historical literature. This title may have been meant as a gesture of respect linking her to Madame Marie Curie. Or, perhaps it was an attempt to link Wu with Madame Chiang Kai-Shek, and thus emphasize her racial difference, but it was also a way of rhetorically elevating Wu's class-status, distancing her from the image of the working-class Chinese immigrant. Gentrifying Wu was a fragmenting move that called up more delicate stereotypes of Asian femininity, compatible with Western gender roles, to make sense of Wu's multiplicity. The gentrifying strategy was sometimes combined with each of the other three rhetorical strategies. For example, in 1959, Edna Yost included Wu in her book, *Women of Modern Science*, where she guided the reader to makes sense of Wu's achievements in the context of her explicitly Chinese femininity:

> Though the quality of her scientific work has earned for her a professional rank rarely accorded women in outstanding American nuclear physics centers today, *Dr. Wu wears it all lightly and unassumingly. Small enough to be described as petite, she dresses in the slit-skirt Chinese garb that becomes her well*. It is a form of dress which, whether or not it is concealed beneath the laboratory coat of the research scientist, indicates her *deep and enduring ties to the land of her birth. She is a true daughter of her people.*[362]

The reader was assured that despite her "professional rank" Wu is too small, submissive, and noble—as upper-class Chinese women were assumed to be—to threaten hegemonic gender norms. Yost used language to evoke a rich heritage which contrasted with the working class background most white readers would have associated with Chinese immigrants. Yost also infantilized Wu, not only by describing her as small, but by positioning her as a "daughter." At the same time Yost exoticized, infantilized, and gentrified Wu, she also domesticated her

[362] Yost, *Women of Modern Science*, 81 [Emphasis Added].

through appeals to pluralism. Immediately following the passage quoted above she added, "Yet in the startling vitality of her handshake is a warmth and communicativeness that *transcends race and nationality*. A *human being of deep womanly reserve,* that handshake casts aside all artificial reservations to get at realities."[363] Again, in contrast to the potentially apocalyptic scientific research she conducted as a visibly foreign woman, it was Wu's femininity, that assured the reader of her humanity. The fragmentation of Wu's multiple identities de-emphasized her membership to undesirable marked categories—race and nationality—by positioning her above and beyond those categories. At the same time, her class status and submissive femininity were accentuated, creating an asymmetry—the image of Wu as a submissive lady is inconsistent with the achievements for which she is most notable.

Wu's ability to conform to the aesthetic value of elegance through fragmentation also facilitated her acceptance by the members of the physics community and the public. Wu's mentor, Emilio Segrè, gentrified Wu this way: "Her will power and devotion to work are reminiscent of Marie Curie, but she is more worldly, elegant, and witty."[364] For Segrè, who also referred to her as "militant," Wu's worldly, elegance mitigated the threat of the slave driving Dragon Lady. However, elegance also represents one of the core aesthetic values of physics. A beautiful illustration of the way in which Wu was portrayed as aesthetically elegant is a biographical article, "Chien-Shiung Wu, The First Lady of Physics," which appeared in the *Smithsonian* magazine in 1971, written by Gloria Lubkin, a fellow physicist and advocate for women in physics. The physical form of the article is itself a manifestation of elegance. The

[363] Ibid.
[364] Segrè, *From X-Rays to Quarks*, 260.

pages are thick and glossy and the layout is simple, but interesting to the eye. Several other visual strategies were employed in the article to fragment Wu, and present her as a unified, elegant subject. On the inside pages of the article are a series of close-up, black-and-white photographs of Wu's hands. In the first, her right hand is folded over her left, which is holding a chalkboard eraser. In the second photograph, Wu's hands are pressed together, as in prayer, though the position of the hands instead gives the impression she is giving direction. In the final of these three images, Wu's hands are folded together, right into left. The closed position of her hands in each of the photographs creates a visual sense of feminine elegance and modesty, illustrating what the accompanying text articulated. The series was intended to represent her discovery of "handedness" in the β-decay experiment. Indeed, the text which captions the photographs described the parity experiment. The close up photographs of Wu's hands, disconnected from her body, facilitated her fragmentation. Drawing attention away from the fact that Wu's experiment undermined the aesthetic of symmetry and elegance in physics, the photograph's beautiful representation of "handedness" instead re-inscribed elegance onto Wu's body and in so doing symbolically salvaged symmetry.

While the layout and text of the *Smithsonian* piece certainly emphasized Wu's elegance and explicitly identified her as a "lady," Lubkin drew attention to Wu's Americanization. Like many of the articles described above, Lubkin began by exoticizing Wu in the context of her scientific work:

> The middle-aged Chinese lady emerged from the salt mine near Cleveland, Ohio, and smiled when she saw the daylight once more. Perfectly groomed, as always, in her traditional cheong-san [sic], she had spent the better part of the day 2000 feet down … shielded from the rain of radioactivity and cosmic rays that constantly fall on the earth,

> racks of apparatus had been installed in the house to determine whether a radioactive substance ever emits two electrons at the same time.[365]

This representation of Wu as exotic, but elegant, distanced her from earlier stereotypes of Chinese immigrants as unclean by drawing attention to Wu's personal "grooming." However, we also see the familiar tension between Wu's marks of traditionalism and her Modern scientific work. Lubkin resolved this tension by domesticating her. Lubkin quoted Wu, who explained her choice to stay at Berkeley in assimilationist terms: "[Wu] wanted to learn everything about the United States… to absorb the American way of life."[366] Making sure to point out the ways in which Wu was not just Chinese, but also American, Lubkin linked Wu's national domestication with her gendered domesticity, as well: "And in her spacious apartment, amid a collection of Chinese art and furniture *combined with modern American pieces*, she often entertains—in honor of a student receiving a doctorate or to introduce colleagues to a visiting scientist. Her kitchen is filled with gadgets for cooking in the Chinese style."[367] By underscoring the coexistence of elegance, Chinese tradition, and American modernity in the domestic space of Wu's home, and even her kitchen, Lubkin prevents the image of the militant Dragon Lady from ever forming in the reader's mind. Furthermore, when Wu makes strong statements about her career in physics, like, "I've always felt that in physics you must have total commitment," and "It's not just a job. It's my whole life," Lubkin quite literally softens them by interjecting "she says softly." [368] Through such qualifiers, Lubkin fragmented Wu into more comfortable constructs of Asian femininity.

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[365] Lubkin, "The First Lady of Physics," 52.
[366] Ibid., 53.
[367] Ibid., 52 [Emphasis Added].
[368] Ibid., 52.

Wu was often described in gentrifying terms that simultaneously cast her as a "lady," or as "elegant," and undermined her epistemological privilege. For example, physicist, Anthony Zee noted that in the parity experiment, "Nature first revealed her 'handedness' to a lady"[369] as though it were a secret shared quietly between noble sisters. By gentrifying Wu, Zee made her less threatening. And, through his feminization of Nature, Zee symbolically positioned Wu at the same level as Nature, and thus, undermined her scientific subjectivity. On the first page of the *Smithsonian* piece by Gloria Lubkin, there is a black-and-white photograph of Wu's face, taken from the side. Visible in the image is the high-neck of her oft described dresses, embroidered with the simple outlines of flowers. The photo caption gentrifies Wu and contrasts her Chinese traditionalism and scientific work: "Mme. Wu at home: delicate flowers, the crisp tracery of the Chinese dress, a tenacious mind probing the heart of the nucleus."[370] In the photograph, Wu's eyebrows are uplifted and her mouth is slightly open as though she is engaged in active conversation. On the page immediately facing, this portrait is juxtaposed against an out-of-focus, black-and-white photograph of leaves in sunlight, seen through a window. The composition of this photograph is reminiscent of Asian art with its focus on simplicity and nature. With the magazine open, Wu appears to be in conversation with Nature, bringing it into focus for us, the reader. Like Zee, the editors of *Smithsonian* placed Wu at the same level as Nature, symbolically turning her into a native informant rather than a full scientific subject. Placing Wu on the same epistemological level with nature creates an asymmetry with respect to the traditional subject object split.

[369] Zee, *Fearful Symmetry*, 33. in
[370] Lubkin, "The First Lady of Physics," 52.

The final strategy relates to the mitigation of the threat to the gendered social order posed by women in science, which Wu represented. Naming Wu with the gentrifying honorifics "Queen of Physics" or the "First Lady of Physics," symbolically positioned her as subordinate to an unnamed "King" or "President" of physics. Later in her life Wu challenged such naming strategies. For example, when Estelle Gilson interviewed her in 1980 she began her article with a description of Wu's reaction to these descriptions:

> When I asked Professor Chien Shiung Wu how she felt when another physicist described her as "the reigning queen of nuclear physics," she sat back, smiled the smile of one who has been through that "First lady of physics" stuff before, and said, "Oh, that's horrible. We're all scientists and scientific workers at that.[371]

Wu wanted to be appreciated as a physicist, not as a "woman" physicist. The relationship between Queen and King, First Lady and President, is one of heterosexual marital domesticity. Wu, then was positioned as a complement or companion to the "true" leaders in physics. As queen, Wu could be impressive, beautiful, elegant, even a bit scary, but she could never be truly powerful without her king. And, to her, that was "horrible," given all that she had accomplished. In the context of the parity experiment, these titles position her as subordinate specifically to Tsung-Dao Lee and Chen Ning Yang, who won the Nobel Prize for their theoretical work on the parity problem. Wu was more advanced in her career than either Lee or Yang, who had approached her as an authority on the subject of β-decay. Representing Wu as their queen, is simply an inaccurate metaphor. This also raises questions about why Wu herself did not receive the Nobel Prize for her contribution to the discovery of the non-conservation of parity. Many scientists and feminists have argued that Wu was ignored because of institutionalized

[371] Gilson, "Subtleties and Surprises," 7.

sexism in the nomination and selection process.[372] In fact, there were efforts in the 1990s to nominate Wu for a Nobel.[373]

In 1971, Gloria Lubkin noted that while Wu did not win a Nobel Prize, she did receive many other accolades throughout her career. [374] Among her many awards, Wu received the Comstock Prize, the Wolf Prize, a Research Corporation Award, several awards from AAUW, and numerous honorary doctorates. Historian of science Margaret Rossiter has suggested that Wu should have been awarded a Nobel Prize.[375] Furthermore, she argues that the system of recognition is deeply flawed and has served to keep women, even those at the very top, in a position subordinate to the men in their fields:

> Which women were honored and how many there were of them says a lot about them, but perhaps even more about the men in the field, especially those in position to do the nominating or the electing. In that respect these honors take on the coloring of old-fashioned chivalry: after the knights had jousted each other in hard-fought tournaments, they could present their favorite lady with a flower or a prize. She was worthy, but the top prizes were still in the realm of a gift or personal patronage from the men who fought the battles of science politics rather than based on scientific merit impartially assessed.[376]

As "Queen" or "First Lady," the Nobel, and many of the prizes Wu was actually awarded, were marked by the kind of chivalry Rossiter describes. In fact, just three days before Wu's death in 1997, two physicists, Nicholas Kurti and Christine Sutton, wrote a commentary in *Nature* "correcting" the record on the parity experiment. Kurti and Sutton, frustrated by what they

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[372] Reynolds, *American Women Scientists*, 117; Vare and Ptacek, *Mothers of Invention*, 153; Kass-Simon, Farnes, and Nash, *Women of Science*, 206; Rosenberg, *Changing the Subject*, 186; Des Jardins, *The Madame Curie Complex*, 159–160. It is important to note that including Wu in the Nobel award might have alienated her collaborators at the NSB.
[373] Zhu, "Chien-Shiung Wu," 347–354.
[374] Lubkin, "The First Lady of Physics," 56.
[375] Rossiter, *Women Scientists in America: Before Affirmative Action, 1940-1972*, 330.
[376] Ibid., 332.

perceived as a lack of recognition given to the team of researchers at the National Bureau of Standards, argued that Wu had only been listed as first author on their 1957 publication out of a sense of chivalry on the part of the men of the team. Kurti and Sutton noted that it was customary to list authors alphabetically, but that Wu, who would have been the last author under that system, did not suggest such an arrangement: "When this did not happen, the chivalrous suggestion was made that as Wu was the only woman she might sign first. (One wonders whether 40 years on such a suggestion would be regarded as an early example of affirmative action or a sexist remark!)"[377] Their untimely comment did not go un-rebutted.

Richard Garwin and Leon Lederman came to Wu's defense in a letter to the editor, arguing that no one had ignored the NBS team and that Lee, Yang, and Wu had always credited them as part of the team that discovered the non-conservation of parity.[378] Garwin and Lederman described the order in which events occurred and stressed Wu's role in Lee and Yang's theorizing. Without directly confronting Kurti and Sutton's sexism, they concluded, "It would not be amiss to regard Wu as the originator of the experiment, given the facts as related above. But the NBS team of Ambler, Hayward, Hoppes and Hudson, as well as Wu, were full collaborators and deserve full credit."[379] Designations, such as "Queen of Physics," created asymmetries for Wu—she was beholden to the chivalrous generosity of the men in her field, both for recognition of her achievements and to defend her when others accused her of not having merited such recognition.

[377] Kurti and Sutton, "Parity and Chivalry in Nuclear Physics," 575.
[378] Garwin and Lederman were the first to confirm that Wu's results in the parity experiments applied to muons.
[379] Garwin and Lederman, "History of Parity Violation Experiment," 543.

Sadly, this debate has shaped much of the scholarship about Wu since her death. For example, in her short biography of Wu, Moira Reynolds was uncritical of Kurti and Sutton's assertion that Wu's name was listed first on the landmark 1957 paper. Reynolds concluded, "Whether or not she deserved the accolades she received on the basis of the *Physical Review* article cannot be known. That aside Chien-Shiung Wu was certainly one of the world's outstanding physicists."[380] Here not only is her exclusion from the Nobel unquestioned, but all her other awards are cast as suspect, as well. In 2001, Yuelin Zhu spent the better part of his dissertation on Wu, scrutinizing laboratory notes, notebooks, correspondence, personal accounts, and even weather reports in an effort to determine if Wu truly deserved the recognition she received.[381] The process of gentrifying Wu through honorifics like the "Queen of Physics" served to make her less threatening both to her scientific peers but also to the public. However, these titles created an opportunity for her contributions to be questioned and, thus undermine not only Wu's legacy, but also the perceived potential of all women in science.

Historical factors, such as the centrality of nuclear physics to World War II, made Wu difficult to dismiss as a "serious-minded" scientist. But her multiplicity as a Chinese immigrant woman made her somewhat unintelligible within American science. The figure of the Dragon Lady, an emasculating, militant Asian woman, provided an easy way to make sense of Wu for white European/Americans. However, the Dragon Lady also added to the anxieties Wu and her work provoked during the Cold War Era. Rhetorical strategies of infantilization, gentrification,

[380] Reynolds, *American Women Scientists*, 118.
[381] Zhu, "Chien-Shiung Wu."

exoticization, and domestication were used to neutralize Wu and counter the specter of the Dragon Lady. Through fragmentation Wu's small physical size, heterosexuality, motherhood, American-ness, or the marks of her elegance and submissive Asian femininity, were made to represent her as a whole, making her appear benign and more familiar to her colleagues and the white American public. This resulted in asymmetries, contradictions, and inconsistencies between Wu's remarkable contributions to physics and her supposed "ordinariness."

Conclusion

In 1971, Chien-Shiung Wu told Gloria Lubkin that, for her, physics was "not just a job. It's my whole life."[382] Elsewhere she was quoted as having said, "The only thing worse than coming home from the laboratory to a sink full of dirty dishes, is never having gone to the laboratory at all." [383] In her life, *doing* physics was a primary motivation for Wu. She was absolutely committed to it. And yet, her multiplicity made her scientific subjectivity unfathomable and resulted in a constant questioning, directly and indirectly, of her abilities and her right to do physics, even when she was at the pinnacle of her career. In this section, I show that Wu was keenly aware of the uncertainties and asymmetries I described above. In response, she took an active role in shaping her own representation in order to assert her right to *do* physics, which constitutes a form of differential consciousness. For Wu, physics was the unchangeable fact of her life and her identity. She would change continents, citizenship, shift her gender and racial presentations, sometimes in contradictory ways, but she could not and would not change the culture of physics. María Lugones framework of curdling provides a richer way of making sense

[382] Lubkin, "The First Lady of Physics," 52.
[383] Zong, "Nobel Prize Winners and Dr. Chien-Shiung Wu," 4.

of Wu's responses and resistances to the diverse representations of her. Wu used both separation and curdling in her self-representations. She used split fragmentation while defending her objectivity in response to Bruno Bettelheim's assertion that women approach work with "womanly" feelings, and again when she claimed not to have experienced discrimination in science. She used split curdling by embodying cultural, racial, and gender difference in the space of the laboratory. Each of these fragmenting actions, separating and curdling, allowed Wu to conform to the values of physics and thus gave her the greatest possibility for success.

Wu's feminist consciousness grew slowly over the decades she spent in physics. She often lamented that the United States was not as open-minded about women's scientific abilities and responsibilities as China. Her father's feminism and commitment to her education seemed natural to her. It was a shock to discover that not everyone shared his vision when she arrived in the US.[384] But, the 1964 MIT symposium and Bruno Bettelheim's speech there marked a turning point for her. By that time she was a full professor and had gained quite a bit of notoriety for her role in the non-conservation of parity experiment. She had earned the right to be outspoken. And, she spoke out. For Wu, the problem of women in science was reducible to one thing, "The main stumbling block is in the way of any progress is and always has been unimpeachable tradition. It is a 'tradition' that scientific and technical fields have always been men's fields. And, therefore, it is unfeminine for a woman to try to compete with men in a

[384] "Queen of Physics," 95; Zee, *Fearful Symmetry*, 292–293.

presumably man's field."[385] Though Wu dressed herself in traditional clothes, and preferred traditional Chinese food—facts emphasized in the news and by her colleagues over and over again—that is really where her traditionalism seems to have ended. Her critique of "unimpeachable tradition" is consistent with her upbringing and education in a revolutionary historical and political context. In fact, Wu's interest in science emerged in relation to a movement which framed science, modernization, and the overthrow of tradition as *the* means of cultural survival in China.[386] Bettelheim's traditional, and uncritical views about women's place in the social order, were, for Wu not only representative of sexist, closed-minded thinking, they were anti-modern and unscientific.

In particular, Wu strenuously objected to Bettelheim's assertion that women approach their science with a "womanly" feeling. She rebutted:

> Bringing a womanly point of view may be advantageous in some areas of education and social sciences, but not in physical and mathematical sciences where we strive always for objectivity. I wonder whether the tiny atoms and nuclei or the mathematical symbols or the DNA molecules have any preference for either masculine or feminine treatment.[387]

Wu was still irritated by what she perceived to be a questioning of her objectivity sixteen years later, when she repeated this criticism of Bettelheim using nearly identical wording.[388] For her, the value of objectivity, central to the culture of physics, was paramount. And, bringing a womanly, or manly, point of view to one's work was necessarily subjective. To be womanly, or manly, as a scientist, one would be inherently influenced by social factors that are not supposed

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[385] Mattfeld and Van Aken, *Women and the Scientific Professions: M.I.T. Symposium on American Women in Science and Engineering*, 45.
[386] Zhu, "Chien-Shiung Wu," 30–31.
[387] Mattfeld and Van Aken, *Women and the Scientific Professions: M.I.T. Symposium on American Women in Science and Engineering*, 45.
[388] Gilbert and Moore, *Particular Passions*, 70.

to influence scientific analyses. It is interesting to note that, though the field of feminist science studies had not yet been born and critiques of objectivity from a feminist perspective had not yet been articulated, Wu applied her critique of Bettelheim evenly to both masculinity and femininity. For her, objectivity was not gendered masculine. But, Wu's feminism was marked by the masculinist values of the culture of physics which was explicitly involved in constructing a unified theory of nature and eschewed multiplicity, even among sub-atomic particles, as wild and disorderly. Wu established her scientific subjectivity through a claim to objectivity, which, following Lugones, is necessarily driven by the logic of purity, fragmentation, and splitting. According to Lugones the privileged vantage point that exists outside of the messy multiplicity of history, gender, and culture—what we call objectivity—is produced by the fragmenting of one's marked and embodied identities. In her response to Bettelheim, Wu claimed scientific subjectivity *as a woman*, but also claimed to occupy a subject position outside of gender. This indicates that her response was not truly an act of multiplicity. She did not assert herself to be "heterogenous … multiple, nonfragmented, [and] embodied," rather, her rebuttal of Bettelheim was a form of fragmentation through split/separation.[389]

Another instance of split/separation appeared in an interview Wu gave with Estelle Gilson in 1980. Gilson asked Wu to comment on her experiences with patronizing men in science. Gilson explained Wu's response:

> But, she insists, she has 'never had a problem being accepted.' None at the University of California as a student. None at Columbia. Her only complaint was the perpetual

[389] Lugones, "Purity, Impurity, and Separation," 463.

> necessity of writing grant proposals…. She went on, however, to offer another insight: 'that is the strength of this country — you can never rest on your laurels.'[390]

Wu's claim that she had not been discriminated against represents another example of fragmentation through splitting and separation. The historical record is filled with instances of overt discrimination against Wu. For example, after she graduated from Berkeley, she was not eligible to be hired because of anti-Asian sentiment and restrictions against hiring foreigners.[391] Had it not been for the War, she would likely have been relegated to teaching at women's colleges and had limited access to research facilities. Even at Columbia, where she spent so many years, she did not attain the level of full professor until after the 1957 parity experiment. In fact, Tsung-Dao Lee, who was her junior, was already a full professor when he came to ask her for her assistance as the established expert in β-decay.[392] And of course, there are concerns that Wu was discriminated against, when she did not receive the Nobel Prize along with Lee and Yang. Wu certainly felt the sting of discrimination and prejudice in the comments of Bruno Bettelheim in 1964. And in 1969, in response to charges of gender discrimination and bias in faculty hiring, Wu joined the newly formed Columbia Commission on the Status of Women (CCSW).[393]

There is no question that Wu experienced discrimination and was conscious of it. Wu was outspoken about the under-participation of women in science in the United States. In her 1962 interview with *Newsweek*, she did not hesitate to identify what she saw as the source of the problem.

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[390] Gilson, "Subtleties and Surprises," 9.
[391] McGrayne, *Nobel Prize Women in Science*, 264; Zhu, "Chien-Shiung Wu," 428–434, 470–475.
[392] Zhu, "Chien-Shiung Wu," 434.
[393] Rosenberg, *Changing the Subject*, 251–252; Greenhouse, "Columbia Accused of Bias on Women."

> In the US, Mme. Wu observes, 'it is shameful that there are so few women in science.' … 'In China there are many, many women in physics,' she points out. 'There is a misconception in America that women scientists are all dowdy spinster's. *This is the fault of men.* In Chinese society, a woman is valued for what she is, and men encourage her to accomplishment — yet she remains eternally feminine.[394]

Later, one of Wu's colleagues on the CCSW, Francis Hoffman, described a time when Wu directly responded to prejudice during a review of the university's affirmative action plan, in 1972. "'A young lawyer came out — all full of himself. … At one point he said, 'you can skip over that page because it has a lot of statistics.' Madame Wu responded to the poor fellow, 'I've forgotten more mathematics than you ever knew.'"[395] Wu was a strong advocate for herself and for other women in science and consistently argued that concerns about the fate of "the family" could be easily addressed by men's increased participation in domestic duties and child-rearing. So why, in 1980, did she insist that she had not experienced discrimination to Estelle Gilson? Gilson was perplexed as well. Like so many others before her, she turned to stereotypes of Asian femininity to make sense of Wu.

> In Wu's voice and manner I found an oriental quietness that was not totally unexpected. And the written and oral statements she offers about herself and her career present the same quiet surface. … No disquiet? No anxieties? No sturm? No drang? This must be false, I told myself later, after listening to my tapes and reading my notes. *There's something wrong here.*[396]

In Wu's denials of prejudice or discrimination Gilson perceived, but could not name, what was wrong—the incomplete fragmentation of Wu's multiplicity. As social awareness about the discrimination encountered by members of multiply marked groups increased, the fiction of unity Wu had worked so hard to craft, through her fragmentation into intelligible stereotypes of Chinese femininity, was exposed.

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[394] "Queen of Physics," 95 [Emphasis Added].
[395] Hoffman quoted in Rosenberg, *Changing the Subject*, 255.
[396] Gilson, "Subtleties and Surprises," 9 [Emphasis Added].

Unlike Wu's response to Bettelheim, which was rooted in a deep epistemological commitment, Wu's assertions that she did not experience discrimination may have been strategic. By this time, social movements within the academy had drawn attention to discrimination against Asian American women and other women of color. As the Chinese American community asserted their American-ness during the 1970s Wu was claimed as a representative of the community's "progress." A 1976 advertisement, in the *New York Times,* announced to readers,

> This generation of Chinese Americans have come into their own, with an outlook quite different from that of their immigrant parents. They have put the image of the laundryman or restaurant worker away for good. Indeed, taking the number of Chinese in this country, the ratio of those who have obtained advanced degrees is higher than any other ethnic group.[397]

Addressing the older stereotypes which associated Chinese immigrants and Chinese Americans with the working class and as dirty or immoral, the ad proposed a new model of Chinese identity as members of the professional class. The ad featured photographs and short descriptions of 36 Chinese Americans, including Wu and her colleague Tsung-Dao Lee, who "made important contributions in every aspect of American life, from politics to science, the arts to mass media." The piece emphasized the multiplicity of Chinese Americans and resisted fragmentation: "They have helped to enrich the life in these United States, and they have developed a sense of sharing and participating in its growth. While proud of their cultural heritage, they considered themselves American in every sense."[398] Claiming to be both American and Chinese, advocates of hyphenation advanced an agenda of multiplicity which resisted the mandate of purity. Over the course of Wu's career, Wu went from being an exotic

[397] "Display Ad 1068 - No Title."
[398] Ibid.

rarity in the science lab to being positioned as an "ordinary" model minority. This new image emphasized the multiplicity of Chinese American identity and posed a new challenge for Wu in managing her own multiplicity. Furthermore, in 1975, women of color in science had organized to draw attention to their unique experiences of marked multiplicity and published a report, "The Double Bind: The Price of Being a Minority Woman in Science."[399] In a political climate in which the experiences of women of color were defined explicitly as "double" or multiple, the epistemological imperative of unity would be more difficult to achieve. When confronted with Gilson's question about discrimination, perhaps Wu, despite her feminist commitments, felt the impulse to fragment and distance herself from the minoritized experience articulated by other Chinese Americans and women of color, in an effort to occupy the unmarked unified subject position which allowed her to lay claim to objectivity.

Wu had spent her entire career fragmenting her multiple marked identities as a means of survival. As she approached retirement, the idea that one should be able to claim multiplicity *and* objectivity, as proposed by other women of color in science, might have been unfathomable. Wu's primary commitments were to the culture of physics. Even her feminist rejection of Bettelheim was linked to her desire for objectivity. Given her position as a leader in physics, as a former president of the American Physical Society, her commitment to the most fundamental epistemological tenets of physics is not surprising. Regardless, in her interview with Gilson her attempt to split both identity and history, in order to feign unity, was unsuccessful. In the end, Gilson elected to accept the representation Wu presented of herself

[399] Malcolm, Hall, and Brown, "The Double Bind."

as unified and content with her experience as a woman in science rather than challenge this, now quite formidable, woman's narrative of her life.

Earlier in her career, before attention had been so directly drawn to her multiplicity, Wu was able to achieve fragmentation through curdling without jeopardizing her epistemological privilege. Wu emphasized her multiplicity, her divergence from the image of the ordinary scientist, by fragmenting herself into the recognizable stereotype of a Chinese woman. Though she could have opted for splitting through separation (denying her multiplicity) by assimilating to Western styles of dress, Wu chose to continue to wear traditional clothes, which she went to great lengths to acquire.[400] Once in the United States, Wu would have learned rather quickly that her choice of clothing did not conform to the image of an ordinary scientist, but she would have learned that her body could not conform either. Like several of the participants in Maria Ong's ethnography of women of color in physics, Wu opted to perform her difference and multiplicity. This had the advantage of allowing her to making herself familiar and intelligible to her advisors, teachers, coworkers and the public. However, Wu's performance of her "Chinese-ness" was not true multiplicity. Instead, she replaced her complex and multiplicitous whole, with just one of its parts, her Asian femininity. As such, Wu was enacting the curdled form of fragmentation, strategically. Furthermore, conforming to the expected norms of Asian femininity allowed Wu to conform to the aesthetic of elegance in physics. Curdling served her purpose—*to do physics*.

[400] Reynolds, *American Women Scientists*, 113.

Another way in which Wu exhibited split/curdling was in her tight control of the narrative of her life. Wu wrote six first person narratives about the parity event.[401] She interviewed for articles about her and repeated, sometimes verbatim, what she had said in speech decades earlier. Others have said that Wu was not comfortable with her English and so she wrote down her speeches as an aid.[402] While I accept that explanation as perfectly legitimate, such a practice also had the added benefit of allowing Wu to "stay on message" about the story of her immigration, her views about women in science, and the ways she balanced the demands of work and family. It allowed her to emphasize the aspects of her multiplicity that would preserve her scientific subjectivity. María Lugones offers an explanation of the relationship between the unified subject, embodiment, and institutions that sheds light on why such control over her representations would have been imperative for Wu.

> Since [the unified subject's] embodiment is irrelevant to his unity, he cannot have symbolic and institutionalized inscriptions in his body that mark him as someone who is "outside" his own production as the rational subject. To the extent that mastering institutional inscriptions is part of the program of unification, there cannot be such markings of his body. His difference cannot be thought of as "inscriptions" but only as coincidental, nonsymbolic marks. As his race and gender do not identify him in his own eyes, he is also race and gender transparent.[403]

Wu could not transparently eliminate the inscriptions of race and gender on her body so she became a master at managing them. For example, she could manipulate the image of a Chinese immigrant woman to conform to the aesthetic elegance of physics. Certainly, interviewers added, framed, and probably regularly misquoted her. Nor could she control what others, like

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[401] Wu, "Discovery Story I: One Researcher's Account"; Wu, "'Subtleties and Surprises': The Contribution of β Decay to an Understanding of the Weak Interaction"; Wu, "Chien Shiung Wu"; Wu, "The Discovery of Nonconservation of Parity in Beta Decay"; Wu, "Parity Violation"; Wu, "The Discovery of the Parity Violation in Weak Interactions and Its Recent Developments."
[402] McGrayne, *Nobel Prize Women in Science*, 263.
[403] Lugones, "Purity, Impurity, and Separation," 466.

Emilio Segrè, said about her. However, by choosing not only how she wanted to physically present herself, in her traditional *cheongsam*, but also carefully pre-planning her words, Wu had a hand in crafting her own image as a Chinese immigrant woman and physicist. This demonstrates a form of differential conscious; the expression of her multiplicity represents a desire to make meaning of gender and race according to her own goals, which were to conform to the culture of physics so she could continue to "go to the laboratory."

According to María Lugones, there can be no unified subject without the multiplicitous Other against which the subject is defined.[404] In that sense, representations of Wu as an unintelligible anachronism, out of place and time, and marked by her highly visible Asian female body, constructed the archetype of the white male scientist. Wu became the exception which proved the rule. That she was an anachronism, proved the Modernity of the laboratory. That she was marked by race and gender, proved the ordinariness of white scientific masculinity. Though white women and men of color also provided marked identities against which the unified subjectivity of white male scientists could be defined, the interconnectedness of whiteness and masculinity in science are thrown into sharp relief by figures, like Wu, who were multiply marked by both gender and race. Thus, the circulation of representations of Wu simultaneously contributed to her own erasure. Furthermore, representations of Wu, and probably Lee and Yang, too, may have contributed to the production of the new stereotype through which Asian Americans would be read, the model scientific minority. This new image became widely recognizable as its emergence coincided with an increase in immigration from Asia. Ironically, the stereotype of the model minority challenged Wu's strategies of managing

[404] Ibid., 468.

the "institutional inscriptions" which drew attention to her multiplicity and thus threatened her scientific subjectivity. The model scientific minority also served to obscure Wu's divergence from the image of the "ordinary scientist" as we look back in time. In that regard the process of producing racial/gendered meaning through the figure of Chien-Shiung Wu constructed a system of double erasure both contemporary and historical.

Of the women in this study, Wu achieved the most recognition, in her lifetime, for her scientific contributions. However, it was that recognition and notoriety that most constrained Wu's choices about how to represent herself. Regardless, Wu was successful at managing institutional inscriptions to achieve her primary goal, which was to do physics. Though Lugones argues that fragmentation is a "form of domination," Wu's does not seem to have experienced it that way. Her impulse toward unity and purity was both epistemological and spiritual.[405] Instead, her fragmentation allowed her to experience the deep interconnectedness of the natural world as she described here:

> The sudden liberation of our thinking on the basic laws of the physical world was overwhelming.… We were extremely fortunate to have had the opportunity to join in this great venture! These were moments of exhilaration and ecstasy! A glimpse of this wonder can be the reward of a lifetime. Could it be that excitement and ennobling feelings like these have kept us scientists marching forward forever![406]

Much like Sor Juana did several hundred years earlier, as we shall see in the next chapter, Wu described this spiritual/scientific quest as ecstatic. Her research in physics was about gaining a greater understanding of what she called "the great scheme."[407] As Wu understood it, her path

[405] Ibid., 464.
[406] Novick, *Thirty Years Since Parity Nonconservation*, 35.
[407] "Queen of Physics," 95.

to knowing “the lord” through his creation required unity and purity which she achieved through both curdling and fragmentation, and for her that was supremely rewarding.

Chapter Four
Through the Choir Grate:
A *Feminista* Spatial Analysis of Sor Juana's Epistemological *Mestizaje*

The modern scientific concept of objectivity grants epistemological privilege to what Donna Haraway has called the "view from nowhere."[408] María Lugones has argued that this perspective is constructed to allow the viewer to appear to exist outside of society, race, gender, and history.[409] Thus, in order to occupy that vantage point which exists outside the body and outside of society, one has to become a member of what Sharon Traweek called "the culture of no culture."[410] The stories of Arliner Young and Chien-Shiung Wu have illustrated the complex negotiations required of women of color who want to assert their ability and right do science. As women who inhabited bodies marked by gender, race, class, and culture, Young and Wu had to manage perceptions that they were inherently unable to attain objectivity. In this chapter I turn to a point in the history of science when the epistemological priority of objectivity had not yet been firmly established. I examine how nun, poet, dramatist, and natural philosopher, Sor Juana Inés de la Cruz (1648-1695), navigated the very different epistemological milieu of seventeenth-century colonial Mexico.[411] Sor Juana was one of a number of learned women active among Early Modern Europeans, but was unique because she was born in Mexico.[412] Known as one of the greatest Baroque writers in the Americas and as a proto-

[408] Haraway, "Situated Knowledges."
[409] Lugones, "Purity, Impurity, and Separation."
[410] Traweek, *Beamtimes and Lifetimes*, 162.
[411] Some confusion over Sor Juana's birth date exists. Padre Diego Calleja, her first biographer, records November 12, 1651 as her birth date, while Octavio Paz, cites December 2, 1648 as her birth certificate states. Most scholars now accept the earlier date. Paz, *Sor Juana, Or, the Traps of Faith*, 65.
[412] On Laura Bassi see Findlen, "A Forgotten Newtonian: Women and Science in the Italian Provinces"; on Margaret Cavendish, Maria Winklemann, and Maria Merian see Schiebinger, *The Mind Has No Sex?*; and Schiebinger, *Plants and Empire: Colonial Bioprospecting in the Atlantic World*; and on Suor Maria Celeste see Sobel, *Galileo's Daughter: A Historical Memoir of Science, Faith, and Love*.

feminist, Sor Juana's works were published in both Mexico and Spain. Her publishing career ended abruptly after a theological scandal drew the ire of church officials in Mexico City.

Sor Juana makes an interesting case study because of the scientific and political context in which she lived. First, during the seventeenth century, Western European knowledge production systems were in a state of great flux. Second, epistemological shifts with respect to natural knowledge production coincided with colonial expansion by Western European powers. While the new empiricism and objectivism were being advocated by natural philosophers like Francis Bacon, Isaac Newton, Galileo Galilei, and Rene Descartes, among many others, these had not yet become hegemonic. Materiality and the body became central to the argument for empiricism. Some, though not all, experimentalists advocated the use of the body to physically sense or observe the natural world. They emphasized that it was the mind which evaluated and interpreted the body's sensations.[413] However, the recent rise of mysticism, which privileged divine inspiration as the source of truth, and older knowledge systems like scholasticism, challenged experimentalists' claim that to know nature, one must make physical contact with it. It is not a coincidence, then, that experimentalism emerged in parallel with the colonial project, which was simultaneously gaining momentum. Many expeditions were launched for the purpose of discovering new flora and fauna.[414] As explorers sent plants, animals, and even people back to Europe for scientific study, the "discovery" of new species precipitated distrust in the ancient scholastic texts, which bolstered the case for empiricism.[415] In later periods, religious colonizers often justified the expense of missionizing by pointing to the additional

[413] Descartes was famously skeptical of the usefulness of the senses to making knowledge.
[414] Schiebinger, *Plants and Empire: Colonial Bioprospecting in the Atlantic World*.
[415] Grafton, *New Worlds, Ancient Texts: The Power of Tradition and the Shock of Discovery*.

work they did spreading scientific practices, such as agriculture, to "civilize" colonized people.[416] Kapil Raj has argued that colonized people frequently contributed their own knowledge of their local natural environments, willingly or not, and thus should be acknowledged as co-producers of modern science.[417] Across the globe, European imperialism was a project of territorial, political, ideological, religious, and *epistemological* expansion. During Sor Juana's life, the ideas which form the foundation of modern science—objectivity and empiricism—were still being hotly debated. And, seventeenth-century colonial Mexico, where she lived, was a crucible in which modern science was *becoming* encoded as European and male in relation to global colonial endeavor. But, the new empiricism and the attendant development of disembodied rationality also provided an opportunity to for women like to Sor Juana to use these epistemological changes to their advantage and argue for intellectual equality on the basis that their rational minds were free from the constraints of bodily sex.

I place Sor Juana in the academic genealogy of women of color in science. However, this may seem problematic from two perspectives. First, though Sor Juana and her works have been studied since 1700, when the first biography of her life was published, studies have focused on her contributions as a poet and playwright.[418] Sor Juana is not typically thought of as a natural philosopher. However, during her childhood, before she arrived at the viceregal court of Mexico City, Juana Ramírez had already expressed an interest in learning, writing, *and* nature. She learned to read by the age of three and is reported to have acquired Latin in just twenty lessons. Once literate, she set herself to read her grandfather's library. Juana's interest in

[416] Sivasundaram, *Nature and the Godly Empire: Science and Evangelical Mission in the Pacific, 1795-1850*.
[417] Raj, *Relocating Modern Science*; Raj, "Circulation and the Emergence of Modern Mapping: Great Britain and Early Colonial India, 1764-1820."
[418] Calleja, *Vida De Sor Juana*.

natural philosophy and experiment dates back to that time. In 1691 she described seeing several children playing with a top and the curiosity it inspired in her:

> scarcely had I seen the motion and the figure described, when I began, … to meditate on the effortless motus of the spherical form, and how the impulse persisted even when free and independent of its cause—the top continued to dance even at some distance from the child's hand, which was the causal force. And not content with this, I had flour brought and sprinkled about, so that as the top danced one might learn whether these were perfect circles it described with its movement; and I found that they were not, but, rather, spiral lines that lost their circularity as the impetus declined.[419]

Juana's intense interest in the natural world motivated her to experiment in order to gain an understanding of it. But given that the reigning epistemological framework was scholasticism, she also valued knowledge production through the study of authoritative texts. So, as a girl Sor Juana tricked her sister's teacher into giving her lessons at a parochial school in Amecameca, behind her mother's back.[420] Juana was more than precocious, she was determined to seek out intellectual spaces and avail herself of their resources.

As an adult, Sor Juana had known associations with other natural philosophers, notably mathematician Carlos Sigüenza y Góngora. She identified Athanasius Kircher, a German Jesuit and natural philosopher, as a source of intellectual inspiration and expressed a life-long interest in the natural world in her autobiographical letter, *Response to Most Illustrious Poetess Sor Filotea de la Cruz.*[421] Moreover, natural philosophical themes have been identified in her poetry, particularly her most intellectually ambitious and personal poem, *El Sueño*.[422] Sor Juana

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[419] Juana Inés de la Cruz, "Response," 41.
[420] Ibid., 13; Royer, "Tenth Muse," 145.
[421] Juana Inés de la Cruz, "Response." From this point forward I will refer to this letter as the *Response*.
[422] Beaupied, *Narciso Hermético*; Dixon, "The Geometry of Sor Juana Inés De La Cruz"; Castro López, *Sor Juana Y El "Primero Sueño"*; McKenna, "Rational Thought and Female Poetics"; Paz, *Sor Juana, Or, the Traps of Faith*; Sabàt de Rivers, *Estudios De Literatura Hispanoamericana*; There is much disagreement over the name of this poem. Here I use *El Sueño* (The Dream) as Sor Juana herself referred to it, before its publication, in her *Response* (1691).

scholars have provided us with numerous analyses of her cosmology. Many disagree about which natural philosopher most influenced her epistemology, based on the philosophical references in *El Sueño*. Ruth Hill has asserted that Sor Juana's cosmological views were in agreement with Pierre Gassendi as the poem rejects the Copernican, sun-centered, system but does not reject Johannes Kepler.[423] Susan McKenna classifies *El Sueño* as Cartesian because of its focus on method, mechanism, and its incorporation of Catholic doctrine.[424] Octavio Paz allies Sor Juana with Athanasius Kircher but ultimately declares her master work Neo-Platonist because of its reference to a Prime Mover and because she "never alludes to the discoveries of the new astronomy, and … her world has no clear outlines or precise limits … [and] distances are not only immense but immeasurable."[425] Historian of science Paula Findlen has also argued for Sor Juana's classification as a Kircherian.[426] Because Sor Juana expressed a strong interest in natural philosophy in her poetry and prose, and because she was actively engaged in the epistemological debates of the Age of Reason, I argue that it is appropriate to claim her as a figure within the history of science.

The second cause for care in claiming Sor Juana as a part of the intellectual genealogy of US women of color in science is that she was a Creole, born in Mexico to Spanish nobles.

However, when it was published in 1692 it appeared as *Primero Sueño* (First Dream). Some scholars have argued that this change was made without her consent by the publishers in Spain to indicate that the poem was unfinished and that a second dream would follow; See Paz, *Sor Juana, Or, the Traps of Faith*, 357; While *Primero Sueño* is usually translated as "First Dream" some scholars have argued that an equally valid translation might be "First I Dream"; see *Poems, Protest, and a Dream*, vii.

[423] Hill, *Sceptres and Sciences in the Spains*, 58.

[424] McKenna also argues that Sor Juana must have been familiar with Descartes and other philosophers through her close friendship with Mathematician at the University of Mexico, Carlos de Sigüenza y Góngora. McKenna, "Rational Thought and Female Poetics"; For more on Sor Juana's relationship with Sigüenza y Góngora see Leonard, *Baroque Times in Old Mexico*.

[425] Paz, *Sor Juana, Or, the Traps of Faith*, 383.

[426] Findlen, *Athanasius Kircher*.

Though her birth was illegitimate, which severely limited her social mobility and options, she was positioned near the top of the colonial social hierarchy. However, Sor Juana's significant social privilege requires intellectual caution. In naming her a "woman of color," I risk erasing Sor Juana's racial privilege in the colonial context. I am also in danger of disconnecting the theoretical construction of "woman of color" from the bodies of women of color. I heed Patricia Hill Collins' caution that, like Black feminist thought, women of color feminism must "[avoid] the materialist position that being Black and/or female generates certain experiences that automatically determine variants of a Black and/or feminist consciousness," and that we "must also avoid the idealist position that ideas can be evaluated in isolation from the groups that create them."[427] Thus, in claiming Sor Juana as a part of US women of color feminist history, I seek to strike a balance between ahistorically applying the category "woman of color" and its reclamation as a decolonizing act. In the 300 years since her death, Sor Juana has become an icon for intellectual and cultural production in Mexico. Within the current US political context, Mexicans and Mexican Americans occupy a highly racialized position. Given the esteem Chicanas, Latinas, and other women of color hold for Sor Juana today, I argue that it is appropriate to include her in our intellectual reclamations. Such reclamation allows us to mark race as a constructed category and work against deterministic frameworks which, as Collins has argued, "mask the historical construction of racial categories, the shifting meaning of race, and the crucial role of politics and ideology in shaping conceptions of race."[428]

[427] Collins, *Black Feminist Thought*, 21.
[428] Ibid., 20.

In this chapter, I argue that Sor Juana's engagement with the debate about the usefulness of empiricism resulted in an articulation of an epistemology of multiplicity, or to indicate the racial milieu of colonial Mexico, *mestizaje*. Using border theory and *feminista* spatial analytics, I argue that Sor Juana's use of public space and need for patronage was markedly different from that of male natural philosophers. Sor Juana took advantage of the physical permeability of the convent and manipulated the social rules which regulate that space to make knowledge about the natural world. In the colonial context in which she lived, she doubled sexist, religious, and rationalist rhetorics as a strategy to justify her right to study, read, and write as a woman and as a nun. Sor Juana's manipulations of space, hierarchy, and hegemonic discourses were decolonizing acts which represent her rejection of the emerging epistemological imperative of fragmentation. Finally, I situate my analysis of Sor Juana in history of science discourses which examine the "place of knowledge" as a method of de-universalizing scientific knowledge.

Epistemological *Mestizaje*

I argue that for Sor Juana there was no single natural epistemology, of the numerous debated during her life, that she preferred over the others. Her poem, *El Sueño* is often recognized as epistemologically rooted in the natural philosophical discourses of the age.[429] The poem documents Sor Juana's analysis of the great epistemological question of her time—what is the best way to understand the world: experience, study, or divine inspiration? It is also the

[429] Beaupied, *Narciso Hermético*; Dixon, "The Geometry of Sor Juana Inés De La Cruz"; Castro López, *Sor Juana Y El "Primero Sueño"*; McKenna, "Rational Thought and Female Poetics"; Paz, *Sor Juana, Or, the Traps of Faith*; Sabàt de Rivers, *Estudios De Literatura Hispanoamericana*.

only piece she claimed to have written for her own pleasure in her *Response* to Sor Filotea.[430] The poem follows the lyrical tradition of a mystical flight of the soul used by many poets, but most commonly associated with Dante's *Divine Comedy*. In the first phase of the poem, the soul ascends from the quiet darkness of night on earth, over the mountaintops through the heavens, and towards the sun. As the soul rises it begins to see the natural world with more clarity. In the portion of the poem that Octavio Castro López calls the "physiological journey," the soul demonstrates its understanding of human physiology and its appreciation for Galen. In the poem's "philosophical" section, Sor Juana expressed her thoughts on scholasticism, or what she calls "study," and empiricism. The soul attempts to understand all things from the lowest rung of the great chain of being to the highest, God. But, disillusioned with the sheer volume of all there is to know and understand, the soul finds reason insufficient to understand God. In the final phase of the poem, the soul begins its descent back to earth and to its body and slowly wakes up.[431]

The soul in *El Sueño* ponders the merits of scholasticism and experiment, but settles on neither. For example, Sor Juana makes numerous references to the spheres, the Prime Mover (line 409), and later to Aristotle's qualities (line 526) and his hierarchy. Throughout the poem the cosmos that she paints, while not consistently so, remains Aristotelian, as the Scholastics advocated. But, Sor Juana was clearly influenced by the emerging concept of disembodied objectivity advocated by experimentalists: "… the soaring intellect that now, / unchecked [by earthly concerns], measures the vastness of the Sphere, / observes the harmonious, / though

[430] Juana Inés de la Cruz, "Response," 65.
[431] Castro López, *Sor Juana Y El "Primero Sueño"*; McKenna, "Rational Thought and Female Poetics"; Juana Inés de la Cruz, "Response," xxxix.

richly various, rotation / of heavenly bodies /."[432] For Sor Juana, it was the soul, freed from its body, which was capable of measuring and observing nature. But, in her estimation, experiment on its own was limited in its capacity to elucidate nature's structure: "by observing everything, it [the soul] saw nothing, / nor could it separate [the structures of the universe] / (its intellectual faculties dulled / before the great, diffuse, / and incomprehensible variety / it beheld …"[433] Even freed from the body, the vastness of nature was simply unintelligible to the soul; it saw nothing. The soul then turns back to the scholastic worldview, and particularly to its emphasis on categorization:

> There, thwarted in her operation, / it seemed advisable / to … / ponder, one by one, the things combined / within ingenious / Categories, ten / in Aristotle's postulation, / metaphysical reduction teaching / (the type and genus of all entities/ established solely in mental fantasies, / in which abstract reasoning prizes / essence above matter) / how science is educed from universals, / and, with experience, / emends the defect / of the inability to comprehend / through intuition all creation / and, instead, constructs a ladder leading / from one concept to another, step by step, / ascending to the order, relative, of / comprehension imposed / by limitations of human intellect, which entrusts / its progress to sequential reasoning; /[434]

In agreement with the scholastic paradigm, Sor Juana celebrated Aristotle's categories and of reason which became useful when the soul's own analysis of the natural world stalled because of the "limitations of human intellect." But Sor Juana also advocated experiment, referred to here as "experience," as necessary to supplement categorization. Contrasting the Aristotelian paradigm which valued "essence above matter," with the ability of the new empirical science to "emend the defects" in the older knowledge system, Sor Juana challenges the scholastic epistemology of study. Despite the promise of experiment, she still valued study, and the

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[432] Juana Inés de la Cruz, "El Sueño," lines 301–305, pp. 93-95. Note: I have used the bilingual edition of the poem so that I can compare to the original Spanish, though my analysis presents the English.
[433] Ibid., lines 480–486, p. 103; For example see the debate between Robert Boyle and Thomas Hobbes in Schaffer and Shapin, *Leviathan and the Air-pump: Hobbes, Boyle, and the Experimental Life*.
[434] Juana Inés de la Cruz, "El Sueño," lines 575–599, p. 109.

doctrine contained within traditional texts as epistemologically valuable. For example, the above passage continued with an additional critique:

> doctrine nurtures these feeble forces/ with nourishment of erudition / and preserving, / punctilious, but pleasant, discipline, / instilling vigorous encouragement, / with which, emboldened, / the Soul, to the most / golden laurels may aspire, ascend / the soaring rungs of the most arduous / devoir—calling on one, and then another / branch of knowledge—until, surprised, / she spies the lauded crest, / the treasured terminus to her endeavor … / and with triumphant tread / steps onto the mountain's lofty heights.[435]

For Sor Juana it was not simply categorization alone that led the soul to her "treasured terminus", but its enhancement with doctrine and discipline. The best epistemology was one which incorporated the scholastic values of doctrine and discipline with the new empirical value of experience, through experiment, in order to bridge the gaps in "human intellect."

While Sor Juana valued a well-rounded science that relied on multiple methods of knowledge production, she was cautious about the universal usefulness of experiment and disembodied reason. Unchecked, she feared these could lead to epistemological and spiritual arrogance:

> [Pyramids] in their paired symmetry, / increased in stature as / they decreased in girth, both with such artistry / that … / despite a lynx-eyed observation, / they vanished, lost high among the winds; / … appeared to touch the nearest / star so far from view, the questing eye, / exhausted now, … / plunged back earthward, to the base, where/ it awakened, more or less, / from not insubstantial / dizziness, a punishment / for having ventured to give vision wings;[436]

Here she admonished those who "ventured to give vision wings," perhaps in the form of a telescope, as Kircher did in his *Oedipus Aegypticus*. According to Sor Juana, some things were simply beyond human reason. In the end, Sor Juana and her dream's soul were skeptically appreciative of both study and experiment as ways of understanding the world. Likewise, in

[435] Ibid., lines 600–616, pp. 109-111.
[436] Ibid., lines 354–368, p. 97.

some instances, Sor Juana called on disembodied reason, the new Cartesian mandate to fragment and position one's self outside the influence of the body and society. But, in other cases she quite clearly preferred embodied, physical connection with the material resources of the world. Mirroring Sor Juana's own experience, the soul in *El Sueño*, is described as liberated from corporeal constraints through the solitude of sleep.

> Being, then the body/engaged by deep and welcome sleep/…The soul, then, freed from/ governing the senses…/the gift of vegetative warmth, the mortal/ shell in restful lassitude, cadaver,/ yet with a soul imbued,/ …The Soul, in turn, transmuted into/ beauteous essence and discarnate being,/ …judging she is nearly free of all/ that binds her, keeps her from liberty,/ corporeal chains/ that vulgarly restrain and clumsily/ impede the soaring intellect that now, unchecked, measures the vastness of the Sphere,/…[437]

Sor Juana negatively identifies the body with unintelligent vegetation, death, vulgarity, and restriction. It is the soul which is "beauteous," free, and intellectual. More specifically, it is the disembodied soul which studies the natural world, referred to in this passage as the "Sphere." While the poem's soul is most certainly solitary, Sor Juana situates that solitude in the context of sleep and suggests that it is through dreaming that the soul is freed from the body to explore the God's divine creation.

I argue that in *El Sueño*, and her other writings, Sor Juana advocated an epistemology which resisted the seventeenth-century version of what Chela Sandoval has called the "apartheid of academic knowledges."[438] In the context of colonial Mexico, which was itself a mixture of races and cultures, her knowledge system embraced the best of each of those she had encountered. Thus, Sor Juana's epistemology might best be described as epistemological

[437] Ibid., lines 166–167, 192–193, 200–202, 292–293, 297–302, pp. 87-93.
[438] Sandoval, *Methodology of the Oppressed*, 4.

multiplicity or *mestizaje.*[439] She did not settle on any one method of knowledge production, but instead preferred to have them all at her fingertips because she understood that the diversity of all there is to know and understand requires a diversity of epistemologies. Sor Juana's epistemological *mestizaje* was facilitated by the, as yet, unsettled epistemological milieu of the seventeenth century. For Sor Juana, her understanding of multiplicity extended not only to her epistemological preferences but also to her broad interests, which encompassed poetry, drama, natural philosophy, and theology.

From the Court to the Convent

Sor Juana's epistemological *mestizaje* may have emerged in parallel with her subjectivity as a multiply marked individual, particularly within the space of the court. Because of Sor Juana's multiplicity, her options were severely limited by the social meanings inscribed on her body in the public space of the viceregal court. For her, embracing her multiplicity and retreating to the female space of the convent was her route to making knowledge. She could appear fragmented to the outside world because her body was quite literally hidden, but as we see in *El Sueño*, she was aware of the epistemological importance of her body which was her connection to books, pen, paper, and experiment.

Unmarriageable because of her illegitimate birth, Juana was sent by her well connected relatives to the viceregal court in Mexico City to serve as a lady-in-waiting to the vicereine Lady Leonor Carreto in order to protect her "virtue." Because of the widespread perception of sexual and racial decadence, the cultural climate in colonial Mexico was more religiously

[439] Martínez-San Miguel has also shown that Sor Juana's carols, which were written using multiple voices, including the accented speech of African slaves and native peoples, expressed a multiplicitous colonial identity. Martínez-San Miguel, *Saberes Americanos: Subalternidad Y Epistemología En Los Escritos De Sor Juana*.

restrictive than was Spain's. The virtue of noble women like Sor Juana was strictly regulated. Born out of wedlock, Juana, in particular, represented a threat to Spanish racial "purity," because her options for marriage would have been limited to those of a lower social or racial status. At court, Juana's sexuality was safely contained. As a young woman with intellectual aspirations, the court was also an excellent space for her to indulge her curiosities because it was used for the intellectual entertainment of the viceroyalty. Though she was exposed to the most prominent scholars in the New World, for her, intellectually stimulating discussions at court were not simply about lively debate. The court turned out not to be a good place from which to produce knowledge for Juana because her presence as an intellectual young woman was made into a spectacle.

Unfortunately, Juana's objectification at the viceregal court prevented her from achieving fragmentation, which eventually undermined her epistemological privilege thereby limiting her scholarly activities, particularly with respect to natural philosophy. At court, an intellectual woman became a curiosity that bordered on the unnatural, one that was rarely, if ever, taken seriously. For example, in his laudatory 1700 biography, Padre Diego Calleja recounts an episode in which then viceroy, the Marqués de Mancera, sought to verify Juana's intelligence and impress the Creole and Spanish intelligentsia with his feminine novelty. In order to "disillusion himself at once and know if her wisdom was wonderful [mystical], inspired, acquired, artificial, or unnatural," the Marquès gathered some forty learned men to the court:

> … and in the professions were various theologians, scriveners, philosophers, mathematicians, historians, poets, humanists, and not a few of those who, with allusive cleverness, we will call tertulios [wise men], those, not being cursed by destiny to the faculties, with their great genius and some application, usually make, not in vain, a very good judge of everything. Such distinguished and clever men, they did not disdain the

> youth (Juana Inés was no more than sixteen years old) of the girl to be examined rather than combated, nor did they even avoid the impolite scientific contest, inappropriate for a woman; they were Spaniards. They gathered, then, on the designated day to debate with such curious admiration, and the Lord Marqués attests that what he saw was beyond human belief, he says that like a royal galleon (translating the words of his excellence) she defended herself from the few canoes with which they attacked her, and proved herself, Juana Inés, against the questions, arguments and retorts, that they all, each from his discipline, proposed.[440]

Because science and debate were in the process of being constructed as inappropriate for women, Sor Juana's abilities made her an exception which proved the emerging rule.[441] And, in the colonial gendered social order, women's sexuality was deeply linked with racial panic among Creoles and Spaniards about miscegenation with indigenous, African, and *mestizo* populations. Within María Lugones' framework, Juana's potential to create children marked by race, marked her as a "thick" member of society. Her performance earned her a place in the public eye, as well as the loyal support of the viceroyalty, and positioned her to be able to continue her scholarly performances even after she left the court. In contrast to male natural philosophers, like Galileo, for example, the court was not a place where Sor Juana's ideas could gain status or audience because of the high position of her patrons. Instead, the court elevated *itself* by containing such a fascinating living curiosity in its cabinet.[442]

After five years as a lady in waiting, Juana developed a deep disdain for courtly life.[443] Sor Juana's *Trials of a Noble House*, performed at the Laguna court in 1683, demonstrates her

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[440] Calleja, *Vida De Sor Juana*, 16–17 [author's translation].
[441] For more on how science developed in opposition to women's participation see Schiebinger, *The Mind Has No Sex?*.
[442] See Findlen, *Possessing Nature: Museums, Collecting, and Scientific Culture in Early Modern Italy* on the phenomena of courtly curiosity cabinets.
[443] Boyle, "Los Empeños De Una Casa by Sor Juana Inés De La Cruz," 235; Johnson, "Engendered Theatrical Space," n.p.

contempt for life among the noble class.[444] Octavio Paz described the general format of the play succinctly: "*A* falls in love with the beautiful *B*, but at the masked ball, or in the shadows of the garden by night, he confuses her with *C*; meanwhile in the darkness, *B*, who actually loves *A*, takes him for *D*, who loves her but is abhorred by her. Fate shuffles the cards again and again, until truth triumphs."[445] *Trials* is not overtly critical of gender or social hierarchies, perhaps because the viceregal palace had been Juana's home, one that she returned to between her brief stay at the Convent of the Barefoot Carmelites and her final home at San Jerónimo. It would have been unwise to bite the hand of the patrons who supported her so loyally.[446] However, feminist interpretations of the play have shown that it subtly inverted gender hierarchy through juxtapositions of female and male spaces, challenges to patriarchal authority, and cross-dressing. Catherine Boyle has argued that what Octavio Paz interpreted as the play's "empty perfection," is more accurately a reflection of Sor Juana's disdain of the "empty perfection" of courtly life. Boyle pointed to Sor Juana's use of a male actor cross-dressed as a woman in one of the play's farcical interludes as a device to call the audience's attention to the superficiality of female power within the court and noble women's complicity in their own subordination.[447] The play's main female protagonist, Doña Leonora, named after Sor Juana's patron, is frequently considered a dramatic caricature of Sor Juana herself. Like Sor Juana, Doña Leonora contends with "male characters … intent upon entering space designated as a woman's

[444] The Marques de la Laguna, Conde de Paredes and his wife, were the viceroyalty in Mexico City from 1680 to 1686. The Laguna viceroyalty continued their patronage of Sor Juana as their predecessors, the Marques and Marquesa de Mancera had.
[445] Paz, *Sor Juana, Or, the Traps of Faith*, 327.
[446] Ibid., 108.
[447] Boyle, "Los Empeños De Una Casa by Sor Juana Inés De La Cruz," 235; Johnson, "Engendered Theatrical Space," n.p.

… [while she is] faced with trying to avoid being trapped."[448] While Doña Leonora seeks to escape the control of her father and sexual violation by an aggressive suitor, Sor Juana sought to escape the paternal control of the court and by the time she wrote the play, in 1683, the unwanted intellectual intrusion into her female intellectual space by her confessor, Padre Antonio Núñez de Miranda. Julie Greer Johnson has argued that *Trials* "dramatizes the need for women to … not only develop interior space fully but to endeavor to extend their influence into exterior space."[449] As an illustration of Sor Juana's feelings about the court, *Trials* demonstrates that she found life there superficial, excessively theatrical, and limiting with regard to women's independence and their intellectual pursuits.

Sor Juana's heightened visibility as a very young and intelligent woman in the racialized social climate of colonial Mexico prevented her from being able to produce knowledge about nature at court. In the context of the seventeenth century, only white, Western European, gentle- or noble-men could achieve the fragmented state that allowed them to perform being outside of society transparently. All others, like Sor Juana, were "thick," nontransparent. Thus, the problem for Juana at court was connected to her sexualized body which represented a threat of racial decadence and marked as multiplicitous. In the midst of what she perceived as shallow men and women who had no respect for her intellectual aspirations, and given her limited prospects for marriage, Juana sought an alternative for her future. As she got older, her opportunities for higher learning and continued interaction with the learned men she had met at court would be limited. She knew that even if she could somehow find a noble man willing to

[448] Johnson, "Engendered Theatrical Space," para. 12.
[449] Ibid., para. 17.

marry her, as a wife, there would be no space for studying.[450] She could not stay at court forever and could not go to university. Juana's mother, Isabel Ramírez had, years before, turned down her childhood request that she be dressed as a boy and sent to the University.[451] Thus, she concluded that "given the total antipathy I felt for marriage, I deemed convent life the least unsuitable and the most honorable I could elect if I were to ensure my salvation" and argued that it would not "inhibit the freedom of my studies, nor … intrude about the peaceful silence of my books."[452] Unwilling to enter into an illicit relationship or marry below her station, and unwilling to give up studying, profession of monastic vows was, in Juana's view, the best chance she had to create an intellectual space.

The convent offered Sor Juana the material, social, and epistemological resources she needed. Sor Juana's patrons played a key role helping her gain entry to exclusive convent space which was in short supply in colonial Mexico. Fears about racial miscegenation led Spaniards and Creoles to place their daughters in convents until they were ready to be married as a measure to preserve their "purity." The resulting shortage made the cloisters inaccessible for all but the most elite women who could afford the large dowries required for entry.[453] While Juana did not have the money to finance her profession, with the help of her patrons, she was able to win the financial backing of Don Pedro Velázquez de la Cadena in 1667 to pay the 3000 pesos required as a dowry at the convent of the Barefoot Carmelites.[454] But, after only three

[450] Robert Boyle experienced much the same problem as a gentleman in 17th Century England. The space in which he worked was bound by social conventions that prevented him from achieving the solitude he required for study. See Shapin, "The House of Experiment in Seventeenth-Century England."
[451] Juana Inés de la Cruz, "Response," 15.
[452] Ibid., 17.
[453] Schons, "Some Obscure Points in the Life of Sor Juana Inés De La Cruz," 38–60.
[454] Paz, *Sor Juana, Or, the Traps of Faith*, 108.

months, Sor Juana's health was failing and, finding the order too restrictive, her patrons again came to her aid, this time placing her with the more permissive and aristocratic Hieronymite order at the Convent of Santa Paula, known as San Jerónimo.[455] San Jerónimo allowed Sor Juana outside social contact through its choir grate but also provided her with individual solitude in her cell which was less than ascetic, though there were others more lavish at San Jerónimo.[456] In his biography of Sor Juana, Octavio Paz described the cells at the Convent of San Jerónimo as consisting of two floors: "Each cell had a bathroom, kitchen and sitting room in addition to sleeping quarters. Some were larger still. In truth, the convents were small cities and the cells were apartments or even at times, small houses constructed around enormous patios."[457] According to Paz, Sor Juana purchased her cell in 1691 which was a corner room with "a large window in the room on the second floor so that on clear days, which most were, Sor Juana could see the Valley of Mexico and the two volcanoes of her childhood." In her cell with a view, she kept a library reputed to consist of some 4000 volumes, scientific and musical instruments, and a mulatta slave as her assistant.[458] San Jerónimo's loose interpretation of the monastic vow of poverty allowed Sor Juana to create a solitary physical space within her cell that she was able to use to create knowledge.

The four holy vows—poverty, chastity, obedience, and enclosure—played an important role in the social economy of the convent. The vow of poverty was necessary to ensure obedience, which in turn was required to impose chastity, while enclosure created an

[455] Gomez notes in Calleja, *Vida De Sor Juana*, 35.
[456] Leonard, *Baroque Times in Old Mexico*, 182; Amerlink de Corsi, "El Convento De San Jerónimo En Tiempos De Sor Juana Inés De La Cruz (1668-1695)," 80.
[457] Paz, *Sor Juana, Or, the Traps of Faith*, 120.
[458] Ibid., 128.

environment in which the vows could be enforced. By eliminating personal attachments to worldly things, the vow of poverty erased individual identity and subjugated personal will to the convent leadership and to God. Individuality was further reduced by taking a new name, the uniformity of the habit, strict adherence to daily rituals, communal eating, isolation from the outside world, and, in some convents, a lack of personal sleeping space. Thus, each of the vows worked with the others to ensure conformity within the space of the convent.[459]

Historians of convent culture have shown that while the rules regulating nuns' interaction with the secular, outside world were indeed strict, monastic sisters were often in contact with it directly or indirectly. This communication included personal letters or the exchange of books, direct personal interaction with family and friends, and, more infamously, illicit sexual relationships. Contact was restricted but did take place and was embodied in the architecture of the convent itself.[460] Though many monastic women had lived in *de facto* cloistered communities since the Middle Ages, the Council of Trent imposed the strict cloister on convents in 1563. Prior to that, monastic men and women had lived according to the same set of rules. Enclosure of female conventual spaces required the reconfiguration of monasteries to keep the nuns inside and both lay and monastic men outside. But, because women were considered spiritually inferior to men, nuns required male intermediaries, confessors and priests, to aid them in their communion with God, while monks did not.[461] Special confessionals that straddled the enclosure's boundary had to be constructed and a segregated space within

[459] Smith, *Ordering Women's Lives*, 121, 166; Some women of noble heritage, like Sor Juana, kept their given names indicating their continued association with the outside world. See Lowe, *Nun's Chronicles and Convent Culture*, 162.
[460] Echániz Sans, *Las Mujeres De La Orden Militar*; Lavrín, "Unlike Sor Juana?"; Evangelisti, "Monastic Poverty and Material Culture in Early Modern Italian Convents."
[461] Smith, *Ordering Women's Lives*, 114.

the church or cathedral was created so that nuns could attend the required daily mass.[462] It is this space, called the choir, which connected the cloister with the outside world, a decorative grille or grate marked the boundary. Key keepers within the convent prevented unauthorized breaches.[463] The enclosure of the convents necessarily created spaces where contact with the outside world was possible and the grate was the point through which that contact was mediated. Its purpose was to allow nuns to hear mass, but it became a social space which allowed cloistered women to visit with family and friends, or in Sor Juana's case, with patrons or other intellectuals.

Several spaces within the convent provided natural laboratories for those as inclined to experiment as Sor Juana. The physical structure of convents typically consisted of a church or cathedral; the attached choir with its grate; dormitories or individual cells; a communal eating area; a kitchen; an infirmary; a charter room for the discussion of conventual business; a crypt or graveyard; and an orchard or garden where fruits, vegetables, and medicinal herbs were grown.[464] Furthermore, because nuns were often responsible for the education of young girls, they were required to know how to read, write, sing, and play musical instruments. The acquisition of books was justified by their educational value, but they served the dual purpose of providing access to the culture and society of the outside world. Access to books made convents a unique space of female literacy within the Early Modern world as women were generally excluded from universities. Because many books during the period were only

[462] Echániz Sans, *Las Mujeres De La Orden Militar*, 255.
[463] Of course, occasionally men—doctors, surgeons, or confessors—were required to enter the enclosure usually for the purpose of ministration to the deathly ill or administration of their last rites. When these were permitted entry, they were to be accompanied and the nuns were not to touch or make eye contact with the male visitors. Ibid., 253–256.
[464] Lowe, *Nun's Chronicles and Convent Culture*.

available in Latin, which the majority of the nuns did not read, translation into the vernacular language was also justified.[465] Far from the isolated cloisters we imagine them to be, convents played an important role in the translation, preservation, and circulation of scholastic knowledge in Europe during the Middle Ages—all of which hinged on the permeability of its cloister at the point of the choir grate. For Sor Juana the convent had excellent potential as a space for the production of natural knowledge because of the enforced solitude and the availability of various make-shift "laboratories"–kitchen, infirmary, crypt, garden—contained within its walls.

For Sor Juana, the choir grate, which separated the cloister from the public cathedral, carried the productive power of a border. Similar to the border between nation/states Alicia Arrizón describes, it "function[ed] as an amorphous and porous third entity" through which meaning and constantly shifting identities were made. [466] Sor Juana was made into a nun, a poet, a sinner, or a philosopher depending upon who was waiting for her on the other side of the grate. Keenly aware that these identities were at times at odds with one another, she used her physical relation to the border on the "in" side to argue for her intellectual rights on the other, "out" side. That is, her position inside allowed her to make arguments about women's intellectual abilities that she would not be free to make on the outside, particularly with respect to natural philosophy, a potential threat to the church in the climate of the Inquisition. The grate granted Sor Juana access to the outside intellectual world, simultaneously providing her

[465] According to María Echániz Sans, convents played an important role in the translation and movement of books from the elite Latin based universities to the general public. This typically occurred when nuns left the convent to marry and took translated books with them. Further, she argues that nuns played a special role in the proliferation of women's literacy as girls educated in convents left to marry and taught their own daughters to read. Echániz Sans, *Las Mujeres De La Orden Militar*, 247–252; See also Smith, *Ordering Women's Lives*, 121.
[466] Arrizón, *Queering Mestizaje*, 61.

protection from church authorities. The grate served as both the material demarcation of the physical space of the convent and the source of the various metaphysical hyperspaces she created.

Inside the convent, Sor Juana created what Emma Pérez calls "that interstitial space where differential politics and social dilemmas are negotiated."[467] In contrast to the viceregal court, the restrained "peaceful silence" the vows created within the convent was precisely what Sor Juana needed to focus on her studies and create the intellectual space she so desired. By removing her body from the court, she was able to achieve more transparency to legitimate her intellectual contributions. Because her intellectual space was not contiguous with the physical space of the court, she used the grate's permeability to metaphysically extend her intellectual world beyond the walls of the convent to the court without physically transgressing her vow of enclosure. This allowed her a sort of metaphysical access to the social benefits of the court, such as patronage, while also allowing her to obscure her multiplicity within the walls of the convent. The convent facilitated Sor Juana being taken seriously as an intellectual because, from the perspective of the court, it allowed her to more fully fragment herself. However, I suggest that Sor Juana's retreat to the convent should be seen as a move toward multiplicity because it allowed her to articulate and deploy her epistemology of *mestizaje* which allowed for embodied knowledge production. The grate allowed her work to circulate, and literally hid her marked body from the space of the court, but it also gave her access to a set of rhetorics which she could use to justify her scholarly activities. It was from this third space created by the

[467] Pérez, *The Decolonial Imaginary*, 6.

grate that Sor Juana challenged sexism and colonial control of women's bodies by advancing a sustained argument for women's intellectual equality.

Epistemological Self-Defense

Sor Juana used her position inside the convent to pursue her own scholarly interests and to articulate a proto-feminism that insisted on women's rights to study. Physically removed from the political space of the court, Sor Juana could be quite radical in her poetry. For example, in her "Philosophical Satire," (1689) she directly addressed "misguided men," in the second person calling them "foolish" and "arrogant." In the same poem she defended prostitutes, asking men: "Whose is the greater guilt therein / when either's conduct may dismay: / she who sins and takes the pay, / or he who pays her for the sin?"[468] She uses the familiar form of address throughout the poem. This is evidence that Sor Juana placed herself on the same social level as men. Though she ably defended her right to produce knowledge, both literary and natural, eventually her radicalism ensnared her in local religious politics. In this section I analyze Sor Juana's management of two crises which demonstrate the strategies she used to defend her right to study. First, in 1681, her confessor, Padre Núñez de Miranda, publicly criticized her for her scholarly activities. She responded with a long letter, now called the *Spiritual Self-Defense*. Then in 1690, her scholarship was used for political gain by a supposed friend of hers. She wrote the famous *Response* at that time. In each of her responses to the criticism of her intellectual work, her feminism was more subdued than the poem above. She advanced cautious, reasoned arguments for women's intellectual equality.

[468] Original Spanish: "¿O Cuál es más de culpar, / aunque cualquiera mal haga: / la que peca por la paga, / o el que paga por pecar?" "A Philosophical Satire," in Juana Inés de la Cruz, *Poems, Protest, and a Dream*, 150.

Sor Juana's *Spiritual Self-Defense* is more than an argument about reading and writing. It advocates women's free access to knowledge, natural and otherwise. Sor Juana used the letter to assert the rights of women to study both scriptural and "heathen" works. To justify such a radical proposition, and rebut Padre Núñez's concern for her salvation, she argued that Saint Augustine and Saint Ambrose studied the heathen philosophers and managed to remain sufficiently holy as to be sainted. Making the argument that women and men are intellectually and spiritually equal, she reminded her confessor that studious women such as Saint Catherine, Saint Gertrude and Saint Paula all managed to balance study with piety. Defiantly, she asked Padre Núñez "Do books hinder only my salvation?" Finally, Sor Juana challenged both male supremacy and church doctrine by asserting that she could look after her own soul:

> God, Who created and redeemed me and Who has bestowed so many mercies upon me, will supply a remedy in order that my soul, awaiting His kindness, shall not be lost even though it lack the direction of Y[our] R[everence], for He has made many keys to Heaven and has not confined Himself to a single criterion; rather, there are many mansions for people of as many different natures, and in the world there are many theologians, but were they lacking, salvation lies more in the desiring than in the knowing, and that will be more in me than in my confessor. What obligation is there that my salvation be affected through Y[our] R[everence]? Can it not be through another? Is God's mercy restricted and limited to one man … ? Surely not, nor up to now have I received special light or inspiration from God that He so orders; I shall therefore be able to govern myself by the general rules of the Holy Mother Church, until God enlightens me to do otherwise …[469]

Sor Juana argued, with a dangerously protestant rationality, that there was more than one path to salvation and that God was accepting of many different kinds of people. In keeping with her Jesuit inspired epistemological persuasion she argued that salvation was not limited by knowledge, but guaranteed by desire. Finally, in her most daring move, she challenged Padre Núñez's paternal authority over her salvation and argued that she was capable of following the

[469] Sor Juana quoted in Paz, *Sor Juana, Or, the Traps of Faith*, 502.

rules without his direction. For Padre Núñez, Sor Juana's direct challenge to his authority was also a challenge to the vow of obedience upon which the social and political economy of the convent rested. It was such transgressions of her holy vows that Núñez was angry about.

Within the framework of border theory, Sor Juana's reading and writing, her discussions across the grate, and the circulation of her work all marked transgressions of her vows to enclosure, poverty, and obedience. Given that her ability to engage in these activities was dependent upon the choir grate, they can be seen as a kind of "illegal" border-crossing. Her loose interpretation of the monastic vows allowed her to bring numerous books into the convent through the grate. Little is known about exactly how she acquired her library, however Irving Leonard argued that Carlos Sigüenza y Góngora likely brought both books and instruments to her as he lived only two blocks from San Jerónimo and visited Sor Juana often.[470] In his biography, Padre Calleja insisted that the books were donated by "whoever printed one," though he was inclined to make this distinction because if she had purchased them she would have broken her vow of poverty.[471] Sor Juana also used the grate's permeability to move her own work out of the conventual space as when she handed the manuscript of her *Inundación Castálida* through it to a patron of hers, the Condesa de Paredes, who took the work to Spain for publication in 1689.[472] Sor Juana never physically violated her cloister but she took advantage of the grate in order to extend her intellectual space beyond San Jerónimo's walls and resist the mandate by Núñez not to study.

[470] Leonard, *Baroque Times in Old Mexico*, 182–183.
[471] Calleja, *Vida De Sor Juana*, 23.
[472] Kirk, *Convent Life in Colonial Mexico: A Tale of Two Communities*, 143.

Sor Juana directly addressed her metaphysical violation of the cloister in her *Spiritual Self-Defense*. But rather than justifying her own transgression of the grate, she recast the argument in terms of her right to study. She asked Padre Núñez: "Why must it be wicked that the time I would otherwise pass in idle chatter before the grille [grate], or in a cell gossiping about everything that happens outside and inside the house, or quarrelling with a sister, or scolding a hapless servant, or wandering through all the world in my thoughts, be spent in study?"[473] She identified "chatter before the grille" and allowing the mind to wander outside the convent as wicked, but only when done idly. She did not see her discussions with learned men and the viceroyalty before the grille as superficial, but as purposeful and scholarly. And, as I will describe below, when her mind *did* wander, like the soul in *El Sueño* did, it was not absently, but purposefully in the quest for knowledge. Sor Juana's loose interpretation of her vow of enclosure meant that her intellectual space constituted no transgression of the cloister imposed by the grate—her mind and soul were free to wander the world through the pages of her books or by the power of her own thoughts so long as she remained physically enclosed in the convent and did so for the purpose of enlightenment. But, the scandals surrounding her writing indicates that such transgressions were seen as problematic by her superiors. And so, Sor Juana was put on the defensive. The primary rhetorical and performative strategies she used to justify her border-crossing fit within what historian, Emma Pérez calls the "dialectics of doubling." Like Pérez' revolutionary women several hundred years later, Sor Juana "mimicked men's ideas, in essence, agreeing …[but] performed activities in [her] own way, often

[473] Juana Inés de la Cruz, "Spiritual Self-Defense," 499.

expressing an interstitial feminism—that is a feminism which intervened subtly ….”[474] In fact, Sor Juana doubled multiple discourses—sexist, religious, and rational—in order to maintain her solitary intellectual space and to argue for women’s intellectual equality.

In her *Spiritual Self-Defense* Sor Juana strategically doubled the church’s doctrine of obedience. Addressing Padre Núñez’s critique of the appropriateness of a literary career for a nun, she argued that she never wrote for her own pleasure but at the repeated request of her patrons, the archbishop and the viceroyalty of both Mexico and Puebla, all of whom had great authority over her. These requests were made, she argued, because her God-given talents had become well-known during the time she was at court. Though she had turned them down several times, Sor Juana feared that if she continued to decline the requests of such elevated men, she would appear impudent and disobedient; “In the end I could not but obey.”[475] Even from inside San Jerónimo, Sor Juana’s patrons, who used their status to help her gain access to the limited convent space in colonial Mexico, demanded continued artistic performance from her—Sor Juana had to keep a public face. But, in order to stay out of trouble with church authorities she carefully acted out scorn for the public performances required by her patrons. Calling on her vow of obedience Sor Juana doubled her religious vows, justifying her metaphysical transgression of the border/grate by arguing that her vow of obedience compelled her to write when her superiors asked her to do so. She subtly intervened in church patriarchy by deflecting Padre Núñez’ anger at her disobedience of his authority, and emphasizing her deference to those who had an even higher social status.

[474] Pérez, *The Decolonial Imaginary*, 59.
[475] Juana Inés de la Cruz, “Autodefensa Espiritual.” Author’s translation.

The second, and perhaps larger, scandal Sor Juana faced began when the Bishop of Puebla, Manuel Fernández de Santa Cruz, a "friend" of hers, asked her to write a critique of a sermon by the celebrated Portuguese Jesuit, Padre Antonio Vieyra. Vieyra was a friend of the Archbishop of Mexico, Padre Francisco Aguiar y Seijas. Sor Juana complied and sent her critique to Fernandez de Santa Cruz in a private communication, now called the *Athenagoric Letter*. But, the bishop had no intention of keeping the letter private. He used the letter to shame and anger Aguiar y Seijas, a political enemy, by publishing Sor Juana's critique as evidence of his loss of control over the women under his charge. Fernandez de Santa Cruz added a cover letter to Sor Juana's work praising her critique of Padre Vieyra but condemning her for forgetting her feminine modesty and neglecting her monastic duties. The bishop signed this cover letter "Sor Filotea de la Cruz," to protect his own identity. He then sent both Sor Juana's letter and his condemnation of her to the Archbishop in 1690. In the aftermath of the debacle Sor Juana wrote her *Response* and explained:

> I have never deemed myself one who has any worth in letters … what capacity of reason have I? … Leave these matters to those who understand them; I wish no quarrel with the Holy Office, for I am ignorant, and I tremble that I may express some proposition that will cause offense or twist the true meaning of some scripture.[476]

Having humbled herself to the authority of the church and established herself as an ignorant woman, she argued: "I do not study to write … but only to the end that if I study, I will be *ignorant of less*."[477] In the face of the very real possibility of harsh punishment from the Inquisition, Sor Juana doubled the sexism of the church authorities by feigning the ignorance of femininity.

[476] Juana Inés de la Cruz, "Response," 11.
[477] Ibid., 11 [Emphasis Added].

In her *Response* Sor Juana also doubled the theological division of labor. She asserted that because a nun's duties include the education of children, she should not remain an ignorant woman.[478] Even more boldly, she reminded Fernandez de Santa Cruz that study and piety are not incompatible. As in her *Spiritual Self-defense*, she cited several scholastic women who had been canonized by the Church: "How are we to view the fact that the Church permitted a Gertrude, a Santa Teresa, a Saint Birgitta, the Nun of Agreda, and so many others to write?"[479] Keeping her ego in check, and anticipating the bishop's rebuttal, she went on to urge "if they say to me that these women were saints, they speak the truth; but this poses no obstacle to my argument. …We see, too, that the Church allows women who are not saints to write, for the Nun of Agreda and Sor María de la Antigua are not canonized, yet their writings are circulated."[480] The history of scholarly church women and the circulation of monastic women's writings, Sor Juana reasoned, demonstrated that writing was not considered a violation of the vow of enclosure. Because their bodies remained cloistered, María de Agreda and Sor María de la Antigua's intellectual circulation beyond the walls of the convent was merely metaphysical. Moreover, if Sor Juana strategically used the notion of "piety" along with the dominant sexist ideology to justify her studies to the Church officials:

> And so I continued, as I have said, directing the course of my studies toward the peak of Sacred Theology, it seeming necessary to me, in order to scale those heights, to climb the steps of the humans sciences and arts; for how could one undertake the study of the Queen of the Sciences [theology] if first one had not come to know her servants? How, without Logic, could I be apprised of the general and specific way in which the Holy Scripture is written? How, without Physics, so many innate questions concerning the nature of animals …? How, without Arithmetic, could one understand the computation

[478] Ibid., 55.
[479] Ibid., 59.
[480] Ibid.

> of the years, days, months …? How without Geometry, could one measure the Holy Arc of the Covenant?[481]

For Sor Juana, a broad scholastic education, including natural philosophy, was foundational to the study of theology. If she were to overcome her feminine ignorance and know God's word and world, she argued, she must be given license to study everything from the bible to geometry and physics.

In her communications with church authorities, Sor Juana doubled rational disembodiment, the Cartesian Split, in order to assert her intellectual equality with men. By emphasizing the rationality of women's souls and minds, separate from their bodies, Sor Juana and other advocates of women's intellectual equality, were able to put women on equal footing with men. Sor Juana was familiar with this trend in natural philosophy through her engagement with the numerous books in her library and in her conversations with other scholars from behind the choir grate. This is most clear in her *Spiritual Self-Defense*, where she argued, through a serious of rhetorical questions, that women's souls, uninhibited by bodily gender, are equal to men's at both an intellectual and spiritual level.

> Do women not have rational souls like men? Then, why should they not enjoy the privilege of the illumination of letters with them? Are not our souls capable as yours of the grace and glory of God? Then, why could we not be capable of the same knowledge and science, which are less than that? What divine revelation, what determination by the Church, what dictum of reason was made so severely for us?[482]

For Sor Juana, if disembodied souls were rational, then the handicaps of physical sex should not justify keeping her from her scholarship. In response to the bishop of Puebla, Sor Juana related numerous stories of her personal experiences of disembodied rationality. For example, she

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[481] Ibid., 19.
[482] Juana Inés de la Cruz, "Autodefensa Espiritual."

described an episode in which her abbess demanded that she give up her books.[483] Regardless of the prohibition against books, her rational mind went to work:

> I studied all the things that God had wrought, reading in them, as in writing and in books, all the workings of the universe. I looked on nothing without reflexion; I heard nothing without meditation, … If I saw a figure I was forever combining the proportion of its lines and measuring it with my reason and reducing it to new proportions. … I observed that though the lines of the two sides [of our dormitories] were parallel and the ceiling perfectly level, in my sight they were distorted, the lines seeming to incline toward one another, the ceiling seeming lower in the distance … I pondered whether this might not be the reason that caused the ancients to question whether the world were spherical.[484]

In the architecture of the convent, she could ponder perspective and optics, as she described in the passage above. Though she never described it, one can imagine that from inside the choir she might have thought on the physics of sound as it reverberated through the cathedral. In the garden, she might have observed the life cycle of plants, insects, and small animals. From her cell window, she might have studied the patterns of the weather.

For Sor Juana, the disembodied nowhere place of her mind became a space in which she could create knowledge, even without the aid of the library in her cell. In addition to the social and spatial resources—kitchen, cell, library—at her disposal, the religious solitude imposed at San Jerónimo facilitated this disembodiment. And, through the recent philosophical development of disembodied rationality, she could justify her curiosity by claiming to be freed from the constraints of sex. Sor Juana also reported experiencing disembodied reasoning while in the solitude of sleep:

> … not even have my dreams been excluded from this ceaseless agitation of my imagination; indeed, in dreams it is wont to work more freely and less encumbered,

[483] Sor Juana explained that she dutifully complied until the abbess was no longer in power, three months later.
[484] Juana Inés de la Cruz, "Response," 39–41.

> collating with greater clarity and calm the gleanings of the day, arguing and making verses, of which I could offer you an extended catalogue, as well as some arguments and inventions that I have better achieved sleeping than awake.[485]

Like the soul in *El Sueño*, Sor Juana also found that, when freed from her body her "intellect soared." However, her description of dreaming to "Sor Filotea," though sometimes intellectually fruitful, was not particularly pleasant. Even in *El Sueño* the soul returns to the body during the light of day, which, as a Kircherian, may have symbolized both divine and intellectual illumination for Sor Juana. Finally, Sor Juana related an episode to Fernandez de Santa Cruz in her *Response*, when she was too ill to read and experienced such "vigorous and vehement … cogitations that my spirit was consumed more greatly in a quarter of an hour than in four days' studying books."[486] In each of these cases, Sor Juana doubled the recently emerged rationalist discourses which privileged the disembodied mind as the true seat of knowledge production in order to justify her own studies of the world. If it were inappropriate for women to engage in scholastic learning, her observations of the world made through an active, rather than idle, mind surely could not be seen as inappropriate. However, I argue that, though she doubled disembodied reason in her feminism, embodiment was Sor Juana's preferred state.

It is significant however, that Sor Juana indicates in each of these stories that disembodied pontification on nature was not her first choice. Beyond her books, she also enjoyed experiment which required physical contact with material resources readily available in the convent. Indeed, she even described the results of some of her experiments with cookery:

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[485] Ibid., 43.
[486] Ibid.

> I see that an egg holds together and fries in butter or in oil, but, on the contrary, in syrup shrivels into shreds; observe that to keep sugar in a liquid state one need only add a drop or two of water in which a quince or other bitter fruit has been soaked; observe that the yolk and the white of one egg are so dissimilar that each with sugar produces a result not obtainable with both together.[487]

Such experiments could only be performed from within the body. Though she described using her mind to ponder perspective in the architecture of the convent, that too required the use of her eyes. Using the space and materials available to her within the convent, Sor Juana made knowledge about the natural world which she likely shared with her sisters.[488] Experiments connected with her duties, such as cooking and gardening, would have been easily justified. Without the superficial distractions of the court, Sor Juana found that she could create an intellectual space within the convent even without the aid of the library in her cell. But in the end, whether she was locked in struggle with a strict abbess, tirelessly tossing through a night's sleep, or too ill to read, she much preferred the embodied connection to her books. Again, she explained to "Sor FIlotea", "I confess, too, that though it is true, as I have stated, that I had no need of books, it is nonetheless also true that they have been no little inspiration, in divine as in human letters."[489]

Sor Juana did not limit her doubling to her communications with members of the Church hierarchy. Sor Juana's mystic flight in *El Sueño* doubled both the form and the content of Jesuit natural philosopher Athanasius Kircher's epistemology of ecstasy to create a space from which

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[487] Ibid.

[488] The manuscript of a cookbook, first published in 1979, is thought to have been copied in the 18th Century from notes made by Sor Juana. The book is signed with her name but paleographic analysis has revealed that it is not hers. The manuscript contains a sonnet and 37 recipes. It is possible that the attribution is correct, but regardless of the manuscript's veracity it is clear that even by the 18th Century Sor Juana had become so identified with cookery that the book was attributed to her correctly or incorrectly. See Juana Inés de la Cruz and Convento de San Jerónimo, *Libro De Cocina*.

[489] Juana Inés de la Cruz, "Response," 45.

to argue for women's intellectual equality. Paula Findlen proposes similarities—images of pyramids, the Tower of Babel, the boundless universe, optics, play with light and shadow—between Sor Juana's dream and Kircher's *Itinerarium exstaticum* (1656). Findlen also argues that Sor Juana's dream reflected contemporary, Kircherian ideas about the divinity of light. Kircher and Sor Juana's dreams tied divinity to knowledge, both of which were frequently discussed in terms of "illumination."[490] In the Jesuit's ecstatic journey, he expressed a "universal celebration" of knowledge as the foundation of faith.[491] Both Kircher and Sor Juana found that the ecstatic solitude offered by sleep was key to the pursuit of divinity *and* natural knowledge. As a resident of the "New World," Sor Juana appreciated Kircher's vision, presented in his *Oedipus Aegypticus*, that the presence of pyramids in both Ancient Egypt and the Americas were an indication of the universality of faith. But, by the end of *El Sueño* Sor Juana was not as sure as Kircher about reason's universal usefulness. Thus, Findlen concludes that her dream, a "voyage … across his books," was a "respectful, admiring, but ultimately devastating critique of Kircher's own intellectual assumptions."[492]

In *El Sueño*, Sor Juana also doubled rationalist discourse toward a feminist end. Her engagement with the great epistemological debates of her time, which I described above, allowed her to use the popular discourses of empiricism and disembodied rationalism to argue for women's intellectual equality. Notably, it is only in the very last line of the poem, after its empiricist and scholastic quest for knowledge, that Sor Juana reveals that the sex of the body the soul belongs to is female. It was not unusual for the souls in this genre to be feminine.

[490] Findlen, *Athanasius Kircher*, 335.
[491] Ibid., 38.
[492] Ibid., 335.

Unlike many of her predecessors, who used the image of the soul in flight as an analogy for the soul's mystical or religious quest, Sor Juana's soul was on a quest for natural knowledge. However, if we read the soul's gender as form doubling, *El Sueño* becomes a third space feminist argument that the same process male natural philosophers like Kircher used to free themselves from the limitations of their bodies—disembodiment through the solitude of sleep could also liberate women's minds from their gendered bodies, putting them on equal epistemological footing with men. Her discussion of rational disembodiment, thus, was yet another form of doubling. It was a means of enacting a subtle intervention in sexism, but did not constitute her favored epistemology.

Sor Juana scholar, Yolanda Martínez San Miguel, has argued that Sor Juana's *El Sueño* is a complex commentary on the way women engage with rationalist disembodiment. Martínez-San Miguel argues that the return of the soul to the body at the end of the poem is related to Sor Juana's critique of rational empiricism. It is only after finding the experimental approach to knowledge production wanting that the soul returns to the body, which coincides with the reader's discovery that the body which the soul inhabits is female. Martínez-San Miguel explains that the juxtaposition of the re-embodiment of the soul with its negative assessment of rationalism is a "discursive strategy" which Sor Juana used to argue for women's intellectual equality:

> *La mujer se ve obligada a abandonar su cuerpo para acceder a un conocimiento, pero a la vez se ve imposibilitada para obtener este conocimiento si no puede regresar al cuerpo. El poema sugiere la naturaleza cíclica de este proceso, en el cual la mujer es cuerpo de día y capacidad racional de noche, sólo para volver a ser cuerpo más tarde. Por lo tanto, el poema apunta hacia una epistemología que no puede negar su naturaleza corporal, pero que lo intenta en el deseo de comprobar que el entendimiento*

> *femenino es tan capaz como el masculino, y que las diferencias sexuales son, entonces, secundarias.*
>
> Woman is obligated to abandon her body in order to access knowledge but at the same time finds it impossible to obtain that knowledge without returning to her body. The poem suggests the cyclic nature of this process, in which woman is body by day and rational being by night, only to return to her body again. Thus, the poem points toward an epistemology that cannot negate her corporal nature, but which attempts to do so, wishing to prove that feminine understanding is as capable as masculine, and that sex differences are, therefore, secondary.[493]

According to Martínez-San Miguel, *El Sueño*, advances a knowledge system which does not reduce women's epistemological privilege because of their embodiedness. For Martínez-San Miguel, *El Sueño*, is a comment on the problematic of the new rationalist disembodiment, or Cartesian Split, for women knowledge producers. As I showed above, Sor Juana demonstrated in *El Sueño* that she did not believe that experiment was the only or best method of knowledge production because aspects of God's creation were inaccessible to human understanding. However, she did find experiment valuable to supplement scholastic knowledge, or study. Both of these methods of knowledge production required an embodied knower to physically access her resources. Sor Juana exploited the Cartesian imperative to disembodied knowing when it suited her feminist needs, but it was not her preferred epistemology.

Sor Juana's doubling of each of these discourses—sexist, religious, rational—constituted a form of differential oppositional consciousness. Sor Juana was able to strategically call on each of these ideologies, rather than being called on by them. In the words of Chela Sandoval: "To deploy a differential oppositional consciousness, one can depend on no (traditional) mode of belief in one's own subject position or ideology; nevertheless, such positions and beliefs are

[493]Martínez-San Miguel, "Engendrando el Sujeto Femenino," 270 [Author's translation].

called up and utilized in order to constitute whatever forms of subjectivity are necessary to act in an also (now obviously) constituted social world."[494] Sor Juana differentially used each of her constantly shifting subject positions—nun, woman, intellectual—as a "means and method" for her intellectual survival.[495] Doubling was her "go-to" method for justifying her metaphysical border-crossing.

Conclusion

While Sor Juana was thoroughly entrenched in the colonialism of New Spain, her feminist third space and resistance against the authority of the Church might well have been the first "decolonial imaginary" in the New World. The colonizing mission of the Church outside of San Jerónimo's walls, like Sor Juana's books, manuscripts, and knowledge of the natural world, easily passed through the border/gate into the convent. The grate became a border around which Sor Juana's identities shifted. Her multiple identities, constructed by and through the grate, also cast differing shadows of meaning on the knowledge she produced within the convent. The constantly shifting meanings produced by her doubling of hegemonic sexist, religious, and rationalist discourses depended on who greeted her on the other side of the choir grate. Doubling allowed Sor Juana to create richly layered and multivocal texts which spoke to humanists and natural philosophers, alike. Her illegal border-crossing, through the circulation of her writings, can be read as a feminist decolonizing strategy to achieve several goals. First, Sor Juana resisted the patriarchal and racially coded containment and control of women's bodies by the Church within the space of the convent. Second, she defied the philosophical impulse

[494] Sandoval, *Methodology of the Oppressed*, 31.
[495] Ibid., 59.

toward epistemological purity by embracing a multiplicity of subjectivities, disciplines, and methods of knowledge production. Her articulation of an epistemology of *mestizaje* which included scholasticism and empiricism, embodied and disembodied knowing, can also be seen as a decolonizing move. Sor Juana advanced an epistemology which was compatible with women's intellectual and spiritual equality.

By examining the productive power of space alongside discourse, I have shown that Sor Juana's careful negotiation of space enabled her to create a "third space" that incorporated the best possibilities of each of her worlds while still meeting her epistemological needs. Historians of science have utilized spatial analysis as a part of their project of providing a complete historical, political, and social context for the development of modern science. For example, Steven Shapin has argued that scholars must challenge the perceived universalism of science—the idea that scientific knowledge exists outside of time and society.[496] Within this historiography, the first step in de-universalizing scientific knowledge was to "place" the "view from nowhere;" to geographically "locate" the social spaces in which scientific knowledge was produced. "Placing" knowledge, Shapin has suggested, connects the local and the global, as well as the political and the scientific. Research within the "place of knowledge" scholarship has focused on how scientific knowledge is made and understood to be scientific in a given location.[497] Such studies have explored how rules of science have been shaped by the social

[496] Shapin, "The Mind Is Its Own Place."
[497] Ibid.; Ophir and Shapin, "The Place of Knowledge: A Methodological Survey"; Shapin, "Placing the View from Nowhere"; Shapin, "Here and Everywhere."

rules of certain spaces, the social status of certain practitioners, and the political commitments of the proponents of science.[498]

Though the "place of knowledge" paradigm is well suited to elucidate the influence of social status, such as class, on the development of modern science, historians of science have not examined how space is experienced bodily and differentially according to the kind of body a knowledge producer inhabits. In fact, there are different social rules for different bodies, even within the same space. For example, Shapin has described the transfer of the social rules which governed the space of an English Gentleman's country house to the space of the modern laboratory. However, what he did not account for is how the social rules for the Lady of the house or the scullery maid might *also* have been transferred into the modern laboratory. Such an analysis might seem to be hindered by the apparent absence of those bodies in the spaces he describes. It is precisely the social rules of the Gentleman's country house that either bar entrance into spaces of knowledge production within the house, or dictate that the presence of certain individuals be unacknowledged or unseen. Some science studies scholars have turned to the body in their analyses, however many of them tacitly accept biological definitions of the body and leave the power differentials inscribed upon bodies in relation to scientific knowledge production unexamined.[499] Attention to the social regulation of all bodies within scientific spaces will generate deeper contextualization of scientific knowledge production by examining how the power which defines bodies as normative or non-normative influences who is seen as a scientist in that space, the kind of knowledge produced there, and the circulation of

[498] Schaffer and Shapin, *Leviathan and the Air-pump: Hobbes, Boyle, and the Experimental Life*; Shapin, "The House of Experiment in Seventeenth-Century England."
[499] Latour, "How to Talk About the Body?"; Lawrence and Shapin, *Science Incarnate*.

knowledge through it. Thus, a next step for the science studies project of de-universalizing science is to re-embody the "view from no body."

In Chapter One, I outlined the *feminista* cultural studies methodology which I have employed in the previous two chapters. In this chapter, I applied *feminista* spatial analytics, like border theory, as a departure from the "place of knowledge" framework described above. Border theory has facilitated my investigation of the ways social and scientific meanings were inscribed on the body within and through the spaces Sor Juana occupied. Mary Pat Brady has argued that "The emergence of the Cartesian subject resulted in process that "de-spaced" peoples …"[500] While Brady refers specifically to the spatial implications of colonialism, the "de-spacing" power of the Cartesian subject is also a politics of fragmentation that grants full scientific subjectivity only to those who can transparently appear to be unhindered by social inscriptions on the body. Inside the convent, Sor Juana created a space which allowed her mind to travel beyond the walls of the convent, extending her intellectual reach out into the world, and by physically removing her marked body from the space of the court, she was able to feign fragmentation. Sor Juana's epistemology of *mestizaje* was yet another strategy which allowed her to differentially employ the aspects of Cartesianism that were most useful to her, and leave the rest. In an epistemological climate that was careening toward the fragmentation of the scientific subject, Sor Juana embraced multiplicity. At San Jerónimo, Sor Juana was able to use the various material resources available to her, from the kitchen to the library in her cell, and the convent's enforced solitude to create a feminist third space in which she could produce knowledge about nature.

[500] Brady, *Extinct Lands, Temporal Geographies*, 9.

Mary Pat Brady argues that "an acute spatial analysis [is] part of the repertoire of what Chela Sandoval calls technologies for 'decolonizing the social imagination.'"[501] The "place of knowledge" framework established by historians of science naturally lends itself to just such a spatial analysis of scientific spaces in the seventeenth century. My analysis of Sor Juana demonstrates the potential of *feminista* spatial analyses to transform and expand the "place of knowledge" discourse to account for the social and scientific meanings ascribed to diverse kinds of bodies *in* spaces of scientific knowledge production. Such a shift allows us to make sense of the complex ways in which scientific subjectivities are constructed spatially. Focusing on the constitution of bodies in spaces allows new questions to emerge. For example, might the spatial rules operating in monastic spaces also have been transferred to modern science, as Steven Shapin argued occurred with Robert Boyle's country house? How might the social regulation of bodies in the space of the convent have shaped the development of modern scientific epistemologies? Drawing from Sor Juana's experiences, it seems possible that the mandate for women's ignorance, humility, and obedience might have been incorporated into the culture and politics of modern science. But just as the blasphemy of women's scientific intelligence and subjectivity may be embedded in modern scientific epistemology, so too are opportunities for decolonization and resistance through epistemological *mestizaje*.

[501] Ibid., 10.

Chapter Five
Conclusion

In the introduction to this dissertation I outlined four "value-rational" questions posed by Danish social scientist, Bent Flyvbjerg, as a defining feature of *feminista* science studies methodology: "(1) Where are we going?;" "(2) Is this desirable?;" "(3) What should be done?;" and "Who gains and who loses; by which mechanisms of power?"[502] In this chapter I will use these questions to frame my conclusions. To answer the first question, "Where are we going?" we must first understand two other questions: 1) Where have we been? And, 2) Where are we now? In this dissertation, I have examined three historical case studies to show where we have been, as women of color scientists. This history also sheds new light on the extensive documentation of where we are with respect to the under-participation of women of color in science. Certainly education debts and disparities, under-preparation, and lack of resources all contribute to this underparticipation, but understanding the interaction between structural, epistemological, and cultural barriers is critical to fully contextualize the problem and build a more complete understanding of how scientific knowledge production and social power and authority are entwined. In Chapter One, I proposed *feminista* science studies as a methodology for producing such knowledge. Using cultural studies of science methods and US Third world feminist theories, I set out to make the contributions and experiences of women of color scientists more visible by using diverse reading practices grounded in archival historical research methods. Informed by theories drawn from the work of Evelynn Hammonds, Chela Sandoval, Emma Pérez, Patricia Hill Collins, Mary Pat Brady, María Lugones, and Audre Lorde, I have read the histories of Roger Arliner Young, Chien-Shiung Wu, and Sor Juana Inés de la Cruz

[502] Flyvbjerg, *Making Social Science Matter*, 60.

for distortions, fragmentation and multiplicity, differential consciousness, doubling, and controlling images. In Chapter Two, I re-read primary sources, and added new archival evidence to construct a narrative or Roger Arliner Young's work which took her seriously as a scientific subject and historical actor. In Chapter Three, I used cultural studies methods to incorporate an analysis of race, class, gender, and nation into the scholarly literature about Chien-Shiung Wu. In Chapter Four, I reclaimed Sor Juana as part of the genealogy of women of color scientists and demonstrated how *feminista* spatial analytics, such as border theory, complicate our understanding of the epistemological and political climate in which she operated. In this chapter, I summarize my findings and draw connections and comparisons between each of the cases, propose some answers to the "value-rational" questions above and reflect on the usefulness of *Feminista* Science Studies methodology.

What is at stake politically is easily seen in the cases of Arliner Young, Chien-Shiung Wu, and Sor Juana—women of color threaten established structures of domination. In response to the challenge they pose to institutions of knowledge production, women of color's difference is often naturalized through rhetorics like the eugenic discourse that dominated during Young's career. Naturalization of oppression allows the professional qualifications of women of color to be easily challenged, leading to our continued exclusion from governmental, academic, and scientific structures of power, leaving those institutions unchanged. As these structures are increasingly interlinked through the military-industrial-scientific complex, the ability of women of color to challenge them becomes more difficult and more important. Nuanced histories of women of color in the academy, such as those presented in this dissertation will demonstrate the ways that such structures are linked. Young, Wu, and Sor Juana's stories show that the lives

of women of color scientists are an excellent place to start. When such histories are done without adequate theoretical and methodological grounding, even scholars committed to creating a feminist or anti-racist history of science, can inadvertently perpetuate the erasure of women of color from the history of science by leaving one or the other aspect of her identity unexamined, reducing her to either "woman" or "person of color."

Science on the Borderlands

The firm split between subject and object that was established during Sor Juana's time was thoroughly entrenched by the twentieth century, when Young and Wu where working. Alongside the development of the Cartesian split, women were also increasingly associated with nature, the object of scientific inquiry.[503] But, women of color had a different symbolic relationship to nature than white women. For example, Anne Fausto-Sterling has shown that eighteenth-century biologist, Georges Cuvier's fascination with the anatomy of Khoisan woman, Sarah Baartman—the so-called Hottentot Venus—"worked as a double trope." Fausto-Sterling elaborates, "As a woman of color, [Sarah Baartman] served as a primitive primitive: she was both a female and a racial link to nature—two for the price of one."[504] It was this multiplying of primitiveness that was perceived as fantastically savage and "monstrous" to Europeans of the early nineteenth century, like Cuvier. The association between the bodies of women of color and nature, specifically of the wild, primitive, untamable variety, was forged during the so-called Age of Reason. Racialized and gendered otherness was co-produced with the central values of Modern science—rationality, objectivity, and empiricism—leading to a deep-seated

[503] Schiebinger, *Nature's Body*; Schiebinger, *The Mind Has No Sex?*.
[504] Fausto-Sterling, "Gender, Race, and Nation," 75.

dichotomy that casts white men as authoritative producers or subjects of knowledge, and women of color, such as Sarah Baartman, as objects of knowledge. This dichotomy made the scientific subjectivity of women of color like Chien-Shiung Wu and Arliner Young somewhat unimaginable, even today.

We can see the association of women of color with primitive, wild nature manifested in the lives of each woman in this study. In the pre-ecological paradigm of zoology and the biological sciences, for many of the white zoologists with whom Young worked, she represented a threat to evolutionary progress. Because "Man" was positioned as separate from and superior to nature, rather than part of it, her Black female body was associated with the primitive, deficient and undesirable aspects of nature which the project of eugenics sought to breed out of existence. Young's advisor, Frank R. Lillie, expressed his concerns about her fitness for a career in science and attempted to prevent her intellectual "reproduction" by refusing to continue to be her supervisor. The image of the Dragon Lady used to describe Chien-Shiung Wu is a manifestation of the association between Asian women's bodies and an exotic nature. As a fantasy creature associated with a fictitious distant past, in Western cultures the Dragon represents danger, death, destruction, and greed but is also a widely recognized symbol of Chinese culture. As a nuclear physicist in the post-World War II era, and as former Chinese citizen in the context of the Cold War, Wu's presence in the laboratory also provoked fears of nuclear annihilation. The *New York Post* description of her in 1959 revealed anxieties that she had the potential to be destructive to nature itself. In less uncertain historical moments, Wu's destructive potential was not as threatening, but she was still positioned as an object of scientific knowledge production. In her 1971 *Smithsonian* interview with Gloria Lubkin, Wu was

visually and discursively placed in conversation with nature as an informant, rather than as a scientific actor with full subjectivity. In the context of colonial Mexico, as an illegitimate Creole woman, Sor Juana represented a threat to Spanish racial "purity."[505] Unmarriageable women like Sor Juana, who were only steps removed from the primitiveness of local indigenous and African slave populations, because of their sexually available female bodies, were a constant reminder of the potential for racial decadence in the wild and unfamiliar natural landscape of the Americas. As "women of color" Arliner Young, Chien-Shiung Wu, and Sor Juana had to overcome the double association of their bodies with nature if they were to cross the border from object to subject in order to produce authoritative scientific knowledge.

Each of the women operated within institutional structures which also created borders requiring negotiation. For Sor Juana, the institutions of the convent, court, and Inquisition were the most important institutions in which she operated. In the previous chapter I argued that Sor Juana's confinement in the convent created a very real physical border—the choir grate—which she negotiated in order to make her intellectual life work. But, for Arliner Young and Chien-Shiung Wu professional and scientific institutional structures did not create such tangible boundaries. However, they too managed borders in their lives. For Young, the Jim Crow segregation, which created the need for the HBCU system in which she was educated and taught, created a border that, though not impassible, was extremely difficult for her to cross. When she left the segregated universities of the South to continue her graduate studies at the University of Chicago and the University of Pennsylvania, she crossed both a color-line and the

[505] Spain was, by the colonial period, already racially mixed due 700 years of occupation by the Moors who were of Arab and North African descent.

North/South cultural divide. And, just as Sor Juana's transgressions carried the risk of execution by Inquisition authorities, Young's border-crossing could have meant death for her, as well. For Chien-Shiung Wu, as a Chinese immigrant, she literally crossed a border to enter the United States and pursue graduate education and a career in physics. Because white European Americans associated Chinese culture with pre-modern traditionalism they perceived her crossing as one across time as well as space. To her coworkers, and to the white American public, the image of Wu working in the modern and militarized space of the physics lab while dressed in her traditional *cheong-sam*, created a sense that she too had transgressed a border.

Each of these women managed the borders she encountered using their differential consciousness. That is, they used strategies that worked "with, yet beyond, the demands of dominant ideology."[506] In the case of Arliner Young and Chien-Shiung Wu, that dominant ideology was the hegemonic epistemology functioning in their scientific careers. For Young the eugenic epistemology of fitness was dominant, while for Wu it was the epistemology of symmetry, elegance, and certainty. In order to manage the boundaries between scientific subject and object, they each strategically used fragmentation and multiplicity. For Young the epistemology of fitness marked her body such that fragmentation was extremely difficult to achieve. She attempted to use this strategy when dealing with Frank R. Lillie by carefully explaining that she failed her exams because of the institutional burden she carried at Howard University, while simultaneously downplaying those responsibilities. Ultimately, the line was just too narrow to walk, and Lillie refused to see her in any way but through the eugenicist notion of fitness. Young seemed to have given up fragmentation as a strategy at that point

[506] Sandoval, *Methodology of the Oppressed*, 44.

because later in her life, she very clearly embraced her multiplicity by declaring allegiance to her working class Black roots through her union organizing and civil rights activism. Young's embrace of multiplicity challenged the status quo in Durham with respect to race, class, and gender, drawing the ire of the Black elite, which led to her black listing and constrained her already limited career options.

For Wu, the epistemology of symmetry which dominated her scientific career, afforded her slightly more freedom. Her strategies of fragmentation enabled her to conform to the culture of physics in ways that were simply impossible for Young. By performing her difference through patterns of dress, Wu enacted the curdling form of fragmentation. She conformed to recognizable stereotypes of Chinese womanhood and the aesthetic value of elegance in order to make herself more intelligible to her colleagues. For her, curdling was a form of what Gayatri Spivak has called "strategic essentialism" and which Chela Sandoval has identified as a form of differential consciousness.[507] Curdling allowed her to embrace her difference while conforming to the norms of science. Given the lengths to which she went to continue to dress in a traditional style, it is possible that she was genuinely more comfortable in the clothes with which she was most familiar. But, in the very different cultural climate of the 1970s and 1980s, as compared to the late 1930s when she immigrated to the US, her strategy of curdling no longer served her as well. As awareness about discrimination against women and people of color in the academy increased, embracing her multiplicity or performing her difference through curdled fragmentation drew attention to her difference and threatened her epistemological privilege. By denying that she had ever experienced discrimination, she opted

[507] Spivak, *The Post-Colonial Critic*; Sandoval, *Methodology of the Oppressed*, 68–69.

for a cleaner split/fragmentation by expressing her sameness or equality with others. For Wu, her strategies shifted as the culture around her changed. In each case, however, whether she used fragmentation, curdling or multiplicity, she chose her strategies to preserve her privilege within the world of physics—the "culture of no culture."[508] Her use of several different strategies is a sign of differential consciousness, an awareness that no single way of being will be successful in all spaces because of her multiple marked identities.

In Sor Juana's case, epistemologies were in flux, and because she was excluded from the university, she was less constrained by any particular epistemological paradigm.[509] For her the dominant ideology she had to contend with was colonial sexism and racism which demanded the control and containment of women's sexualities. Of the three women in this study, Sor Juana most successfully and consistently embraced multiplicity with respect to both epistemology, and, as Yolanda Martínez-San Miguel has argued, her colonial subjectivity.[510] Because of the numerous epistemological options available to her, Sor Juana had the freedom to articulate an epistemology of *mestizaje* which incorporated elements of scholasticism, empiricism, disembodiment, and embodiment. Because the disciplines were still in the process of forming, and many scholars were generalists, she also embraced a multiplicity of subjects from humanist letters to natural philosophy. As such, she resisted the growing momentum toward the specialization that has resulted in what Chela Sandoval calls the apartheid of

[508] Traweek, *Beamtimes and Lifetimes*, 162.
[509] It is important to note that not all natural philosophy occurred within Universities at that time and there were numerous other natural philosophers, such as her role-model Athanasius Kircher, who operated within religious institutions.
[510] Martínez-San Miguel, "Engendrando el Sujeto Femenino"; Martínez-San Miguel, "Saberes Americanos."

academic knowledges.[511] However, like Wu, Sor Juana demonstrated she was cognizant of her marginalization because she differentially used several strategies to negotiate the politics of knowledge production from inside the convent. Using her differential consciousness, she doubled rationalist, sexist, and religious discourses to justify her border-crossing.

Many analyses of Sor Juana's life and work have painted her as a tragic figure because sometime after the second edition of her book was published in Spain in 1692, she sold off most of her great library. Because she did not publish again, many scholars have assumed that she stopped writing at that time as well. It is suspected that she gave up writing due to intense pressure from within the Church hierarchy, but it was also possible that Sor Juana sold her library to raise funds which were desperately needed after a disastrous flood led to a great hunger riot destroying the viceregal palace in 1692.[512] However, recently discovered manuscripts suggest that Sor Juana did not stop writing, but merely stopped publishing.[513] In his 1700 biography of Sor Juana, Padre Diego Calleja indicates that she spent the last few years of her life in the service of her convent and that a terrible sickness overcame the sisters. Sor Juana dutifully ministered to the sick, contracting the disease and eventually succumbing in April of 1695.[514] Regardless, of whether she stopped writing or publishing, voluntarily or by coercion, during her active period Sor Juana had significantly more freedom to determine *how* she would make knowledge about nature because empiricism had not yet been settled upon; because natural philosophers were not limited to nature but were free to ponder politics, religion, and myriad other subjects now considered separate from the domain of science; and

[511] Sandoval, *Methodology of the Oppressed*, 4.
[512] Codding, "Sor Juana and Her Worlds," 23; Maza, *La Ciudad De Mexico En El Siglo XVII*, 33, 65.
[513] Kirk, *Convent Life in Colonial Mexico: A Tale of Two Communities*, 167.
[514] Calleja, *Vida De Sor Juana*, 26–27.

because her position inside the convent meant that the rules which governed her were not primarily epistemological. The regulation of Young and Wu, within their respective institutions, was explicitly epistemological.

In his series of value-rational questions, Bent Flyvbjerg asks, "Who gains and who loses; by which mechanisms of power?"[515] The histories of each of these women demonstrate that epistemology is the mechanism by which power is gained and lost in the careers of women of color scientists. The eugenicists of Young's time argued that heredity set the limits for human achievement, but these stories show that in addition to the social factors that regulate who is admitted into and granted authority within spaces of scientific knowledge production, epistemology set the limits. For Young the epistemology of fitness which dominated the biological sciences in the early part of the twentieth century, severely limited her options for both conformance (through fragmentation) and resistance (through multiplicity). For Wu, the epistemology of symmetry, allowed her significantly more degrees of freedom. She was able to use both forms of fragmentation, splitting and curdling, to elevate her epistemic privilege. And for Sor Juana, the malleability of epistemology granted her the most freedom of the three. She was able to embrace multiplicity without compromising her epistemic privilege. However, for women in her time any claim to epistemic privilege was dangerous. For Arliner Young, Chien Shiung-Wu, and Sor Juana the epistemologies and institutions in which they did their science created multiple kinds of borders with which they had to contend. They used differential consciousness, fragmentation, multiplicity, and curdling to manage the association of their

[515] Flyvbjerg, *Making Social Science Matter*, 60.

brown bodies with primitive, wild, and deficient forms of nature which denied their scientific subjectivity.

Reflections on *Feminista* Science Studies Methodology

In this dissertation I have used feminist cultural studies methods in conjunction with spatial analytics, such as border theory, and US Third World feminist theories. This has allowed me to shed light on the ways in which race, gender, and science worked as norms in the lives of each of my subjects. In particular, I have used reading strategies that have enabled an analysis that acknowledges the agency of each woman in her life. Though both Arliner Young and Sor Juana have been presented as "cautionary tales" it is evident that despite the immense challenges they faced, they were each actively involved in negotiating those challenges with whatever tools they had available to them. Though Wu is often held up as an exemplar of women in science, she too encountered barriers to her participation and was active in managing them. Young, Wu, and Sor Juana's differential consciousness led to distortions, contradictions, and discontinuities in their narratives. For example, without the framework of Black (w)holes and differential consciousness, Young's letters to Frank R. Lillie and Dr. Peter Murray might seem to indicate she was, as Kenneth Manning claimed not "in a condition to do much for herself," rather than the strong leader within her community that other evidence showed her to be.[516] The framework of differential consciousness allows us to read between the lines, and make sense of what was left unsaid. Allowing for the possibility of double meanings and half-truths enables us to reconcile the Young's pleading voice in her correspondence with her white male advisors and her unrelenting resistance in her

[516] Manning, "Roger Arliner Young, Scientist," 7 [Emphasis added].

correspondence with her mentor, Ernest Everett Just. In Wu's story, the framework of curdling helps us to make sense of a woman who seemingly embraced her cultural heritage, was outspoken within her community about women's participation in science, but claimed to have never experienced discrimination. And, in Sor Juana's case, border theory and third space feminism enables us to understand how the convent might have been a space of liberation, albeit an imperfect one. Without the proper analytical tools, these discontinuities have led other scholars to rely on stereotypes of women of color to make sense of their stories. *Feminista* analytics have allowed me to interrogate those distortions, contradictions, and silences to provide both a more accurate and more liberatory narrative.

I have provided deeply contextual narratives of Young, Wu, and Sor Juana's lives and works. Each of them has as many differences as they do similarities, if not more. However, following the standpoint theory advocated by Patricia Hill Collins, outlined in Chapter one, there are some common threads that can be seen running through each of them. First, each of these women had to contend with the positioning of women of color as "primitive primitives." Though white women in science must also contend with the association of their bodies with nature, the cases presented here demonstrate that there is a different symbolic association of women of color with wild, untamable, destructive, and deficient forms of nature. Second, Young, Wu, and Sor Juana each used differential consciousness to navigate the epistemological terrain in their lives. Though they used different strategies, each of them can be seen to be consciously using various dominant ideologies to their advantage. Third, the epistemological paradigms in which these women operated shape their experience by regulating their ability to conform and resist to the social norms of science.

In order to identify potential candidates for this study, I reached out to many practicing women of color scientists. I asked them who had come before them, who might have been there to hold the door open for them. As I explained my project to these women, the stark epistemological division between the natural/physical sciences and the qualitative social sciences and humanities emerged. Many of the scientists expressed concern about my case study methodology. Several told me that they could tell me about themselves and a few friends and colleagues but worried they would not be "representative" of women of color scientists. Others told me that they personally know all the women of color in their fields. The comments of these women of color scientists reveal a conscious awareness of their under-representation, but their allegiance to positivist epistemologies lead them to dismiss their own experiences as statistically insignificant. The only "statistical" identity they would claim for themselves was as "outliers" and insisted that they could not possibly *know* about the "women of color" experience in science, even when they have the entire population at their disposal. That is, they insisted that the entire population's experiences are so unique they defy generalization to the entire population. And yet, they seemed to yearn for the story I told them I wanted to tell. Many were very enthusiastic about my project and felt that it filled a great need within their communities for a sense of their history and belonging in the sciences. Based on the cases presented in this study, and the anecdotal evidence of the practicing women of color scientists I wrote to, it is clear that there is no unifying story about "women of color" in science. Any two stories are likely to have as many differences as they do similarities. From the positivist perspective many women of color scientists bring to bear on this question, that there is no unifying narrative may appear devastating. However, within Lugones' framework, unity can be

understood as an imperialist impulse. Instead, the multiplicity of experiences women of color have in the sciences should be interpreted as an epistemological strength. The *feminista* science studies approach allows for some generalizable knowledge to be produced without obscuring or erasing the differences between women.

I responded to the scientists' methodological and epistemological concerns by explaining that by using case study methodology, my study gains robustness from diversity. The cases presented here create a rich topography of experiences. *Feminista* science studies generates a catalogue of experiences that can be integrated using Patricia Hill Collins' stand point theory, which I discussed in Chapter One. While the traditional case-study model allows for some generalizability thus providing epistemological access for women of color scientists, in fact, my methodology works in a completely different register. Objectivist, positivist accounts that insist on generalizability would seek to describe some kind of average experience of women of color in science and thus, must by definition disregard women of color in science as outliers. I explained to the women of color scientists I contacted that the very thing we seek to study vanishes as soon as we apply such a method to our study. Instead what is needed is a method which does the opposite of generalization. What is needed to make women of color scientists visible is contextualization. I believe this study is a small step toward bridging the epistemological gaps which divide women of color scientists from the methods which would make our experiences more visible.

Flyvbjerg's first and second value-rational question ask the social science researcher to reflect on where society is headed with respect to a given issue and whether or not the current

path will lead to a more socially just or ethical future. In the long view of the history of women's engagement with science, the ever increasing specialization of science represents a narrowing of the epistemological options available to generate knowledge about nature. Given that epistemology was a key factor in shaping the experiences for the women of color in this study, the trend toward interdisciplinarity in the sciences is encouraging. If we seek to diversify the sciences with respect to gender and race, this study indicates that diversifying the range of epistemologies used to generate scientific knowledge will be critical to in achieving that goal. If we adopt a modern version of Sor Juana's epistemology of *mestizaje* as a kind of interdisciplinarity, it also suggests the need for a more liberal, humanistic education for scientists.

Diversifying the epistemologies of science is no small task as the current structure of science is resistant to change at that most fundamental level. Deviations from the scientific method lead to marginalization but can also lead to innovation.[517] The big question for feminist science studies has long been, can there be such a thing as feminist science? I suggest that we also ask: Can we incorporate a diversity of ways of knowing into science and still create authoritative, reliable knowledge about the natural world? What would science look like if we were to insist that scientists be, like Sor Juana, humanists, too? Chien-Shiung Wu had some ideas in this regard. Though she was firmly resistant to any suggestion that the positivist epistemology of science should change, she also recognized the need for change. For example, in a 1971 piece in *Physics Today* on women in physics Wu asked,

[517] Wylie, "The Engendering of Archaeology Refiguring Feminist Science Studies."

> Would there be beneficial effects to society as well as to science if more women were encouraged to go into sciences? Men have always dominated the fields of science and technology. Look at what an environmental mess we are in. They have brought us to the gigantic brink of environmental ruin. The air is polluted; lakes, rivers, seas and oceans are contaminated. Women's vision and humane concern may be exactly what is needed in our society. If there were more women like Rachel Carson to warn us of chemical pollution, Dr. Alice Hamilton to call attention to occupational health hazards and more women like the young woman doctor [Frances Oldham Kelsey] who helped safeguard us from drugs like thalidomide, the world would be a more pleasant and safer place in which to live.[518]

The problems Wu highlighted disproportionately affect communities of color, and because of our marginalization affect women of color in particular. Wu put her science in the service of communities of color by using physics to assist with research into sickle cell anemia in the 1970s.[519] Wu felt that diversity in science was key to transforming it into a field which serves humanity, a point not made lightly by a woman who had worked on the Manhattan Project. I argue that, like the social sciences, the natural sciences should begin to guide themselves by the value-rational questions proposed by Flyvbjerg. This will require a radical transformation of science, technology, and engineering at the most fundamental epistemological levels, and will take a considerable amount of time. But, an epistemological shift within the sciences might begin with diversifying the education of young scientists to include humanistic studies, social science, and ethics.

I set out to create knowledge about women of color scientists that would fill large gaps in the history of science and feminist science studies. What I learned is that the invisibility of women of color in these fields is deeply epistemological. To create knowledge that makes sense of the complex relationships between gender, race, and science has required that I play a card

[518] Lubkin, "Women in Physics," 23.
[519] Lubkin, "The First Lady of Physics."

from Sor Juana's hand. Ultimately, interdisciplinarity, or epistemological *mestizaje*, had the most potential to create liberatory knowledge about women of color in science. A multiplicity of methods was required to fully represent the multiplicity of experiences women of color have in science. In this study I have combined cultural studies, and literary reading methods with traditional historical and archival methods. I have drawn from the fields of Black studies, Asian American studies, Chican@ studies, women's studies, feminist science studies, the sociology of scientific knowledge, philosophy of science, and post-colonial studies. And, in addition to histories of women and science, I have used histories of the Cold War, Civil and Labor Rights, colonial Latin America, Early Modern Europe, and the history of religion to construct the narratives I presented in the previous three chapters. Because women of color scientists as an object of social inquiry have been marginalized within numerous disciplines and subfields, this study required the use of a multitude of epistemological paradigms.

Epistemological *mestizaje* was also the most liberatory for me personally. Interdisciplinarity freed me from the one-dimensional epistemology of universalism in which I had been trained as a chemistry student. Epistemological *mestizaje* guided me out of the trap of statistical significance that keeps women of color in science hidden, so I could argue for our social relevance.[520] Though, the epistemological shifts I made in the journey from chemistry, through history, to feminist studies, were difficult, even painful at times, it is only after having embraced less positivist ways of knowing that I have been able to see that my own experiences of marginalization in science mirror, in small ways, the experiences of Young, Wu, and Sor Juana. For example, my broad interests in literature, my undergraduate activism in diversity

[520] Ginorio, "When N< 1 or 2."

related issues, were completely mystifying to my colleagues in chemistry, but they represent a common experience for women of color in science. I even gained insight to the affectionate nickname I was given in the first laboratory I worked in professionally, "Díaz the Damager." On the eve of the twenty-first century, my very light brown queer female body still marked me as a threat to the space of the all-white, heterosexual, male laboratory in which I worked. Embracing interdisciplinarity has allowed me to find epistemological value in my own multiplicity and my embodied experiences as a woman of color in the laboratory. I now recognize that my epistemological journey began when I consciously rejected the notion that I must conform to the Eurocentric masculinist norms of the laboratory. That was the moment in which I embraced multiplicity, and it ultimately led me away from the positivist paradigm in which I was trained. In the words of Patricia Hill Collins, this transition has allowed me to "learn to trust [my] own personal and cultural biographies as significant sources of knowledge."[521] It has opened a world of new possibilities and created a space from which I can begin to imagine a natural science that values multiplicity.

[521] Collins, "Learning from the Outsider Within," S29.

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Vita

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