Abstract

Since 2008, a worldwide financial crisis combined with plummeting trust in institutions has led to significant changes in the organization and funding of research and education. These changes have troubled the very foundations of universities, but they also have created new opportunities to re-imagine and re-form practices of knowledge production, a key concern of Science and
Technology Studies (STS) and feminist science studies (FSS). Here we reflect on how these changing institutional landscapes as well as increased demands for substantive ethics training create openings for novel institutional practices that embody core insights of STS and FSS. Specifically, we describe the creation of the Science & Justice Training Program (SJTP) at the University of California, Santa Cruz. Taking its inspiration from recent feminist science studies re-workings of responsibility as response-ability, founders of the SJTP created novel pedagogical and research practices that enabled collaboration across all divisions of the University. A focus on justice proved critical to our efforts. Justice, in its call to attend to the first principles that shape collective life, allowed us to open up the space of research ethics in novel ways, and helped us to create the basis for working across disciplines on shared problems and objects. As STS and FSS increasingly move toward generating new modes of gathering and new practices of care, we suggest that justice may open up models of collectivity that fit with the current zeitgeist and produce the kind of responsive knowledge and institutions long imagined by scholars of FSS and STS.

Introduction

We live during times that are at once troubling and promising. Around the world, economies have collapsed, the gap between the rich and poor has grown dramatically, and trust in public institutions has plummeted (Lipset & Schneider, 1983; Pharr & Putnam, 2000; Picketty, 2014; Putnam, 2000). Just fifteen years after celebrations anticipating a prosperous new millennium—one united by the forces of globalization and the promise of science and technology, hope for the future has turned into widespread concern and questioning of the basis of sustainable life. Yet in this questioning there is also new opportunity. In many parts of the globe, and in many different walks of life, people are gathering together to reimagine how we might constitute a more just and livable world.

Universities have emerged as one important site of these transformations. Public universities in particular have become a core node in a wide-ranging debate about what kinds of knowledge and skills are
worth investing in, what value we can expect from that investment, and who should benefit (Fischer & Stripling, 2014; Marginson, 2011; Nixon, 2011). Although it seems unthinkable to those who grew up in the wake of dramatic post-WWII investments in higher learning, today even leaders in higher education challenge the worth of a university degree (Lederman, 2008). Like many established institutions, universities face unprecedented cuts and are under intensified pressure to demonstrate their practical value.

However, this pressure and these cuts are experienced unevenly. Anticipating greater economic returns, many academic administrators—including those at the authors’ home institutions—have made decisions to selectively support science and engineering over the arts, humanities and social sciences. Yet these decisions come at a time when even science and engineering are under pressure to prove their relevance and are also facing painful budget cuts from federal funding bodies. In a 2014 article published in the *Proceedings of the National Academy of Sciences*, prominent biomedical chemist Bruce Alberts and his co-authors call upon biomedical scientists to confront the fact that National Institutes of Health (NIH) budgets will no longer continue to grow (Alberts et al., 2014). Further, access to these shrinking public coffers require scientists and engineers to demonstrate “broader impacts” and to provide expanded ethical training for their students (Schienke et al., 2009). Although scientists and engineers might receive more support, new federal laws that mandate deepened engagements with ethical and social issues now encourage them to share resources with their social science, humanities and arts colleagues.

These changes, combined with calls to reimagine, deepen and broaden approaches to science and engineering ethics, have created novel opportunities (Schienke et al., 2009; Tuana, 2012). Specifically, they open up new possibilities—full of promise and danger—for Science and Technology Studies (STS) and feminist science studies (FSS) to bring their theoretical developments to bear upon the pedagogical and research
practices of their home turf: universities. STS and FSS scholars have long sought to open up spaces in which scientists, engineers, humanists, social scientists and artists may work together to create knowledge that is responsive to a broader range of societal concerns and needs. Beginning in the 1980s, various initiatives were launched with these goals in mind and new curricula were developed (Barad, 2000; Rosser, 1995). One particularly noteworthy nationwide effort was “Women and Scientific Literacy: Building Two-Way Streets,” a program created and administered by the American Association of Colleges and Universities with support from the National Science Foundation. This program, which ran from 1996 to 1999, sought to increase the participation of women and racial minorities in the sciences, expand the science content of women’s studies, and broaden the content and teaching methods of science, engineering, and mathematics to include methodological and epistemological insights from feminist science studies with an eye towards making ethical and social concerns integral to these curricula. Broad societal shifts and concerns have created the opportunity for these efforts, which were previously experimental and often on the margins of the institution, to become mainstream initiatives.

Here we reflect on our efforts to navigate these changing institutional landscapes. Specifically, we describe the challenges and promise of forming at UC Santa Cruz the Science & Justice Working Group (http://scijust.ucsc.edu) and its companion, the Science & Justice Training Program (Science & Justice Research Center (Collaborations Group) 2013). Both the group and the program have cultivated formal and informal infrastructures for generating discussion and research at the juncture of the natural and social sciences, arts, humanities, and engineering. These infrastructures have enabled us not to build a separate program or department, but rather to thread the insights of FSS and STS throughout the university and to build relationships and programs that work across its intellectual and institutional boundaries.

A focus on justice proved critical to our efforts. Justice is one of the
three fundamental principles of the Belmont Report (1979), an investigation commissioned by the National Commission for the Protection of Human Services of Biomedical and Behavioral Research. The Belmont Report provides the foundation for research ethics and legal protections at all institutions that receive U.S. federal monies. Focusing on human subjects research, the Report puts three classical liberal principles at the heart of its recommendations: respect for persons, beneficence, and justice (Research, 1979). However, in practice dominant institutionalized forms of science and engineering ethics often bypass the fundamental issues of equality, fairness and equity that the Belmont authors call us to attend to in their invocation of justice (Schienke et al., 2009; Tuana, 2012; personal communication with Patricia King, 2004).

Those of us engaged in forming the Science & Justice Working Group and the Science & Justice Training Program were inspired by Belmont’s call, but not bound by its invocation of classical liberal principles. Our turn to justice entailed a more fundamental questioning of the first principles that guide any society and its pursuit of knowledge. John Rawls captured this aspect of justice in the opening pages of his enormously influential book, *A Theory of Justice*: “Justice is the first virtue of social institutions” (Rawls, 1971/1999, p. 3). Of course there is a danger in orienting around this lofty notion of justice. As Rawls himself explains, as the staring point of social life, justice is “uncompromising”—it is that which one cannot be against (Ibid., p. 4). As bedrock, justice can lack mobility, play and the sense that things could be otherwise. As the first virtue of social life, it easily resists critique. And yet, à la Foucault, we do not believe dangers can be avoided, no matter our approach (Foucault, 1977, p. 163). Perhaps more to the point, as Donna Haraway has taught us, if we are to understand and enable responses to our world, we must “stay with the trouble” (Haraway 2010; Haraway 2012). More thoughtful—and indeed, just—practices arise from tempering justice’s elevating powers with a situated questioning of the collective basis of our lives (Fraser, 2009; Haraway, 1988). Thus, the work of imagining and enacting
justice is always open, and never finished (Derrida, 1992, 1994). It involves an ongoing creative working together.

Oriented around this expansive conception of justice, Science & Justice at UC Santa Cruz departed dramatically from the bureaucratic concerns about proper process that shape much of what today operates as science and engineering ethics. In the United States, institutional ethics in the form of bureaucratic governance of research practices by Institutional Review Boards (IRBs) has done much to respond to the egregious abuses of human subjects—abuses that motivated the writing of the Belmont Report. Yet, increasingly, this form of ethics has lost its responsiveness to the actual conditions and practices of research (Rothman, 1992). Designed to meet the formal requirements of regulatory law, rather than the evolving needs and concerns of those who give their time and bodies for research, not surprisingly this approach to ethics spawned by the Belmont Report and reflected in IRB review practices generates little enthusiasm from either scientists and engineers or FSS and STS scholars.4

We found that refocusing on justice, while not a perfect answer to these problems, offered a more constructive mode of engagement (Science & Justice Research Center (Collaborations Group), 2013). While this focus partly arose out of local commitments to social justice—social justice is a core institutional value at UC Santa Cruz—justice also proved a better concept to work with for reasons that moved beyond our local context. In its call to question the first principles of a society, it allowed us to open up the space of ethics in novel ways. In its attention to questions about the common good, it helped us to create the basis for working across disciplines on shared problems and objects. It inspired us to consider what new models of collectivity might better fit with the current zeitgeist and produce more responsive, robust knowledge (Latour, 2005; Matsutake Worlds Research Group, 2009; Mol, Moser, & Pols, 2010; Puig de la Bellacasa, 2011).
The trouble and the promise

In the recent rounds of cuts to universities, departments and programs committed to the critical study of science and technology fared unevenly. For example, in 2011 the Academic Program and Administrative Services Review Core Council at Pennsylvania State University recommended defunding its Science, Technology and Society Program. On July 1, 2012 the program formally closed its doors, falling victim to administrators seeking ways to meet budget deficits and improve “efficiency.” Yet, in the same year that Penn State defunded its STS program, Harvard University, an institution with a longstanding PhD program in the History of Science, officially launched its Program on Science, Technology and Society through its John F. Kennedy School of Government, offering a secondary field concentration in STS to students pursuing PhD, Doctor of Design, and SJD degrees. Other universities are responding to budget cuts by funding academic initiatives that support the development of science and engineering, creating new opportunities for funding and support for STS and FSS.

These new opportunities present challenges and potential dangers. Much like the dilemmas that research subjects face as they are more routinely invited to the same table as scientists and engineers, STS and FSS scholars often find that inclusion into new science and engineering initiatives does not necessarily entail meaningful engagement (Benjamin, 2013; Reardon, 2005; Viseu, 2015). Writing STS and FSS scholars into a grant is not the same thing as treating them as central players who shape research principles, goals, and practices. Yet, despite these familiar challenges, the current moment presents possibilities for creating new institutional practices that foster the kinds of intellectual change long-imagined by STS and FSS scholars.

In this space of trouble and promise, Science & Justice at UC Santa Cruz arose. Inspired by a bike ride through the UCSC meadow, animated by lively breakfasts at a beloved Santa Cruz brunch spot, and encouraged by a close colleague and friend, Science & Justice was born of a desire
and hope that it would be possible to craft new spaces and gatherings where, in the company of colleagues from across the university and beyond, we could ask, ‘What kind of world do we want to live in?’

This effort grew out of years of sustained intellectual dialogue among scholars at UC Santa Cruz who believed in the power of this university on the Pacific’s edge to sustain transformational thought. Perhaps most famously, UC Santa Cruz is home to the History of Consciousness Department, founded in 1967, where faculty and graduate students have pushed beyond disciplinary conventions to create inquiry adequate to the task of engaging with the world as it is, and as we want it to be. UC Santa Cruz also is home to inventive pedagogy committed to social justice pioneered in its Community Studies Department, founded in 1969. Both Reardon and Barad chose to come to UCSC partly because of this history and the potential it offered to build novel spaces for thinking, teaching, and transformative change.

Yet Reardon and Barad arrived on campus on the eve of dramatic challenges to public education. The worldwide financial crisis of 2008 combined with powerful conservative political movements, led to widespread defunding of public institutions. Public universities were amongst the hardest hit, and in many ways the University of California became the epicenter in national debates about the values and goals of public higher education (Brown, 2011; Lye et al., 2011). Beginning in 2008, staff and faculty positions were slashed, salaries furloughed, and student-to-faculty ratios sharply increased while undergraduate tuitions skyrocketed in the midst of controversial changes in the governance of the University of California (Byrne, 2011; Meister, 2009, 2011). While austerity was similarly imposed on other universities, it was felt particularly sharply at the University of California where it represented a dramatic departure from California’s historical commitment to tuition-free public education.

These historic budget cuts came along with increased pressure to rethink and re-articulate the ways in which university research and teaching benefit broader publics. While born out of a dire situation, this
spur to change also created some room for the kind of work we envisioned. Discouraging of elite and insular scholarship, the climate encouraged scientists, engineers, and STS and FSS scholars at UC campuses to work together to reimagine what a science and engineering for the people of California—and all their many companions—might look like (Haraway, 2008). In an unexpected way, this situation created openings for arriving at shared goals and collaborative projects, positive outcomes of what were otherwise a devastating set of changes and challenges.

Research ethics: From rules of conduct to experiments with engagement

In universities, social scientists and humanists most frequently are asked to collaborate with scientists and engineers under the banner of “ethics.” Ethics emerged as an institutional framework during the 1960s and 70s in response to a series of highly publicized scandals including the infamous Tuskegee Syphilis Study, the use of disabled children during for hepatitis research at the Willowbrook State School, and the injection of cancerous HeLa cells into patients without their knowledge or consent (Rothman, 1992; Skloot 2010; Steneck et al., 2007). Public exposé of these experiments prompted the Belmont Report, a report that investigated these abuses of human subjects and prompted the implementation of standardized ethical procedures by Institutional Review Boards (IRBs).

These developments brought much needed attention to paternalistic and sometimes abusive actions of researchers. Yet they also conceptually divorced “knowledge” from the “implications of knowledge.” IRBs and science and engineering ethics programs focus their attention on delineating how knowledge should be collected and used, not on how knowledge should be produced. Given this lack of attention to the practices most central to the intellectual life of researchers, not surprisingly, many scientists and engineers—who otherwise have strong ethical convictions—fail to find inspiration in this institutionalized version of
ethics. Indeed, Eric Cech (2014) recently found that despite engineering schools’ increased emphasis on teaching engineering ethics, earning an engineering degree today is correlated with a “significant decline” in students’ commitment to the “public welfare.”

In building Science & Justice, we sought to understand in more detail what might be driving this disconnect. As a first step, we surveyed what counted as Responsible Conduct of Research (RCR) training. RCR emerged in the 1960s and 1970s in response to the research regulation reforms in an effort to teach the next generation of scientists how to discern proper research conduct from misconduct. NIH first mandated formal training in RCR curricula as a component of National Research Service Awards Institutional Training Grants in 1990. Though it allowed grantee institutions to determine the content and format of the training, the NIH suggested that training cover conflicts of interest, data management, professional standards, authorship and attribution, institutional policies for reporting misconduct, and the proper uses of human and animal subjects (Mastroianni et al., 1999; Steneck et al., 2007). The scope of the NIH’s mandate grew to include all graduate and postdoctoral trainees at granting institutions (and not just those funded by the grant). From the time of the first federal mandates to the present, implementation of RCR training has been haphazard and for the most part led by volunteer instructors (Bulger & Heitman, 2007; Steneck et al., 2007). Instruction is typically in the form of lectures, case studies and multiple-choice test modules on websites, with little to no attention paid to the history, politics, or economics (DuBois et al., 2010; Mastroianni et al. 1999).

From our perspective, the most important shortcoming of RCR pedagogy is its reliance on hypothetical case studies that implicitly delineate what is and what is not relevant to ethical decision-making. Consider “A New Dialysis Machine,” a test case used in the National Online Ethics Center. In this case, the reader is asked to choose between two competing models of dialysis machines. The first uses an expensive reusable filter that must be autoclaved in the unreliable
conditions of a poor hospital, and therefore carries some risk of infection. The other uses an inexpensive disposable filter that decreases the chance of infection, but must be continually resupplied from the manufacturer, thus creating high costs and dependence on a shaky supply chain. The reader is asked to balance the financial considerations against the patient safety consequences of each option and provide an argument about which path to choose. This is a plausible way of framing the problem, yet it does not direct the reader’s attention to the intellectual property laws or the unjust distributions of resources that create the material conditions for the dilemma in the first place. In other words, what is not possible to ask within this hypothetical case study is whether the decision space presented to the engineer is itself a formalization of an unjust political and economic regime. Yet it is this very regime that the engineer may need to recognize and understand in order to respond fully to the ethical problem posed.  

A survey of intellectual property activism and scholarship demonstrates that these deeper questions of political economy are of interest to scientists and engineers. For example, scientists and engineers have played important roles in illustrating the ways in which patents stifle genomics innovation and the availability of pharmaceuticals (Andrews, 2002; Kapczynski et al., 2003; Kapczynski et al., 2005; S. Reardon, 2013). While the new dialysis machine case presents realistic trade-offs an engineer might face, it limits the decision space, too narrowly defining where a student can begin their ethical consideration.  

Clarifying this limitation of RCR training is not to suggest that it is a waste of time for scientists and engineers. Learning institutionally mandated research practices helps avoid overt abuse and misconduct. However, it also is necessary to have institutional spaces that make it possible to rigorously assess how research practices form and how the objects of research are constituted within sociotechnical systems. The lack of such spaces, we suggest, constitutes a primary reason for the widespread dissatisfaction with the RCR model, as it avoids many
fundamental issues that scientists and engineers find vexing (Jasanoff, 2011). While the individual engineer hardly can be expected to solve large-scale problems of intellectual property regimes or to fundamentally alter inequalities between wealthy and impoverished nations, there nonetheless exists a disjuncture between what the RCR presents as “ethics” and what scientists and engineers find ethically and intellectually compelling (Cech, 2014; Science & Justice Research Center (Collaborations Group), 2013). Thus, it leaves scientists and engineers who often rightly sense ethical issues at their own lab benches with few options to pursue those concerns.¹³

**From responsible to response-able**

In order to avoid some of the pitfalls of standard ethics frameworks, we took inspiration from feminist science studies scholars, who re-conceptualize ethics as situated, relational, and open-ended. This work marks a shift from an ethics figured as individual responsibility to an ethics of “response-ability” (see especially Barad, 2007; Haraway, 2008; Schrader 2010, 2012). More than a clever play on words, response-ability, Donna Haraway argues, is not about aligning one’s actions with a set of universal ethical principles. Instead, it requires cultivating practices of response. These practices are developed and done with others, both human and non-human, in a process of ongoing exchange.¹⁴ Feminists have written about this kind of responsive ethics in the context of agility training (Haraway, 2008), harmful algae research (Schrader, 2010), brittlestars enlisted in biomimetic and nanotechnology research (Barad, 2007), affective and bodily mutual articulation in human-animal co-domestication (Despret, 2004), and longterm patterns of relating between orchids and insects (Hustak & Myers, 2012). In each of these accounts, the authors illustrate how skills, knowledge, and even bodies emerge from dynamic choreographies of response, or processes of becoming-with one another (Thompson, 2005).

One condition for response-ability in the university is a better
accounting of the conditions and consequences of knowledge production. Here, we found the work of Karen Barad particularly insightful. In *Meeting the Universe Halfway*, Barad substantially reworks conventional notions of responsibility so that we might better account for the entangled material and discursive apparatuses of knowledge production (Barad, 2007). Her use of the term “apparatus” has deep theoretical roots, but one way of understanding the apparatus is as a vastly expanded version of the “methods and materials” lists familiar to scientists. Beyond just a list of instruments, equipment, software, methods of accounting for background noise, and error analysis used to perform and analyze experiments, Barad suggests that we should account for all the material relationships that are part of knowledge-making practices, including political, social and cultural ones. Accounting for the apparatus by providing an “equipment list” is already a crucial aspect of securing the objectivity of scientific investigations. Barad builds on this, enlarging the scope of what needs to be included in an objective accounting of the full set of material factors that go into producing scientific results (Barad, 2000). This expanded work of accounting does not happen in a space separate from where research is imagined and designed; rather, it is integral to scientific practices. Ethics is therefore neither merely a matter of gaining consent for human subject participation in the design of an experiment, nor a set of post-facto philosophical considerations of scientific results or impacts. Facts and values, matter and meaning, are made together at the lab bench (and in the field, at the blackboard, and all the spaces where scientific research is done). Attending to the multiplicity of entangled apparatuses that constitute scientific practices enlarges the scope of ethics and understands the consideration of justice as integral to the practice of science. By not making ethics exterior to knowledge, but rather a part of it, a Baradian approach to response-ability makes doing ethics more concrete and practical for the working scientist.

Indeed, one way of understanding response-ability is that it is what makes ethics do-able. Codified and institutionalized models of ethical
pedagogy operate at too abstract a level, disembodying and disarticulating knowledge-making practices from their material conditions, inducing—even requiring—disengagement from the very concerns that animate many scientists and engineers (Müller, 2012). Thus, pre-established, codified ethics bypasses what ought to be central to ethical practice: engagement. Of course, codes must be developed, understood, and followed in most cases, but vexing problems of scientific and engineering practices that demand response cannot be engaged from within the pre-circumscribed spaces of codified ethics. Ethics in the fullest sense is only do-able when scientific and engineering practices are accountable to the conditions and consequences of knowledge production.

Creating the space of response-ability: The emergence of Science & Justice at UC Santa Cruz

Science & Justice at UC Santa Cruz was born out of this desire to build concrete institutional spaces where practices of response-ability could be cultivated. Orienting around justice proved an important first step. As previously mentioned, UC Santa Cruz has a long history of attracting scholars who wish to push at the edges of disciplinary boundaries in order to conduct research that might contribute to a more just world. Thus we found that justice hailed faculty and graduate students from across all five divisions of the university. For many of our scientists and engineers, it was a particularly welcome call. For them, all too often ethics had become an administrative hoop to jump through rather than a meaningful engagement with the questions that motivate them. Justice promised a new beginning, an opportunity to transcend closed and constricting forms of bureaucracy and to build institutions and knowledges that could support a greater diversity of lives. It encouraged us to ask what principles and practices should guide these efforts (Reardon, 2013). Justice also oriented us around collective work, a kind of work familiar to our colleagues in science and engineering, and long sought after in the social sciences and humanities. For all these reasons, justice proved a good
partner to ethics, and to our efforts to foster response-able modes of knowing and enacting collective worlds.

Collaborative work also formed an important point of common orientation. Science & Justice began with the formation of the Science & Justice Working Group (SJWG) in the Fall of 2006. To begin with, the group consisted of a small group of graduate students, research staff, and faculty. Since then it has become a bi-weekly meeting that regularly gathers around 30-40 faculty, research staff, graduate students, and interested professionals and activists in the surrounding area. From the very beginning, the SJWG avoided standard academic talks where scholars imparted their findings. Instead, we gathered together to work on shared problems. Emphasizing a problem-driven model of inquiry facilitated the group’s ability to encourage dialogue among people with widely varying backgrounds. It provided a common concern around which to gather.

In an early example that proved formative to later efforts, two graduate students from forensic anthropology, Cris Hughes and Chelsea Juarez, came to us with a problem they were encountering as they attempted to identify the remains of missing persons sent to them by the State of California. The state required that they assign a race to the bodies to aid in identification. Hughes and Juarez argued that the method of determining ‘race’ used in forensic science obscured rather than illuminated the correct identity of the body. The racial categories encoded into their database were developed in the Southeastern United States and reflected different social histories than the Californian context. Because of this, Hughes and Juarez found that the racial categories in the database did not correspond with the categories people used to describe themselves and others. Recognizing that this problem was not only technical, but also social and political, they came to Science & Justice to enlist help in imagining how to create new categories that would aid in returning the bodies to their proper resting places. In the SJWG meetings, they were able to discuss their concerns with social scientists and
historians who understood how historical processes shaped the construction of racial categories, and life scientists who could help illuminate how racial categories are differently understood and used in their fields. Using these conversations as a starting point, Hughes and Juarez were able to unpack the entangled social, political and scientific dimensions of the problem. Not only did this create a deeper knowledge of the problem, it enabled them to respond to it by opening up new avenues of intervention.\(^{19}\) In this case we found that orienting around a concrete problem gave all participants entrée into the discussions.

As a result of these experiences, core members realized that methods developed within the SJWG had the potential to yield new types of research that both function as interventions in how science is practiced and provide new avenues for achieving social justice.

**Science & Justice Training Program**

Building on the success of these cases in the SJWG, in the spring of 2009 we wrote a grant proposal for the National Science Foundation’s Ethics Education in Engineering and Science Program to develop our methodologies and formalize them in a graduate student training program. The grant proved successful and in the Spring of 2010 UCSC launched the Science & Justice Training Program.

While the focus of this paper is not the infrastructure of the training program, there are some key features that are necessary to outline in order to understand the development of our pedagogical and collaborative practices. Graduate students from any division are welcome to participate regardless of their previous training and expertise, and students from each of the five divisions have participated in the program at some level.\(^{20}\) In the first iteration of the training program, students enrolled in an introductory course cross-listed in the Sociology, Biomolecular Science and Engineering, and Feminist Studies departments that covers introductory literature in STS and FSS. This course began to build a cohort of students knowledgeable about each others’ work.\(^{21}\) Over the
years it has been taught, this course evolved to focus on teaching students how to identify and respond to connections across their areas of research, so that they might create collaborative projects. For their final projects, the students each wrote a research proposal in the style of a National Science Foundation grant application, which was then judged by an interdisciplinary panel of faculty that chose a cohort of eight to ten Science & Justice Fellows. Fellows received two terms of funding, allowing them to focus on their research projects. In many cases, their departments contributed a portion of the funding, which proved important for gaining wider faculty support for the program. In the following term, the Fellows enrolled in a second methods course, in which they developed their project. Fellows received continued mentoring as they began their projects and were expected to continue contributing to the Science & Justice community through activities such as helping to shape events for the SJWG and writing collectively authored articles (Science & Justice Research Center (Collaborations Group), 2013).22

Of course creating a new graduate training program on campus proved a major undertaking that involved tremendous time, energy and diplomatic skills. However, we were aided by one institutional feature of UC Santa Cruz: Despite being a home for a number of important STS scholars—especially in the FSS tradition—the campus had no single, formalized program, department, or location for STS research and teaching. Therefore we were working across shifting disciplinary boundaries from the outset; there was no precedent for walling off STS off from other disciplines. This points to a benefit of having no de facto community: it creates the need to continually “retie the knot” (Haraway, 2008, p. 1).23 To be sure, this distributed structure required greater organizational labor, but ultimately led to a wider base of support.

Our pedagogical innovations have been mutually supportive with other aspects of the S&J programming, and our ongoing efforts to build enduring working relationships across intellectual and institutional boundaries. Teaching students across disciplinary boundaries not only
creates practical connections across divides, it also encourages new forms of interactions among the faculty who support these students, as well as new kinds of inquiry in the students’ home departments. Finally, it provides a concrete site in which to develop the kind of response-able research we envisioned—research that can respond to the full range of epistemic, ethical and political dimensions of contemporary technoscience.

The SJTP was a modest attempt to create the training needed to foster response-able research. Below is a distillation of the pedagogical methods we found useful in this project.

**Collaborative practices: Gathering around objects**

While many recognize that robust inquiry that supports more livable worlds requires interdisciplinary collaborations, academic cultures have not been particularly good at fostering such engagements. We have found in our courses and SJWG meetings that unknowingly held and caricatured views of other disciplines are the most common cause of conflict. Even among students and faculty who have the best of intentions to produce collaborative work, it is challenging to adequately understand and generously engage with another discipline’s methods and histories. One temptation posed by this trouble is to jettison the disciplines and work from a non-disciplinary framework. However, in our context this is not a plausible solution, largely because our Fellows need to produce research that is legible in their own fields for the sake of their dissertation projects and job prospects.

We have found that our most successful response to this deep-seated shortcoming has been to gather around objects. In the SJWG and SJTP, we encourage students to craft new objects: from solar greenhouses to newspaper editorials; from interdisciplinary workshops and collaborations to written accounts of our dialogues. Extending Bruno Latour’s call to understand objects as gatherings around which new forms
of democracy can be built, we have found that gathering around objects is both more productive and lower stakes than gathering around theories or ideals. In Latour’s dingpolitik,24 objects are not essential and unchanging, but are instead produced through gatherings. They are that which congeal out of difference and what we share across divides. They make up our common world (Latour, 2005).

In order to activate this potential of objects to gather us across difference, we begin the training program by asking students to bring in their object of study. We then ask the students to provide a five-minute description of their objects.25 These presentations are usually told as if their objects were well-bounded—what Latour would call smooth objects or matters of fact (Latour, 2004). However, by asking other members of the seminar to articulate associations they have with the object, it quickly becomes clear that none of the objects presented are as safely bounded as they first appeared. Consider, for instance, the object of one student working on the politics of climate change: “carbon.” Carbon, an object that for many appears to be a well-bound single molecule, turned out to have a surprisingly lively set of associations. Among them were: the political and linguistic habit of dropping the ‘dioxide’ of carbon dioxide; its status as a shorthand for all other greenhouse gasses; how we track public opinion and how it matters; the governance of carbon economies; the role of skepticism in public life; the shortcomings of the concept of “anthropogenic;” the politics of meat consumption and car use; the apocalyptic discourses of climate change; and papal indulgences.

This exchange helps illustrate how an object can serve as a spark to ignite conversation. Conversely, it also draws attention to how the people gathered reshape their object in the course of their discussion. It soon becomes evident that what started out as an uncomplicated matter of fact had become a matter of concern. When the concern is shared, as we have found it often is, it provides a foundation for collaboration. In each course, the multiple iterations of this exercise resulted in students independently developing interdisciplinary research clusters organized
around problems of mutual concern, such as climate change, water resources, and genetic testing.

Importantly, we begin the objects exercise prior to assigning “The Aesthetics of Matters of Concern” by Bruno Latour (2008), in which he discusses his idea of objects and things as gatherings. Because we welcome students from all campus divisions, it is a priority to create a space in which everyone feels comfortable making a contribution. We have found that beginning the course by having the students discuss their “object” is especially effective, because scientists and engineers often already have an “object” in a traditional sense that can be made readily present in a classroom. Solar cells and jars full of dead krill are just a couple of examples. In contrast, humanists and social scientists, who are not often asked to identify objects within their research projects, face difficulties articulating specific objects. Their frustrations are encapsulated in one sociology student’s exclamation: “I don’t know what my object is!” Although some humanists and social scientists were able to present objects in a traditional sense, such as CO$_2$ or Ritalin, their research clearly focused on the controversies around those objects. However, once the Latour reading is introduced, they too began to think about how they are part of world-making and object-making. For scientists and engineers, such readings encouraged a reconsideration of their previously well-bounded objects as always having entailed complex social and political relationships. Since each of the students struggle with the implications of having something familiar made strange, these complimentary forms of discomfort create a collaborative and sympathetic collective environment.

**Methods for mapping response-ability**

Once we are at the same table and gathered around common objects, it is necessary to develop shared practices that can foster response-ability for these objects. One exercise we found useful in this context was situational mapping. Medical sociologist Adele Clarke developed situational maps as a method for addressing a lack of reflexivity in social-
science methods arising from grounded theory (Clarke, 2005). These maps ask the researcher to identify and lay out the major human, nonhuman, discursive, historical, symbolic, cultural, and political elements within a research situation. They also situate the researcher by making explicit the role that the researcher’s personal experience and “intellectual wallpaper” play within the research situation (Clarke, 2005, p.85). We found that situational maps helped students articulate areas of inquiry that move them across disciplines and spaces that are typically separated. Mapping out the material and symbolic domains that constitute objects cultivates reflexive research and helps students to account for their dual roles as participants in and analysts of the situation in which their objects exist.

Another mapping exercise we invited the students to experiment with is genealogical mapping. This method builds on Foucault’s notion of genealogy (Foucault, 1977). For Foucault, genealogy is not a search for origins, but rather a meticulous practice of tracing the embodied, historically-situated, contingent, multiple, and heterogeneous conditions of possibility that produce the objects and subjects of knowledge-making practices. Taking Foucault’s notion of genealogy as inspiration, Barad (2000, 2007) articulates a method of analysis that is attuned to a shift of objective referent from individual object to “phenomenon:” namely, an accounting of the heterogeneous multiplicity of material-discursive apparatuses that produce and are an inseparable part of the phenomenon being investigated. In particular, the mapping exercise begins with identifying the diverse apparatuses that are the conditions for the possibility of investigating and producing particular phenomena in the laboratory. Students then worked with these initial sketches to add specific lines of entanglement between various apparatuses. This exercise complemented the opening object exercise and helped students develop their analytical skills more systematically in thinking about the complex set of practices that condense and sediment into their objects (what they originally took to be independently existing objects). Key to this
exercise is learning to consider the specific genealogies of each of the apparatuses and to discern how they matter in the study and production of each object. No two objects fit into the same genealogical maps; the details are crucial.

Students in our course found that situational and genealogical maps were not only useful for explaining their situations to themselves, but also for providing colleagues from other disciplines with concrete and largely jargon-free entrance points to their research. This created new opportunities for collaboration around shared concerns. For our students who had not previously examined their situation as researchers within their projects in a structured sense, this use of situational and genealogical maps proved particularly helpful. In course evaluations, one student noted that situational mapping was particularly helpful in decentering herself from a position of expert-researcher and instead developing a model of research that enabled collaborative work with other participants in the ‘situation.’ Through these exercises we were able to adapt qualitative social science and humanities methods to overcome the exclusions at the heart of standard ethics models: the situation or phenomenon became the unit of analysis rather than the individual object, and attempts to participate response-ably in technoscientific systems became the primary purpose of ethical inquiry.

**Close reading: attending to exclusions**

Developing research practices that focus on the absences, differences, and silences of technoscientific systems also has been important in our movement toward ethics as response-ability. In particular, re-reading a technoscientific object with an eye toward silences has helped students to question the seeming completeness of a situational or genealogical map. Jane Gallop (2000) offers close reading as a way to attend to elements of a text that appear marginal or subordinate on a cursory reading, but which nonetheless become conspicuous or surprising when given further attention. Emphasizing repetitious or troubling portions of the text that
interrupt the assumed flow of a narrative, close reading highlights elements that are too often silent. Delving deeper into such silences allows students to find connections or resolve conflicts across disciplines that may have otherwise remained unexamined. In our class evaluations, one student noted in reference to the technique of close reading: “The ways I want to engage with thinking and creativity are valued in this space in a way that they are not within my discipline. That the desire to work for social justice is not seen as something to be tagged on [sic] at the end of the project, and that pedagogy is seen as important to the content.”

Susan Leigh Star’s work also offers methodological approaches to discursive silences that more directly engage the project of science and justice. In a 2007 interview, Star emphasized the critical importance of the lived experience of disadvantaged subjects for understanding technoscience in general. She argued that if we worked to take down the “Transcendental Wall of Shame” that prevents open discussion of personal experience amongst academics, “we could stop using technology to sequester people and their experiences. If we begin with those who are excluded, shamed, and silenced, their lives will become the most important philosophical questions to be answered” (Star, 2007, p.229). By always starting investigations into the conditions and consequences of technoscience with the question “cui bono?” one is able to follow the silences and absences in discussions of technoscientific systems (Star, 1991). As our courses emphasize, and as our students’ projects described below illustrate, methods that illuminate differences, silences, and absences in technoscientific discourses teach researchers to raise and engage questions about who research helps and serves. As scientific research becomes even more central to legitimating and constructing worlds, this skill will only become more important for envisioning and enacting a world that supports a greater diversity of lives (Benjamin, 2013; Harding, 1991, 2008).

**Modest enactments of science and justice**
One of the more important—and unexpected—lessons learned by many of the graduate students in our training program is that justice in scientific and engineering systems is not accomplished by remaking the entire world around a pre-figured sense of what justice looks like. Instead, it is necessary to become modest and do the hard work of attending to the specificities of one’s situation (Haraway, 1997). This experience highlighted the need to rethink what counts as “success.” Contrary to the academic habit of seeking conclusive and final results, they found that justice work is necessarily iterative, ongoing, and untidy. As the students came up against roadblocks and revised their projects, initial disappointments were replaced by commitment to work with more modest and specific goals.

The experience of Kate Richerson, one of our Fellows who works on mathematical models of fishery conservation, nicely illustrates this dynamic. Richerson initially developed her project to rectify a lack of ecological data about a lake in Sierra Leone that is a critical source of subsistence fishing. Modeling the fishery was hampered by a lack of adequate accounts of the ecological pressures at play, which included such factors as the presence of large poaching fleets. Through interviews she sought to develop localized knowledge about the historical and present-day fishery stocks, but she quickly ran into a problem commonly faced by interviewers: the lack of mutual trust between her and her interview subjects. She found that the politics of her research methods significantly complicated what it would mean to act response-ably. Although she was disappointed that the interventions she had planned did not materialize, Richerson’s project demonstrated that even localized interventions can be limited by one’s positioning as a researcher.

A similar lesson emerges from another project, in which two of our Fellows from the Physics Department, Derek Padilla and Ian Carbone, wrestled with making energy-efficient models of food production available to small-scale organic farmers. Both worked in a lab that was developing solar cells for greenhouses. The cells allow wavelengths that plants use
for photosynthesis to pass through, and absorb the remaining wavelengths, converting them into electrical energy. Building a greenhouse with these cells would enable a farmer to produce the energy needed to run greenhouse infrastructures (e.g., fans, electronics, temperature regulation, etc.) on site, and perhaps earn income on energy returned to the grid. In addition to this project’s technical and scientific challenges, Padilla and Carbone were drawn to this project because of its potential to allow them to act on their ethical and political interests in making agriculture more sustainable. However, they soon realized that this technology would mostly benefit large, industrial-scale greenhouse operations. While they certainly wanted industrial farms to be more energy efficient, Padilla and Carbone also felt that smaller-scale organic farming ultimately offered a more sustainable model of food production, and wanted to create a version of the new greenhouse technology that would work for these small organic farmers. Thus, they planned a pilot project in which small-scale farmers would use a greenhouse with the novel solar cells on their farms and collect data about how energy collection worked and how it affected plant growth.

It is notable that from the outset these material physics students framed their PhD project around an opportunity to intervene in food system ethics. However, as they developed their project in our science and justice framework it became even more unique. When they first began the Science & Justice Training Program, Padilla and Carbone held a familiar perception of science and justice: take technologies from the powerful and give them to ‘the people.’ Yet without a sufficiently specific understanding of who ‘the people’ were and what they wanted, the justice component of their work was too nebulous. Using qualitative social science methods developed in the research methods seminar, Padilla and Carbone interviewed a number of small organic farmers to see how such technology might be of use. They quickly found that their dingpolitik was not quite what they anticipated—the solar panels did not gather people in the way they had hoped. Many of the small-scale farmers they
interviewed had made deliberative choices to avoid technology-driven farming and were not interested in a pilot project that would draw them into high-tech engineering questions. Although this result was disappointing, it prompted Padilla and Carbone to re-imagine their object in relation to other constituencies of food systems justice projects, such as educators and artists. Padilla and Carbone went on to use the ‘green’ greenhouse as an educational tool for students and members of the Santa Cruz community to learn about sustainable agriculture and nutrition alongside properties of light and color under the luminescent solar concentrating roof. Having expressed a desire to do research at the intersection of science and justice, Padilla and Carbone thus reconfigured what a physics degree and subsequent career might look like when organized around a more modest understanding of justice. Both Fellows went on to find academic jobs that valued their response-able approach to physics: Padilla in a physics and chemistry department in a community college, and Carbone in an environmental studies department in a small liberal arts college.²⁷

Another Fellow’s project also illustrates the importance of reassessing research projects in order to imagine how we might participate more response-ably within the technoscientific worlds we help to build. Initiated by discussions at SJWG meetings, Martha Kenney, an S&J Fellow, and Ruth Müller, then a visiting graduate student from the University of Vienna, developed a collaborative project around re-reading interviews conducted by Müller. Müller’s dissertation (Müller, 2012) was concerned with the life stories and labor conditions of postdoctoral researchers in the biological sciences in Austria and the U.S. These junior scientists, whose lives were defined by a constant rush to advance in a rigidly defined career track without much space for family and social connections, occupy an important role in the contemporary university, where a constant sense of insecurity motivates fast-paced knowledge production. Müller’s work shows how this sense of constant rush and individual competition is also corrosive to the social relations that are
necessary for effective knowledge production in the laboratory. The researchers she studied rarely found opportunities to discuss shared hardships in a supportive space. Müller found that her interviews offered the postdocs a space to discuss their work and lives. They also brought her into close contact with peers who, much like Müller herself, were struggling to build their careers. Affected by the interviews and attentive to the shared labor conditions, she became interested in analyzing the role she played in the research situation as an STS scholar.

In the context of the SJTP, Müller and Kenney sought to use the feminist literature on practices of care in technoscience to address the troubling questions about careers, lives, and the management of public universities that had remained unsettling for Müller as her dissertation came to an end (Mol, Moser, & Pols, 2010; Puig de la Bellacasa, 2011). Müller and Kenney revisited Müller’s interview transcripts together, re-reading them for the moments where the conversations interrupted business-as-usual in the life science worlds of the postdocs. In an article they co-authored, Müller and Kenney show how the interviews created situated moments of reflection, connection, and disruption that might have acted as forms of resistance to the procrustean demands of life science careers (Müller & Kenney, 2014). By returning to a project that seemed complete, Müller and Kenney were able to move beyond diagnosis and toward thinking about how research practices can also be mundane care practices by allowing for new narratives, subjectivities, and collectivities to arise that challenge those commonly available (Mol, Moser, & Pols, 2010). For example, “what postdocs had thought was a personal struggle to meet the demands of a life science career [became] a collective problem not only but also through the process of participating in an STS study” (Müller & Kenney, 2014, p. 18). While interfering in the working lives of life science postdocs is a mundane intervention, it still matters. Reading interviews as “agential conversations”—conversations that interfere in the worlds they study, Müller and Kenney demonstrated that justice work within STS can be directed toward modest, ongoing, and
situating efforts.

**Why Science & Justice?**

Along with the Science & Justice Training Program, the broader Science & Justice initiative at UC Santa Cruz is engaged in a situated, modest approach that has faced its own share of limits and trouble. Our recent experience of becoming a research center illustrates some of the ongoing challenges. Founders of S&J thought long and hard about whether to take on this more institutionalized formation. Fears of being shaped by and implicated in institutional politics and procedures worried us, but ultimately we understood that there was no escaping these kinds of dilemmas. With promise there is always trouble. With new construction comes new cuts. The challenge is to engage in them in a manner that cultivates response-ability.

All of this became immediately manifest as soon as we moved into our new space. Science & Justice had not had a designated physical space before, and this resource afforded us expanded freedoms to organize meetings and house visiting fellows. However, the Community Studies department previously occupied the space we were given. As already noted, Community Studies—a hallmark of the UC Santa Cruz’s commitment to social justice—offered a unique activist-oriented undergraduate major. In the worst of the “cost-cutting” phase of the financial crisis at the University of California, the Santa Cruz campus “suspended” Community Studies. When we moved into a few of their old offices, someone anonymously wrote “oxymoronic term” underneath our “Science & Justice” sign that identified the location of our offices. While we don’t know with any certainty who wrote this, we assumed it was a Community Studies student and we sympathized with the implicit critique. In a university that increasingly channeled funds to science and diverted funds from efforts such as Community Studies that were explicitly devoted to social justice, what, one might ask, did science have to do with justice?
Indeed, it was a well-placed remark that resonated with a long-standing concern of ours. While this paper has emphasized the need to take advantage of shifting institutional demands and to orient STS and FSS scholarship towards reshaping the University itself, we recognize that new opportunities for us come at a cost to other programs that deserve support and yet are increasingly marginalized.

We also recognize the particular risk in adopting justice as a guiding framework. Justice is a powerful rhetoric that is itself hard to resist; thus, it can produce single-minded activism and a loss of criticality (Rose, 2004, 2012; Ticktin, 2011). These problems are compounded when justice is united with the universalisms of science (Reardon, 2013). Much suffering has been wrought by hegemonic and colonial efforts to build universalized knowledge and justice together; a single knowledge and a single justice excludes too many. For “science and justice” to do the STS and FSS work of fostering response-ability, we must make science and justice mutually unsettling, tempering any bent toward universalism.

However, if we can “stay with the trouble” (Haraway, 2010, 2012) rather than ignore or give in to it, our efforts at UC Santa Cruz demonstrate the potential of orienting around justice. Justice calls us to think about what might be, at the same time that it compels us to account for and respond to what has gone before. Rather than presuming a world already made, justice imagines a world in the making between past and future (Arendt, 1968/2002; Barad, 2010; Derrida 1994). It asks us not to stand back and observe the world as it is, but to response-ably make it. While “world-making” can have a grandiose ring to it, it is, we suggest, ultimately a more humble and open endeavor. World-making does not assume that we have a final grasp on how the world is put together, what is right and wrong, or indeed that we all share one unambiguous world.

On our campus, these aspirations and imaginaries of justice have gathered scientists and engineers together with colleagues in the humanities, social science and arts to substantively engage with one another. Thus, while a “Science & Ethics Research Center” or a “Science
“Science & Justice” proved the more provocative and promising endeavor. It made us “stay with the trouble” of making worlds together, a first critical element of response-ability.

Our focus on teaching also proved crucial to our success. Teaching makes up much of the everyday practice of university life. It is what we do together. While the S&J Training Program seeks to train the next generation of graduate students how to better respond to the join between questions of knowledge and questions of justice, it also seeks to remake our university by teaching our faculty and our institution new ways of thinking and working together. Training graduate students also provides a concrete site in which to develop the kind of response-able research we envisioned—research that can respond to the full range of epistemic, ethical and political dimensions of contemporary technoscience. While our students did not “change the world” in the ways in which some of them might have at first hoped, they have helped to innovate mundane, yet world-making, practices.

Ours is but one example of what might be possible in the contemporary moment. While the times are disheartening in many ways, the current turbulent state of universities, the demand that science contribute to social goods, and the limitations of dominant institutionalized forms of ethics all open up the chance to create new ways of getting on and knowing that better respond to contemporary lives and problems. The pedagogy and practice of science and justice developed at UC Santa Cruz is one effort to make good on this potential, and to create technoscientific worlds that are more open, modest, indeterminate, and hopefully better, where what counts as better is always a matter of our concern.

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Notes

1 Noteworthy is the 1987 Barnard Conference on Women in the Natural Sciences (sponsored by the Barnard Center for Research on Women), one of the earliest conferences creating an opportunity for conversation between feminist science studies scholars (many of whom were trained in science, some of whom remained active scientists) and women scientists who did not have prior knowledge of the growing field of feminist science studies. The keynote speaker was Evelyn Fox Keller.

2 More information on this program can be found at http://aacu.org/womenscilit/index.cfm

3 Jenny Reardon and Karen Barad formed and led the first iteration of the Science & Justice Training Program and co-taught the courses from 2010-2012. Jacob Metcalf was the postdoctoral fellow for the initiative. Martha Kenney was a Fellow in the first cohort of Science & Justice Fellows.

4 It is important here to distinguish between institutionalized ethics and ethics as a commitment to doing good in the world. We do not believe
there is anything inherent about ‘ethics’ as an intellectual and practical engagement that leads to narrow bureaucratic formations, particularly as embodied in research governance practices in the U.S. Instead, such formations have been the product of a very specific set of articulations that we are only able to briefly describe.


6 For one explanation of these events see nstallingorder.org/2013/03/27/sts-program-at-penn-state/ (accessed June 24, 2014).

7 One of the lasting impacts of the Belmont Report is that after 1979 research subjects increasingly have been invited to the table to discuss policy and ethics, a trend that escalated with HIV/AIDS patient and community advocacy and activism in the early 1980s and the rise of a neoliberal self-health orientation subsequently through the rise of HMOs and social media (Epstein 1996; Epstein 2007).

8 Jenny Reardon, Karen Barad, and Donna Haraway gathered for these breakfasts. Rebecca Herzig went on walks with Reardon in the UC Santa Cruz and raised the important question: ‘What are we after?’ These early beginnings of Science & Justice as an aspirational endeavor eventually lead Reardon and Metcalf to search for ways to develop concrete support and recognition for the many graduate students eager to develop it.

9 Our use of ‘science for the people’ here is meant to invoke Science for the People, an organization of scientists and engineers that formed in 1969 (see http://science-for-the-people.org/, accessed June 18, 2014). Science & Justice asked what Science for the People might look like if it took on board three decades of FSS and STS scholarship.

10 In the U.S., the most consequential research regulation is the “Common
Rule”, Title 45 Section 46 of the Code of Federal Regulations, which requires all institutions that receive federal research money and conduct human subjects research to use Institutional Review Boards (IRBs) to protect research subjects from individual harms. The propriety of governing research practices in the social sciences and humanities according to the Common Rule and its implicit assumptions about research ethics has been vociferously contested, particularly when it interferes with social justice goals (for example, see: Basset & O’Riordan 2002; Dingwall, 2008; Duster et al., 1979; Librett & Perrone, 2010; Shea, 2000). The U.S. Health and Human Services, which enforces the Common Rule, recently solicited input for the first major revisions in decades, and received requests for major changes to research ethics governance in the humanities and social sciences from the National Academies that addresses some of these concerns (Committee on Revision to the Common Rule, 2014; Health and Human Services, 2011).

This resource is sponsored by the U.S. National Science Foundation and hosted by the National Academies of Engineering. See: http://www.onlineethics.org/Resources/Cases/DialysisMachine.aspx. Accessed 5/22/2015. The Online Ethics Center (OEC) recently launched a project to substantially overhaul this resource, including efforts to make case studies contextually richer.

As recent critiques of the increasingly popular ‘Engineering to Help’ model demonstrate, limiting the possibilities for exploring moral and political contexts can also turn seemingly benevolent projects into boondoggles of wasted effort (Schneider et al., 2009).

STS scholars have produced numerous studies that document and demonstrate these limitations of the RCR model (Bucciarelli, 2008; Conlon & Zandvoort, 2011; Kline, 2001; Lynch & Kline, 2000; Vaughan, 1996). Many of these STS-inspired critiques of ethics pedagogy have analogues in the literature oriented toward philosophy audiences. See for example...
Haraway develops this notion of response-ability in her critical assessment of Jacque Derrida’s writing on animals (Haraway, 2008). Drawing on Derrida’s claim that much of the history of philosophy is an iteration of an unaccountable distinction between humans who respond and animals that react, Haraway argues that contemporary bioethics (especially as it regards animals) is overly committed to logics of calculation and sacrifice. Rather than understanding animals as merely reactive and ethics as merely the calculation of properly sanctioned instrumental use relationships, Haraway insists that animals be understood as co-laborers worthy of, and themselves capable of, response. She writes, “Response, of course, grows with the capacity to respond, that is, responsibility. Such a capacity can be shaped only in and for multidirectional relationships, in which always more than one responsive entity is in the process of becoming. ... Answering to no checklist, response is always riskier than [calculation],” (p. 71). Knowing is thus always a multidirectional engagement, and knowing well requires capacititating response from within knowledge-making practices even if the other party is nonhuman.

Importantly, for Barad, discursive practices are not merely linguistic practices, nor are they exclusively human. Diffractively reading Bohr’s crucial insight that scientific concepts are instantiated in specific laboratory apparatuses (which give meaning to particular concepts to the exclusion of others), through Foucault’s notion of discursive practices as specific historical conditions of intelligibility, Barad develops a notion of discursive practices as specific material configurations, where the notion of materiality is also reworked. Importantly, apparatuses are material-discursive, not material and discursive. For more details see Barad (2007).
Similarly, Astrid Schrader has argued that what counts as evidence within experimental configurations is critical to the possibility of both identifying causal relationships and responsibility. Tracking how marine ecologists have attempted to account for the toxicity of dinoflagellate blooms in estuary ecosystems, Schrader demonstrates that the temporality of causal relationships within these experiments is of critical importance for the political and ethical consequences of the knowledge produced (Schrader, 2010).

Several STS and FSS scholars also have observed the limits of institutionalized ethics and have re-envisioned ethics in ways that are friendly to science and justice practices of response-ability. See for example Rajan (2006), Fortun (2008), and Tuana, et. al. (2009).

John Rawls captured this foundational aspect of justice in the opening pages of his enormously influential book, A Theory of Justice (Rawls, 1971/1999, pp. 3-4). We have not failed to note that this strong alignment of truth and justice might also account for the power of justice to gather our science and engineering colleagues.

Specifically, Hughes and Juarez went on to create a survey on the definition and use of racial categories in forensic science. They distributed the survey to members of their professional society not only to create data about the practices and views of their colleagues, but also to open up a discussion about the definition and use of race in forensic science. Currently Cris Hughes is using the methods of forensic anthropology to study social justice issues surrounding U.S.-Mexico border deaths. Her early findings suggest that the remains of Mexican migrants from the rural, Southern states and indigenous communities are more likely to remain unidentified. These findings can be used to identify the structural vulnerabilities that lead to uneven identification of human remains.

UCSC is administratively split into five Divisions: Arts, Humanities,
Social Sciences, Engineering, and Physical and Biological Sciences.

21 When the NSF funding came to a close in 2012, we re-structured the training program so that it would be sustainable after the grant ended. For instance, the two courses have been combined into one that preserves the essential features of each. Student proposals are now proposals for collaborative events that the SJWG hosts, continuing the tradition of cross-facilitations between the SJWG and the SJTP. While students no longer receive fellowship funding, they do have the opportunity to organize events funded by the Science & Justice Research Center.

22 In addition to op-eds that have appeared in the local press, several students from the first and second cohorts co-authored, together with Reardon, Barad and Metcalf, a paper on Science and Justice that appeared in *PLoS Biology* (Science & Justice Research Center (Collaborations Group), 2013).

23 Two of our Fellows, Zachary Caple and Katy Overstreet, started a group for experimenting with collaborative methods that they called ‘Retying Knots,’ inspired by Haraway’s figure.

24 Latour recently reminded us that the word *thing* derives from the Old English “ding” which means a meeting or assembly. A thing, or a gathering, arises around a matter of concern.

25 This object exercise is indebted to FSS’s long history of rethinking objectivity (Keller, 1985) both in terms of the object and subject of knowledge. For example, Barad (2007) argues that the objective referent is not an individual independently existing object, but rather an entanglement of multiple and heterogeneous agencies. FSS scholars also argue that knowing subjects are also more than individual thinkers. Key to this rethinking has been the contributions of feminist empiricism (Longino, 1990), feminist standpoint theory (Harding, 1991), situated knowledges (Haraway, 1991), and agential realism (Barad, 2007). See also the work

26 “Phenomenon” has a particular meaning in agential realism. To gloss a rather involved account, phenomena are the entangled web of diverse agencies that constitute and are inseparable from the object of investigation. See p. 389 of Barad (2007) for a sample drawing of a genealogical map; the phenomenon illustrated there is quantum physics.

27 To hear one of these students’ own account of their Science and Justice experience, see http://www.youtube.com/watch?v=B6rwEi3vZRE (accessed June 24, 2014). His description of his S&J project begins around minute 51.

28 Building on the success of the training program, in 2011-12 administrative leaders at UC Santa Cruz encouraged Reardon to create a Science and Justice Research Center. Ultimately her proposal was successful, and the University provided physical space, as well as funding for a half-time administrative assistant and programming.

29 This formulation draws on Karen Barad’s concept of “agential cuts,” which adapts from Niels Bohr conception of the experimental apparatus as enacting cuts between the object and the agencies of observation. She argues that we need to take responsibility for the cuts we participate in enacting; with each cut we “contest and rework” what matters and what is excluded from mattering (pp. 178-179).

30 As Naomi Klein has astutely argued, financial crises often become the cover for eliminating programs and efforts that fall outside of political favor. The major has recently been re-instituted—but not the department, which was disbanded.

31 The formation of the Science & Justice at UC Santa Cruz was in many ways shaped by the California context during the Financial Crisis. While much of the restructuring of universities and research is being is being
experienced worldwide (often characterized as the ‘Neoliberalization of universities’), the specificities of both the promise and the trouble importantly varies between institutional and national contexts. We offer this account not so that our model can be “imported” wholesale into other contexts (though some of our techniques might prove useful). Instead, we hope to learn from other researchers in &TS and FSS what becomes possible as institutions make difficult changes. We would be interested in hearing about other initiatives to compare the knowledge formations that arose in similar times, but different places.

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Bios

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