

FEMINIZM4ALL

A Framework for Feminist Technology Intervention

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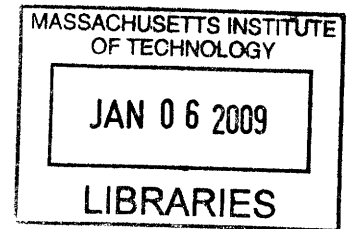
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Submitted to the Program in Media Arts and Sciences,
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Abstract

This thesis describes a feminist framework for technological interventions. I first define the problem by contrasting studies from psychology with research from other social sciences to determine that the primary reason for the gender imbalance in technological spaces is based in hostile work environments and not in the fact that women are disinterested as recent psychological research claims. This lack of diversity affects how technology products are shaped and how consumers interact with these artefacts. I outline a techno-feminist approach to intervention by looking at legislative and technological interventions into tech workspaces. Because this thesis is concerned with creating a framework for interventions rather than an individual technology, I describe different collaboration and production models typical to contemporary technology. These models are Web 2.0, open source software production, and collaborative platforms for distributing physical technology objects. In order to find out how to build a technological framework for making technology spaces more equitable for women, I created two projects. The first one is a Web 2.0 platform that provides data about gender and the technology workspace as well as instructions for visualizing it. The second one is a collaboration on a feminist technology for the workplace. The conclusion of the thesis is a description of future work based on these two projects.


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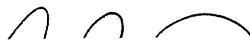
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Introduction and Overview

I am one of seven women graduating this year with a Master's Degree from the MIT Media Laboratory's Program in Media Arts and Sciences. The number of male graduates amounts to more than three times that. Between 1995 and 2006, overall female enrollment in the Media Lab averaged at 23 percent only climbing up to 29.1 percent in 2001. This thesis addresses the gender gap in technology workplaces (both academic and non-academic). Its aim is to create a technological framework for feminist interventions in these spaces. This means that the thesis explores feminist technology but also questions related to mobilizing labor and participation in the techno-feminist cause. In the following paragraphs I will give a brief overview of the structure of this thesis document and the main arguments contained therein.

In the Background chapter I contrast studies from psychology with research from other social sciences to determine that the primary reason for the gender disparity in technological spaces is the environment itself – not the fact that women are disinterested in technology work as psychologists argue. This is the first basic definition of the problem that this thesis seeks to address. I then examine how the gender imbalance shapes electronic products and, by extension, consumers of technology. Subsequently, I explore how this information can be turned into action by describing both legislative as well as technological gender interventions. The final section focuses on technological production and participation models, examining how interventions could be distributed and feminist labor mobilized.

The Related Work chapter is a survey of existing feminist interventions into technology production from a broad range of fields. Some of the people involved in these projects would probably not describe their efforts as primarily feminist. However all of the projects described in this section are in some way using technology in an effort to promote gender equity in technological spaces. I describe these projects primarily to establish a context for present and future work. I also look at some of my past projects to explain how this thesis differs from them.

In the Implementation chapter I am describing two feminist technologies that I have developed in collaboration with others. The first project focuses on data visualization and makes use of Web 2.0-style participation conventions. The second project is developed in the style of an open source software project. Both projects were critiqued by a group of experts. The results can be found in the Evaluation chapter. In the concluding chapter I re-visit some of the issues raised in the critique and outline plans for future work.

Chapter 1: Background

1.1 RTF-FEM: How to Make Studies About the Gender Gap in Technology Productive

Trends are showing that female involvement in U.S. technology production is small (22 percent) relative to the overall representation of women in the U.S. Workforce (46 percent) and not growing. According to the “2007 Scorecard” published by the Center for Women and Information Technology, the number of computer science bachelor's degrees awarded to women dropped from 36 to 21 percent between 1983 and 2006 (NCWIT 2007). But the decline does not just happen at the point of recruitment: retention of female technology workers has also proven difficult. This section takes a look at different ways in which the gender disparity in technological workspaces is being explained through studies by researchers. It hopes to provide a entry point into the thesis which proposes technological designs for transforming these workspaces.

In June 2008, the Harvard Business Review published *The Athena Factor: Reversing the Brain Drain in Science, Technology, and Engineering* an international study of women in the field of science, technology and engineering (SET). It found that women are well represented in the lower rungs of the corporate career ladders where 41 percent of the scientists, engineers, and technologists are women. However, the distribution over different disciplines varies. The highest female representation can be found in scientific and medical research (66 percent) and the lowest in engineering (21 percent). What is striking about the study is the fact that in their mid to late thirties 51 percent of all of these women abandon their careers because of hostile workplaces, (63 percent reported having been harassed on the job) or reasons related to feeling isolated and lacking the same social network that men are perceived to have. Forty percent reported feeling “stalled” or “stuck” in their careers (Hewlett et al. 2008, i). A *New York Times* article quotes the authors saying that the result of not having the same social network as men is “that women tend to find themselves shunted into roles as executors or helpers – without ever understanding why – while men occupy the more illustrious creator and producer roles” (Belkin 2008).

This stands in stark contrast to the results of recent studies from the field of psychology, some of which attribute the low female involvement in technology to a lack of interest on the part of women. An example is a study authored by a team of researchers from the University of Kansas led by Joshua Rosenbloom that will be published this summer in the *Journal of Economic Psychology*. The study entitled “Why are there so few women in technology? Assessing the role of personality in career choices” suggests that women are underrepresented in the technology workforce because men and women “differ systematically” in their interests, and that these differences in interest account for the gap. The authors say that “much of the difference in entry into information technology

(IT) is the result of the fact that, on average, men and women value different aspects of work, and therefore, make different career choices.” (Rosenbloom et al., 11) Participants of the study were a subject group of Information Technology (IT) professionals and a control group of non-IT professionals. The participants of the subject group are similar to the participants of the Athena report in that they had already spent parts of their professional lives in technological work environments. The study found that men and women who like to explicitly manipulate tools and machines were more likely to choose IT careers. Men on average scored higher in the area of this type of preference. The authors conclude that these differences in preference “can account for an economically and statistically large fraction of the occupational gender gap” (Rosenbloom et al., 1).

A related long-term study from the field of psychology is the “Study of Mathematically Precocious Youth” (SMPY) by Camilla Persson Benbow and David Lubinski of Vanderbilt University. The effort has been underway since 1971 and is projected to run for a total of 50 years. According to the researcher's website, seven books and 300 articles have been based on the SMPY study. Conceived in the 1970s, the study's early focus was on how the United States can adequately train scientific leaders but “contemporary interest and concern” (Lubinski et al. 2001, 309) has led them to also study the gender gap in science and engineering.

The main participants of the study are groups of mathematically “gifted” teenagers (528 males, 228 females). They are identified around age 13 and tracked into adulthood. For a recent report, a group of graduate students from top U.S. math-science programs were also studied. Both groups submitted SAT scores, completed biographical questionnaires and, depending on their age, were subject to two standard measures of personality looking broadly at values and vocational interest.

The study found that men deemed by the researchers to be “mathematically gifted” were more likely to go into physical sciences and engineering while women who had the same level of mathematical performance chose careers in medicine, biological sciences, humanities, and social sciences. Similar to the University of Kansas study, the Vanderbilt study found that these women had a preference for working with the organic while the men favored inorganic objects. Women were also found to value “people contact” in their work and on average had better verbal skills than the men. The researchers attribute the fact that women were not choosing engineering and physical sciences and preferring careers in other fields to these abilities.

Both the University of Kansas as well as the Vanderbilt studies reach similar results using measures of personality and aptitude that are widely accepted in the field of psychology. But what can psychological testing methods say about human beings and what do they omit? How useful are the studies above to explain the gender gap in the technology workplace? What social messages do the results imply? Consequently, what kinds of tools for change can they provide?

A widely cited case study for the effects of psychological testing methods on society is the intelligence testing done with 1.75 million U.S. military recruits during World War I. Before this gargantuan effort, intelligence testing was not widespread. Historian John Carson observes in "Army Alpha, Army Brass, and the Search for Army Intelligence" that through the testing, "intelligence" as a term became an accepted and widespread criterion for military assessment "[...]as reflected in the many official and semiofficial reports that officers were required to prepare on one another, over the course of the war intelligence became a characteristic that officers increasingly noticed and commented on when assessing their subordinates and explaining successes or failures" (Carson 1993, 281).

While Army intelligence tests do not directly say anything about gender differences, they say something about how psychological testing methods work and what their effect on people is. In the *Mismeasure of Man* paleobiologist Stephen Jay Gould analyzes the testing methods, including how these methods might affect minorities. Gould critiques, for example, "our tendency to convert abstract concepts into entities" (Gould 1981, 24) which is expressed in the term intelligence. Besides looking at craniometry as a measure of intelligence, he also studied military intelligence testing in the Alpha and Beta exams – "the first massproduced written tests of intelligence" (Gould 1981, 195). The Alpha test was given to literates, Beta was a pictorial test given to illiterate recruits. Recruits were to solve logic puzzles consisting mainly of analogies. However, there was obvious cultural bias in these exams. It started with the test-taking mode. Many of the illiterate recruits had never held a pencil (Gould 1981, 212). The images that they were confronted with for the most part did not reflect their lived reality. For example, in one sequence recruits were asked to draw missing items in a picture. One such missing item was a net on a tennis court (Gould 1981, 211). Since tennis was at the time an elitist sport, it was unfair to expect everyone to know the setup of a tennis court. Although few recent immigrants took the Alpha test, there were questions that according to Gould were found difficult to answer by immigrants, for example: "Crisco is a: patent medicine, disinfectant, toothpaste, food product" (Gould 1981, 200). Overall, minorities and immigrants did not do well on the test. Racial segregation was written into the law at the time, but along with the relative poverty and cultural backgrounds of the test subjects it was not taken into account by testers. To Gould, it was clear that the test that ostensibly tested intelligence in fact measured radically different qualities such as the relative similarity of the participants to the testers in terms of race, class, and income.

The psychologist Robert Yerkes was in charge of the testing and of the analysis of the results. He resorted to strange circular arguments in order to prove that intelligence was a native property of human beings and completely free of any kind of environmental influence. According to Gould, Yerkes found "strong correlations between average score and infestation with hookworm" (Gould 1981, 218). Since hookworm was related to

poverty, it would seem obvious that low scores were connected with living a less privileged life. Yet, Yerkes saw the cause for the hookworm infection not in poverty, but in “low native ability” (intelligence) which would then result in a hookworm infection. While the example may seem absurd to a reader today, it shows how obvious the influence of the test subject's background and environment were on the results of the test, and how the testers deliberately did not pay attention to this but were eager to rate each individual on the same scale. Gould saw rating, or the “propensity for ordering complex variation as a gradual ascending scale” (Gould 1981, 24) as one of the primary fallacies of biologically determinist testing efforts such as the Alpha and Beta tests.¹ The scale in this case was determined by psychologists, people coming from a privileged academic background. The definitions of skills, knowledge, and context that went into making this scale was defined by a class of scientists and imposed mainly on a less privileged group of recruits.

The Athena report does a good job at examining the many different factors influencing many different female experiences in technology workplaces. It focuses mainly on women but also brings in comparison data on men when needed. The report concentrates on the retention of women in the technology workforce and results in recommendations which are charting a path of action for companies and institutions that are interested in growing and maintaining a diverse workforce. In contrast, it is obvious that the psychological testing paid comparably little attention to how men and women experience their environment. Instead, the psychological testing focuses on an abstract notion of personality, distilling overall statements; for example, that women favor the organic while men prefer the inorganic. If we look at this from the perspective of Gould, this abstraction of a concept can be problematic. The reification of women's and men's innate tendencies to differ in choice into a very palpable concept provides an easy, unified explanation that might not tell the whole story.

Research done in the 1970s by Carol Gilligan suggests that psychological testing methods might falsely evaluate women's abilities because they do not take into account how women and men might see things differently. Consequently, these testing methods produce skewed results. In her 1981 book *In a Different Voice* she examines scoring methods used by Lawrence Kohlberg, a developmental psychologist most famous for a theory about the moral development of children. Kohlberg found that at the age of eleven, girls were at a lower stage of moral maturity than their male counterparts.

All participants in Kohlberg's study were asked to respond to a moral dilemma involving a man named Heinz that has become to be known as “Heinz's Dilemma.” Heinz

¹Today's tests that rate humans in aptitude such as the Scholastic Aptitude Test (SAT) taken by students looking to enter U.S. universities are more refined than the Army Alpha test. However, they are descendants of that same test. The SAT was first developed by one of Yerkes' students, C.C. Brigham, who became secretary of the College Entrance Examination Board. Gould writes “[...] the Army Alpha was the granddaddy, literally as well as figuratively of all written mental tests.” (Gould 1981, 199).

has a wife who is very ill. To save her life, he considers stealing a drug from the pharmacy which he cannot afford. Gilligan contrasts interviews with both a girl and a boy to explain where Kohlberg's method fails. The boy sees a "conflict between life and property that can be resolved by logical deduction" (Gilligan 1982, 31) like a "math problem with humans" (Gilligan 1982, 26) while the girl expands the question to an issue not of whether Heinz should steal the drug but "rather how Heinz should act in response to his awareness of his wife's need" (Gilligan 1982, 31) interpreting the problem as issue of continuous, contextually dependent relationships. Since this possibility is not taken into account by Kohlberg's scoring system, the girl's judgements are rated a full stage lower than the boy's. Gilligan said that Kohlberg's method provides a response to the question "What does he see that she does not" (Gilligan 1982, 31) . However, the same method does not address the girl's point of view.

Both the University of Kansas as well as the Vanderbilt studies fail to address that, being in the minority in technology spaces, women could have a different perception of the social dynamics of their environment and the overall climate in the field than the men, that factors other than biography and personality could have a big effect on their choices and preferences. Karen Tonso's anthropological ethnography research in a public engineering university illustrates how the results of studies done by psychologists such as the Vanderbilt and Kansas efforts diverge from the findings of more integral, holistic fields like anthropology, social studies, and sociology. Over several years, Tonso, a former engineer, conducted research on 274 first-year and fourth-year engineering students over several years at a state university concerned about the education of female engineers. This subject group is comparable in age and stage of professional development to the group studied in the Vanderbilt University SMPY research cited earlier. In the abstract to her 1998 paper "Engineering Gender – Gendering Engineering What About Women in Nerd-Dom" she writes: "The study found numerous instances of engineering being conceived of by students as male profession with women marginalized for not appearing to conform to the culture of the profession" (Tonso 1998). In contrast to the psychology studies which see participant's choices and values as largely separate from their environment, Tonso's study found that in the engineering education context knowledge and skills come with a set of cultural values that prioritize males and take a pejorative view of women. The study is compelling evidence that in the educational setting where an engineer's professional identity is build, women are devalued and may therefore be less motivated to eventually join the engineering profession.

Tonso conducted cultural identity interviews with individual students where she asked students to describe and reflect on their environment. One pattern that formed throughout these interviews is described by Tonso as follows: "At Public Engineering School (PES) there are no terms for talking about women engineers as engineers as members of the engineering community" (Tonso 1998, 3). This illustrates that women face

completely different cultural barriers than the men in the process of professional socialization, a process that the psychology studies do not take into account. This also brings back to mind Gould's criticism of the Army intelligence tests which were infused with cultural values of one class and blind to the fact that it was imposing these values over another.

Another study that looks at how men and women are affected differently by technological environments is "Gender: Integrated Report of Findings" conducted in the series "Free/Libre and Open Source Software: Policy Support" (FLOSSPOLS) by researchers from the University of Cambridge with participants from the Free and Open Source Software (FOSS) Community. Similar to the Athena Report and Karen Tonso's study at PES, the FLOSSPOLS study found that women are not disinterested in FOSS but rather are actively kept out of FOSS communities by males who create environments that are hostile towards women. The researchers collected both quantitative but also qualitative data. The questions mainly address the FOSS environment. Results show in remarkable ways how perceptions vary depending on gender: in the survey, 75 percent of the women answered "yes" when being asked whether they had witnessed or been subjected to discriminative behavior against women within the community. This stands in stark contrast to the replies of 78 percent of males who answered the same question with "no" (Nafus, Leach, and Krieger 2006). Quite obviously, FOSS men are not aware of the plight of women in the community and consequently do not empathize with their female colleagues.

Although women's and men's views on discriminative behavior diverge sharply, they agree that women as a minority do stick out. Two thirds of men and women surveyed said that in offline contexts women often get more attention as a woman rather than a FOSS participant. In offline contexts this is even more prevalent. Seventy-five percent of women said that it is true or mainly true that they receive more attention as women than as members of the FOSS community. The fact that FOSS women as a minority are singled out because they are different from the male majority bears negative implications for the women. The researchers report that in the ethnographic portion of the study, "[...] women related their experiences of prolific sexual attention, and men too relayed to us their observations about how women are sexualised in F/LOSS" (Nafus, Leach, and Krieger 2006, 29). The authors of the study write that the heightened amount of sexual attention makes women feel alien and "can disrupt mentoring relations and communication in general" (Nafus, Leach, and Krieger 2006, 29). Being singled out because of gender causes women to feel uncomfortable and possibly miss out on things that men in the same field take for granted. This consequently helps to create and maintain inequality.

The FLOSSPOLS study also found that men and women's points of view sharply diverged again when asked: "For whom is it easier to get acknowledgement for work in

the community?" 62.5 percent of women answered that it is easier for men, while 81.2 percent of men said that gender did not matter. The authors write that members of the FOSS community tend to refer to the way they organize as a "meritocracy." However, they also describe the FOSS community as a place where reputation is built not just through actual contributions but also in the process of "flaming" others. This is a type of unfriendly, aggressive, posturing behavior. So what is really perceived as "reputation" greatly differs from actual merit. The authors recommend that public policymakers for whom the report is intended "would do well to recognise that the mere mention of gender raises in many peoples' minds a set of problems that, as individuals, they feel they are not a part of, and for which imagined remedies constitute a threat to meritocracy" (Nafus, Leach, and Krieger 2006).

Studies like "The Athena Factor", Karen Tonso's work at PES, as well as the FLOSSPOLs study provide a relatively straightforward, but multifaceted image of technology culture as it affects women and possibly also men who might not fit the predominant macho culture. All three studies underline the importance of taking into account that women and men might perceive technology environments differently and consequently be affected in different ways and how that might lead them to ultimately abandon their technology workplaces. All of these realizations are in the end more productive than the psychology studies which have found the reason for the gender gap to be in men and women's differing statistical personalities and preferences. If one looks at technology culture from the point of view of Karen Tonso, "The Athena Factor," and FLOSSPOLs, actions can be taken on many levels to change technology environments into more equitable spaces.

1.2 The Gendering of Engineering Processes

While female participation in the creation of technology is showing no signs of growth, women have become a dominant force in the consumption of technology. According to the National Center for Women and Information Technology's 2007 Scorecard, women in the United States started outspending men on consumer electronics products in 2003, with a collective purchasing power valued at \$55 billion. But women are not just consuming more on the hardware side, according to the market research company Anderson Analytics, social networking software platforms such as Facebook and others are now twice as popular with college-age women than with men of the same age group (Snyder Bulik 2007).

This gender disparity on the producer and on the consumer side shapes not just how products are made but also how consumers are made. Both the invention process and consumption of inventions are closely related. The technologically progressive has to

be socially progressive in order to innovate. This means that on the whole, both the technological and the social are not separate entities but interconnected processes. Taking a cue from the last section, I want to explore perspectives that state the problem in such a way that enable action.

Some of these perspectives come from a subset of feminist technology studies that analyzes the gendering process of consumer technologies. The analysis is based on research looking at technology, gender, and society as the aforementioned complex set of relations, one shaping the other (MacKenzie and Wajcman 1985). They describe how these complex relations manifest in contemporary technology and bring to light the “gendering” of consumer technology, offering a comprehensive feminist picture of every step in the social shaping process of a particular technology - from design, prototyping and user testing, to manufacturing, marketing, sale and subsequent use.

Most of the studies cited in this section were conducted as part of a project initiated in 1988 by the Vienna Center (European Coordination Center for Research and Documentation in Social Sciences). The Center brought together scientists interested in gender and technology. The results of the subsequent five year project are published in *Bringing Technology Home – Gender and Technology in a Changing Europe*. Two contributors of the this effort also published in *Gender & Technology in the Making* which is an in-depth study about the role of gender in every stage of the production and use cycle of a microwave.

In the introductory chapter to *Bringing Technology Home*, Cynthia Cockburn and Ruža Fürst-Dilić argue that technology, gender, and society are processes that are up for constant re-negotiation and that this implies that there is a potential for action and intervention as technology is seen as “shapeable” rather than a neutral, static entity. They also make it explicit that they themselves do not claim a position of neutrality. They see their research as a basis for improving conditions for women. “There are clear pointers here for to a feminist strategy on technology” (Cockburn and Fürst-Dilić 1994, 19). Specifically, Cockburn and Fürst-Dilić are suggesting four aims. These aims start with a very basic commitment to defending “women's right to healthy, sustainable, paid, work” (Cockburn and Fürst-Dilić 1994, 19). In terms of technology they affirm women's rights to be included in technology design “to generate a more holistic perspective on human needs and the technological possibilities for meeting them” (Cockburn and Fürst-Dilić 1994, 19). The other two aims are subsets of this larger effort, looking at gender relations and technology as well as making technology more inclusive.

In “Women users in the design process of a food robot: Innovation in a French domestic appliance company”, Danielle Chabaud-Rychter looks at female involvement in technology innovation process. She studies the engineers, technicians, marketers, designers and testers of a food processing machine. Her study found that the engineers, technicians and designers were predominantly male while the test users were females recruited from outside of engineering/design professions. The people charged with the

invention of the food processors constructed the machine mainly based on an abstract idea of how the female user would work with their product. This abstraction was reinforced by the marketing department, which provided the designers not with the market data and interpretative narratives about female consumers. The product was tested by a mostly male quality control team associated with the engineers as well as by a completely female group selected from non-technical professional fields. The women were mainly observed and their behaviors and remarks compiled in a report while the quality control technicians had direct meetings with the design team (Chabaud-Rychter 1994).

The author describes how this brings to light influence that the values of the team of engineers and marketers have in the shaping of the product. First, a gender-stereotyped group of testers was selected and therefore a female user group deliberately constructed. Second, the comments that the female user group made were not treated in the same way as the comments that the quality control team made. As people from an unrelated profession, the specific knowledge of this group of testers was not taken as seriously as that of the quality control team, they were undervalued (Chabaud-Rychter 1994).

The female testers in the food processor study worked in a profession unrelated to engineering and therefore not seen as actively working on the technical features of the food processor. In their book *Gender and Technology in the Making* published in the early 1990s, Susan Ormrod and Cynthia Cockburn do an extensive study of every stage in the production, sale and use of a microwave and among other findings they write about how occupations within the engineering process were rated by people working in that environment.

While the food processor study illustrates how engineering tends to take perspectives coming from members of professions that they see as unrelated less seriously, Cockburn and Ormrod's microwave study brings to light a hierarchy within engineering culture that values certain types of work over others. The engineering staff at the microwave factory studied by Ormrod and Cockburn was mainly male. However, there were two female technicians charged with analyzing and improving the assembly line process. Although being officially called "technicians" the women did not see their jobs within an otherwise male production engineering team as technical and were hesitant to see themselves as part of the engineering process. Ormrod and Cockburn write "We felt that the reluctance of Wendy and Karen to claim technologist status partly reflected an observable fact: their jobs had more to do with people and less to do with things than those of the male technicians" (Cockburn and Ormrod 1993, 51). This is evidence that a hierarchy of skills and practices within technology producing communities exists and that it is re-iterated by both men and women. If we look back at the the Vanderbilt study cited in the Background section, this is particularly concerning. The study found that women on average had better verbal skills and valued "people contact" (Lubinski et al. 2001).

However, as the example above shows, the jobs where women are likely to perform better than men due to having, on the whole, better-than-average communication skills are at the lowest level in the engineering and technology power structure.

Also, another look back at the FLOSSPOLS study will help shed more light on this power structure. In FLOSSPOLS, the majority of women said that it was more difficult for them to be acknowledged for their work. Here we can see the same mechanism at work on a more broad scale. However, FLOSSPOLS identifies some of the causes for this hierarchy, pointing for example toward the practice of flaming as a way to build recognition. This suggests that the social shaping process is not something that is just determined by the technology itself but by the social processes surrounding it and that these can be re-shaped.

An example for this is “Sweeping away the dust of tradition: Vacuum cleaning as a site of technical and social innovation” a chapter in *Bringing Technology Home* written by Riita Smeds, Outi Huida, Elina Haavio-Mannila, and Kaisa Kauppinen-Toropainen, a Finnish study that traces the Central Vacuuming Systems (CVS) from the factory to the homes. Like the food processor and the microwave study, it found very distinct division of labor along gender lines in the engineering and production process. However, once the technology had reached the home, there were signs that the division of labor was not as pronounced if certain conditions were met. It showed that male partners in mixed-gender relationships were taking a more equal share in vacuuming when the technology was introduced in the home. The authors attribute this “social innovation” to the technical innovation. However, they also found that income and educational status of the female partner made a difference in how much the male partner was going to participate in housework. This research shows that social as well as technological processes do influence the genderedness of technology. It shows that genderedness can become less pronounced if technological change happens. At the same time, the genderedness of technology can also be changed if societal conditions change – for example, if women who have historically earned less now have an equal or higher income than their male partners.

If this were extended to the food processor innovation process, it could be suggested that if engineering and marketing took into account that there are multiple ways in which gender and by extension human relations can happen, that men and women might have complementing sets of knowledge if they contribute equally, then a more gender sensitive innovation process would happen. On the other side, Smeds, Huida, Haavio-Mannila et al suggest that efforts need to be made not just by engineering culture but also on a more general level. They suggest that both men and women need to “operate more independently in different spheres of life” (Smeds, Haavio-Mannila, and Kauppinen-Toropainen 1994, 39). Their research suggests that new technologies such as the CVS can change how housework is shared but that efforts need to be made from the

side of consumers to escape role clichés. In the spirit of the “Social Shaping” literature it can be said that technological innovation has to make social innovation possible and the other way around. The technologically progressive has to be socially progressive as well.

1.3 Interventions

So far, the focus of this text has been to counter arguments that women's innate dispositions keep them from entering and staying in technology careers. Studies were cited that showed that hostile environments and not women's personalities make a more compelling argument when finding reasons for explaining the gender gap in science, technology, and engineering. Then, I discussed studies that examine the effect of overrepresentation of males in technological workplaces on products and consumers and vice versa. The question now is how can the theory be made productive. First, I will be looking at public policy, specifically Title IX and other legislation enacted to counter sex discrimination. Because this thesis argues for a technological solutions to the problem of gender inequality in technological spaces, I will then also bring in Alison Adam's *Artificial Knowing*, a book that dismantles sexism in Artificial Intelligence (AI) but also briefly explains the necessity and difficulty of creating feminist AI Projects.

1.3.1 Legislative Intervention

Title IX, also known as the Patsy T. Mink Equal Opportunity in Education Act, went into effect on June 23, 1972 in the United States. It states that “No person in the United States shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving Federal financial assistance.” (Anon 1972). Although the legislation does not mention sports explicitly, it is credited with having had a dramatic effect on this field. The American Association of University Women reports that before Title IX, there were fewer than 30000 varsity athletes at the university level. According to the AAUW, “the number is now more than five times that (AAUW).” As the opportunities grew, the female participation in sports went up. The numbers are impressive proof, that human preferences are tied strongly to opportunity and favorable environments and less to innate dispositions as suggested by the psychology studies cited earlier. Title IX in sports created a precedent for showing that the number of females could go up in a field if favorable conditions were created and maintained through monitoring.

But although Title IX has had its biggest effect on sports, conditions in this area are still less than ideal. In response to the requirements of Title IX, many women's teams

were created at schools and universities. However, the AAUW reports that two thirds of the money is still going to male athletes. In addition, Title IX in sports does not prohibit schools and universities from forming separate men's and women's teams. While participation in sports is growing, a situation that can be described as “separate but not equal” still prevails.

The fields of Science, Technology, Engineering and Mathematics (STEM), are only starting to receive Title IX scrutiny. The issue of the lack of gender equity despite Title IX was first raised at a 2002 hearing by the U.S. Senate Subcommittee on Science, Technology and Space with testimony from many concerned scientists and entrepreneurs. Senator Ron Wyden, presiding over the meeting noted at the beginning that the hearing marked the “first Senate hearing in 20 years dedicated primarily to the issue of women in the hard sciences”(U.S. Senate Subcommittee on Science, Technology, and Space 2002). The consequence of this and a subsequent hearing was that Senators Ron Wyden and Barbara Boxer requested a report on Title IX from the Government Accountability Office which was published in 2004. The report has shown that while research efforts from the STEM disciplines receive billions of dollars in funding from federal sources, few of them have made efforts to comply with Title IX ever since it was enacted in 1972. The report found multiple reasons why institutions were not complying with Title IX some of which are mutually constitutive and show a larger systemic problem.

The report investigated four grant awarding agencies, the Department of Education (Education), the Department of Energy (Energy), the National Aeronautics and Space Administration (NASA), and the National Science Foundation (NSF). Under Title IX, both the federal agencies as well as recipients of federal grants have compliance responsibilities (U.S. Government Accountability Office 2004, 5). The report found that out of those four agencies, only Education completed all required monitoring activities. However, even if complaints were made about grant holding institutions, it was difficult for the federal agencies to “determine whether grantees have investigated Title IX sex discrimination complaints they have received, since grantees are not required to report on their activities” (U.S. Government Accountability Office 2004, 5). The report found evidence that grantees were not even setting up procedures to resolve Title IX sex discrimination complaints as required by Title IX. However, since these institutions again were not required to report back to the granting agency, it was difficult for the granting agency to determine compliance. Testimony from students, research staff, and faculty at recipient institutions included in the report shows that the institutions do a poor job at educating students and employees about their rights. The researchers write : “[...]scientists and students at most schools we visited told us that they thought Title IX covered only sports and did not know the law also encompassed academic issues” (U.S. Government Accountability Office 2004, 11). But even if faculty, researchers and students knew that they could file a complaint, they said that they were unlikely to do so because

they feared retribution from colleagues and supervisors. Female faculty members also determined that they would not file a complaint as it could endanger their tenure cases and take them away from their research for too long (U.S. Government Accountability Office 2004, 11).

The report makes a clear statement that Title IX needs to be enforced in STEM. Grant giving agencies were given a copy of the report before it was published and their replies are printed in the back. They all vow betterment. But it is crucial to find appropriate ways in enforcing Title IX. If we look at the situation in sports where female participation has been steadily growing over the years but is largely kept separate from male teams, it is clear that this is a less than ideal model and should not be copied by universities looking to increase female participation and retention in STEM. Rather, an appropriate way in addressing inequality needs to be found.

In 1994, an effort by senior female faculty in the School of Science at MIT was made to address gender inequities within the school on various levels. They started by polling their female colleagues within the School of Science about their experiences at the Institute. They discovered that the stories resembled each other and that patterns started to form regarding the status of senior women faculty. In 1995, a Committee on Women Faculty was established by the Dean of the School of Science and “Individual issues of space, resources, equipment, previous underpayment of pensions, and responses to outside offers were rapidly addressed” (Vest, Birgeneau, and Bailyn 1999). In the time span between 1994 and 1999 the number of women faculty increased much more rapidly than it had in decades before. This shows that in STEM, the culture is the largest barrier to for gender equity and that interventions are needed from individuals from within that work culture. Else, the enforcement of gender equity legislation will probably not ever be effective.

However, there are examples where enforced sex discrimination legislation has been successful. Such as in Norway, where in 2006 a law required all publicly listed companies to get the percentage of women on their boards up to 40 percent, or, if the board was dominated by females, raise the male share by the same amount within two years. If the companies did not comply they were forced to disband. As with efforts like the Athena report, the Norwegian champions of the 40 percent quota did not argue gender equity but economic necessity. Enforcing the 40 percent quota was difficult. The Guardian Newspaper reports that “Out of 611 affected companies, 470 had not a single female board member.” Today, two years later, Norway has the highest proportion of female board members. There was some opposition but executives interviewed in the Guardian credit the new legislation with making it easier to undercut the old boy networks (Norwegian: gutte klubben grei) (Roberts 2008) which have been found to keep women from succeeding by the studies like the Athena report.

The Norwegian example shows that legislation can be a useful tool to change the

status quo very quickly. In the case of Title IX legislative change can come with its own set of problems demonstrating that legislation is not the only means for change. The senior female professors at the MIT School of Science brought forward a social transformation of their environment by having the Institute re-examine how resources were distributed. The second part of this section will therefore concentrate on reflecting about technological interventions, that could for example help to support people who want to intervene into the dynamics of their technology workspace. It will also focus on the conceptual difficulties of creating feminist technology for interventions.

1.3.2 Technological Intervention

As explained in the previous section on the genderedness of consumer electronics, innovation processes are only reluctantly taking female perspectives into account. As far as the consumers go, social innovation is possible but driven in a very limited way by the technology. Alison Adam gives a detailed account of the many ways that “gender is inscribed in artificial intelligence systems” (Adam 1998, 9) in her 1998 book *Artificial Knowing*. The book is a feminist critique of AI systems which assume the masculine view of the world to be ubiquitous and therefore exclude women's ways of knowing.

In the last chapter, Adam discusses feminist AI student projects that she supervised. The first project she discusses is a legal expert system to advise on UK Sex Discrimination Law. As with Title IX, UK Sex Discrimination Law requires the victims to file a complaint and prove that their rights have been violated. However, victims are often not aware of the protection that the law can bring them. As any law is up to interpretation by the courts and therefore constantly up for renegotiation, an AI system can help someone seeking advice to assess the feasibility of a case. According to Adam the project was however never tested in a “practical setting” and therefore data on its use is not available.

The second project that Adam discusses is a computational linguistics project. It is a formal model for predicting inter-gender miscommunication. The model is based on existing research that shows differences between female-female, male-male, and mixed-gender natural language interactions. Adam cites research that shows that in situation of inter-gender miscommunication, women tend to do the repairing, which is a factor that the system takes into account. Adam however cautions that there is an inherent danger to suggesting that “men's and women's linguistic interactions follow universal patterns.” She provides a solution to this dilemma by saying “Yet making the cultural roots of the model explicit serves to underline the difficulties of generalizing linguistic misunderstandings” (Adam 1998, 136). Still, Adam is conflicted about the projects described above. She criticizes that although made from a feminist viewpoint, both the law project and the

linguistics project are using the same symbolic representation structures that she worked so hard to dismantle in the other chapters of the book. However, she concedes, it would be premature to give up feminist AI altogether because of this, and that these projects provide building a case for other such initiatives: “By continuing to build on the practical projects just begun and through women's refusal to give up the ground made in relation to the technology, we gain a glimpse, however small, of how things could be different” (Adam 1998, 151)

1.4 Distribution: How to Channel the Intervention

Both the Government Accountability Report on Title IX and Adam's account of the difficulties of making feminist AI a reality are indicators that technology is not an easy territory for gender intervention using either public policy or technology. The question that I am exploring in this section is how to channel a technological intervention. Both of the AI projects that Adam describes are designed with the vision of cultural transformation both on the code level but also on the societal level, aiming to intervene in the existing discourse in gender, technology, and society.

But how can we mobilize more people to participate and make similar projects? As an entry point into answering this question, I will turn to art and art history as fields that create and analyze the changing role(s) of the audience. In the 1960s and 70s artists increasingly included their audiences as active participants in communications processes rather than passive contemplators of static objects. On a 1974 lecture tour through US colleges and art institutions, Joseph Beuys talked about “the whole question of potential, the possibility that everybody has now to do his own particular kind of art, his own work, for the new social organization. Creativity is national income” (Rothfuss). Beuys' concept of the “Social Sculpture”, saw everyone as a potential creative contributor in a bigger effort to bring social transformation. His use of sculpture as a term to describe this endeavor, illustrates how he along with other artists of his generation was expanding the grammar and vocabulary of art to include immaterial manifestations and new models for collective authorship within the field. As a consequence of this expansion, the concept of audience was expanded as well and vice-versa.

This thesis aims to build a technological framework for expressing feminist viewpoints through technology. Similar to Beuys' claim that everyone can be an artist, the thesis sees everyone involved in technology as a potential creative contributor to bringing social transformation to the field. Therefore, I will now outline several areas in which creative contributions are already made in the contemporary technology landscape. The Implementation section will then expand further on how this kind of collaboration can be applied to techno-feminism (Wajcman 2004; Wajcman 1991) and I will conclude this thesis document with an outlook as to what future efforts could be.

1.4.1 Web 2.0

Beuys' vision of a society of producers has to a certain extent manifested itself in contemporary technology as what is commonly known as Web 2.0, a collection of services which facilitate user-contributed content on the World Wide Web. However, these services are to a large part provided by companies and therefore a majority of these services is profit-oriented. This section will briefly look at the potentials and drawbacks of Web 2.0 labor model.

“Web 2.0 is the business revolution in the computer industry caused by the move to the internet as platform, and an attempt to understand the rules for success on that new platform. Chief among those rules is this: Build applications that harness network effects to get better the more people use them. (This is what I've elsewhere called 'harnessing collective intelligence.')" (O'Reilly 2006)

This is a widely referenced definition of Web 2.0 made by Tim O'Reilly. The definition makes it clear that business aspects are very important to Web 2.0 – that the main aim of successful business is to know how to harness “network effects”. But what does that mean? In “Key Differences between Web 1.0 and Web 2.0”, a technical paper by Graham Cormode and Krishnamurthy explain “the essential difference between Web 1.0 and Web 2.0 is that content creators were few in Web 1.0 with the vast majority of users simply acting as consumers of content, while any participant can be a content creator in Web 2.0 and numerous technological aids have been created to maximize the potential for content creation” (Cormode and Krishnamurthy 2008). However, they observe that the business aspect is in a lot of cases hindering this, that communities are “fenced in” by the companies running them, such as is the case of the popular social networking site Facebook which does not at the time of this writing interoperate with other social networking sites. And even if they did interoperate, all of the big Web 2.0 services like MySpace, Facebook, Flickr, Photobucket, IMDB, YouTube, etc. except for Wikipedia are run by for-profit companies.

But what does the actual participation in these platforms look like? A study done by market research company Hitwise during one week in April 2007 found that the passive consumers of Web 2.0 sites outnumber the producers. The study found that 0.2 percent of all US visits to photo sharing platform Flickr involved a user uploading a images to the site. For YouTube the percentage of US visits involving video uploads was 0.16. The percentage of visits where edits were made to Wikipedia was at 4.59 percent. The study also found that the 18-25 demographic was the largest group of consumers but that older segments of the US population were the more active producers.

As platforms such as Facebook, Flickr, MySpace, and YouTube have grown criticism of Web 2.0 has spread. First Monday, the same journal that published Cormode

and Krishnamurthy's article in June 2008, dedicated its March 2008 issue to critical perspectives on Web 2.0 "to help and expose, explore and explain the ideological meanings and the social, political, and ethical implications of Web 2.0" (Zimmer 2008) In this issue, a group of authors look at labor issues for example Kylie Jarret, who criticizes that Web 2.0 does not help in articulating individual and collective social power as it is "organised by the dictates of a neoliberal socio-political hegemony." This is similarly echoed by most of the authors in the issue - however, on the whole, the tone is not necessarily pessimistic. At the end of the issue, David Silver likens Web 2.0 to the dotcom bubble of the late 1990s. However, he says that the generation growing up with today's technologies has a different understanding of the media landscape: "This is the generation for whom broadcast media – and its silent, obedient audiences – is rapidly fading and for whom conversations make more sense than lectures. This is a new generation with new writeable behaviors and it's hard not to be hopeful about that" (Silver 2008). When looking at the Hitwise study that found older demographics to make up a comparably larger share of contributors to certain sites, there might be another reason for hope.

Outside of the world of academic publishing, an initiative with the name "Autonomo.us" was founded by free software activists, hackers, and scholars connected to the Free Software Foundation (FSF). According to its Franklin Street Statement on Freedom and Network Services (Autonomo.us 2008) the group was created to "provide moral and technical leadership" on the issue of protection of users of networked services that include Web 2.0 platforms. The Franklin Street Statement expresses optimism about the social contribution that user labor can make but see a need to formalize relationships between services and guarantee that the products are accessible to all.

To sum it up, it can be said that Web 2.0 consists of a range of different stakeholders. There are the users who have in large numbers taken on roles as producers. Then there are the services that facilitate this production. However, the big services that attract the most users like Facebook, YouTube, Flickr and MySpace are facilitated by corporate entities, that place restrictions on how these services can be used and therefore keep them from realizing their full potential. Web 2.0 also stands for a transformation: Large numbers of people now use the Internet in the read-write manner and therefore provide ground to build on for those who want to provide participative services that are of the non-corporate, political nature.

1.4.2 Open Source Software Production

In the first section I described studies about the Free and Open Source Software (FOSS) community as a work space and the barriers that women face in this environment.

In this section I will focus on the FOSS production model. Although it is a difficult space for women to work in, there is a lot to be learned in how FOSS organizes labor. This in turn can help formulate participatory technologies that will actually benefit women and men who do not fit the predominant macho culture that the studies cited in the first section describe.

The open source software production model organizes different ways in which people can use, change, improve, and re-distribute the software that others have written. Similar types of code-sharing has happened at some level since programmable computers have existed. When the popularity of computers grew and more companies became involved in software production, companies increasingly made code proprietary. As a reaction to this development, Richard Stallman, a former programmer at the Artificial Intelligence Lab (AI Lab) at MIT founded the GNU Project in 1983 and the Free Software Foundation in 1985. The GNU Project worked on a operating system that was designed from the beginning to be free and open to modify. While working on the operating system, Stallman and his colleagues also developed the GNU Public License (GPL) which provided the legal framework. It guarantees that components of any software that was released under this license are open to anyone who wants to modify them. Karl Fogel writes in *Producing Open Source Software* that the combination of the two efforts was the major contribution of the Free Software Foundation and the GNU Project, because it helped to spread political awareness among programmers: “The importance of the Free Software Foundation was not only in the code they wrote, but in their political rhetoric. By talking about free software as a cause instead of a convenience, they made it difficult for programmers not to have a political consciousness about it” (Fogel 2005).

Fogel's Book is a guide mainly to managing open source software projects. Similar to the 1999 book *The Cathedral and the Bazaar* by Eric S. Raymond, Fogel takes the reader through the steps of creating and managing an open source effort in similar ways as Raymond's book did six years earlier. While Raymond mainly talks about Fetchmail, a project he created and managed, Fogel's book is a general guide. His writing reveals that creating and managing a FOSS effort is as much a communications challenge as it is a technical challenge. Fogel gives advice on writing a mission statement, choosing a good name, choosing a license, describing features, giving updates about a project's status, as well as putting together documentation and developer guidelines. He also advises on communicating a project so that the threshold for new users to become involved is low. He uses the term “hactivation energy” when describing this threshold.

In addition to outlining the communications challenge, the book also helps demystify technical means for collaboration in the form of version control systems. These systems are standard for organizing a project and sharing code among several developers. Fogel explains them in a way that is easy to understand for people new to this domain.

A chapter that is particularly interesting is “Social and Political Infrastructure”. It explains how to create the social foundation of an open source project by producing “an atmosphere of fairness that people can rely on as a de-facto form of governance” which will then create “institutional permanence.” This outlines another component of running an open source project: the social challenge.

Towards the end Fogel's book takes a look at corporate involvement and how that might influence the social challenge that a project might pose. Fogel's book takes the corporate involvement in FOSS for granted as an option and outlines different models for organizing it. This is not the case in Raymond's *The Cathedral and the Bazaar* because at the time, corporate involvement in FOSS production did not exist at the scale as it does today. Raymond's essay leading up to the book helped the Netscape Corporation make the decision to give away the source code of their Netscape Communicator software. In his “Epilogue” he quotes Eric Hahn, the CTO of the Netscape Corporation as writing to him in an email “on behalf of everyone at Netscape, I want to thank you for helping us get to this point in the first place. Your thinking and writings were fundamental inspirations to our decision” (Raymond 1998). Netscape created the Mozilla Organization which was instrumental in producing the popular open source Internet browser Firefox. Comparing Fogel's guidebook to Raymond's writing can help understand how the open source production model has grown to structure participation in software development for growing numbers of individuals, groups and corporate entities over the years.

1.4.3 Distribution of Physical Objects

As Fogel's book outlines, open source software has many established social and technical conventions. These conventions govern participation and production in these projects. But what about physical objects? Are there similar processes in place for facilitating collaboration and distribution for hardware as there are for software? This section will look at different ways participatory development of hardware has been explored.

Eric von Hippel's *Democratizing Innovation* is a book about the innovations made by users of physical goods as well as software products. It explains how people participate in the advancement of products by creating their own innovations improving and/or customizing those products and how companies can benefit from the innovation labor of users. Chapter 7, titled “Innovation Communities” is of particular interest to this thesis because it explains how these groups of users organize.

Von Hippel uses a community of kite surfing innovators created by Saul Griffith, Eric Wilhelm, and Tim Anderson and their Internet platform www.zeroprestige.org as a case study for explaining characteristics of innovation communities concerned with

physical objects. One such community characteristic is that in the development process, physical objects primarily manifest as information objects such as models created with computer aided design (CAD) software. These files were exchanged through zeroprestige.org. Members of the community found out ways of having fabric for their custom kites cut out by sail lofts and shared the files for making cuts on computerized equipments used by sail lofts.

Besides the exchange of information objects and manufacturing techniques, von Hippel also mentions user-to-user assistance as a defining characteristic of innovation communities. He cites studies that show that this type of exchange adds value to a community. As to what this could mean to the innovation process as a whole, von Hippel writes "An answer that appears to be emerging is that there are private benefits to assistance providers, just as there are for those who freely reveal innovations." (Von Hippel 2005, 106)

Eric Wilhelm, one of the members of zeroprestige.org founded the popular do-it-yourself platform "Instructables" in 2005. The platform offers users a way to share instructions for making all kinds of products. It also provides forums and the ability to form groups. For example, zeroprestige is now also a group on Instructables. Instructables provides the group with a forum, social networking possibilities, and a way to organize their instructables under a common heading within the larger community.

Instructables is a general Web 2.0. application. It provides an infrastructure to help makers like the members of zeroprestige to communicate and produce. An innovation community that is pursuing a more politically focused cause is the Open Prosthetics Project (OPP). On the OPP website, project leaders refer to Eric von Hippel's definition of lead users when explaining their motivations. They founded the project to facilitate collaboration between users, makers, and funders. The objective is to share designs in order to speed up the innovation process in the field of prosthetics. The hope is that companies will adopt these designs and that the work done by the group will eventually benefit a greater public. As in von Hippel's definition of what a lead user is, the members of the project have found current prosthetics to be severely lacking and are putting their expertise into further development of these devices. As the development of products is multidisciplinary, the group uses a variety of existing platforms such as the social networking site Ning, the software development infrastructures Google Code and Sourceforge, as well as wikis for collaboration purposes.

1.5 Summary

In this chapter, I have contrasted studies from psychology with research from other social sciences like sociology and anthropology on the gender gap in technology workplaces. I have found that psychology does not offer much of an impetus for action as the cited psychology studies claim that women are statistically different from men and on the whole lack interest in technology. Studies from other fields of social science however have found that the women are not disinterested but actively kept out of the field by hostile working conditions. I find this to be a far more productive approach because environments can be transformed.

I then outlined the need for feminist intervention into technological spaces by citing both legislative as well as technological efforts and the progress that has been made. Because this thesis explores topics related to creating a framework for technologies that intervene into the gender dynamics of technology workplaces, I then explored topics related to technology labor and participation. In this context I paid special attention to software and hardware production models in contemporary technology that have mobilized contributions from large numbers of people.

As software is easier to distribute than hardware, the most successful models described above are software-centric models. However, as von Hippel points out, in the development stage, physical objects to a large part manifest as information objects in the form of CAD files. These, along with the knowledge about manufacturing processes are ultimately shareable in similar ways that software is.

Communities like the Open Prosthetics Project and zeroprestige have developed infrastructures for developing and sharing these types of information objects among a community of users. These infrastructures enable the aforementioned communities to open up hardware design to participation by large numbers of people. In the case of the Open Prosthetics Project, the objects that the collective labor produces are an intervention into the production and social reality of prosthetics today and can therefore serve as a model for the design of interventions into other areas of life.

Chapter 2: Related Work

The Background section gave a definition of the problem and looked at the necessity for feminist interventions and at different distribution practices. This section surveys existing feminist interventions in technology production and the channels through which they are distributed. Even though some of the projects described below are not known primarily as “feminist”, they are feminist insofar as they use technology in an effort to create more equitable technology spaces for women. They are projects from the fields of techno-political art, free and open source software production, educational technology, and the game industry. I am looking at a broad range of fields because I am interested both in the projects themselves but also how they are distributed and mediated to the public and what the challenges manifest in this process. Some of the efforts that I am going to describe have been going on for years, in one case even decades. Therefore, I want to make it understood that I am not citing these projects in order to compare my own efforts to them. Rather, I want to continue to establish a context for both present and future work. In this effort, I will also describe some of my own projects done at the MIT Media Lab in order to explain my own motivations.

2.1 Feminist Hacking

Within the history of feminist art, one project is particularly relevant to the context of distribution of software and hardware based interventions that I am exploring in this thesis. *Female Extension*, a project by Cornelia Sollfrank is a very clever hack. The project revealed biases on several levels of the art system, biases that it aimed to correct in a comical way while at the same time revealing them.

In 1997, a renowned art venue in Hamburg, the Hamburger Kunsthalle announced a competition called “Extension” for art that “comprehends Internet as medium and object” (Hamburger Kunsthalle). This net art competition was created to inaugurate a new contemporary art gallery within the museum. As the title suggests, the objective was to create an extension of the museum – not into physical, but into the virtual space. However, the rules of the competition which required artists to upload their work on the museum’s server reflected a misunderstanding about the nature of net art. The museum neglected to take into account that net art can happen on “all levels (services) such as for example Email, MOOs, context systems, etc” (Sollfrank).

Cornelia Sollfrank created a program that generated random net art projects in the form that the museum expected. As required by the museum, she uploaded these projects to the museum’s server. The individual projects were submitted under the names

of 127 non-existent female artists from a variety of countries. The museum did not catch on and expressed pleasant surprise about the number of female participants in a statement to the press on July 3, 1997. The museum reported having received 280 submissions of which two thirds were from females. The jury of the competition was baffled about the great number of submissions from women but did not see that there was a pattern. As the three main winners, all of them men, were announced, Sollfrank revealed her intervention with a press release.

Female Extension developed interventionist technology, but the communications strategy was what made the technology effective. The net art generator generated art that fit the requirements of the museum while the communications strategy was also closely connected to museum's public relations efforts. Both the technology and the communication of *Female Extension* were closely related but in opposition to the system that they were intervening into.

2.2 Debian Women

Debian Women is an initiative that does not create women-friendly software but contributes in significant ways to "software that is better suited to a wider range of people because there are a wider range of people making it" (Wallach 2008) - says Hanna Wallach, one of the founders of Debian Women, one of the first women's groups in free and open source software (FOSS). Debian is an open source Computer operating system developed by a community of volunteers. On its website it is advertised as "The Universal Operating System". However, when Debian Women was founded, the ratio of male to female Debian developers was approximately 950 : 4. According to Wallach, this called for a "social intervention."

A lot of discussion went into creating Debian Women. Arguments like the typical "women are just not interested" misconception were expressed. "Friendliness", as another potential female stereotype was also debated: "Erinn, one of the people who founded Debian Women, was really opposed to friendliness being perceived as a primary goal of Debian Women" says Wallach. And then there was the question if and how Debian Women would include men:

"Something people were not sure of at the beginning was whether men should be part of Debian Women. Some people felt that they should not be. One of the strengths of Debian Women was that men were allowed to be involved. Because almost all of the existing developers were male - having men involved made the project about integration" (Wallach 2008)

Debian Women manifested as an IRC channel, mailinglist, and a mentoring program, encouraging more women to become software producers. Hanna Wallach: "We really wanted to focus on women making that transition from user to developer". According to Linux, the number of females in the New Maintainer Queue soon increased to 8 within five months of the foundation of Debian Women. Members of the group also filed a bug report to call attention to the fact that the personal pronoun "he" in the English language pages of the Debian website was off-putting for women. Another member, Fernanda Weiden, filed a bug report protesting the addition of sexist CPU monitoring program named "hot-babe" to the distribution (Marson 2004). As the results of the FLOSSPOLS study cited earlier suggest, it does not help to just bring up the numbers. One of the main contributions of Debian Women has been to change the culture of the Debian developer and user community.

"We don't have so many problems in Debian anymore where a girl turns up in an IRC channel and people make a bunch of sexist comments. I had not realized how much this had diminished until I turned up to an Ubuntu Open Week IRC session about women in Ubuntu and I was really surprised at the number of sexist comments" (Wallach 2008)

Ubuntu is a Linux distribution that was derived from Debian. It attracts a growing group of users because it provides a very accessible, easily installable desktop computing environment. These end users are not necessarily aware of what it means to be a woman in free software. According to Wallach the challenge now lies in educating these users "Ubuntu has a potentially much bigger problem than Debian nowadays." (Wallach 2008)

As a quote by Karl Fogel earlier states, open source software is as much a technological convenience as it is a political cause. Ethnographic work done within the Debian community by Gabriella Coleman and Benjamin Mako Hill shows that besides learning software engineering skills, "[...] participation in Debian over time represents a form of ethical learning and socialization in which new values are adopted while others are refined and enlarged" (Coleman and Hill 2004). They describe this development to be exemplified in the Debian New Maintainers Process. This is a formal process where people wishing to become New Maintainers are mentored in both technological and ethical concerns. They do not mention however, that this process is more difficult for women. Bringing the gender perspective into the ethical code of Debian by for example mentoring women wishing to become maintainers is one of the chief contributions of Debian Women.

Wallach found over time that women are just not recruited in the right way by the free software community. In 2006 she was running the GNOME Women's Summer Outreach Program. This program was a software development effort similar to Google's

Summer of Code but targeted specifically at women. Because the organizers of the Women's Outreach Program had carefully worded the advertisement to appeal to female coders, GNOME received 100 applications to the program from women. In contrast, not a single woman applied for Summer of Code positions with GNOME in 2006. The advertisement of the Women's Summer Outreach read: "You don't need to be the world's greatest coder to take part, since several mentors will be assigned to get you up to speed and help with any problems." (GNOME Foundation 2006) The advertisement did not foreground the competition aspect as much as previous advertisements. The drastic increase in female applicant rates caused Google to sponsor six instead of the initial three female participants.

The two examples from open source software production reveal two challenges that were addressed: The communication in the community and the communicating outside of the community. The second effort shows that besides mastering programming languages, technology communities are better off if they specialize in other vocabularies and languages in order to include a diverse group of producers.

2.3 Lifelong Kindergarten

"We want [our products] to be appealing for boys and girls – and especially girls" (Resnick 2008) says Mitchel Resnick, the director of the Lifelong Kindergarten Group at the MIT Media Lab. The group researches educational technology for children. The focus of Lifelong Kindergarten is to reach a broad range of people and help them find their own individual interest in technology. To achieve this, the group has designed a set of educational technologies but also established a range of distribution channels for their hardware and software products.

The group's relationship with the LEGO toy company which started in the 1980s is the distribution channel that has been in place for over two decades. The collaboration started when Resnick was a Phd student at MIT working with Seymour Papert. Based on the work of Resnick, Papert, and others, LEGO developed a brick kit which could be programmed with a computer. The kit was released to schools in 1988. Resnick says: "When LEGO was first developing this [product] based on our work, their initial prototype used only black and yellow bricks" (Resnick 2008). Resnick explains that the reasoning behind this was that a mono-colored brick would be taken seriously but that he and the other researchers disagreed with this "We said this should be playful. It is going to attract a wider range of people if you have more colors. Also, we had to argue to include little mini figures" (Resnick 2008).

When the programmable bricks were released to a wider audience under the name "LEGO Mindstorms Robotics Invention Kit" in 1998, the figurines had all but

disappeared. Resnick says that the Mindstorms kit reached a lot of people. However he also says that what is troubling is that the Mindstorms appeal to only a certain segment of the population: males. In schools Mindstorms were used equally by girls and boys, but in the afterschool context, the girls only made up about 30% of users.

Around the time when Mindstorms was released, Resnick and researchers at the Media Lab were developing the "Crickets" a much simpler robotics kit focused on adding computation to all kinds of arts and crafts activities. In the spirit of the Crickets, Resnick suggested to LEGO to design a different kit that would be focused less on robots but on making "little creatures", he was picturing little animated animals. LEGO took the suggestion and came out with the "Extreme Creatures" kit. It was designed in the same cold techno look as Mindstorms. At this point Resnick felt that he and his group needed to build an alternative channel for their products. Resnick says "That is what made us feel like we have to turn the Crickets into a product." (Resnick 2008) They eventually spun off PICO, the "Playful Invention Company" which now sells Cricket Kits to schools. He found that without an appropriate communications strategy, the technology was difficult to distribute in the cultural climate that Mindstorms and similar products had created:

"When we turned the Crickets into a product we struggled with one thing: if you describe Mindstorms – there is a single word you can use: robots. People know what you mean when you say robots. When you look at the things that we build with the Crickets, a birthday cake that plays a song when you blow out the candles, a cat that miows when you pet it, a little kinetic sculpture that moves up and down based on how you talk. We had a hard time knowing how to describe all of these things. We like that there is a wide diversity of things that you can build but there is a communications challenge. We ended up saying things like: it is a kit for building musical sculptures, interactive jewellery and other artistic inventions." (Resnick 2008)

PICO is funded to a large part by the owner of LEGO. This means that LEGO is free to use the ideas as well as the hardware and software that PICO produces. This is welcomed by Resnick and his group. The example above illustrates a technology product manifests as a software and/or hardware instance that can enable or disable a certain type of behavior depending on the cultural concept and idea that stands behind it. The "communications challenge" above is that cultural idea. In the case of the crickets, this seems to have worked out, as LEGO is going to soon release a kit similar to it.

The LEGO collaboration is just one example how Lifelong Kindergarten has organized the distribution of products and ideas. Together with the Museum of Science in Boston, Lifelong Kindergarten founded the Computer Clubhouses, an after school program in disadvantaged communities worldwide that emphasizes technology. In the

early 90s when the clubhouses were created, Lifelong Kindergarten was strongly involved: “At the very beginning, we played a critical role in creating the Clubhouses, and we've been advisors throughout. But now the Museum of Science runs the Clubhouse network” (Resnick 2008) says Resnick.

As for the newest product of the group, the Scratch programming language and Web 2.0 project sharing platform, it is not yet clear where this will go. One likely possibility according to Resnick would be to create a non-profit which would then take over Scratch.

What is characteristic about how Lifelong Kindergarten distributes projects is that the strategy is always tied to existing channels. Mindstorms were tied closely to LEGO as an existing product, the Clubhouses extended hitherto non-technical afterschool programs. Even the PICO Crickets that were difficult to communicate were a reaction or an extension of an existing product. Scratch, the newest product is distributed mainly through a Web 2.0 style website which is designed to look similar to the popular video sharing website YouTube. In order to reach a broad audience that they aspire to with their message, they are using already existing cultural concepts from education, commercial media and Web 2.0.

2.4 Brenda Laurel: Management Literature

“Culture work excites the will to action. It requires means of dissemination, often found in commercial media which after all are at the intersection of communication technologies and the market economy” (Laurel 2001, 11). This is a quote from Brenda Laurel's book *Utopian Entrepreneur*. The book starts with a description of how Laurel realized that she could not shape pop culture with her humanist values if she remained an outside critic, or defined herself as an “artist”, or even “political activist” (Laurel 2001, 10). Laurel describes “humanist” work as “values-driven work”. She says that in the function of a humanist and culture worker she had to become a part of pop culture and market economics in order transform the mechanisms governing these domains.

Having decided to change the system from the inside out, Brenda Laurel founded the gaming company “Purple Moon” in 1996 after two decades of involvement in the gaming industry and four years of preliminary research into creating games for girls at (Laurel 2001, 45) the Interval company. At the time, girls were not seen as a viable target audience, even though there was evidence that games like *Myst* and *Mario Brothers* had a higher female audience than other games. Consequently, investors brought up the too familiar gender stereotypes such as the intrinsic disinterest of girls in games.

Unlike fashion or cosmetics companies, Purple Moon did not take advantage of girls insecurities in their product design and marketing approach (Laurel 2001, 45). However, Purple Moon did do market research. They found that “girls didn't mind violence

so much as they disliked the lack of good stories and characters” (Laurel 2001, 40). What Purple Moon offered were environments that “provided emotional rehearsal space for dealing with personally relevant issues and ethical dilemmas” (Laurel 2001, 45). Like Carol Gilligan, Laurel realized that there was something that is special about how girls experienced their lives but that existing games did not take this into account and instead privileged the male experience. She turned this knowledge into a business. Purple Moon launched their first two CD-ROM games and a community web site in 1997. Both games were rated by PC Data Magazine as in the top 50 entertainment titles during the holiday season of that year. By the time Purple Moon went out of business in 1999, the community website had 240000 registered users who visited at least once a day and viewed 35 pages on average (Laurel 2001, 24). This was years before social networking became popular.

The company shut down and merged with Mattel after approximately three years in operation. Laurel says that having run a socially responsible business and having played a role in bucking “decades of sexism in the computer gaming industry” (Laurel 2001, 35) dampened the personal impact of the business failure. Losing her business was financially unrewarding, but that the work had provided her with personal satisfaction, recognition, and influence that did not disappear along with the company.

The book reads a bit like management literature for idealists. Its tone is instructive. Its message is that although the model may not have been a success in the business world the first time around, it may still be viable. Laurel's account shows that there is a possibility for changing pop culture by not by taking an oppositional stance like Cornelia Sollfrank's *Female Extension* did but by becoming a part of it and shaping it from that position.

2.5 Personal Related Work

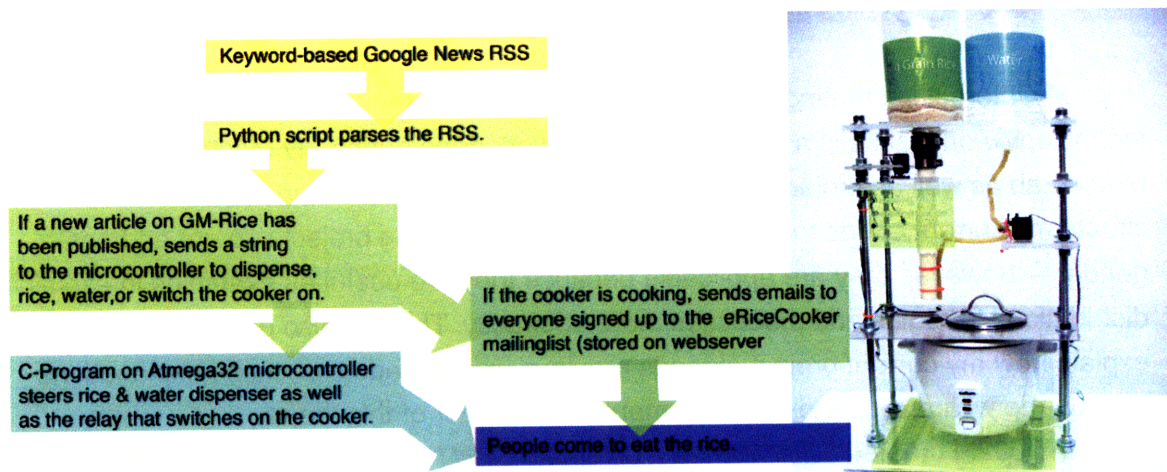
My interest in creating a framework for distributing feminist interventions in technology workplaces is a result of previous work done during my Master's studies at the Media Lab as well as projects developed before my time at the Lab. In this section, I will situate my current efforts in a longer process. The following projects do not address gender – however, they are applicable because they are useful as examples in explaining distribution strategies and processes more abstractly. This will also give me a chance to explain how my current project extends previous work. In addition, these explanations provide me with a segue to the Implementation chapter of this thesis.

In 2002, I created *SuPerVillainizer – Conspiracy Client* (www.supervillainizer.ch), a project aiming to undermine Swiss data retention legislation. The legislation requires Swiss Internet Service Providers (ISP) to retain data about their customer's Internet and email

usage for a period of six months. It was enacted in the wake of September 11 with terrorism as justification. Privacy activists criticize the fact that data is being collected without any evidence or indication of actual criminal or terrorist activities. I share these concerns and created *SuPerVillainizer* as a response. The project is a website that gives users the chance to create email conspiracies. To date, users can either choose from 3134 villains contributed by other users or create their own. Users can then connect these villains through a conspiracy. The system automatically assigns email addresses to all villains and the villains then start to exchange conspirative emails. As of today, 2781 conspiracies have been created and 403987 emails sent. The many contributed villain and conspiracy names extend government-issued language surrounding terrorism and crime. Over the last six years, *SuPerVillainizer* has provided a space for user contributed content surrounding the war-on-terrorism rhetoric.

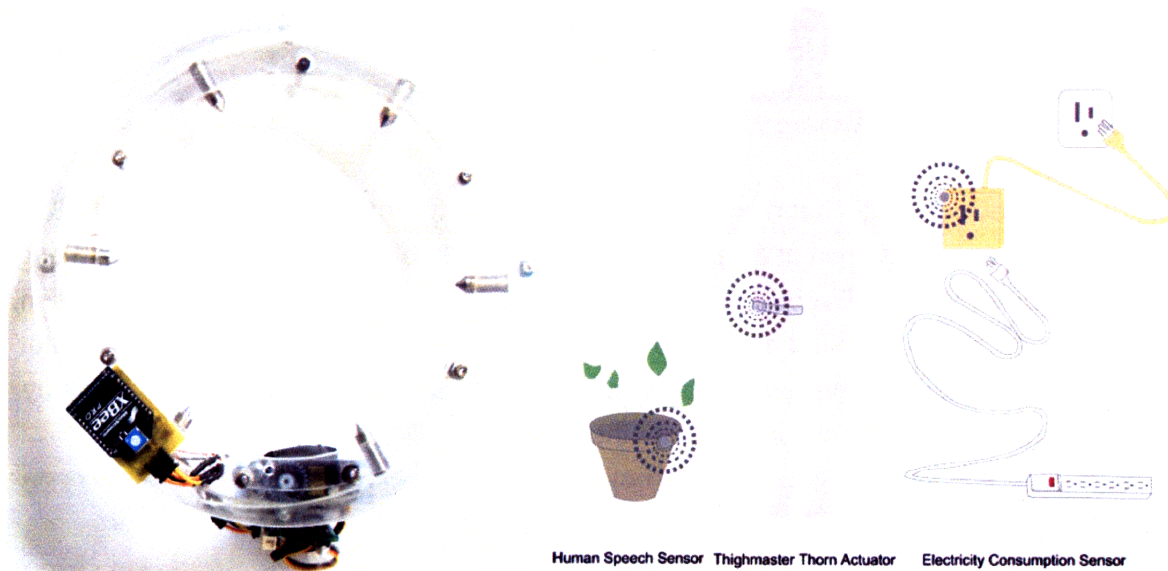
At the Media Lab, I joined the Computing Culture Group, a research group that explores cultural and political applications of technology similar to *SuPerVillainizer*. However, the work of the group focuses on the physically embodied rather than the type of software based art that I had been making over the seven years. During my time in the group I explored hardware based art in several projects, two of which I will briefly describe here. Then, I will explain how these experiences inform my current efforts.

My first project at the Lab was *eRiceCooker* (web.media.mit.edu/~rusti/eRiceCooker), a rice dispensing and cooking apparatus that is connected to Google News. For every new article about genetically modified rice that *eRiceCooker* finds on Google News a bit of rice is added to the Cooker. When enough rice is accumulated for a meal, *eRiceCooker* automatically adds water and cooks the rice. When the rice is done, email invitations to eat the rice are sent out. This project is similar to previous work like *SuPerVillainizer* in that the network is an integral component.



A block diagram explaining the *eRiceCooker* process (left) and the *eRiceCooker* apparatus (right).

Thighmaster, another project that I created at the Lab addresses technologies surrounding environmental conservation. *Thighmaster* is a ring worn on the thigh, that drives stainless steel spikes into the wearer's leg when the ring receives a signal that sensors placed on power outlets in the wearer's home have detected a high level of electricity usage. For one thing, I was interested in creating a technology for the Wireless Personal Area Network (WPAN) using Xbee a ZigBee/IEEE 802.15.4 compliant wireless networking device where the network would be controlling a human rather than the other way around. Furthermore, the system is a technology for thinking about how current technology research addresses energy and environmental preservation issues.

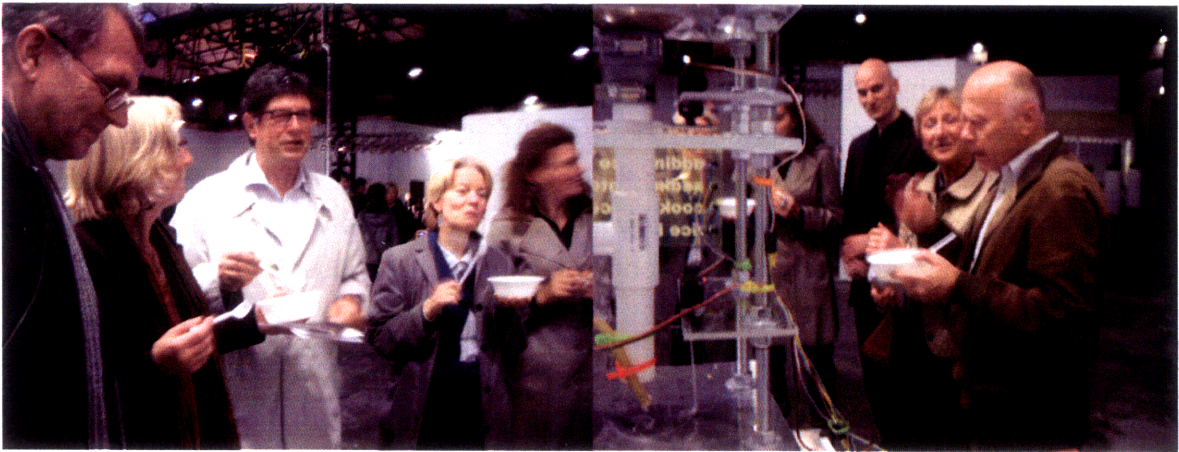


The *Thighmaster* device with the Xbee wireless networking device (left) and a diagram of the whole *Thighmaster* system (right).

As objects, both *Thighmaster* and *eRiceCooker* have a limited radius of agency. A student at the Media Lab once made the observation that “hardware does not follow software in that unlimited copies cannot be made for free.” Being documented on the World Wide Web, both projects developed some kind of viral presence in this space. They were featured in a range of blog postings and newspaper articles. A french-speaking blogger wrote: “*Thighmaster*, by Swiss artist Annina Rüst, is without any doubt the best tool to rid oneself of environmental self-incrimination.” (sumoto.iki 2007)

What was particularly interesting to me is the fact that *eRiceCooker* has been featured on several weblogs dealing not with art but with genetically modified foods. A video of *eRiceCooker* was uploaded to the video sharing platform YouTube without my intervention and has been viewed 1776 times. The project was called “a wonderful and novel concept for social conviviality and structured participation” by the jury of Eyebeam's Eco Visualization challenge (Natalie Jeremijenko, Martin Wattenberg, Joey Roth, Casey

Caplowe, Elizabeth Thompson, Michael Mandiberg, Brooke Singer) a competition where it received a honorary mention.



Pictures of the exhibition in Dortmund at Hartware MedienKunstVerein.

eRiceCooker has been shown internationally in two exhibitions. In March 2008, eRiceCooker was shown at Eyebeam, an art and technology center in New York along with other winners of Eyebeam's Eco Visualization challenge in "Feedback : Exhibition." In October 2007, I installed eRiceCooker in the exhibition titled "Sie nennen es Realität" at Hartware MedienKunstVerein in Dortmund, Germany alongside with recent projects by other alumni of the Zürich University of the Arts.



Pictures from the Exhibition at Eyebeam in New York.

My work including *SuPerVillainizer* and *eRiceCooker* was also featured in the book *Media Arts Zürich 13 Positions from the New Media Program* which encompasses 10 years of artistic production by 13 students or alumni of the school. The authors write:

“As in her previous works, Rüst creates an 'awareness tool' for issues relating to the electronic aspects of our lives. [...] The meal itself turns out very dry and sober although this is entirely appropriate for a “rice cooker that reads the news.” [...] Rüst uses the media-hyped debate about GM foods as an opportunity to foster direct social intercourse over a shred meal. The appliance, which is designed to resemble a piece of laboratory equipment, is puristic in design and reminiscent of other classical web-linked appliances such as the Coffeemachine and Telegarden” (Hübler et al. 2008, 196)

Despite this level of distribution. I was dissatisfied with how objects like *eRiceCooker* and *Thighmaster* find their way into the world. Yes, exhibitions and documentation on the WWW can help the distribution – but the visitor numbers of exhibitions are limited and as far as the network goes it is not the distribution, as is the case with *SuperVillainizer*. Especially the last two examples in Related Work I have shown that there can be other channels for distribution. In the next section I will make an attempt to chart this territory.

Chapter 3: Implementation

This section describes two projects. One of them is an interventionist technology that I am building with a collaborator. The other is a platform in the Web 2.0 style encouraging collaboration surrounding data about the gender configuration in technology workspaces. The projects represent two different approaches at techno-feminist collaboration. The idea is not to choose between the two approaches but to use two very different styles of collaborative projects as a basis for finding out what the design criteria for a bigger framework for collaboration on feminist technologies could be.

To clarify what I mean by techno-feminist collaboration and by framework, I will do a short recap of arguments and explanations so far. In the Background chapter, I contrasted studies from the social sciences and from psychology to determine that the primary reason for the gender imbalance in technological environments is the environment itself not the fact that women are statistically not interested. I then looked at how this imbalance shapes electronic products and, by extension, consumers of technology. I charted out a general necessity for intervention and described several participatory collaboration models. In the Related Work chapter, I described feminist efforts that have achieved a high level of distribution through collaborative participation. I also described my own situation as a maker of critical software and hardware and my long-standing interest in distributing projects from within a larger framework.

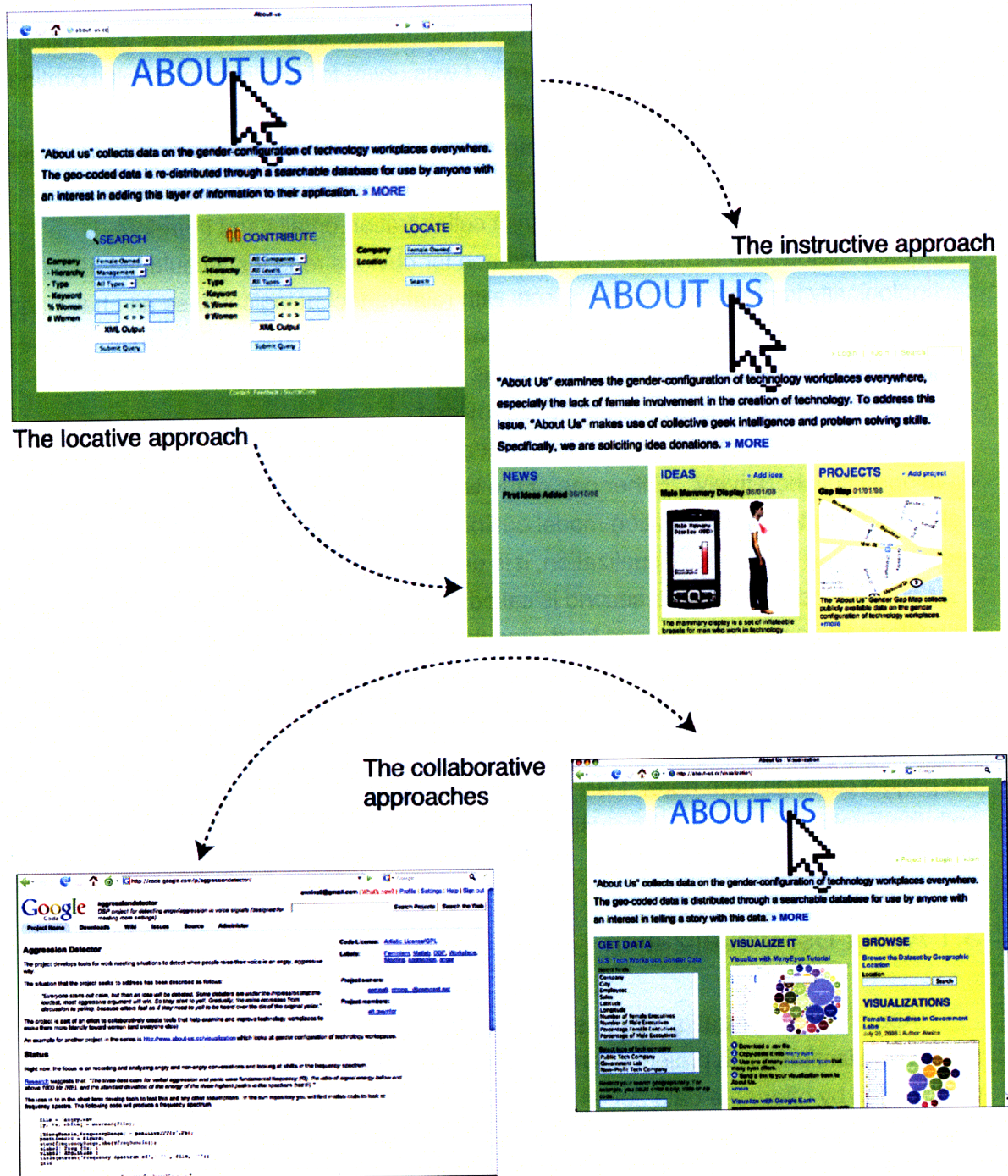


Presenting FEMINIZM4ALL during the Spring 2008 Media Lab Sponsor Meeting

This thesis is a step towards defining what a distribution framework for feminist hardware and software projects could be. Projects that are made with the understanding that intervention is needed in technological environments because these environments are excluding women and others who do not fit the predominant macho culture that pervades these spaces. I initially called the project About Us. The name is derived from the “About Us” sections of websites which, as the name suggests, often contain

descriptions of the company or other entity that the website belongs to. In the case of technology companies, this often gives an insight into the gender configuration.

I chose to make two different projects because relatively late in the process of developing the technology related to the thesis, I realized that I needed to first find out what feminist collaboration actually entailed before building a framework for it. The illustration below outlines my process.



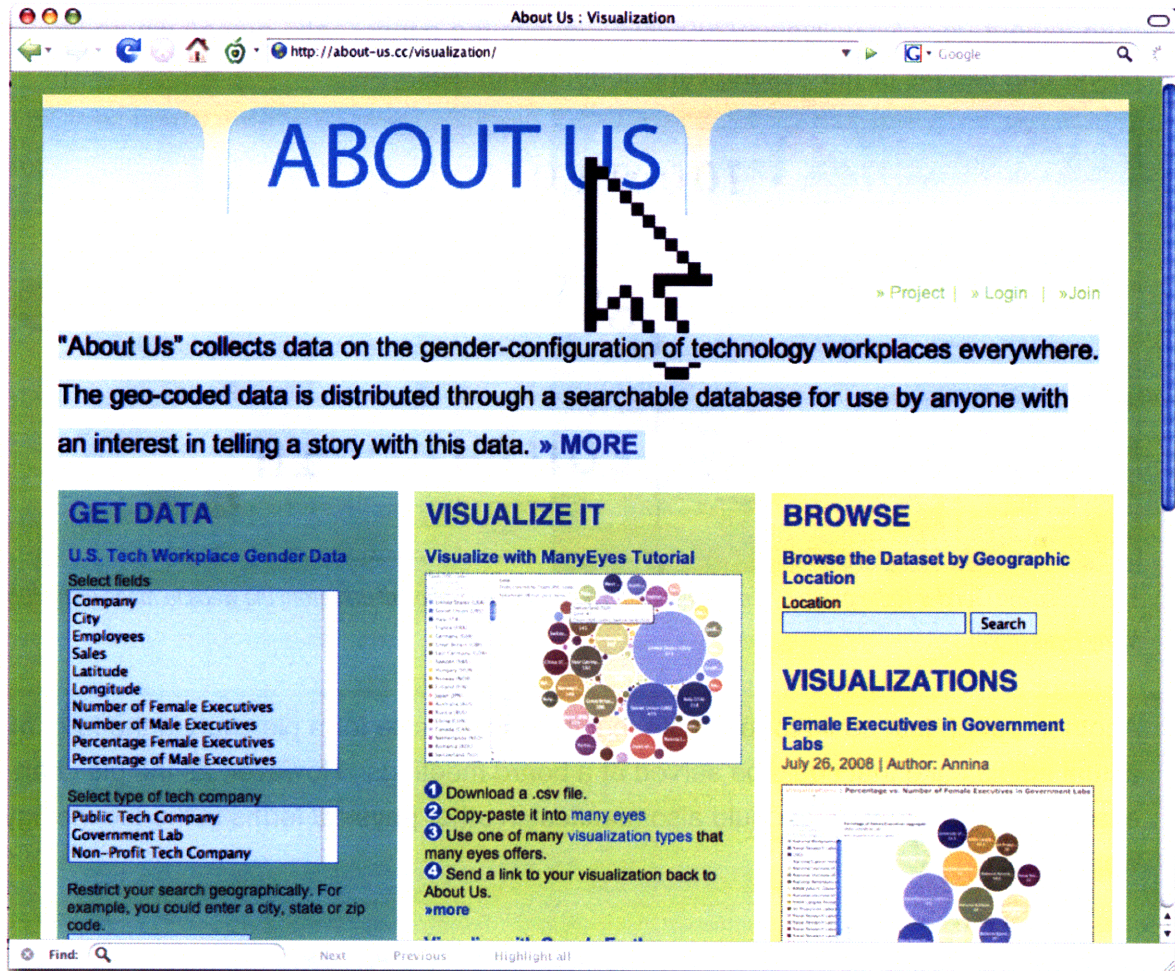
Initially, I was convinced that in order to enable interventions in technology workplaces, I needed to create a framework that would operate with GPS (Global Positioning Service) or similar locative technologies. I pursued this idea for a while before realizing that the density of GPS-enabled devices was not high enough, and therefore, due to the enormous price of entry, I would not find many people to contribute to the project. I also realized that GPS and similar locative technologies tend to disperse a crowd rather than unify it.

After the locative approach, I pursued an instructive approach where I was taking the term “feminist collaboration” very literally. I was going to build a form of collaboration platform that was going to function very much in the form of the popular Internet collaboration platform Instructables, except that all the collaboration would be happening for the techno-feminist cause. However, as explained above, I did not and still only marginally understand what techno-feminist collaboration entails and therefore, I eventually abandoned the instructive approach for obvious reasons. I could have technologically implemented both projects with relative technological ease as I have done in many other projects. However, what was really important to me for this project was finding a new conceptual approach and this is something that neither of the project-approaches mentioned above could have provided.

I therefore decided to go one step back and find out what kinds of projects could be developed collaboratively. Either one of the two projects that I am going to describe below adheres to one distribution model outlined in the Background section. The first project is called About Us: Visualization, it is designed as a Web 2.0 site that encourages user-contributed content. The second is called “Aggression Detector.” It is a collaboration with Gloria W., a programmer and lead-organizer of the all-female open source project Grrrlcamp. For the Aggression Detector project I chose the open source production model. To evaluate the project and to chart future work, I invited a group of six experts in technology and feminism to give me their opinions on what needs to be done and where the project could go from here. I will describe the outcomes of these critique sessions in both the Evaluation and the Conclusion chapters.

3.1 About Us: Visualization

About Us: Visualization is website in the Web 2.0 style (www.about-us.cc/visualization). The project examines the gender configuration of technology workspaces by offering a data set as well as an interface to customize that data set. The website also contains tutorials on visualizing the data set using various platforms, such as Google Earth, Many Eyes, and Scratch. In the spirit of Web 2.0, there is a sharing feature that displays documentation of visualizations on the website.



The About-Us: Visualization website at www.about-us.cc/visualization

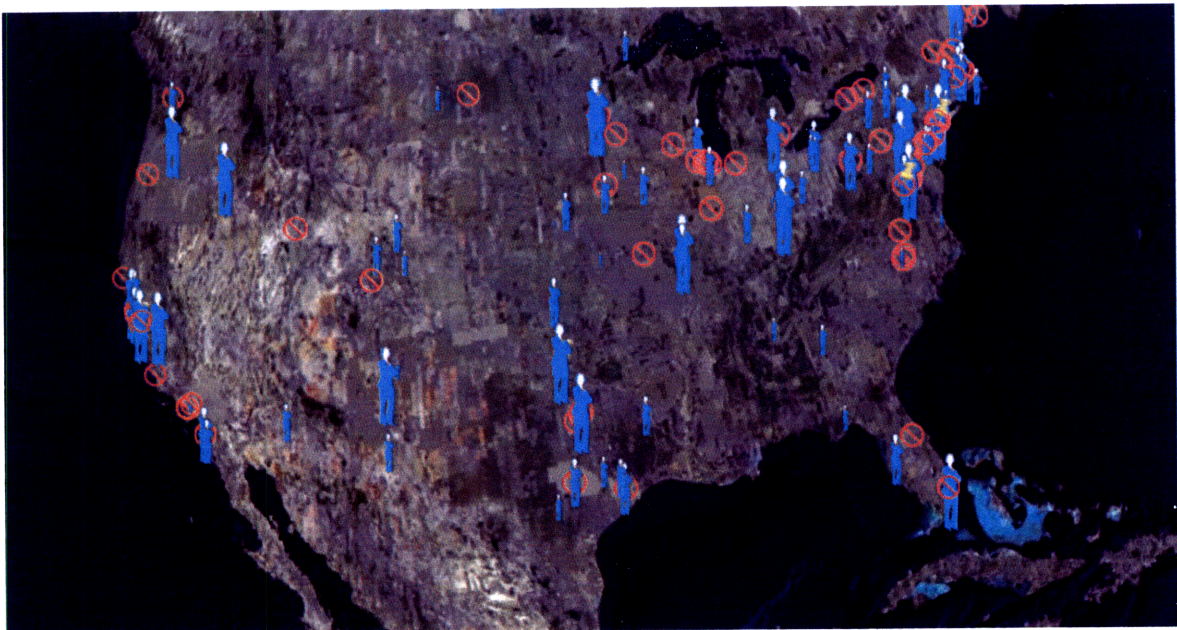
The idea behind About Us: Visualization is that a multitude of visualization possibilities will help disseminate information about gender and technology into spaces where it might not go otherwise. Visualization in this context is used to help individual users tell a story with the data. Members of the IBM Visual Communication Lab, makers of the visualization platform Many Eyes express this social aspect of visualization very well when they write on the Many Eyes website: “Visualization is a catalyst for discussion and collective insight about data.”

Many Eyes is a platform for uploading data sets and visualizing them with a set of pre-defined visualization tools. The tools offered by Many Eyes reflect the contemporary data visualization grammar: bar chart, scatter plot, line graph, stack graph, pie chart, country map, world map. About Us: Visualization takes a different approach: The website offers the data set but leaves the visualization up to the user. The importance is placed on the data set instead of on a particular visualization method, because the focus of About Us is on reading the numbers, but also on spreading the data. This can for example happen in the form of a game, such as Eric Rosenbaum's “Guess the Gender Ratio”

3.1 About Us: Visualization Technical Description

The data contains approximately 7000 records of information about U.S. technology workplaces. It contains public companies, federally funded labs, and non-profits. There are general data fields about the company, such as name, address, latitude/longitude, total number of employees and sales. Then there are fields related to gender configuration such as the percentage of female executives and the number of female executives. All of this data is publicly available, mainly through the Edgar database maintained by the U.S. Securities and Exchange Commission. However, due to time constraints, the data that I am using now comes from Corptec, a database of technology companies. Therefore, before releasing the website to a broader public, I will need to write a script that retrieves the data from Edgar.

When initially collecting the data, it was important to me to geo-code the data so as to enable interventions in actual physical spaces. To store the data, I am using a PostgreSQL database with PostGIS, the spatial database extension for PostgreSQL . PostGIS extends PostgreSQL databases to store GIS (Geographic Information Systems) objects. The About Us : Visualization website runs on a Debian operating system. The site was built using GeoDjango, the GIS branch of the web framework Django which is written in Python.



A visualization in Google Earth of percentages of females in U.S. non-profit technology companies.

Django adheres to a Model Template View (MTV) pattern. This means that what is commonly called the “business logic” of a website, the view, is separated from how information is displayed in the template. The model separates the view from the database. It abstractly represents the database structure and is therefore separate from the code

used to process the data. This is advantageous because it provides the same interface to any database supported by the web framework. GeoDjango extends Django to offer specific functions and tags for interacting with geospatial data on the model, view, and template level. Although I am currently not making use of all of the features that GeoDjango offers, it is a good basis for further explorations.

3.2 Aggression Detector

Aggression Detector is a collaboration with Gloria W. I asked her what type of tool she would want and she sent the following description back:

“One of the biggest complaints in the workplace is excessive male aggression. It usually happens in a meeting setting, where people are facing each other in a sort-of circular pattern, in a small room or section of a building (subdivided somehow, at least with walls about 5 to 6 feet high. Sometimes it is a separate room).

Everyone starts out calm, but then an idea will be debated. Some debaters are under the impression that the loudest, most aggressive argument will win. So they start to yell. Gradually, the noise increases from discussion to yelling, because others feel as if they need to yell to be heard over the din of the original yeller” (W. 2008)

She had the idea for the aggression detector and I offered to make it for her as a collaborative project. I wanted to be involved in this mode of collaboration in order to understand how collaborative engineering of feminist technology products works. As described in the “Personal Related Work” section, I have mainly been making projects from my own subjective viewpoint. This also holds true for About Us: Visualization. It is a project that very much expresses my viewpoint on what data people should visualize. The aggression detector project is an attempt to de-program myself in that regard by assuming somebody else's viewpoint in a collaboration.

Initially, our discussion on how the project should be approached centered around hardware platforms. However, by looking at how people involved in similar Digital Signal Processing (DSP) efforts develop their projects, I found out that it is customary to first experiment in a numerical computing environment like Matlab or Octave and then transfer code to a language like C or C++ or to some kind of specialized hardware. In order to be compatible with this field, I decided to use Matlab and its open source equivalent Octave as a programming environment for the Aggression Detector. The idea is that the aggression detector could be run on a Laptop and possibly later on specialized hardware.

It will make a loud disruptive noise when it detects aggression. I started a project on developer platform Google Code (code.google.com/p/aggressiondetector). Gloria and I are the owners of the project. At this time, only one other person has joined the project. In an effort to test a first audience reaction I posted the project to Matlab and DSP newsgroups and this person wrote back expressing an interest in supporting the project. I also got a reply from a psychologist who explained that it is very difficult to tell aggressive yelling from playful shouting but the overall tone of the response was positive.

In addition to researching production conventions, I researched existing efforts to detect aggression and aggressive shouting. Most research into aggression and stress is conducted with systems that use separate microphones for all participants. This is the case in situations where participants interact over the phone with automated voice recognition systems (Burkhard et al. 2006). Research most applicable to the situation of having several people shout at the same time comes from Sound Intelligence, a company in Groningen, Netherlands. They developed a system to work in conjunction with the surveillance cameras set up by the city of Groningen. The system looks for aggressive shouting in order to direct the attention of the person watching the cameras. This system obviously does not require the participants to speak into individual microphones. There is no gender-specific data on whether the system identifies verbal aggression expressed by men and women equally or if this is not the case. The researchers write: "The three best cues for verbal aggression and panic were fundamental frequency (f_0), the ratio of signal energy below and above 1000 Hz (RE), and the standard deviation of the energy of the three highest peaks in the spectrum (std E)" (van Hengel and Andringa 2007) To start, I have developed a Matlab script that tracks sound level and a user defined frequency range over time. We are now collecting audio clips of situations where aggressive yelling happens in an office setting. One possible source is the popular TV show "The Office". However, this is just one possibility and it remains to be seen if this approach is effective for mixed-gender meeting room settings.

As explained in the Background section, engineers tend to believe that they are creating "universal" technology. However, since they are a very homogenous group in respect to gender and many other qualities, they often forget that their own background shapes products. The Aggression Detector does not pretend to have this universal quality.

Chapter 4: Evaluation

4.1 Critique as Evaluation Method

This thesis aims to build a technological framework for expressing feminist viewpoints through technology. It scrutinizes existing viewpoints, production methods, distribution channels and cultures and seeks to identify points of feminist technological intervention within these pre-existing conditions. Specifically, two approaches were created. One involves Web 2.0-style production and distribution, the second one open source software collaboration. To evaluate these projects as a first step towards a bigger framework, I decided not to do a usability study but instead invite six experts for several critique sessions. In the following paragraphs I will explain the process of critique and why it is a useful evaluation method. Then, I will summarize the results of the critique session. In the concluding section I will outline the next steps.

In the paper “Usability Evaluation Considered Harmful (Some of the Time)” Saul Greenberg and Bill Buxton take a scrutinizing look at evaluation methods used in Human-Computer Interaction (HCI). Greenberg and Buxton write that usability evaluations might not always be useful at every stage of the development cycle and certainly not the only way to evaluate a project. For them, critique as it is done in art institutions and design firms is a valid method of evaluation. They describe critique the following way:

“The designer presents the artifact to the group (typically a mix of senior and junior people), and explains why the design has unfolded the way it has. Members of the group respond: by articulating what they like and dislike about the idea, by challenging the designer’s assumptions through a series of probes and questions, and by offering concrete suggestions of ways to improve the design. This is a reflective and highly interactive process: constructive criticisms and probing demands that designer and critics alike develop and share a deep understanding of the design idea and how it interacts within its context of use” (Greenberg and Buxton 2008, 118)

In their paper, Greenberg and Buxton explain that critique is a rigorous well-established process of evaluation. I acknowledge that critique is not the only form of evaluation but that at this stage, having experts critique my project might be more instrumental in shaping the future of the project than a simple usability study would be.

Due to scheduling constraints, I set up two critique groups consisting of two people each and two critiques with just one person. The biographies of the critics can be found in the Appendix. The first group consisted of Persephone Miel and Hanna Wallach and the

participants of the second group were Joan Morris DiMicco and Ellen Hume. The critics in the two separate sessions were Caroline Jones and Elizabeth Stark. I chose the critics based on their expertise in a range of fields that I found applicable to the project. The critique proceeded as outlined by Greenberg and Buxton.

4.2 Results of the Critique

In terms of basic usability of the About Us: Visualization platform the critics pointed out a few problems. It became clear very quickly that downloading .csv files does not make the process very intuitive for newcomers to the site. Elizabeth Stark suggested making it more obvious that the site offers possibilities for viewing the data without having to download it and import it into another program. She also suggested finding a way to provide instant visualizations in order to make the site easier to use for non-technical people. Joan Morris DiMicco suggested keeping the .csv download, but making a window where users can copy-paste data directly into Many Eyes or another platform without having to download a file.

Caroline Jones expressed concerns with the overall design direction of the project. She encouraged me to look at less obvious information for visualization like data from sensitivity training for employees of technology companies – data that is less about the numbers but more about the culture. She suggested applying a similar technique to the Aggression Detector, by training the Detector on applicable clips from television phenomena like the workplace comedy “The Office.” The idea behind this is that by incorporating popular culture, it can be understood by people in workplaces not just on the code and tool level but also in terms of the cultural space that the project seeks to interfere in. Keeping this cultural coherence in mind was her recommendation for future work – both in collaborations with others and in work that I might do myself.

Overall, it is my subjective impression that the project resonated more with Hanna, Joan, and Persephone. The premise seemed clearer to them. To Joan, who is a researcher at IBM, it made sense that engineers would respond better to a technology telling them when they are behaving aggressively than if somebody from the human resources department were to assess them. Persephone asked “is it the point to detect aggression or is it the point to disrupt potential aggression?” She said that the device might help curb aggressive behavior among technologists as long as there is no “judgement” expressed by the computer. Similar to Joan she also expressed that this might work specifically in a technological environment but that she would not expect groups like the city council to use it. Hanna brought up the question of false positives in aggression detection and whether that could weaken the response to the relief that the device could provide. Ellen said to keep in mind that aggression is a very blurry term and

that people who might be insistent might come across as aggressive. One solution that Persephone, Hanna and I discussed was that the device would have to provide a possibility for adjustment by the users. In terms of potential usage scenarios, Hanna and Persephone wondered if it would make a difference if a woman or a man instigated the use of the device. There was a general agreement in this group that there should be a way to recruit and engage potentially feminist men. Both Hanna and Persephone had experienced this challenge, Hanna in Debian Women and Persephone in a group on gender and technology at the Berkman Center where she works.

Hanna also brought up an interesting point about the nature of technology and technological research. She said that a lot of research is going into speaker separation and that it would be interesting if that could be subverted. For example the question would then not be how to count the speakers in the room but to count the women. Persephone told us that when she goes to conferences she has a tendency to count the women in sessions and workshops. She said that she then shares this count over email with a friend who does the same thing. The three of us then decided that it would be interesting to have this kind of "score keeping" broad scale.

On the whole, the critiques helped reveal deficiencies in the user interface, as a user study would have. However, discussing the project with a group of experts has helped me discover and articulate unresolved issues that go beyond the interface and possible ways of finding solutions for them. I will describe some of these in the following section.

Chapter 5: Conclusion and Future Work

In this thesis, I explored topics related to mobilizing labor for creating feminist interventions in technological workplaces. Contrary to my past projects I was not going to make a feminist technology, but rather, a participative framework for technologies surrounding gender equity in tech workplaces. As explained in the Related Work chapter, I have made technological projects that facilitated varying degrees of human participation for several years. The two projects described in the thesis are new insofar as they represent steps towards a framework as explained in the Implementation chapter. In the following, I will outline the next steps I am intending to take based on the critique that I received .

In the critique session with Persephone and Hanna, Persephone asked me whether I had ever attempted a comprehensive mapping of all the points of intervention that could be taken. So far, I have not done that. At this point however, this is the appropriate thing to do. Therefore, as the next step, I will create an infrastructure for a participatory mapping. My collaboration with Gloria has shown me that involving others can greatly help expand the scope of a project. I am hoping to achieve a similar effect with the mapping.

I hope that this mapping will have a unifying effect on the project and will help define what the cultural concept of feminist technology for the workplace is. The problem that I am currently facing is similar to the communications challenge that Mitchel Resnick outlined when I interviewed him for the Related Work chapter. The fact that feminism could be engaged by technology is not a very familiar thought especially to engineers.

The projects developed so far will serve as examples for the cause of feminist intervention using technology. At the same time as making the mapping I will continue to develop both the Visualization platform and the Aggression Detector. I could also imagine developing the score-keeping application together with Persephone and Hanna as another sample project towards a larger effort.

At the same time, I do also want to create other, less pragmatic projects such as the Male Mammary Display. This is an undershirt for men working in technology environments that are not gender-balanced. The undershirt can be inflated at the breast level to display concern.

Feminist technology as a whole is at this moment not a widely known cultural concept. I hope to have made both a practical as well as a theoretical contribution towards finding more diverse ways of producing and consuming technologies. However, in the thesis I also emphasize an interventionist approach, underscoring the urgency to defend the right of both women and men to more equitable and diverse technological workspaces.

Appendix: Critic Biographies

Dr. Caroline Jones

Dr. Caroline Jones is the Director of the History, Theory and Criticism Section and Professor of Art History at the MIT Department of Architecture.

Ellen Hume

Ellen Hume is the Research Director at the MIT Media Lab's Center for Future Civic Media.

Persephone Miel

Persephone Miel is a Fellow at the Berkman Center for Internet & Society at The Harvard Law School where she directs the Media Re:public project, examining the impact of participatory journalism on the information environment.

Dr. Joan Morris DiMicco

Dr. Joan Morris DiMicco is a Researcher in the Collaborative User Experience Group at IBM Research.

Elizabeth Stark

Elizabeth Stark is a fellow at the Yale Information Society Project.

Dr. Hanna Wallach

Dr. Hanna Wallach is a postdoctoral researcher at the University of Massachusetts Amherst.

References

- AAUW. AAUW - Title IX Athletics on Campus.
<http://www.aauw.org/advocacy/laf/lafnetwork/library/athleticsCampus.cfm>.
- Adam, Alison. 1998. *Artificial Knowing: Gender and the Thinking Machine*. 1st ed. Routledge, February 19.
- Anon. 1972. *Title IX, Education Amendments of 1972*. July 23.
<http://www.dol.gov/oasam/regs/statutes/titleIX.htm>.
- Autonomo.us. 2008. Franklin Street Statement on Freedom and Network Services. July 14.
<http://autonomo.us/2008/07/franklin-street-statement/>.
- Belkin, Lisa. 2008. Diversity Isn't Rocket Science, Is It? *The New York Times*, May 15, sec. Fashion & Style.
http://www.nytimes.com/2008/05/15/fashion/15WORK.html?_r=1&sq=women%20technology&st=nyt&adxn1=1&oref=slogin&scp=2&adxn1x=1216095637-CoMDtGzzQq/85+XGR556dw.

- Burkhard, F., J. Ajmera, R. Englert, J. Stegmann, and W. Burleson. 2006. Detecting anger in automated voice portal dialogs. In *ICSLP*.
- Carson, John. 1993. Army Alpha, Army Brass, and the Search for Army Intelligence. *Isis* 84, no. 2 (June): 278-309.
- Chabaud-Rychter, Danielle. 1994. Women users in the design process of a food robot: Innovation in a French domestic appliance company. In *Bringing Technology Home: Gender and Technology in a Changing Europe*. Open University Press.
- Cockburn, Cynthia, and Ruža Fürst-Dilić. 1994. *Bringing Technology Home: Gender and Technology in a Changing Europe*. 1st ed. Open University Press.
- Cockburn, Cynthia, and Susan Ormrod. 1993. *Gender and Technology in the Making*. London: Sage.
- Coleman, E. Gabriella, and Benjamin Mako Hill. 2004. The Production of Ethics in Debian and Free Software Communities: Anthropological Lessons for Vocational Ethics. *Idea Group Publishing* (July 1).
- Cormode, Graham, and Balachander Krishnamurthy. 2008. Key differences between Web 1.0 and Web 2.0. *First Monday* 13, no. Number 6 - 2 June 2008 (June 2).
<http://www.uic.edu/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/2125/1972>.
- Fogel, Karl. 2005. *Producing Open Source Software How to Run a Successful Free Software Project*. 1st ed. Sebastopol, CA: O'Reilly.
- Gilligan, Carol. 1982. *In a Different Voice: Psychological Theory and Women's Development*. Harvard University Press, May 24.
- Gnome Foundation. 2006. Women's Summer Outreach Program 2006.
<http://www.gnome.org/projects/outreach/women/>.
- Gould, Stephen Jay. 1981. *The Mismeasure of Man*. New York: Norton.
- Greenberg, Saul, and Bill Buxton. 2008. Usability Evaluation Considered Harmful (Some of the Time). In *CHI 2008 Proceedings*. Florence, Italy, April 8.
- Hamburger Kunsthalle. extension - Internet als Material. *extension - Internet als Material*.
http://www.hamburger-kunsthalle.de/_aext/wettb.htm.
- van Hengel, P.W.J., and T.C. Andringa. 2007. Verbal aggression detection in complex social environments. In *Advanced Video and Signal Based Surveillance, 2007. AVSS 2007. IEEE Conference on*, 15-20. doi:10.1109/AVSS.2007.4425279.
- Hewlett, Sylvia Ann, Carolyn Buck Luce, Lisa J. Servon, et al. 2008. *The Athena Factor: Reversing the Brain Drain in Science, Engineering, and Technology*. HBR research report. Boston: Harvard Business School.
- Hübler, Christian, Felix Stalder, Nils Röller, and Yvonne Wilhelm. 2008. *Media Arts Zurich. 13 Positions from the New Media Program. Edited by the Department of Art & Media Zurich University of the Arts*. Scheidegger & Spiess.
- Laurel, Brenda. 2001. *Utopian Entrepreneur*. The MIT Press.
- Lubinski, David, Camilla Persson Benbow, Daniel L. Shea, Hossain Eftekhari-Sanjani, and Marcy B.J. Halvorson. 2001. Men and Women at Promise for Scientific Excellence: Similarity Not Dissimilarity. *Psychological Science* 12, no. 4 (July). doi:Article.
<http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=5129963&site=ehost-live>.
- MacKenzie, Donald A, and Judy Wajcman. 1985. *The Social Shaping of Technology: How the Refrigerator Got Its Hum*. Milton Keynes, England: Open University Press.
- Marson, Ingrid. 2004. Debian group encourages women developers. December.
<http://news.zdnet.co.uk/software/0,1000000121,39181049,00.htm>.
- Nafus, Dawn, James Leach, and Bernard Krieger. 2006. *Gender: Integrated Report of Findings . Free/Libre and Open Source Software–Policy Support (FLOSSPOLs)*. Cambridge, UK: University of Cambridge. Google Scholar.
- NCWIT. 2007. NCWIT Scorecard 2007 A Report on the Status of Women in Information

- Technology. National Center for Women and Information Technology.
http://ncwit.org/pdf/2007_Scorecard_Web.pdf.
- O'Reilly, Tim. 2006. Web 2.0 Compact Definition: Trying Again. *O'Reilly Radar*. December 10.
<http://radar.oreilly.com/2006/12/web-20-compact-definition-tryi.html>.
- Raymond, Eric S. 1998. The Cathedral and The Bazaar. February 9.
<http://www.catb.org/~esr/writings/cathedral-bazaar/cathedral-bazaar/ar01s13.html>.
- Resnick, Mitchell. 2008. . July 8.
- Roberts, Yvonne. 2008. You're fired! . *The Guardian*, March 6, sec. Life and Health.
<http://lifeandhealth.guardian.co.uk/women/story/0,,2262450,00.html>.
- Rosenbloom, Joshua L., Ronald A. Ash, Brandon Dupont, and LeAnne Coder. Why are there so few women in information technology? Assessing the role of personality in career choices. *Journal of Economic Psychology*. doi:10.1016/j.joep.2007.09.005.
http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6V8H-4PV2RPM-1&_user=10&_coverDate=10%2F06%2F2007&_alid=766712036&_rdoc=1&_fmt=high&_orig=search&_cdi=5871&_sort=d&_docanchor=&view=c&_ct=1&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=27978b0cc409dadb3530a427eb24d2d9.
- Rothfuss, Joan. Energy Plan for the Western Man. *WAC | Joseph Beuys | Energy Plan for the Western Man*. <http://www.walkerart.org/archive/C/9C4315B360BFDC526167.htm>.
- Silver, David. 2008. History, Hype, and Hope: An Afterwrld (March 3).
<http://www.uic.edu/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/2143/1950>.
- Smeds, Riita, Elina Haavio-Mannila, and Kaisa Kauppinen-Toropainen. 1994. Sweeping away the dust of tradition: Vacuum cleaning as a site of technical and social innovation. In *Bringing Technology Home: Gender and Technology in a Changing Europe*. Open University Press.
- Snyder Bulik , Beth. 2007. Apple, Facebook tops for college students. *Advertising Age*, October 8.
- Sollfrank, Cornelia. Female Extension. *Female Extension*.
<http://www.artwarez.org/femext/content/femext.html>.
- sumoto.iki. 2007. Eco-mortification. *Fluctuat.net*. October 21. <http://www.fluctuat.net/blog/5998-Eco-mortification>.
- Tonso, Karen. 1998. Engineering Gender – Gendering Engineering: What about Women in Nerd-Dom? In Annual Meeting of the American Educational Research Association, 47. San Diego, CA, April.
- U.S. Government Accountability Office. 2004. *Gender Issues Women's Participation in the Sciences Has but Agencies Need to Do More to Ensure Compliance with Title IX* Report to Congressional Requesters. United States Government Accountability Office .
<http://www.gao.gov/new.items/d04639.pdf>.
- U.S. Senate Subcommittee on Science, Technology, and Space. 2002. *WOMEN IN SCIENCE AND TECHNOLOGY*. Washington, DC: U.S. Government Printing Office, July 24.
http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=107_senate_hearings&docid=f:91728.wais.
- Vest, Charles, Robert J. Birgeneau, and Lotte Bailyn. 1999. A Study on the Status of Women Faculty In Science at MIT. *The MIT Faculty Newsletter*, March.
<http://web.mit.edu/fnl/women/women.html>.
- Von Hippel, Eric. 2005. *Democratizing Innovation*. Cambridge, Mass: MIT Press.
- W., Gloria. 2008. E-Mail. Re: Some questions. July 8.
- Wajcman, Judy. 1991. *Feminism Confronts Technology*. University Park, Pa: Pennsylvania State University Press.
- . 2004. *TechnoFeminism*. Cambridge, UK: Polity Press.
- Wallach, Hanna. 2008. Interview. July 29.
- Zimmer, Michael. 2008. Preface: Critical Perspectives on Web 2.0. *First Monday* Volume 13, Number 3 - 3 March 2008 (March 3).
<http://www.uic.edu/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/2137/1943>.