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The Maternal Voice in the Technological Universe

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Prepared by:
Margaret Honey

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When I think about the world of technology, I think about a world that is rigidly gendered; that is, a world that is the exclusive province of men and is governed by a form of logic that is abstract, calculable, and depersonalized. To my way of thinking, the technological universe is characterized by a type of rationality that in certain schools of thought is known as instrumental, in which the means are divorced from the ends or the ends from the means and there is a preoccupation with issues of domination and control. These are the negative images I have. I also have images that might be characterized as envious and somewhat desirous — in this respect, the technological universe is powerful, tough-minded and strong. People who have entered this universe have the goods; that is, they have something I don't have, but I want. As a result, they are decidedly different from me — they have succeeded in gaining access to a world that remains attractively Other.

There are other domains that are similar to the world of technology. For example, sports — I place games like football and basketball in this same category — the military is another example, or the world of high finance, and I could probably go on and on. I tend to think of such worlds as phallic universes — this is my shorthand and it means something quite specific. They are worlds that systematically exclude the maternal, they are indifferent to personal needs, and they banish values such as nurturance and care to the privatized domestic world of the home. The phallic universe is characterized by a slippery amalgam of means and ends — winning is everything and yet when victory is not realized the means are quickly accorded their own triumphant status. And yet, as I've said above, these phallic universes also signify power, potency, and prestige and in this respect they remain a source of envy.

Background

Historical approaches to the study of women's involvement with technology have focused on the ways in which women have been at the mercy of technology rather than being empowered users or creators of technology, or contributors toward technological change (McGaw, 1982; Wright, 1987). During the 1970's and 80's, however, women entered the skilled end of the computer industry in increasing numbers. As of 1990 women held 32.4% of the systems analysts jobs, 41.1% of the jobs in operations and systems, and made up 35.7% of our nation's mathematical and computer scientists (Frankel, 1990). Despite these in-roads, computer science continues to be a professional arena which is perceived and experienced as hostile to women (Pearl, et. al., 1990).

For the past several years a group of us at Bank Street's Center for Children and Technology[1] have been doing research on adult technology experts.[2] Our inquiry was designed to counter traditional deficit model

studies, which claim women are excluded from technological professions and thus have limited knowledge about technology as a whole. We were interested in the women who had gained access to and achieved a certain level of professional stature within technological worlds. In particular, we wanted to investigate their interpretive and meaning-making processes — what significance did they attribute to their work and what did they find compelling about it?

We began this research with certain theoretical suppositions about the nature of technological objects. Technological objects are symbolic and as such they are over-determined. The task of decoding the symbolic nature of technologies is a hermeneutic endeavor that involves an intellectual process of deciphering and uncovering hidden or latent meanings (Ricoeur, 1970). The computer serves as an interesting case in point. Like all symbolic objects, computers have meanings attached to them that are both manifest and latent, and perhaps more than any other object on the contemporary horizon computers have been used to both illustrate and embody different aspects of human potential and human imagination. Computer scientists working in the area of artificial intelligence attempt to breath life into technology by endowing machines with aspects of human intelligence; the prototypic example of this being the intelligent chess-playing computer.[3]

In his research on "The Army and the Microworld," Paul Edwards (1990) makes the point that "Computer work — programming, computer engineering, systems analysis — is more than a job. It is a major cultural practice, a large-scale social form that has created and reinforced modes of thinking, systems of interaction, and ideologies of social control" (p. 102). As part of a larger cultural discourse, the computer and, increasingly, information technologies in general, embody a kind of hyper-rationality that is privileged in our culture as a whole. The work of the computer scientist takes place within a rule-bound, logical universe that is freed from the constraints and messiness of day-to-day life. The culture of computer science is thought of as rigorous, intellectually demanding, and requiring "hard" knowledge to both participate and succeed in. As Sherry Turkle and Seymour Papert (1990) note, "Both popular and technical culture have constructed computation as the ultimate embodiment of the abstract and the formal." And indeed, the rationalist tradition within which the work of the computer scientist is embedded, has long been associated with maleness and masculinity — with a kind of hard mastery that is opposed to the softer, more interpersonally oriented world of women (Cohn, 1990; Edwards, 1990; Keller, 1985; Turkle, 1984, 1988, 1990). In this sense, then, the computer is the ultimate technological object and it embodies in exaggerated fashion those aspects of technology which are most phallic in nature.

In her research on programming styles, Sherry Turkle has written extensively about the ways in which the dominant computer culture — the world of culturally produced meanings — supports and legitimates a certain way of appropriating technology which she characterizes as "hard mastery." As Turkle (1984) describes it, "Hard mastery is the imposition of will over the machine through the implementation of a plan. A program is the instrument of premeditated control" (p. 104). For the hard master, there is a perfect fit between the cultural promise of technology and its personal realization, and it is this fit that allows for the articulation of personal desires that are more often than not divided along gender lines. Soft mastery, on the other hand, is more like the "give-and-take" of conversation, rather than imposing ideas on the machine, ideas emerge and evolve through the process of interaction. As a cultural practice, however, this kind of conversation with technology is not privileged; and as Turkle's work documents, when women attempt to appropriate technology they more often then not find themselves in situations of conflict. Hence, the woman who assumes that if she does something wrong with her computer it will explode in her face.

In a different but related domain, Carol Cohn (1987), a feminist scholar and peace activist, writes about the discursive culture of defense intellectuals — those individuals who articulate the theory that both informs and legitimates America's nuclear arms policies. Cohn was one of a group of college teachers who attended a summer workshop on nuclear weapons, nuclear strategic doctrine, and arms control. Her involvement in the summer institute led her to undertake an analysis of the language of this culture — a language she calls technostrategic. Cohn not only documents the obvious and expected aspects of this culture, such as the use of phallic and gender-laden imagery (long discussions took place on the relative value of different "penetration aids" or how to "get more bang for your buck"), but she also analyzes the more subtle and less transparent role that the language of strategic defense analysts plays in masking the reality of nuclear death and devastation. As Cohn writes:

> In the ever-friendly world of nuclear weaponry, enemies "exchange" warheads; one missile "takes out" another; weapons "marry up"; "coupling" is sometimes used to refer to the wiring between mechanisms of warning and response, or to the psycho-political links between strategic (intercontinental) and theater (European-based) weapons. The patterns in which a MIRVed missile's nuclear warheads land is known as a "footprint." These nuclear explosives are not dropped; a "bus" "delivers" them. (1987, p. 698)

Cohn's point is that this kind of talk serves to domesticate and tame the forces of nuclear destruction. The metaphors that these men use to characterize their work, minimize the horrific and deadly nature of the weapons they describe — "they are a way to make phenomena that are beyond what the mind can encompass smaller and safer, and thus they are a way of gaining mastery over the unmasterable" (p. 698). As she became more enmeshed in the language of the defense community, Cohn describes her own experience of losing site of the reality which she had originally come to study — it was no longer possible for her to hold onto the images of devastation and destruction that most of us associate with nuclear war.

Cohn's research is a poignant example of the ways in which gender, language, and technology can combine to shape and inform the cultural practices of a community of individuals. Her work illustrates, in turn, the ways in which cultural practices allow certain patterns of meaning to flourish while excluding or banishing others. In our own research on gender and technology, we were interested in investigating how the technological cultures within which women worked would impact on the ways in which they would appropriate and make meaning out of different areas of technological expertise. As Teresa de Lauretis (1986) has stated, "the relation of experience to discourse is what is at issue in the definition of feminism" (p. 5).

What is at stake in this inquiry is the larger issue of women's desire. We are all well aware of Freud's famous query: What does woman want? Indeed, the very fact that Freud posed such a question has served as the bane of much feminist debate and deliberation. Rather than trying to address a question that was born of a one-sided orientation to the problem of desire itself, psychoanalytically oriented feminists have begun to shift our focus away from the object of desire (the father or phallus) to the subject of desire (Benjamin, 1986, 1988; Chodorow, 1978; Gilligan, 1982, 1986; Gilligan & Stern, 1986). The question then changes: it is not *what* — in what object do we locate our desire — but rather *how* — how do we as woman articulate our needs and wants? However, as I discussed earlier, the discursive practices that constitute the technological universe complicate the ways in which meanings and expressions can arise. The question of woman's desire, then, becomes especially problematic when we attempt to articulate it in relation to a universe that is so clearly phallic in nature. Thus, in our own research, we were curious about how these technological experts would navigate such slippery terrain — how would they make meaning and derive pleasure out of a phallic universe?

In part, we were suspicious: These were women who had gained access to a technological domain and entered a universe that required hard-core knowledge. Although we were not altogether sure what these women

would sound like, we were fairly certain they would not sound like women. We thought we would hear them engage in a kind of hyper-logical talk; we imagined they would stride efficiently through our interviews in a clean and concise manner. We were thus surprised when we began to hear echoes of a different kind of discourse — one that was distinctly maternal in tone.[4]

The Research

We conducted 28 in-depth interviews with women (17) and men (11) who were deeply engaged in computer related activities. The interviews were carried out with programmers, computer engineers, computer scientists, and aerospace engineers. They worked in industry and in private and public research and development centers, as well as for hardware manufacturers and software development houses. The women ranged in age from 21 to 44, and the men from 27 to 39.

One of the questions that we explored in-depth with our interviewees was what excited or compelled them about the nature of their work. Both the women and men talked about deriving pleasure from the processes that their work involves. They described their enjoyment in the routines of their work, the problem-solving, and the detail work that computer programming often entails. However, when the women spoke about being compelled by the process of work, they also spoke about getting pleasure out of problems or processes that circled around someone else's enjoyment, involvement and delight. Their orientation was distinctly interpersonal — the pleasure they found in their work came from embedding technology in the larger context of human relationships and human interactions. The men, in contrast, were much more likely to talk about the immense enjoyment they derived from the technology itself. They described the pleasure they got out of working on particularly complex technical problems — problems that moved them further away from the user toward the technology itself.

My colleague, Jan Hawkins (1990, 1991), first called attention to these distinctly different perspectives in terms of the what she called the aesthetics of understanding. Drawing on the work of aesthetic philosophers, she has characterized the difference between men's and women's orientations as opaque and transparent, respectively. In her interpretation, the men tend to get arrested by the technological devices themselves, whereas the women tend to see through the objects to the larger context of human interactions.

In this paper I will explore this issue from another perspective — one which is grounded simultaneously in an analysis of the discourse of technological culture and the work of psychoanalytically oriented feminist

theory. In particular, I will explore the distinctive features of the interpretive frameworks that women and men use to characterize the pleasure they get out of the work they do with computer technology. I will pay close attention to the language that they use and the metaphors they apply as they characterize and describe the work that is appealing to them.

The Women

Of the 17 women we interviewed, 13 of them expressed an orientation toward their work that contained elements of a maternal voice which has as its focus the needs and experiences of others. This orientation can be further characterized by three distinct interpretive frameworks: i) Pleasure in technology's communicative potential; ii) Pleasure in making technology accessible; and iii) Pleasure in the collaborative nature of technological work. A fourth framework also emerged that can be characterized by pleasure in the personal accomplishments that can result from computer-based work.

Pleasure in Technology's Communicative Potential

> I'm excited about the potential that it opens up for people. I mean having the video connection between our two sites was really exciting to me — it was incredibly thrilling to me. I thought that the way that it allowed people to be brought together that wouldn't have been otherwise, was fantastic. And I still feel that way about it, a lot, so I'm certainly excited about what it can offer. And totally intrigued by the fact that often it offers you something that you didn't anticipate. (42, computer scientist, corporate research and development center)

> One of the things I really liked doing, and that's probably why I transferred, actually, was the space stuff...working on building networks that would interface people. I worked on one project... for the space station people, to manage all their information. And that was really exciting, because we were designing a new network, we were going across the country, we were hooking all the networks together - I think the wide area networks and interaction with other people always were exciting to me... (27, systems engineer, government research and development center)

> The communications stuff I do, the fact that I can be talking with people around the world easily, and the sort of chance interactions I have with people are quite exciting. (40, computer scientist, software company)

The three women who speak here reference the *potential* of the technology, and they locate this potential in what it can *open up* for

people. What is compelling about the computer-based technologies with which they work are the possibilities for communication and exchange between people that they can facilitate. Words like *exciting, thrilling,* and *fantastic* are used to describe the technologies' capacity to bring people together. Metaphors that have to do with creating and fostering connections are also used to describe their enjoyment in their work: *building, interfacing, and hooking* are the capacities of the technology that are talked about. Encountering the unexpected is also a source of pleasure, particularly when it leads to an unanticipated exchange between individuals.

The portrait that these women paint is expansive in tone, and we are left with an image of *technology as possibility* — as something that can expand and enhance the range of communicative activities among people. There is a surprising absence of "tech talk" — there is no mention of file transfer protocols, satellite hook-ups, internet access, or TCP/IP connections, or any number of terms that role off people's tongues when they are talking about telecommunications technologies.[5] Rather than calling attention to their knowledge of complicated and sophisticated technical undertakings, these women choose to emphasize the communicative and relational capacity of the technology.

Pleasure in Making Technology More Accessible

> The whole concept of expert systems and artificial intelligence just - it hits me wrong for a couple of reasons. First, I just think it's really scary that we're attempting to replace human expertise with machines... I can't see how you could ever get the knowledge that is in, you know, people's heads, or the knowledge in a discipline into a group of discrete facts in a computer system. I just didn't see how that would be possible to do objectively. ... My whole goal in doing this business, and in getting in technical writing, is ultimately a desire that I have to make technology more accessible to people. And I think that that's what we're always trying to do in doing this work, is to make people understand complicated systems, and show them that things really aren't all that complicated and people can understand them. And so having the opportunity to design the user interface for that system was just a golden opportunity. (28, computer scientist, technical consulting company)

> My day to day activity is much more focussed on how do we get the technology into our place. And that is not as driven with the technology being an exciting part — it's the capability that it brings to you, I mean, getting that machine in, the new machine in, is very exciting, because it has additional capability. It's not

> because it has some kind of special components. My excitement comes because if I can do things well, me and my organization, if we can do those things well, than the users have better tools, and with the users having better tools, they can accomplish their research projects. So my focus is always on the user, the researcher, the people who have the needs. (35, chief of computer systems, government research and development center)
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> My interest in user interfaces comes from two, I think comes from two areas. One reason I took psych courses, I majored in psychology, is I find people interesting. And that there are people who are afraid of computers – computers are wonderful toys, all right. To a large extent that's how I feel about them. And they can do amazing things, and they can free you up to do really good fun stuff. A piece of software is only as usable as the interface on it. And if I can help somebody, if I can put together something that takes the mundane grudge-work out for somebody, then I've really done something to help them, and help them be more creative. And relieve them of a tedious task. You know, computers are good for tedious tasks, they don't care. People get bored –it's not fun. (37, computer scientist, corporate research and development center)
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> I think what I like best is when you look at some of the prototypes and you show them to other people they get really excited. And it isn't like it's something hard — it doesn't look hard to them, it looks like something very easy and very usable and very valuable. That's the biggest satisfaction. There are two aspects, there's a lot of satisfaction in doing it and then seeing how other people respond to it. (44, multimedia developer, software and hardware manufacturer)

The women in this group locate the value in their work in making technology more transparent and accessible for others. They derive genuine pleasure from taking into account the user's perspective and point of view — demystifying the technology so that fruitful and productive engagement is possible. In general, these women see technology as a facilitator and enhancer of human potential, rather than as a more efficient substitute for human capabilities. Indeed, attempts to use the computer to replace human thought and action are seen as frightening.

Computers can bring relief from tedious tasks. They can be used to free people up and help people become more creative. The interpretive emphasis is on the technology's expansive and liberating potential; helping others to appropriate and make use of this potential is a source of

satisfaction. These women talk about making technology less hard. Their goal is to make technological objects friendlier and more conversant with peoples' needs. And they derive genuine pleasure from witnessing other people's satisfaction in their work. The impression one gets is that these women want to turn technological objects into companionable partners — helpmates that will genuinely improve the quality of human life.

Pleasure in the Collaborative Nature of Technological Work

Mmm...well, I think for me the most exciting projects are ones where you are building up something that's new, where you're building up a new capability, or you're participating with a group of people to put something together. You know, and, um, so anything that would involve that sort of thing. Um, I think, right now we're getting a little bit into space station work, and for me that's really exciting, to do that. (33, computer scientist, government research and development center)

In terms of the things that are most satisfying about my job, they're probably more people things than technology things, in that, like I really enjoyed running the conference I ran, this week. I like being the person who sees what things fit together and which groups of people should talk to each other. I like having a sense of what the technology's good for, but in fact don't get tremendously turned on by making that be real, myself. (40, computer scientist, software company)

Hmm, there's a lot of things that I like, to narrow it down to one would be hard. I guess off the top of my head one thing I enjoy doing — something that I've been doing today — and that's at the initial conception of a concept, of an idea, try and find the different people I need to talk to and gather the information necessary. I enjoy that — I also enjoy on the other hand, once there is a problem sitting down and actually stepping it out — how logically does this problem get solved — not as much in the big picture at that stage, but more of the specifics of sitting down and saying, 'OK I need to read from a file, how do I do that.' So I like the broad picture when it's with people and I like the very specific picture when it's with the computer. (26, knowledge engineer, industry)

I guess that I think of them in two categories. One is things that I actually physically myself do at the computer. So, for example, I kind of like debugging software. If a programmer says "okay, here's a new version, try it out," and I have a data set that I've been working with and I try it out and something works a little bit

> strangely – part of me says "oh, my God, we've got another bug in the software!" but part of me regards it as a fun problem to work on. The other thing that's been interesting to me more lately, since I've moved beyond the actual programming, is really thinking about design of software, and having ideas that then can get worked out in more detail with other people. I think that's a more collaborative process. (38, computer scientist, corporate research and development center)

The four women who fall into this group talk about collaborative processes and building up knowledge in conjunction with others. It is the generative process of working with or finding out information from others that they find satisfying. Creating a new capability, bringing to life something that hasn't existed before, is genuinely exciting and the fact that this happens in collaboration with others is valued.

It is the people aspects of their work that are satisfying. Bringing out other's capabilities, gathering information from others, and communicating with and learning from other people are all seen as pleasurable parts of the design process. The locus of satisfaction is found not in the technological objects themselves, but in the kinds of discursive communities that form around technological projects, or in problem solving that involves talking with and learning from others. Once again, the metaphors are generative and connective — building, creating, collaborating are the descriptors that these women use.

Pleasure in Knowledge

> What intrigues me the most is when you've got something that works and you fix it to make it better and then suddenly it doesn't work anymore and you have to figure out what you did, and go back and trace over it, and figure out where you went wrong, and correct it from there. The fact that you have to sit there, and work at it until it works, and there's really no one you can ask, and you have to figure it out yourself. Because if you bring something you've written to somebody, they'll look at it, and it's very difficult for someone to understand someone else's code. And so it's yours, and you have to figure it out, kind of thing. (21, computer engineer, industry)

> I like being handed a program that doesn't fit, say, into the space available and I have to basically look through it and rewrite it to try to make it fit smaller — which reminds me of journalism. That's a task that I find pleasing. I like the general feeling of being faced with a problem that hasn't really been figured out, where there's a lot of specs written that have technical information but no one's

> ever actually done this task. It's sort of like I go into it knowing it's possible, and then kind of spending enough time with the information until it sinks in — what would be needed to get done, and then have it be done and be able to feel the difference between when I thought I would never figure this out and then when I have. I mean, I think that's why I've succeeded at this stuff, at some point along the line I succeeded at some point, and understood that if I spent long enough figuring it out, I would get it. (43, programmer, software company)
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> Anytime my program doesn't work, it's a problem I enjoy solving. And I get particular satisfaction when I've worked really hard on a problem and gotten discouraged, and wanted to get help, and I didn't get help, and I ended up solving it myself. That's very satisfying to me. So it isn't so much any particular kind of problem, cause all the problems I work on seem to be, I mean, they're similar. (36, programmer, software company)
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> It's like the flow physics is what I get into - what I've been working on is like vertical take-off aircraft. The harriers that take off from - straight up. What I've been doing with this is, there's a specific part, the lift jets, that I've been looking at. And instead of putting in a whole aircraft, you put in one very, just the lift jet and a flat surface that sort of resembles this plane, and look at just like the physics that make this things work, that nobody really understands all the small-scale features of this flow, we really don't - experimentally we don't have things that can measure it to that detail. And yet I'm getting some of these details and it's like "no, guys, you know, it works like this" and that kind of thing is what really get - excites me, and that anything I can do to dig into that kind of thing is what would be my favorite problem to work on. (27, aerospace engineer, government research and development center)

The women in this group derive pleasure from the feeling of self-reliance they experience while problem solving. They talk about the importance of figuring things out themselves, of getting some of the details — a process that results in ownership of knowledge which is satisfying. In particular, challenging one's own capabilities, proving to oneself that indeed you can do it, is gratifying. To feel the difference between when I thought I would never figure this out and when I have, is especially rewarding. And for at least one of these women, there is also pleasure in the competitive advantage that knowledge buys you: I'm getting some of the details.

The metaphors they use describe a process that is a mixture of patience and perseverance. They talk about siting there and working at it until it works, and spending time with the information until it sinks in. One is left with the impression that their relationship to technology is largely contemplative in nature. Like an accomplished teacher who assesses each student according to their individual needs, they spend time with their computer programs tracing over, figuring out, and correcting.

The Men

When asked to describe aspects of their work they found exciting or compelling the 11 men we interviewed all described processes that in one way or another moved them closer toward the technology. As a group they can be characterized by three types of interpretive frameworks: i) pleasure in the process of abstraction; ii) pleasure in deciphering the mysteries of technology; iii) pleasure in the process of design.

Pleasure in the Process of Abstraction

> Every once in a while, it may be every several weeks to maybe even every few months, I come on a problem that really excites me and gets me running, I mean, I sort of eat drink and sleep it for a period of time... I can give you an example of one that obsessed me for a while, and I certainly enjoyed. ...Five years ago, we needed to go into software production, large scale software production, and we needed to have software tools with which to do that. I was the guy charged with coming up with the software tools, either finding them on the market or creating them. So, I had been able to find these things called assemblers on the market, and we even ordered a quarter million dollar machine, that would be able to run some assemblers... But I wasn't very happy with the performance of any of these assemblers, they all seemed to run too slow, and, you know, they would inhibit the creative process... So one night I was just thinking about, well, gee, couldn't I... make it faster? And I reduced the problem to a matter of what I call symbol look-up. Symbol look-up's gotta be the critical thing, how fast can I do symbol look-up on, on our little home computers, on our IBM pc's? So I then worked on that problem for a little while, just kicking it around in my head, and got it down to I think about an eight instruction loop. Eight little instructions, and from those eight instructions, I immediately extrapolated and figured out that I could make an assembler that ran close to a hundred times faster than anything else existing... (32, programmer, software company)
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> ...We had a situation at the beginning of last year, where we had to think about how to represent the types of interactions people do on a computer, and ...hired some people who were in the Ph.D.

program at Columbia in AI, to work at a plan I had for representing videotext interactions, or computer interactions... And we built this whole system, it was really quite elegant, and it caused us to have to abstract a lot of the types of things you do on computer, a lot of the types of interactions and a lot of types of responses, and what you do with that information. It was very good work, it was the type of work I like to do, trying to abstract and represent it, knowledge representation... So I like to abstract things, I like to write knowledge representation things. That's something I really like, to draw the sort of design phase, to solve the design problems. (28, programmer, software company)

...We've always had the attitude that we could - as far as what could be done on computer, we could do it. ...There came a time when I was doing the main editor core, which allows um, which the other parts of the editor use to edit text, and put up different windows, and things like that, and it came to a point where we wanted to allow as much functionality as possible. ...It was very slow, it just seemed to be unacceptably slow. And I remember, ...I just sat and I said "boy, we're really in a jam now - I mean, it does a lot, but we're working on a machine that runs very slowly, you know, what can we do?" ...And we just put a little mind effort together, and, ah, on one issue we came up with a way of, of speeding it up, and then I came up with some hardware scrolling and doing some other things, that together it sped up the program to a desired speed. And to me that was problem solving in its simplest form. Where we saw a problem that we had no idea how to solve it, and we were able to, in the process, just thinking about it, we were able to come up with some great ideas, and it was very encouraging... (27, programmer, software company)

The kinds of things that I like, I've sort of burned out on them a bit, but what I did like – the software we did was pretty technically complicated compared to most kids' software, that is the underlying models were complicated. I don't know whether it shows up on the screen, but there was a lot of kind of math and problem-solving in the programming which I liked, and which was pretty difficult for me. But it was the kind of stuff I thought I should be able to know how to do, because I couldn't see anything that I obviously didn't know how to do. So I do enjoy that kind of pretty well-defined, highly specified problem, which was very obvious if you got it right and very obvious when you got it wrong. And, you know, computers are marvelous things to let you go all night at them, so I spent a lot of enjoyable time just locked in to problems. So solving some of the programming problems I think

was the most enjoyable part for me. (39, programmer, educational development group)

The pleasure these four men derive from their work comes from a kind of mental wrestling they engage in with the ideas and procedures they generate in relation to the technology. They delight in mental effort, in kicking ideas around in their heads, in abstraction, and extrapolation. There is a sense that these men see themselves as taking risks that they alone are challenging themselves, and that the projects they work on involve a great deal of technical sophistication. One gets a sense that the enterprises these men work on are large, their missions are difficult, they carry the burden for success and failure, and they deeply enjoy the challenges involved. There is also an obsessive quality to what they do — they eat, and drink, and sleep these problems. There is talk about being *locked in,* and one gets a sense as well that they derive erotic pleasure from these obsessive and engaging tasks — computers are marvelous things to let you go all night at them.

Their descriptions are laden with technical terminology — there is talk of target machines, symbol lookups, and instruction loops. Technology is the topic of conversation; there are no human reference points; the universe that gives them satisfaction is an exclusively technical one.

Pleasure in Deciphering the Mystery of Technology

I guess the real problems that excite me — um, there's all sort of levels... In, you know, in any computer, when I say its a system, within this system there's a lot of other little things, and the real hard problems are interactions. Interactions where the cause of the problem is not where the problem shows itself. So there's this trail which comes round to what I said, it just shows you you don't understand the system. And so it takes a rethinking about all the things that, you know, the problem's over here, but what causes it, really started it, the chain of events - I guess that's what I mean - the chain of events that leads to the problem, the longer it is, the more interesting. (32, software engineer, software company)

...There's an area where something that I didn't consider is causing problems down the road... – I'd like to get an answer to that. I guess in my business there's – I get problems from testing, from quality assurance on the product, and they can be very complicated scenarios, that caused this really disastrous thing to happen. And to track something like that down is satisfying. One approach that we often take is sort of a binary search method – you can get a report from a tester that has, say, twenty steps in the sequence of events that finally leads to the problem. And to actually fix that

> thing, it really could be any one of the twenty steps that are causing the problem to eventually occur... (29, software engineer, software company)
>
> What I've always found kind of curious about computers is that you can use them to program, but you can also spend time to find out more about the computer and how it operates... and, so you discover things. And what are you discovering? You're discovering something that someone made, as opposed to science, where you're discovering something that has occurred naturally. ...When a computer system is designed, the designer is not fully aware of all the ways that it can be used, and all the little things that'll happen, all the little idiosyncrasies. So that's kind of fun in itself, but I think really the most fun is – well, what got me into it was being able to set up a series of steps to solve a problem. And that you really had, you had full control, and it, that machine, would follow out your orders exactly, and do it. And so it was a really nice tool, and it was a nice kind of environment to work in. (33, programmer, software company)
>
> That's a good question... Designing the structure of the system... ...You take a problem - and I really can't give you any specifics, because this in many ways is the basic way of approaching problems - would be to try to solve the problem based on the structure that the problem seems to have. ...Its looking at the situation and trying to eliminate the irrelevant aspects of it, or the parts that at the first level of development may not be relevant, so trying to get to the core of the problem. (30, computer scientist, university research and development center)

The men who fall into this category derive pleasure from extracting the secrets that the computer harbors. Despite the fact that technological objects are man-made, they are accorded a uniquely mysterious — as yet undiscovered — elusive character that is reminiscent of the scientists relationship to the natural world (Keller, 1985). Indeed, one of the men articulates this: When a computer system is designed, the designer is not fully aware of all the ways that it can be used, and all the little things that'll happen, all the little idiosyncrasies. Hence, for the programmer, the computer is a mysterious puzzle that must be solved.

Not surprisingly, then, the problems that are most exciting for these men are the ones that are not obvious. One engages in a detective like task of tracking down the root of the trouble — ferreting it out by stepping through a chain of events. And the longer the chain of events, the more interesting the problem.. Trying to get to the *core* of the problem — a

process that takes you further and further into the interstices of the technological environment — is most compelling. Missions that entail tracking *t*hings down are especially satisfying. The appeal lies in making the invisible, visible; and the computer is an especially satisfying environment to do this in because logic and order can be used to unearth the mystery . Programming allows you full control, and the fact that the computer follows your orders exactly is a source of pleasure because of the certainty that systematic activity will unearth the deepest levels of the machine's idiosyncrasies.

Pleasure in the Process of Design

Making things understandable is something that gets me excited. So when I'm building a system, thinking a lot about how people are going to use it, and trying to develop it in a way that people will relate to and will be meaningful to them and trying to think of what are the right metaphors to make this work. ... I'll tell you an example...I'm not sure if it works as an example, I'll just start and then we'll see if it works. One project we're working on [is] programmable bricks...one way to use these programmable bricks is just to link them to a computer and sort of send a program down into the brick and then disconnect it, and then the programs in the brick. But it might be nice not to have the computer at all, and to have a bunch of buttons on the brick, and then by pushing these buttons on the brick, you can write a program. So maybe this brick with a computer inside has like a two-line display, and maybe it has twenty buttons. So its relatively small, maybe its the size of a deck of cards, so I'm not talking about a really tiny brick, but maybe the size of a deck of cards. And sort of, maybe the size of a calculator. (32, programmer/designer, university research and development center)

Some of them have to do with, I guess there's sort of two kinds of technical ones. One is the way the tool would actually get used. ...For example, I talked to somebody who told me that the way this thing is supposed to work is you have these data streams, we call them, which run in columns, so one of them might be verbal transcript, which would be text, right, and each of these is chronologically ordered, and another column might have not text at all, but graphics, which, you know, little lines, and whatever notation system you might have, representing whatever you're interested in like, when somebody's gaze changes,.. ...One interesting thing that happens is if we were talking at the same time, and, and we have a little bit of overlap in conversation, it might be on the order of three or four words that we say, that happen at the same time. So if you looked at these two columns,

> you'd see a line that had your words and mine lined up together. But within that, we don't know how they actually line up, right? I don't actually know which words were on top of which other words, et cetera. ...You might want it to flip from being vertical to being horizontal, right? So, so those three or four words that you say and the three or four words that I'd say would then line up like this, and then we could actually align much more, ah, finely, if you will. And so, I thought that was a cute idea... (35, computer scientist, corporate research and development center)

> The notion of how someone navigates the space of possibilities in any given computer program is something you have to ask every time and it's always a fascinating question requiring different answers... The notion of, you want to give somebody some functionality, and you want to figure out how to give them, you want to figure out how to give them as much of the functionality as possible, but do it, hand it to them in such a way that it's something that they can get control over very easily. And that's the high level, and most interesting problem. (31, computer scientist, software and hardware manufacturer)

At first glance, the three men who fall into this category appear to be focused on the user in a way that seems similar to the women who take pleasure in making technology more accessible. Although these men articulate interest in creating technological environments that meet the needs of users, as their descriptions of what they find compelling progress the user tends to disappear from view. What they appear to be genuinely interested in are the design issues involved in creating computer-based environments.

Their focus is on the surface structure of the technology — how many buttons a programmable object should have, how many lines of display should appear, how big the object should be, how words that denote different conversational structures might line up, and so on. What is intriguing for these men is figuring out the details of the object — thinking through the ways in which its various gadgets and devices will function. Although they talk of wanting to find out how someone navigates the space of possibilities, and voice a desire to create as much functionality as possible, it is as though they cannot resist the allure of the technological objects themselves. As a result, they are unable to keep their gaze centered on the user, and their focus shifts to the objects they are designing. Even when they talk about user oriented design issues their talk is abstract, and unlike the women it is not about demystifying the technological universe. Rather, the sense one gets is that they are interested in controlling and containing the object for the naive user.

Conclusion

In a related study, I (Honey, 1988) investigated the ways in which adolescent boys and girls appropriated and made meaning out of a computerized fantasy role-playing game modelled on Dungeons and Dragons. The fantasy scenarios that boys constructed as they interacted with this simulated world elaborated and expanded upon the symbolic content of the game. Indeed, the boys were able to use the game environment as a source of narcissistic satisfaction and confirmation. The girls, in contrast, constructed multiple interpretations of the game, some of which resisted or refused the fantasy content altogether.

The metaphors that such games embody — metaphors of conquest, domination, and control — allow young boys to slide easily and effortlessly into the universe of play so that the process of developing expertise and triumphing over the game-world is a much more seamless experience for them than it is for girls. Video games are both simulated worlds that hold out to the player the possibility of ultimate control through the elimination of ambiguity, and they are fantasy spaces in which dramas unfold, often leading the player on a heroic quest of one sort or another. The appeal of video games resides in their unique blending of these two dimensions of experience.[6]

For the men in our study, computers embody both of these elements — they are unpredictable, mysterious and deeply puzzling, and yet they are environments in which control can be achieved through systematic analysis and problem solving. It is the blending of these two processes — mystery and mastery — that makes computers particularly alluring objects for the men. Like the boys playing video games, the men are comfortable with the discourse that surrounds the technological universe — they appropriate its procedures and practices and make use of its terminology. They locate the source of their satisfaction and pleasure in the instruments with which they work, and for the majority of them the quest that is most satisfying is one that takes them deeper and deeper into the soul of the machine.

What, then, might we make of the other voice we hear — the voice that is distinctly maternal in tone? It is not an expression of innate femininity — an indication that by virtue of our sex we are more nurturing and peace-loving. As Sara Ruddick (1989) points out, this kind of “rhetoric and the theory run up against two facts: men are not so warlike and women are certainly not peaceful” (p. 151). Rather, the fact that we hear these maternal voices suggests both a way in which we locate ourselves in our work as women, and a means whereby we domesticate or “make-safe” technologies that are otherwise experienced as threatening. The former is

expressive, the later defensive — and these postures are taken up simultaneously; one does not exist without the other.

In her work on the question of women's desire, Jessica Benjamin (1986) suggests that what is needed is not an alternative symbol in which to locate the expression of desire, but an alternative way of thinking about how the psyche is structured. She proposes a non-phallic mode of psychic organization that takes account of the development of self in relation to others. By realigning the discursive boundaries of psychoanalytic theory, it becomes possible to rethink the articulation of women's desire in terms of an intersubjective space. What we as women want, then, is no longer merely a matter of a symbolic dance around the quest to either *have* or *be* the phallus. Desire can be articulated in relation to an intersubjective reality in which the self's creative processes are linked to and shared with the experiences of others. Benjamin is clear, however, that this understanding of psychic development is only one piece of the developmental puzzle; the intersubjective mode both complements and contradicts the more phallicly structured intrapsychic mode. As she states:

> The self that develops and accumulates through such experiences of recognition is a different modality that sometimes works with, but sometimes is at cross-purposes to, the symbolized ego of phallic structuring. It is essential to retain this sense of the complementary, as well as the contrasting, relationship of these modes. Otherwise, one falls into the trap of choosing between them, grasping one side of a contradiction that must remain suspended to be clarifying (p. 94).

Retaining a sense of the complementarity as well as a sense of the contradiction that exists between the intrapsychic and intersubjective modes of experience allows us to avoid the pitfall of labeling women's desire as exclusively maternal. Indeed, it helps us to see the paradox that is inherent in giving voice to our desire within a phallic universe, for it is impossible to know the truth of desire given the patriarchal nature of the social world in which we live. The paradox, then, is that women's desire is always both expressive *and* defensive.

As Sherry Turkle and Seymour Papert (1990) have found, "Women are too often faced with the not necessarily conscious choice of putting themselves at odds with the cultural associations of the technology or with the cultural constructions of being a woman" (p. 151). The maternal voice is born of this conflict — while allowing us to position ourselves as women in relation to technology, the maternal voice also serves to domesticate and tame the cultural discourse of technology. Thus, the presence of this voice suggests both possibilities and limitations.

The tendency demonstrated by the women in our study to locate the value of their work in making technology more transparent and accessible to others is a humanizing influence on a domain that is often experienced as inhospitable to the needs and concerns of non-technical users. The other side, however, is that this kind of maternal talk also functions like safety valve — ensuring a well-trodden path out of a domain that frequently puts us in conflict. As a result, we tend to resist deep engagement with technology, a phenomenon that Sherry Turkle (1988) has termed computational reticence. Thus, the degree to which we can imagine creative and far-reaching uses to which technology can be put is limited.

In a related piece of research (Brunner et. al, 1990), we asked this same group of technological experts to write a reply to the following scenario: If you were writing a science fiction story in which the perfect instrument (a future version of your own) is described, what would it be like? The results of this research complement the interpretive frameworks that emerged in our interviews. In their fantasy scenarios the women tended to see technological instruments as people connectors, or communication and collaboration devices. The men, in contrast, tended to envision technology as extensions of their power over the physical universe. Their fantasies were about absolute control, tremendous speed, and unlimited knowledge. Here are two scenarios that illustrate these different orientations; the first was written by a woman and the second by a man:

> The 'keyboard' would be the size of a medallion, formed into a beautiful piece of platinum sculptured jewelry, worn around one's neck. The medallion could be purchased in many shapes and sizes. The keyed input would operate all day-to-day necessities to communicate and transport people (including replacements to todays automobile). The fiber optic network that linked operations would have no dangerous side effect or by product that harmed people or the environment. (computer engineer)

> A direct brain-to-machine link. Plug it into the socket in the back of your head and you can begin communications with it. All information from other users is available and all of the history of mankind is also available. By selecting any time period the computer can impress directly on the user's brain images and background information for that time. In essence a time-machine. The user would not be able to discern the difference between dreams and reality and information placed there by the machine. (Perhaps this is all a nightmare.) (Computer programmer)

The kinds of devices that the women dreamed up were friendly and inviting — they tended to be small, robust, companionable objects that fit

fluidly into the daily context of women's lives. The men's fantasies, on the other hand, were grandiose — they imagined devices that had both tremendous power and tremendous speed — devices that resulted in instantaneous, brain-zapping gratification. Indeed, the men's fantasies often contained dangerous and militaristic images that we associate with the deadly potential of technology.

As my colleague Cornelia Brunner (1991, 1992) has noted, both voices are necessary components of what might be thought of as a technological world view. By itself, the masculine voice leads to technological advance, which however, can be enormously destructive and deadly in its potential. And the maternal voice has a downside as well; it "does not seem, on the surface, to promise the kinds of breath-taking (in the positive as well as negative sense) advances in technology we have witnessed" (Brunner, 1992, p. 10).

As we have noted, however, the discursive reality that constitutes the technological universe leaves little room for the presence, let alone the realization, of the maternal voice. Indeed, many of the women we interviewed spoke about feeling marginalized and isolated within their professional communities. Our goal in carrying out this research was to identify the different pathways and different points of view that characterize women's entry into and relationship with technological work, so that we might articulate a different framework for thinking about issues of gender and technology. What we have discovered is that it is essential to hold in sight both the complementary and contradictory aspects of these gender-laden perspectives on technology. It thus becomes possible to imagine the ways in which the maternal voice might serve to humble and humanize the grandiose (and frequently destructive) nature of technological discourse, and the ways in which this grandiosity might, in turn, be used to stretch the imaginative potential of the maternal voice.

Endnotes

[1] This paper reflects the work and thinking of a number of my colleagues; thus, I use the plural "we" in representing the ideas and thoughts that evolved in collaboration with them. I would like to thank Katie McMillan for her work on the transcripts, her contributions to the development of the interpretive frameworks elaborated in the paper, and her careful reading and re-reading of the manuscript. Cornelia Brunner's, Jan Hawkin's, Peggy Clement's, and Babette Moeller's ideas have had a major impact on the content and shape of this paper. And our weekly discussions around the women and technology project at the Center for Children and Technology served as an important developmental space in which a number of the ideas contained here emerged.

[2] This research was originally funded by the Spencer Foundation (Women and Technology: A New Basis for Understanding). Jan Hawkins was the principal investigator; Cornelia Brunner, Peggy Clements, Margaret Honey, and Babette Moeller were the project staff.

[3] For an excellent discussion of the history of artificial intelligence see Sherry Turkle, *The Second Self*, pages 239-247.

[4] I see the term maternal voice as a component of what Sara Ruddick (1989) has identified as *maternal thinking* — the kind of reflective thought that develops around the demands of motherhood for preservation, growth, and social acceptability. I also see the term maternal voice as bearing a direct relationship to the ideas that Carol Gilligan (1986) developed in, *In a Different Voice*,, and to the *Women's Ways of Knowing Collective* (1986).

[5] File transfer protocols allow you to send and receive information over telecommunications networks, satellite hook-ups is generic terminology used to describe a range of different systems that allow for the transfer of video images; the internet is an electronic mail system connective governmental institutions, military branches, educational institutions, and commercial companies throughout the world; TCP/IP connections stand for Transmission Control Protocol/Internet Protocol.

[6] I owe this insight to Sherry Turkle, who first articulated it in her book, *The Second Self.*

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