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COMPUTATIONAL RETICENCE: WHY WOMEN FEAR THE INTIMATE MACHINE

'I wanted to work in worlds where languages had moods and connected you with people.'
(A young woman talking about mathematics and computers)

The computer has no inherent gender bias. But the computer culture is not equally neutral. This essay looks at the social construction of the computer as a male domain through the eyes of women who have come to see something important about themselves in terms of what computers are not.

There is much talk about women and 'computerphobia.' My research suggests that women's phobic reactions to the machine are a transitional phenomenon. There is the legacy of women's traditional socialization into relationships with technical objects, for many of them best summed up by the admonishment, 'Don't touch it, you'll get a shock.' There is the legacy of a computer culture that has traditionally been dominated by images of competition, sports and violence. There are still computer operating systems that communicate to their users in terms of 'killing' and 'aborting' programs. These are things that have kept women fearful and far away from the machine. But these are things that are subject to change. More persistent are reactions that touch another and deeper set of issues. I believe that the issue for the future is not computerphobia, needing to stay away because of fear and panic, but rather computer reticence, wanting to stay away because the computer becomes a personal and cultural symbol of what a woman is not.

Since 1976 I have been involved in studies of computers and people using a methodology both ethnographic and clinical. My concern has been with the detail of people's relationships with computers and with the social worlds that grow up around them. In order to best make the distinction between phobia and reticence I will take

my examples from interviews with women who are involved with computers, women who do not fear them but who take their distance in a way that inhibits their creativity, and that ultimately will impoverish the computer culture as well. In particular, I draw my examples from a study of twenty-five Harvard and MIT women taking and succeeding in computer programming courses. And I focus on one woman, who here I call Lisa, who speaks in a particularly clear voice to a set of widely shared concerns. The central issue for these competent and talented women is not phobia or lack of ability, but a reticence to become more deeply involved with an object experienced as threatening.

REJECTING THE INTIMATE MACHINE

Lisa is 18, a first-year student at Harvard, and surprised to find herself an excellent computer programmer. Not only is it surprising, but 'kind of scary.' Most 'scary' is protecting her involvement with computers from the idea of seeing herself 'as a computer science type.'

> 'You know, the typical stereotype; I had a home room in high school that just happened to be the math lab and there were these little kids who walked around with pants that were too short and they had little calculators with all these fancy functions and they wore them on their belt and they played chess incessantly and talked about their gambits and the things they were doing in their advanced calculus courses and all the great hacks they were doing on the computer; and they were always working with their machines. I was contemptuous of them. They stayed away from other people. They took the computers and made a world apart.'

Women look at computers and see more than machines. They see the culture that has grown up around them and they ask themselves if they belong. And when, in high school and college, they look at the social world of the computer expert, they see something that seems alien. At the extreme, they see the social world of the 'hacker,' a culture of computer virtuosos. It is a world, predominantly male, that takes the machine as a partner in an intimate relationship.

The computer is a medium that supports a powerful sense of mastery. As people develop their mastery of things and their relational skills with people, most strike a balance. They balance the need for mastery of skills and concrete materials with the desire to do things with people where the results are never as clear. For some people, striking this balance becomes a difficult struggle. Relationships with people are always characterized by ambiguity, sexual tension, the possibilities for closeness and dependency. If these are felt as too threatening, the world of things and the world of formal systems becomes increasingly seductive. They turn to formal systems in engineering, in chess, in mathematics, in science. They turn to them for their reassurance, for the pleasures of working in a microworld where things are certain and 'things never change unless you want them to.' In other words, part of the reason formal systems are appealing is because they provide protective worlds.

Pride in mastery is a positive thing. But if the sense of self becomes defined in terms of those things over which one can exert perfect control, the world of safe things becomes severely limited—because those things tend to be things, not people. Mastery of technology and formal systems can become a way of masking fears about the self and the complexities of the world beyond.

This pattern of using formal microworlds as protective worlds existed long before computers were dreamed of. But the computer offers some new possibilities. The computer offers its users a formal system, but it is also active and interactive. It is easily anthropomorphized. Its experts do not think that it is 'alive.' But it is a medium onto which lifelike properties can be easily projected. It supports the fantasy 'that there is somebody home.' It is, of course, only a machine, but because of its psychological properties it supports an experience with it as an 'intimate machine.'

When people fear intimacy, they are drawn to materials that offer some promise, if not for a resolution of their conflict between loneliness and fear of intimacy, then at least for some compromise. The computer offers this promise. It offers the promise of perfect mastery. And in its activity and interactivity, it offers the illusion of companionship without the demands of friendship (Turkle 1984).

Computers become particularly seductive at a certain moment in psychological development: the moment of adolescence. There are new sexual pressures and new social demands. The safe microworlds the child has built—the microworlds of sports, chess, cars, literature, music, dance, or mathematical expertise—can become places of escape. Most children use these havens as safe platforms from which to test the difficult waters of adolescence. They

move but at their own pace. But for some, the issues that arise during adolescence are so threatening that the safe place seems like the only place. They come to define themselves in terms of competence, skill, in terms of the things they can control. It is during adolescence that the 'hacker culture' becomes born in elementary schools and junior high schools as predominantly male—because, in our society, men are more likely than women to master anxieties about people by turning to the world of things and formal systems.

In high school, Lisa saw young men around her turning to mathematics as a way to avoid people and describes herself as 'turning off' her natural abilities in mathematics. 'I didn't care if I was good at it. I wanted to work in worlds where languages had moods and connected you with people.' And she saw some of these young men turning to computers as 'imaginary friends.' She decided to avoid them as well. 'I didn't want an imaginary friend in a machine. If I was going to be alone, if I needed to withdraw, well, then I wanted to read, to learn about human psychology by reading about it, if I didn't always have the courage to learn about other people by being with them.'

The computer is rejected as a partner in a 'close encounter.' When women are introduced to it in cultural contexts where the most successful users seem to 'love the machine for itself,' they define themselves as relational women in terms of what the 'serious' computer users are not. Although hackers are a small part of the general population, the culture of young male programming virtuosos tends to dominate the computer cultures of educational institutions from elementary schools to universities. Hackers are not great in their numbers, but they are visible, dedicated and expert (Kiesler *et al.* 1984; 1985; Turkle 1984).

THE NEGATIVE IMAGE OF THE HACKER

The hacker's relationship with computers is often characterized by a violent form of risk taking. This violence is not physical, rather it is psychological: there is intensity, turbulence, aggression. There are the pleasures of flirting with destruction. The hacker at his computer constantly walks a narrow line between 'winning' and 'losing.' Hackers talk about complex computer systems as places where you can let things get more and more complicated, until you are on the edge of being out of control, but where the pleasure is in the challenge of being able to pull them back.

Joe is 23. He has dropped out of a computer science degree pro-

gram in order to devote himself more fully to MIT computers. He contrasts his love for the violin ('it can only do so much and your fingers can only do so much') with the limitless possibilities of the computer.

> 'With programming, whatever you think of—and you are always thinking of something—it can be immediately translated into a challenge. That same night. You can set yourself up to do it some really esoteric, unusual way. And you can make a deal with yourself that you won't be satisfied, that you won't eat or go out or do anything until you get it right. And then you can just do it. It's like a fix. I couldn't get that kind of fix with the violin. I could be obsessed, but I couldn't get the high.'

With the computer as your medium there is no limit to how much you can flirt with losing in your pursuit of winning. There is no limit to the violence of the test. The computer becomes a medium for playing with the issue of control by living on the narrow line between having it and losing it. MIT hackers call this 'sport death'—pushing mind and body beyond their limits, punishing the body until it can barely support mind and then demanding more of the mind than you believe it could possibly deliver.

Anthony, 20 years old, an MIT senior, is a computer hacker who is very aware of the pleasures of sport death and its lack of appeal for women.

> 'Computer hacking is kind of masochistic. You see how far you can push your mind and body .... Women tend to be less self-destructive—hackers are somewhat self-destructive. They don't take care of their bodies and are in general, flunking out. Burnout is common. Women are not so into sport death; they are more balanced in their priorities. The essence of sport death is to see how far you can push things, to see how much you can get away with. I generally wait until I have to put in my maximum effort and then just totally burn out.'

There are very few women hackers. Though hackers would deny that theirs is a macho culture, their preoccupation with 'winning' and with subjecting oneself to increasingly violent tests makes their world peculiarly male in spirit. There is, too, a flight from relationship with people to relationship to the machine—a defensive

maneuver more common to men than to women.

The hacker's relationship with the computer is filled with technical risks, but it gets much of its emotional charge because it offers respite from personal ones. Hackers talk a lot about 'getting burned.' Because if you are primarily motivated by a need to feel in control, 'getting burned' is one of the worst things that can happen to you.

Anthony has 'tried out' having girlfriends:

'I used to get into relationships that usually led to me getting burned in some way .... With computers you have confidence in yourself and that is enough. With social interactions you have to have confidence that the rest of the world will be nice to you. You can't control how the rest of the world is going to react to you. But with computers you are in complete control.'

Sex and romance are desirable, but they are risky. 'Sport death' is risky too, but it is a special kind of risk where you assume all the risk yourself and are the only one responsible for saving the day. It is safe risk. Anthony sees sex and romance as another, more disturbing kind: 'Hacking is safe in that you are in complete control of your computer world, and sex and relationships are risky in that the rest of the world has control.'

Anthony compares human relationships to the sense of accomplishment and control that he can get from a machine. This does not mean that he sees machines as a 'substitute' for women. But he is not sure that he can function in the worlds where you can get burned.

The men in the hacker culture see it as incompatible with a life with women. 'Computer hacking is almost pure pleasure with very little risk. But it is not as fulfilling as romance because in the end you have just made a few lights blink. But you only have so much energy. You can either spend it on computers or you can spend it on people.' The women who watch these men observe their obsessions, observe their antisensuality, observe the ways in which they have put things rather than people at the center of their lives and count themselves out. This does not mean that these women are not computer-competent. But along with their competence comes a fear of the machine as a potentially destructive force.

Robin is a sophomore at Harvard, a musician who has gone through much of her life practicing the piano eight hours a day. But she rebels against the idea of a relationship with the computer. She

doesn't want to belong to a world where things are more important than people.

'I saw people being really compulsive but really enjoying it. I saw that these guys sort of related to their terminals the way I relate to the piano and I thought, maybe I can do that too. I saw all these people running around with the same intensity as I have with the piano and they tell me that I'll probably be good at computers. These are the guys who are helping me do this course. And they keep telling me, yes, you're going to be real good at it. Don't worry about it, but you're going about it in the wrong way. They tell me I'm "not establishing a relationship with the computer." And to me that sounds gross. It is gross to me, the way these guys are. I don't like establishing relationships with machines. I don't like putting it that way. Relationships are for people.'

I ask Robin to talk to me about her relationship with her piano, a machine, but she insists that it was a completely different thing. The piano took her away from people, but then it brought her closer to them. The involvements of her male peers with the computer only shut people out. 'These guys are incredibly drained. You can't talk to them. I don't want to be part of their world.'

'I know this guy, this computer person. He never had a friendship at Harvard. He'd come to breakfast saying that he'd stayed up all night with his terminal and he got frustrated and burned out but he seemed to enjoy it somehow. It was better for him, I guess, than staying up all night talking to a friend. That seems really sad. There's a lot of communication going on around here. People stay up all night talking to friends. But, Mike would not do that. He managed with his terminal.'

How does the hacker look to non-hacker men? Many men are critical of the hacker's single-minded devotion to computers, critical of his lack of social skills. Men's reactions to the computer are similar to those of women, but there is a difference in men's reaction to the hacker's style of exploring the machine in a manner close to abandon and which celebrates risk. Men identify with it. They recognize it as a learning strategy which they find admirable and of which they are capable. Women tend to be more defensive.

Risk taking has a gender valence. Boys are taught to react to risks positively, to view them as an opportunity to expand their knowledge and skill. In our culture, when a boy shies away from risk, he runs what may be a greater risk: the accusation of being called a sissy, 'girlish' in his ways. The female child is more often directed away from situations that might cause trouble. The tree may be too tall to climb; the rock may be too slippery to clamber over. Being a 'good girl' is defined as a virtue where good may mean passive enough to not get into trouble. Good may also mean passive enough to accept knowledge only in a safe, directed, 'cookbook' form.

Risk taking opens up powerful learning strategies. Jessie, a computer science graduate student at MIT, recognizes it as something that hackers have and she doesn't.[1]

'It seems to me that the essence of being a hacker is being willing to muck around with things that you don't fully understand. Playing around with things you don't understand requires a certain amount of self-confidence. Every so often things do get broken. If you break something, you have to believe that this is not necessarily because you are incompetent, but because every so often that happens. Every so often somebody fries a board or trashes an important file or what have you. Part of the essence of being a hacker is accepting the fact that some time you may be the one responsible for some such lossage.

When faced with a situation that they do not have the facts to understand, people vary as to how much they are willing to just "try things." A hacker will typically try things if he or she knows enough about the domain to think up any plausible things to do. A non-hacker will tend not to try to make changes until he or she understands what is going on.... Hacking requires that one feel good about solving problems by means other than the "right procedure." '

Jessie has experimented with the 'risky' learning strategy, but does so with inhibition. She sees it, somewhat wistfully, as male.

'I am still teaching myself not to be afraid of "screwing things up." I think that being a "hacker-type" correlates with things like having played with explosives or taken apart things or climbed dangerously up trees and that type of thing as a child. It seems as though women are less willing to take things apart and risk breaking them, to try things when they don't know what they are doing and risk getting into trouble.'

To use risk taking as a learning strategy you have to be able to fail without taking it 'personally.' This is something which many women find difficult. They want to be 'good students.' This can leave them so preoccupied with possible failure that they shy away from the chance of success. In fact, the women in my study have taken risks in learning. Even taking a programming course confronted Lisa, a 'language person,' and Robin, a 'music person,' with serious challenges. But they, like other women I interviewed, made it clear that they saw such challenges not as risks but as hurdles—hurdles that have been imposed from the 'outside.' The risks they are willing to accept responsibility for are risks in relationships. 'There it is worth it; there I can do it.'

Risk taking as a learning strategy demands that you sacrifice a certain understanding of what is going on. It demands that you plunge in first and try to understand later. To take an analogy from the world of the computer's second cousins, the video games: it is almost impossible to learn to play a video game if you try to understand first and play second. Girls are often perceived as preferring the 'easier' video games. When I have looked more closely at what they really prefer, it is games where they can understand 'the rules' before play begins. Both Lisa and Robin crave transparent understanding of the computer. For example, although both apologize for their behavior as 'silly,' both like to program the computer to do everything they need to build their larger programs, even when these smaller, 'building-block' procedures are in program libraries at their disposal. It makes their job harder, but both say that it gives them a more satisfying understanding. They don't like taking risks at the machine. What they most want to avoid is error messages.

When women look at the programming virtuosos around them, they, unlike men, see themselves as cut off from a valued learning style. Male risk taking is equated with computational 'intuition.' In educational and professional environments where hackers present an image of 'the best,' women often see themselves as lesser. They see themselves as 'just users,' as competent but not really creative.

FIGHTING AGAINST COMPUTER HOLDING POWER

The computer is a 'psychological machine.' On the border between mind and not mind, it invites its anthropomorphization, its psychologization. It does this almost universally, for children and grownups, men and women, novices and experts. This does not mean that people see it as 'alive,' but rather, there is a pull to psychologize the machine, to give it an intellectual and aesthetic personality. The computer facilitates a relational encounter with a formal system.

I have found that many women are drawn towards a style of programming that is best characterized as such a relational encounter (Turkle 1984; in press). It is marked by an artistic, almost tactile style of identification with computational objects, a desire to 'play with them' as though they were physical objects in a collage. A fluent use of this programming style can be a source of creativity. But many women fight against something that needs to be distinguished from programming style. They fight against the computer as psychologically gripping. They experience anthropomorphization as seductive and dangerous. Paradoxically, in rebellion against feeling 'too much' they develop an attitude towards the computer that insists it is 'just a tool.'

The 'just a tool' response is widespread in our culture. It is certainly not associated primarily with women. But I believe that when women use it, it is with a special force; particularly strong feelings stand behind their insistence on the 'neutrality' of the technology.

First, insisting that the computer is just a tool is a defense against the experience of the computer as the opposite, as an intimate machine. It is a way to say that it is not appropriate to have a close relationship with a machine. Computers with their plasticity and malleability are compelling media. They have a psychological 'holding power.' Women use their rejection of computer holding power to assert something about themselves as women. Being a woman is opposed to a compelling relationship with a thing that shuts people out.

Contemporary writing about women's psychological development stresses the importance of connection in the way women forge their identities. Women are raised by women. Unlike men, they do not need to undergo a radical break to define their sexual identity. Unlike men, they are allowed, even encouraged to maintain a close relationship with the woman, the mother with whom they had an early experience of the closest bonding. Girls grow up defining their identity through social interaction; boys, through separation

(Chodorow 1978; Gilligan 1982; Keller 1983; 1985).

The boy's experience of early separation and loss is traumatic. It leads to a strong desire to control his environment. Male separation from others is about differentiation but also about autonomy, 'the wish to gain control over the sources and object of pleasure in order to shore up the possibilities for happiness against the risk of disappointment and loss' (Gilligan 1982, 46). Women grow up differently. Men 'shore up possibilities for happiness' by autonomy, rules and hierarchy; women look to affection, relationships, responsibility and caring for a community of others. In *In A Different Voice*, Carol Gilligan talks about 'the hierarchy and the web' as metaphors to describe the different ways in which men and women see their worlds. Men see a hierarchy of autonomous positions. Women see a web of interconnections between people. Men want to be alone at the top; they fear others getting too close. Women want to be at the center of connection; they fear being too far out on the edge. Men can be with the computer and still be alone, separate and autonomous. When women perceive this technology as demanding separation, it is experienced as alien and dangerous.[2]

Lisa began her work with computers by thinking in terms of communicating with them, 'because that's the way I see the world.' But her communication metaphor began to distress her: 'The computer isn't a living being and when I think about communicating with it, well that's wrong. There's a certain amount of feeling involved in the idea of communication and I was looking for that from the computer.' She looked for it, and she frightened herself: 'It was horrible. I was becoming involved with a thing. I identified with how the computer was going through things.'

'Wait a minute, a machine doesn't go through things; going through things is a very emotional way of talking. But it is hard to keep it straight. It seems to you that they are experiencing something that you once experienced. That they are learning something and you lose sight of the fact that this whole ability … I don't even want to say the computer's ability. I don't like anthropomorphizing; I fight very hard against attributing emotions to that machine.'

For Lisa, success with the computer has meant a process of alienation from it. Her efforts go towards depersonalization, towards developing a strategy towards computers that is 'not me.' 'I need to

become a different kind of person with the machine.' This is a person who commands rather than communicates.

When Lisa psychologized the machine and thought of programming in terms of communication, she was responding to the computer as many people do. The computer responds, reacts, 'learns.' And the machine allows you to externalize your own thought. As one 13-year-old told me: 'When you program a computer you put a little piece of your mind into the computer's mind and you come to see it differently.' The experience is heady and encourages anthropomorphization.[3] But if Lisa's impulses to psychologize the computer were commonplace, her reaction to them was more typical of women than men—to rebel against the feeling of mind speaking to mind, almost to punish herself for it: 'You are working with the computer and you can almost identify with what a computer is going through. But then, that is awful. It's just a machine. It was horrible. I was becoming involved with a thing.'

Lisa's 'identification with what a computer is going through' is an identification with the computer as a mind. The computer is an 'evocative object' (Turkle 1984). It upsets simple distinctions between things and people; there can no longer be simply the physical as opposed to the psychological. The computer, too, seems to have a psychology—it is a thing that is not quite a thing, a mind that is not quite a mind. By presenting itself as an object 'betwixt and between,' the computer provokes reflection on the question of minds and machines. Very soon after meeting a computer, even the novice programmer learns to write programs that he or she perceives as more complex than the rules used to create them. Once people build these kinds of rule-driven systems, questions about the relevance of the idea of program to the working of one's own mind acquires a new sense of urgency.

ROMANTIC REACTIONS

The position toward which children tend as they develop their thinking about people in relation to computers is to split 'psychology' into the cognitive and affective, into the psychology of thought and of feeling (Turkle 1984). And then they can grant that the machine has intelligence and is thus 'sort of alive,' but distinguish it from people because of its lack of feelings. Thus, the Aristotelian definition of man as a 'rational animal' (powerful even for children when it defined people in contrast to their nearest neighbors, the animals) gives way to a different distinction. Today's children 'ap-

propriate' computers through identification with them as psychological entities and come to see them as their new 'nearest neighbors.' And they are neighbors which seem to share in or (from the child's point of view) even excel in our rationality. People are still defined in contrast to their neighbors. But now, people are special because they feel. Children will grant the computer a 'sort of life,' but what makes people unique is the kind of life that computers don't have—an emotional life.

Many adults follow the same path as do children when they talk about human beings in relation to the new psychological machines. This path leads to allowing the possibility of unlimited rationality to computers while maintaining a sharp line between computers and people by taking the essence of human nature to be what computers can't do. This is precisely what Lisa does when she confronts the machine that seems to have a mind:

'I suppose if you look at the physical machinery of the computer mind, it is analogous to the human mind. We were looking at a bare machine and how all the little wires could be compared to neurons. So, in that sense, yes, the hardware is the brain and I can see how the software could be the mind. But, the saving grace, the difference is emotion. Now I haven't heard anybody yet reduce emotion to a series of electrical impulses. I hope I never do. And I think that's the line you can draw. That's where you say, "We can emote, this thing may be able to do something like thinking, but it can't love anybody."'

Although she makes them herself, Lisa objects to all comparisons between computers and people. A question in our interview about minds and machines causes her to cut me off sharply and then to reflect on her own inconsistency.

'I get really edgy when people start comparing computers to human beings or asking questions about how they might be alike or not alike. And it is a strange thing. I go and attribute all of these qualities to the computer and condescend to get mad at the computer and give it the dignity of my emotion wasted on its stupid metal framework, but at the same time, if somebody starts saying, "Don't you think that there might be similarity between a machine process and a human process or don't you think that there might be a program so that people could come

If you could say with numbers what I say now in words,
if theorems could, like sentences, describe the flight of birds,
if PPL had meter and parabolas had rhyme,
perhaps I'd understand you then,
perhaps I'd change my mind.

If two convergent sequences produced some assonance,
or vectors made a particle of literary sense,
if triangles were iambs and equations anapests,
then maybe I'd acquire a bit of numerical interest.

If Cicero's orations were set down in polar form
and the headaches numbers give me weren't, excuse my
French, enorme,
if a graph could say 'I love you,' it could sing a child to sleep,
then from this struggle I might find some benefit to reap.

But all this wishful thinking only serves to make things worse,
when I compare my dearest love with your numeric verse.
For if mathematics were a language, I'd succeed, I'd scale the
hill,

I know I'd understand, but since it's not, I never will.

Lisa's poem expresses her profound reticence about formal systems. Despite her talent, she preferred to stay away from them. 'I didn't see that proving a theorem was anything like writing a poem. I never thought of mathematics as creative or human; and the people who studied them, well, when I thought of "people who studied mathematics," I thought of these dry, emotionless little people who ran around and talked to computers all day.'

Lisa's reticence has many facets, but she keeps coming back to two themes. First, formal systems don't bring people together, they rupture what Gilligan called the 'web of connectedness' that dominates women's way of seeing the world. Second, formal systems allow for 'only one way' of doing things.

> 'When they used to talk to me about mathematics as a language I would say, "Well, look, if I were speaking Spanish, I could say that thirty million different ways." Here, it's either right or it's wrong and that's it. And I don't like the regimentation.'

Lisa dislikes anything where there is 'only one way.' She loves language for its 'shades of meaning.' Ambiguity and nuance make

her feel at home. Erik Erikson, writing from within the psychoanalytic tradition, has suggested how women's experience of their bodies as an 'inner space' that is hidden, diffuse and ambiguous affects their experience of the world (Erikson 1963). The 'nailed down' quality of formal systems feels unfamiliar and threatening.

Clearly, women's feelings about formal systems go deep. Erikson's work on body image suggests a terror of the non-ambiguous; Evelyn Fox Keller's work on women and science suggests that women's early and (relative to men) unruptured experiences with closely bonded relationships alienates them from the traditional 'male' stance toward formal systems, a stance characterized by the separation of subject from object (Keller 1985).

The issues that are raised by looking at gender and formal systems are complex, but something about the computer's contribution is becoming increasingly clear. When people are put in computer-rich environments, supported by flexible and powerful programming languages, and encouraged to use the computer as an expressive material, they respond in a diversity of styles. In such environments, the computer, like other powerful media including paints, pencils and words, becomes a screen for the projection of differences. Unlike stereotypes of a machine with which there is only one way of relating, the computer can be a partner in a great diversity of relationships.

People make the computer their own in their own way. For example, some take to the computer in a way that emphasizes planning and structure. Others naturally move toward a different style. They prefer to 'grow' their programs from small elements, often changing their goals as they go along. The programs that result from using these two styles can be equally effective, clear and easy to use. The difference is not in the product but in the process of creation. With the computer, there is not 'one way.' On the contrary, the range of styles of appropriation suggests the metaphor 'computer as Rorschach' (Turkle 1980). Like the Rorschach inkblot test, the computer presents an ambiguous material that encourages the projection of significant inner differences.

In relatively unconstrained settings, the computer facilitates a new basis for engagement in technical and mathematical thinking, one that allows for their appropriation through a 'close encounter' with an interactive, reactive 'psychological machine' and with computational objects that can be experienced as tactile and physical. It is a style that emphasizes negotiation rather than command of compu-

tational objects, a style that suggests a conversation rather than a monologue. This is a port of entry into the world of formal systems for many people who have always kept at a distance from them. It is a port of entry with particular significance for women. The computer offers a new cultural opportunity to expand the social base of mathematical and scientific fluency.

But people are not always introduced to computers in a way that exploits this opportunity. In fact, it happens all too rarely. Lisa and Robin are taking an excellent and imaginative introductory programming course, but even there, both of them are experiencing it as a place where they are being told the 'one right way' to do things. This 'one right way' emphasizes 'structured programming' with its aesthetic of control through structure, specification and planning. There is much virtue in this computational aesthetic, but both Lisa and Robin say their learning styles are at war with it. Robin wanted to play with the smallest computational elements and build things from the 'bottom up.' Lisa was frustrated by the strategy of 'black boxing' that helps the structured programmer plan something large without knowing in advance how the details will be managed. Both rebelled against the regimentation of there being 'one right way' to do things.

In the course that Robin and Lisa are taking, those whose intellectual style favors the highly analytical, the structured and the specifiable, will be drawn to the computer, while others, and many women among them, will continue to see what it takes to 'think right' in the computer culture as alien. And even when they succeed in the course, they keep their psychological distance. I believe that a symptom of this distance is their 'neutralization' of the computer when they describe it as 'just a tool.'

We know that pencils, oil paints and brushes are 'just tools.' And yet, we appreciate that the artist's encounter with his or her tools is close and relational. It may shut people out, temporarily, but the work itself can bring one closer to oneself, and ultimately to others. In the right settings, people develop relationships with computers that feel artistic and personal. And yet, for most people, and certainly for the women I studied, this was rare. When they began to approach the computer in their own style, they got their wrists slapped, and were told that they were not doing things 'right.'

When this happens, many people drop out. They see themselves as deviant, as not 'good at the computer.' Or, and this is what one sees most often with talented women such as Lisa and Robin, they

'fake it.' They try to do it the 'right way.' Lisa talks about turning herself into a 'different kind of person.' Robin talks about giving up on her desire to 'build from little pieces on up' and to have a fully transparent relationship with the computer. 'I told my teaching fellow I wanted to take it all apart and he laughed at me. He said it was a waste of time, that you should just "black box," that you shouldn't confuse yourself with what was going on at that low level.'

We cannot know what Lisa and Robin would be feeling if they had been encouraged toward a more personal appropriation of this technology. As I have said, the roots of reticence seem to go deep. But we do know that given the introduction they did have, they, like most of the women I interviewed, ended up denying the computer any role as an expressive medium. This is not surprising: given the way they have been using it, it isn't one. Frustrated in a personal style of use, they become vehement about the computer's status as a neutral 'tool' because they have been denied any other relationship with it. To put it more sharply, they have been denied an authentic relationship with it.

Lisa sums up her computer experience with the word 'regimentation.' She is afraid of children learning to program because she wouldn't want them equally regimented. She wouldn't want children 'tied down to being very careful and very regimented and very concise and syntactically correct.' Lisa says that her best moment in her programming course was when she saw, through the computer, something she might have missed in mathematics. 'In mathematics I could never see that it didn't have to be just one way. But I can see that a little with the computer. And I am starting to get very excited about that.' And then she came back to the question of children with a more optimistic tone: 'I think maybe kids could bring, well, they could open up new frontiers for computers, because they have such wild ideas that they could do great things if people just let them.'

The children may indeed lead us.[4] The computer that could support 'wild ideas' is the computer as an expressive medium. We must ask if the vehemence behind women's insistence that the computer is 'just a tool' will be as great when they have greater opportunities to experience it as material which allows highly differentiated styles of mastery and personalizes the world of formal systems for men and women alike.

NOTES

1   The quotation from Jessie is taken from an interview done by MIT graduate student Ronnie Rosenberg, 'Female Hackers,' unpublished paper, December 1983. In this paper, Rosenberg makes the very interesting point that when women look at male risk-taking style with computers they equate that style with 'intuition.'

2   From this perspective, computers become much more attractive when they are used to support communications through networks. The question here will be whether particular computer networks bring people together—who would not normally have been together or whether they 'deteriorate' communication—that is, people who would have spoken face to face now speak screen to screen.

3   The holding power of a mind-to-mind connection is there even for the non-programmer. When you use someone else's program, software someone else has written, there is still the fantasy of a mind-to-mind communication between you and the software writer.

4   A leading computer visionary who has long stood for the 'personal appropriation' of programming has done much of his work with children. See Seymour Papert, *Mindstorms: Children, Computers and Powerful Ideas*, New York: Basic Books, 1980.

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