Feminism and Constructivism: Do Artifacts Have Gender?

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This article explores possibilities for establishing dialogues between feminism and constructivism in the field of technology studies. Based on an overview of Norwegian feminist debates about technology, it indicates several points where feminism and constructivism meet and can mutually benefit from each other. The article critically examines feminist studies questioning the problems of technological determinism, social determinism, and essentialism. It criticizes constructivism for a lack of concern for gender and politics but holds that it is still possible to use theoretical tools from constructivism in feminist analyses. Fruitful dialogues require the application of the principle of symmetry to the dialogues and sharing some common ground and mutual recognition of each other's strengths and weaknesses.

The "new" constructivist sociology of technology promises a better grasp of the complexities of technological development.[1] As feminist researchers, we see this as an interesting challenge also to the emerging field of feminist research on technology. The aim of this article is to explore the possibilities of establishing dialogues between feminism and constructivism. We base our reflections and suggestions on our own experiences of working with feminist technology studies in Norway since 1980, which by the end of the 1980s led us to constructivism.[2]

AUTHORS' NOTE: This article refers to the authors' experiences within the Women and Technology research group of the Foundation for Scientific and Industrial Research at the Norwegian Institute of Technology (SINTEF), Institute for Social Research in Industry (IFIM), Trondheim, Norway. The authors emphasize that the "we" used in the account of the group's history is, of course, only two members' interpretation of what took place. The other four members of the group, Hjørdis Kaul, Elin Kvande, Bente Rasmussen, and Knut H. Sørensen, have no independent voice in this article about our history. We are heavily in debt to all four for inspiration and many fruitful discussions. We also thank Ann Rudinow Sætnan for her helpful suggestions and careful reading of our Norwegian attempts to write English.

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Feminist research looks for changes in gender relationships. Because we take feminism as our point of departure, we are concerned with the possibilities for change in gendered social structures and thus with the political aspects of constructivism. The role of "politics" is a reemerging topic of debate within constructivism as well as in feminist studies (Bijker 1993; Cockburn and Ormrod 1993; Law and Bijker 1992; Wajcman 1991). Is constructivism a useful theoretical approach given the feminist perspective of political change? Thus we paraphrase Winner's (1985) question—"Do artifacts have politics?"—in gendered terms: "Do artifacts have gender?" More recently, Winner (1993) has criticized constructivism for its lack of politics, for neglecting the social consequences of specific technologies, for lack of concern for groups other than the powerful, and for being inherently conservative. In discussing feminism and constructivism, however, we find it futile to rely on general characterizations and to reject an extensive research tradition on that basis. We share Winner's political critique of technological determinism, but his critique of constructivism often seems to confuse a critique of theory with a critique of practices. We agree that constructivists generally have neglected politics and gender, but rather than merely criticizing their practices, we also examine their theoretical concepts to see what they might offer to feminist researchers. To borrow another phrase from the debate, we let "feminism confront constructivism" (Wajcman 1991) with our feminist questions based on a Scandinavian approach to technology studies.

Technology is traditionally regarded as a male activity and arena. In engineering, the link between humans and machines has been studied in terms of "man-machine" systems. Feminist research has shown that these man-machine systems still exist as masculine dialogues (Cockburn and Fürst-Dilic 1994), and they are reiterated within the social studies of technology. Can constructivism, as a counterpart to technological determinism, offer tools for a better understanding of change in these relationships where the dominance of men and masculinity are so persistent?

To address these rather complicated questions, we examine our own encounter with constructivism. We use our own experiences as feminist students of technology because we find it important to begin with feminist questions and ask whether constructivism can contribute to a better understanding of the gender and technology relationship. We do not want to let constructivism set the agenda, nor do we want to end up with another general critique of constructivism. However, we want to take seriously the feminist epistemological claim that knowledge production is situated (Haraway 1991). By trying to be open, self-reflexive, and personal by pointing to paradoxes in our own research, we attempt to make the process visible.

During the 1980s, we were "situated" in a Women and Technology group at the Institute for Social Research in Industry (IFIM), doing contract research mainly for the Ministry of Work and the Norwegian Research Councils.[3] IFIM is part of the Foundation for Scientific and Industrial Research at the Norwegian Institute of Technology (SINTEF), one of the larger private technical research organizations in Europe. Because SINTEF is closely involved in research cooperation with the Norwegian Institute of Technology (NTH), the main educational institution for civil engineers in Norway, our group was located in "the belly of the beast." Technology has always been central within IFIM's research. Our research was rooted in the Scandinavian tradition of democracy at work but was also inspired by the British labor process approach. In technology studies, democracy at work became participatory workplace design and regulation of technology, and much research was done in cooperation with trade unions. The emerging field of women's studies, at that time in a close dialogue with the women's movement within which we were also active, served as our other source of inspiration. At first our research questions were conceived in the women's movement and were formulated in accordance with the conditions laid down by feminist politics. We tried to share with other women our curiosity and concern for technology.

The history of the group can be described briefly as starting with the question (from 1981), "What are the impacts of new technologies on women's lives?," and ending with the question (from 1992), "Do artifacts have gender?" The two questions highlight two changes in our research orientation: first, our discussion shifted from women to gender and, second, we moved from studying mainly consequences to addressing the broader field of the genderization of technologies. Examples from our own research show that some of the Scandinavian debates ran parallel to the development of what we now call constructivism (Cronberg 1986; Lie et al. 1988). The questions we raised ten years ago are still relevant, but can they be posed more clearly and answered better from within a constructivist approach?

Women and Technology: The Same Old Questions?

When we started our research on women and technology, we found that we were at the junction of two research traditions that did not point in the same direction. On the one hand, research on women and work seldom focused on the relationship between women, the content of their work, and the technologies they used; it instead examined the relationship between

work and home. Technology studies, on the other hand, analyzed either design processes or the impact of new technologies on working conditions. These studies investigated mainly leading-edge industries, places where there was a lot of new technology but few women. As feminist researchers interested in women and technology, we had the ambition to bring the theme of technology into women's studies and the theme of gender into technology studies.

We were interested in new technologies because they offered an opportunity to study change. Studying technological development meant studying social change, and it was obvious to us that the field of social studies of technology included the possibilities of studying changes in gender relations.

How did we understand technology at the time? We quote from a paper presented at a Norwegian national conference of women's research in 1981.

> What has to be decided is whether technology "has" specific consequences (Blauner), whether specific consequences are "built into" technology (Braverman), or, as an alternative, whether consequences depend on how one uses technology and who has influence over how it is used. We reject theories involving technological determinism on the grounds that they are poorly substantiated. (Lie et al. 1983, 7)

When looking back, we must admit that our wish to confront technological determinism seemed to be stronger than our arguments. However, our uneasiness about it was one of the main reasons for our future interest in constructivism. Our reasoning about technological determinism continued.

> [Theories involving technological determinism] involve a narrow theory of technological development that does not take into account social and economic factors. However, we will not go to the other extreme and maintain that technology has no explicable effects on developments in working life. We feel it is best considered as an intermediate variable, rather than a causal variable, so that it still has an explanatory value. We hold technology to be an independent factor, but it is one among a number of factors whose importance varies. It is therefore significant to study the consequences of technological development while avoiding treating technology in isolation. (Lie et al. 1983, 7)

Our aim was to study women and technology in different contexts educational institutions, work organizations, housework, and leisure. W wanted to shed light on women's use of existing technologies rather than d more empirical research on women's general lack of access to technology We wanted to show that women handled technologies actively and compe tently. It was important to study women as students of technical subjects an as professionals working with technologies and to focus on women's use c technologies at home and in the workplace. We saw an increase in the numb

of women in technical educations and professions as a road to equality, and we worked for this aim politically as well as in our research. Another strategy aimed to empower women within different industries where they feared being "left behind by the technological development." Our strategy was to use our research to make their tasks and skills visible, thus making women see their own importance. We tried to impart this knowledge through different channels by speaking, writing, and setting up trade union training courses directed specifically to female audiences.

We believed that a better understanding of the relationship between women and technology must be based on data from different contexts, and our critique of technology studies of the time followed from this belief.

> The greatest weakness of much of technology studies is the generalized nature of its formulations. Working life is viewed as one. However, the results of more specific studies of a particular problem, one individual branch or workplace, present many nuances. The general conclusions concerning developments in working life are ultimately based on generalizations from studies of those branches of industry where the automatization process has come furthest, that is, primarily the processing and workshop industries. These generalizations and the considerable interest in these branches are based on the belief that they are the most technically advanced and therefore are leading the way. It is, however, highly uncertain how relevant these results are to the development in female occupations. (Lie et al. 1983, 9)

Our studies stressed the futility of generalizing from one context to another and from studies of certain technologies to statements about technological development in general.

In the empirical studies within different fields, our main questions were as follows.

- How can women influence the development and implementation of technologies in different settings or locations?
- To what extent are women's attitudes to technology different from those of men?
- How are skills in women's work influenced by changes in technology? Are there specific "hidden" or unrecognized skills within female-dominated occupations?
- What impacts do technologies have on women's traditional work in the home or in everyday life?

Echoes of similar questions are still heard within feminist technology studies, although they are formulated differently today. The way we raised them clearly touches on the problem of essentialism, a question to which we return later.

The heritage of the (Tavistock) socio-technical school meant that our studies were *task oriented*, stressing what people *do* as important for their experience of technology. Because of the sexual division of labor, women and men not only use different technologies but use the same kinds of technology differently and have unequal access to training and information. Thus we needed studies more concentrated on women's tasks and tools. We reanalyzed our earlier studies of industrial work focusing on different positions of men and women in relation to machines (Kaul 1988, Sørensen 1988). We studied office computerization and tele-working and found that the "office revolution" never took place because the intellectual efforts of office workers were underestimated while the capacities of computers were overestimated (Lie and Rasmussen 1983, Lie 1988). We attempted to demonstrate that household technologies were made to satisfy the wishes of male designers rather than those of women houseworkers (Berg 1988, 1994a). We studied women civil engineers and discovered that they were very close to technology but confronted a hostile social environment (Kvande 1984, Kvande and Rasmussen 1990).

Our studies were also *change oriented*, and we assumed that technologies were not to be taken for granted. The social shaping of technology provided an alternative to technological determinism (MacKenzie and Wajcman 1985). Social shaping did not imply social determinism (such as always defining women as victims). Although our studies mainly concerned consequences of technical change within different fields for women, we emphasized that technologies were not "given" and stressed the importance of user participation. Empirical studies of housework and tele-work showed that technology was not necessarily used to achieve specific social change (Lie et al. 1988). Several of our studies concluded that changing technologies initiate a period of instability and provide *possibilities* for social change, but we also saw that desirable changes had to be initiated by human action.

We learned from these studies that even if intentions were to be baked into technology, they would still not necessarily lead to the intended consequences. This way of thinking about technology is related to the constructivist notion of "interpretative flexibility" (Pinch and Bijker 1987), one of the most useful theoretical concepts for substantiating the critique of technological determinism (Bijker 1993). This is also where Winner's criticism goes wrong. It is not open to the kind of relativism that we consider crucial for political action.

Our efforts to define a gender-sensitive concept of technology were not particularly successful in the first round (Berg and Rasmussen 1983), but our concern for the possibilities of influencing technology cleared the way for a stronger focus on how technologies were made.

Paths to Influence

Women's possibilities to influence the processes of change was to us a main research question. The Scandinavian tradition of democracy at work was an interesting path to explore as a possibility for improving women's working conditions and attachment to the labor market and thus their general status in society.

When new technologies are introduced in Norway, workers are entitled to participation. Since 1975, a special agreement between the national federation of unions (LO) and that of employers (NHO) allows employees to influence decisions concerning the introduction of new technologies. Local unions can elect a specific shop steward who is responsible for technology issues. The Work Environment Act of 1977 mandates the right to information on plans for new technology and gives unions the right to influence concerning health and safety. The law also gives each worker the right to variation and cooperation at work, and it emphasizes an active role for employees in improving their own working conditions. Work researchers played an important role in the initiatives and in the formulation and implementation of the law. Workers have to influence on both the individual and collective levels, but they generally lacked knowledge of how to use the new possibilities of co-determination and had little knowledge of technology. Because the workers were active and motivated, we had audiences and discussion partners in our research projects.

The Scandinavian research on technology and work suggested that to make it possible for workers to influence the impacts of technological change, one had to move "upstream," that is, from where technology was applied to where it was designed (Elden et al. 1982). To implement the laws and agreements for democracy at work, workers' participation had to begin in the early stages of the design process (Ehn 1988). We criticized the research approach, however, by pointing to the limitations implicit in its reliance on the linear model of innovation, which included only the phases of design and implementation. We argued for the inclusion of the phase after implementation, what today we would call the consumption phase, to include users as active participants in the process (Lie and Rasmussen 1983, 1990).

Because studies of technology generally investigated areas considered the leading edge of technical change, such as processing industries and engineering, women workers were not included. Moreover, when workers were included in the design process, the unions that were invited to participate were the strongest ones (Nygaard and Bergo 1975, Ehn 1988). These were the male strongholds of the labor movement. When we started a study of office computerization, we decided to work in two parallel ways. First, we

studied the introduction of computers in the office and found that the predominantly female workforce and a gendered hierarchy were the reasons why computers simply were added to a traditional organizational structure. Communication, interpretation, and serving others were the main tasks of female office workers, and the skills they developed to perform these tasks were generally confused with feminine "natural abilities," so that the importance of their tasks and skills remained invisible. Second, we used the knowledge we acquired in trade union courses for women office workers. However, we kept the two initiatives apart and did not include participatory design in our research. Why could this not be another "success" story of Scandinavian participatory design? The women office workers are not invited to participate by developers of the computer systems, and the office workers' unions are not powerful enough to set the agenda for participation. Because the skills of office workers are not valued as much as those of a labor aristocracy among male industrial workers, our initial work had to include an effort to substantiate and make visible the skills needed in women's work. Such an initial step was not required in the other projects of participatory design.

Today, women are present in office organizations and hospitals where dramatic technological change is taking place. But with constructivism, the focus of technology studies has moved another step "upstream" to the laboratories and technical institutes. Women again have disappeared from the "interesting" field of study as research has moved to new arenas where women are scarcely present (Berg 1994b). Why are women continuously "slipping away" from the analyses?[4]

Feminist Social Determinism?

Even within feminist research during the 1980s, little attention was paid to technology.[5] One of the reasons for this, we think, can be found in the traditional definition of femininity as concerned with the "soft" aspects of society. In Norway, the debate about "female culture" in the women's movement emphasized this. Technology was identified as belonging to the "hard" aspects of society and thus considered a threat to female culture. In this sense, technology represented just another disguise for patriarchy—and could be reduced to social power relations. Substantially helped by technological determinism, the picture of technology as an evil force of exploitation and destruction in the hands of men posed technology as the opposite of femininity, as something to attack rather than to study. In this context, in our own critical explorations of technology, we have tried to put an end to tw

myths: that women have little to do with technology and that women fear technology.

Is it true that women have little to do with technology? When studying what is generally defined as technology, one will find men as designers of technology, teachers of technical subjects, and participants in political debates. In everyday life, men seem to tinker more with machines: cars, computers, and so on. As long as one does not question the *concept of technology*, this predominance of men seems to substantiate the view that women have little to do with technology. Following the relativist and/or reflexivist critiques of science, we hold that the theories and concepts we use to answer our questions are also socially constructed and thus gendered. The generally accepted, traditional concept of technology associated technology with heavy and greasy machinery and, later, with new technologies such as computers (Sørensen and Berg 1987). This understanding of technology, with its masculine connotations, was also reflected in the research literature. By including technologies connected to women's work, such as housework and office work, it became evident that women had a lot to do with technology, but not necessarily in the same way as men. The discussions about the concept of technology are important because technical artifacts used by mainly women tend to be excluded, reinforcing the connection between men, masculinity, and technology.

Another widespread belief is that *women fear technology* because it destroys "feminine" values. Alternatively, women are said not to participate in technological design because they suffer from techno-fear. There are, however, better explanations. First, studies show that women are denied access to technologies and technical competence (Kvande 1984; Rasmussen and Håpnes 1991). Second, machines and technical systems are designed according to the designers' expectations about women users. A non-competent user is often the point of departure as well as the result (Lie 1985). Third, studies of women civil engineers show that they are critical of the way technology is taught and the way certain technologies are designed (Kvande 1988). Faced with technologies that do not suit their needs or interests, users tend to protest or avoid them. An entirely appropriate response or critical protest has often been confused with techno-fear (Turkle 1988).

These two myths about women and technology are connected. When technology mainly used by women is treated as "real" technology, we develop a different and more nuanced view of women's attitudes to technology. These attitudes show a great deal of variation. We found women loving their washing machines and mobile phones, we found women critical of the inflexible systems in their computers, and we found women who were indifferent to telephone answering machines and videotext systems. Such

differences should also help us to understand that neither gender nor technology should be taken for granted and that the details of specific technologies and gender relations must be studied within their contexts. By focusing on women as active users and producers of technology, we were able to make more nuanced the one-dimensional picture of women as victims of technology. We do not deny that women are victims of technology—women often are, and so are men—but this is not the only aspect of women's relationship to technologies. The challenge is to see how the vicious circle of victimization can be broken—and how we go about this without ending in barren essentialism.

The Problem of Essentialism

Feminist research from the 1970s has been criticized for essentialism and for relying on simplistic, dualistic categories of gender. In this context, essentialism refers to the attribution of inherent and general gender-specific traits to men and women. Essentialism can be seen as a kind of gender determinism. The concept of gender, developed during the 1980s, aims to question these dichotomous distinctions between the two sexes by emphasizing not only *differences between* women and men but also *differences within* each category (Moore 1993). Gender studies give accounts of gender as fluid, flexible, and complex. It is a matter of process, and it is socially constructed by negotiations on all societal levels.[6] How can we still insist that there are gendered patterns of inequality without relying on some kind of sociological or biological determinism? Here we want to throw light on two related aspects of this debate: first, the discussion of sameness and difference and, second, the discussion of sex and gender.

Within gender studies, the concepts of "women" and "men" have proved problematic.[7] These difficulties find an echo in questions such as the following. Are there specific female values or interests? Who can speak on behalf of women? Do we reproduce subjugation by insisting on a feminine way of doing things? In our own research, the problem of essentialism is reflected in the change of focus from women and technology to the genderization of technologies. In our empirical and theoretical work, we were concerned with variations and differences in women's relations to technology. We also encountered the problem of essentialism in our practical work oriented toward recruiting more women to science and civil engineering education. The category "women" is complex, and it is difficult to generalize from this category.

To say that gender is socially constructed through negotiations means that male and female are continually in the making. Thus there is ample opportu-

nity for change in gender relations. But in a society based on hierarchy and inequality, gender negotiations do not take place between equal partners. Hierarchy and inequality cannot simply be wished away, and we need to explore how they are negotiated in relation to technology to locate possibilities for change. And, yet, changes in people's relations to technology may take place without changing the patterns of inequality. The paradox is that to be able to ask political questions, we still have to speak about male and female, and sometimes about men and women, without implying that these are two inevitably dichotomous categories. Within a feminist understanding, social constructivism includes the concepts of power and hierarchy, which have to be considered when studying gender relations. Within constructivist studies of science and technology, however, we detect a reluctance toward using these concepts, and they seem not to be included in the mainstream analytical tools.

Essentialism is also related to the traditional distinction between biological sex and social gender. In English, there is a distinction between sex and gender parallel to the distinction between nature and culture (Haraway 1992). In Norwegian, the one word, *kjønn*, is used for both sex and gender. This means that the distinction between biological sex and social gender has often been implicit and has slipped away from our explicit agenda. The advantage of the concept of *kjønn* is that it points to the interrelatedness of sex and gender and does not presuppose a clear dichotomy or a choice between biological *or* social phenomena. We think that finding concepts that question rather than presuppose dichotomies is important. Thus the difference in language is a path to explore further.

A parallel problem in constructivism arises in discussions of the distinction between technology and society (Bijker and Law 1992b) as shown by the metaphor of the "seamless web." We do not yet have concepts that catch the interwoven meanings of what have previously been thought of as separate categories.

How can we speak about male and female without being labeled essentialist? Femininist researchers are striving not to reiterate the stereotypical categories, but who can look "unbiased" on this subject? Ignoring gender categories is just as bad a solution as is essentialism. The lack of concern with gender in the "new" sociology of technology seems to be based on a myth that taking gender as the starting point is inherently essentialist. The challenge, as we see it, is to find a "third way," where speaking about gender is meaningful without relying on essentialist assumptions.

In the feminist debates about the "science question in feminism" (Harding 1986), we have found interesting elements and inspiration for exploring further what a third way might imply. Harding identifies three feminist

epistemological positions: feminist empiricism, standpoint theory, and feminist postmodernism. In our opinion the third way is located in the tensions between what she refers to as standpoint theory and postmodernism. This means a location where our knowledge can be both stable and on the move.

The challenge is to say something meaningful about *patterns* of inequality ending neither in dualism nor in ignorance of gender. When insisting on speaking sometimes about male and female or femininities and masculinities to indicate differences, we again insist on the importance of specifying context. We have found inspiration to elaborate along such lines in the feminist critiques of science and especially in the concept of situated knowledges (Haraway 1991b). As gendered subjects, our research is situated within specific discourses, times and places, class relations, knowledge structures, and so on. Thus we do not insist that our research has *the* answers but insist that we produce knowledge valid within certain contexts and frames of analysis. This applies to the concept of technology as well as that of gender. In short, the pleasures of the dilemma can be expressed in the following way: How can we insist on gender as a socially constructed category—continuously in the making, fluid and flexible—and at the same time be feminists, insisting that it makes a difference whether one is a man or a woman?

Feminist Questions, Constructivist Answers?

We shall now return to our research questions and ask again whether there are better answers to be found within a constructivist approach. The main questions that we still find relevant are the following: what are the impacts of new technologies on women's lives, and how can women influence technologies in the making?

It should come as no surprise when we conclude that, within mainstream constructivism, our feminist questions have not been raised or addressed. The question of end users' influence was vital within the labor process tradition but less so within constructivist writing. Mainstream constructivism has been concerned less with empirical studies of technological impacts than it has with the more general ambition of proving that technologies are socially constructed. Consequently, constructivism has had little to offer when it comes to extending our empirical knowledge with regard to impacts or users of technology. However, we see a focus on users and impacts within a constructivist framework as one of the more fruitful possibilities of dialogue between feminist research and constructivism (Berg and Aune 1994).

Gender is rarely an explicit concern of constructivists. We read about men building networks, following strategies, and reaching agreements; in this

sense, the old story about man-machine systems is repeated. This takes us back to the political aspects of constructivism. What we see as the greatest potential of constructivism is its consistently non-deterministic perspective on technology. This implies a potential for influence during all stages of technological processes and so also potentials for change. To study this potential empirically, not to mention trying to participate in such processes, has, however, been of marginal interest to constructivist researchers. The Norwegian tradition of "sociology from below" has been important within feminist research but not within constructivism. The question of power that is so central within feminist studies was also important in the *social shaping* tradition but has no central position within constructivism. Who decides what is a relevant social group? And where is the analysis of power differences between relevant social groups and between them and the "non-relevant" groups?

When we read constructivist stories about networks and strategies, only the knowledge that "man" in this context is not a gender-neutral concept enables us to read some of them also as stories about gender—mainly stories of masculinities. Think of all the interesting stories we have missed because of this lack of attention to gender. What does technology mean for the construction of men and masculinities? What is the importance of technologies and technical environments for the creation of bonds between men? And which role does technology, especially technical competence, play in the reconstruction of male power and female subordination?

Some feminist researchers have seen this challenge (Berg 1994a, Cockburn 1983, 1985; Hacker 1989; Lie forthcoming; Sørensen and Berg 1987; Wajcman 1991, 1995), but perhaps male researchers might tell us more—and perhaps differently—about the construction of masculinities in relation to technology (Haddon 1991). If knowledges are situated and if the reflexivity is necessary, it is strange to notice that the researchers' own (understanding of) gender has rarely been made an explicit concern in constructivist writing about technology.

Does the constructivist approach consider an explicit gender perspective unnecessary? The program of following the actors seems to imply that as long as *women* do not appear as important actors or as a relevant social group, *gender* is not a relevant category. If gender were important, it would reveal itself as such and appear as empirical evidence. Such a position can hardly be defended by researchers who argue that scientific "discoveries" are socially constructed. The relevance of gender does not spring to one's eyes unless gender is actively used as an analytical tool. Here it suffices to point out the efforts of feminist researchers during the last 25 years in making visible the effects of gender on all levels of society. Before gender

was introduced as an analytical tool, this knowledge was invisible and nonexistent.

A Future of Constructive Dialogues?

If, however, we feel so uneasy about mainstream constructivism, why have we not rejected it as a tool for our research on technology and gender? When criticizing constructivism, we have applied a flexible interpretation of what constructivism is about. We have criticized its practices or "effects" but, following an anti-deterministic line of reasoning, we believe that such shortcomings do not necessarily imply that constructivist theoretical concepts are useless or that constructivism cannot serve as an analytical instrument for gender studies of technology. We see several points where feminism and constructivism meet and can mutually benefit each other. A most important meeting point is in the attempt to analyze technologies and gender as social constructs. This means that gender is important in the social construction of technology and that technologies are important in the social construction of gender. Meaningful dialogues require the application of the *principle of symmetry*. The participants have to share some common ground and recognize one another by paying attention to each other's strengths and weaknesses.

During recent years, we have participated in and benefited from the larger constructivist theoretical debates. We see signs of a new awareness of gender in connection with technology, and we find the renewed interest in technology assessment interesting. We share with constructivism a curiosity concerning how technologies have come to be as they are. We share the belief that they could have been different and that technology is an important and all too often neglected aspect of our lives. Constructivism has brought *actors* and the *micro* level into focus in technology studies, just as in feminist studies research has concentrated on empirical studies on the micro level. Moreover, the need to embrace complexity and heterogeneity is recognized in both constructivist and feminist studies of technology.

We share with constructivism the concerns and problems of the seamless web of the social and technological. We acknowledge the "need to blur the boundaries of categories that are normally kept apart," in the words of Bijker and Law (1992a, 4). These categories include the technical and the social, culture and nature, human and non-human, sex and gender, and masculinity and femininity. In feminist studies of technology, the powerful image of cyborgs has gained increased attention. In her entertaining and deadly serious writings on cyborgs, Haraway (1991a) has shown possibilities for manifold

encounters.[8] We draw attention to cyborg images in this context because they catch the tensions and possibilities in taking responsibility for dualisms and, at the same time, try to overcome them. This is also a fruitful attempt to mix technology with feminist politics and new images of women and gender relations. To us, "cyborgology" represents one of the common grounds for feminism and constructivism where there are rich possibilities for dialogues of many kinds.

Another meeting point is the extension of construction processes to include the phase of consumption with users as actors. Such an approach is elaborated by Akrich (1992) in her description of the design of photoelectric lighting kits with which users were not supposed to tamper. In her account of this construction process, Akrich introduces the concept of *script* in technology and emphasizes the user's role in the shaping of the technology.[9] The concept of script as "rules" for users' behavior, and the description of how this script is designed and built into the artifact, mean that gender can be included in the script. To "follow the actors," including the users, gives us the possibility of including women as active actors and not only as victims of technology, which has been a prevailing view in the feminist studies of technology.

Constructivism directs our attention to artifacts as part of the "glue" that keeps society together, which again implies "that the social is not purely social at all" (Law 1991, 7). We fully agree, as in our approach we study how gendered artifacts may constitute part of the glue that sometimes keeps gender relations stable, sometimes on the move (Berg 1995; Lie 1994). The concept of *delegation* in Latour's writing about hotel keys and the automatic door closer can be useful for analyzing delegation of gender to artifacts (Latour 1991, 1992). Thus constructivists could use their own tools to elaborate an understanding of how artifacts are gendered and thereby encourage further studies on the meaning of the preservation of gendered inequality and on possibilities for change.

Winner (1993) did not find politics in constructivist studies of artifacts and has criticized constructivism for finding the black box of technology empty when the constructivists open it. We share his concern for a lack of politics, but we are not convinced that the black box is "a remarkably hollow one." We find people and processes, although we still ask for power relations and gender relations within the processes. To us, constructivism is political in the sense that it is a well-founded argument against both technological and social determinism. When it opens the black box, we see a multitude of negotiations, controversies, and, in our opinion, possibilities for change.

An issue we now are interested in following up is how to handle the fruitful paradox of the hardness or "ready-made" character of technological artifacts

while exploring the possibilities of change offered by interpretative flexibility. As we see it, an acknowledgment of hardness is not a return to "old-fashioned" technological determinism. We have previously felt troubled by the constructivist focus on never-ending networks of social actors, afraid that technological artifacts would again evaporate and return as "pure" social struggle. But a growing concern for the interpretation of artifacts and their *scripts* holds technology contingently in view. To us, the study of technical artifacts is important because, as social constructs, artifacts are reservoirs of information on socio-cultural patterns but also on possibilities for change within these patterns.

Then we come back to our question: Do artifacts have gender? It should not come as a surprise that our tentative answer is yes, they do. Artifacts do have gender and gender politics in the sense that they are designed and used in gendered contexts. But holding that gender is inscribed in technologies does not mean that they are not open to change. As we have tried to show here, to say that artifacts have gender implies talking about gender and technology as simultaneously negotiated and constructed within the metaphor of the seamless web or of the cyborg. Dialogues between feminism and constructivism offer the possibility of learning more about gender and technology relations. Feminist politics cannot do without an understanding of the power of technology, and technology studies will remain rather stodgy without the tensions and pleasures of gender politics.

Notes

1. We use a rather loose notion of constructivism here that includes social constructivism, actor network theory, and systems approaches. This usage is fairly similar to that of Bijker (1993).

2. Social studies of science have not been a central field in Norwegian social research. In a Norwegian context, this is important to keep in mind because constructivism has its roots in the sociology of science.

3. The activities of this research group were funded by the Ministry of Work (1981-1985) as a specific program was launched for studying technical change and equal opportunities. The activities continued until the last two persons in the group—the authors—left IFIM in 1992. Most of us still work with questions related to this field.

4. Our empirical studies indicated that when comparing men and women within the same context, men are often more concerned with technical artifacts and technical content of their work, whereas women are more interested in questions of use and impact. Does this also apply to female and male researchers in the social studies of technology? The technically intensive branches and the scientific-technical milieus seem to attract more male than female researchers. Even within this field of research, there is a marked sexual division of labor related to research focus and perhaps also to the choice of theoretical approach.

5. Here we should mention Cynthia Cockburn's work as an important exception and source of inspiration for us. Cockburn's (1983) book, *Brothers: Male dominance and technological*

Change, was the first study we found of gender and technological change in industry. She has visited us several times and has been a most valuable discussion partner.

6. Social processes in which both gender and technologies are made and remade can be studied as processes of negotiation (Rudie 1984, Haavind 1982). By the concept of negotiation, we mean the conscious efforts to preserve technology as a male domain and, perhaps more importantly, the almost invisible, unintended, or unconscious aspects of gendered relationships—the details of everyday action—where gender, social inequality, and male power are often reproduced (Lie forthcoming).

7. There is a vast body of feminist literature dealing with this problem. The title of an anthology of Dutch feminist writing, *Sharing the Difference*, pinpoints the tensions in these debates (Hermsen and van Lenning 1991). We can add that we see many similarities between this account of Dutch feminism and the Norwegian debates.

8. It has taken us considerable time and effort to get a feeling of what cyborgs are about. They are not easily translated from a U.S. context to everyday life in Norway.

9. Cowan (1987) discussed the role of users or the consumption of technology in connection with actor network theory in the widely read "yellow" book on constructivism (Bijker, Hughes, and Pinch 1987). Since then, we have not found many articles that elaborate on the role of users.

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