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Configuring the User as Everybody: Gender and Design Cultures in Information and Communication Technologies

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Based on two case studies of the design of electronic communication networks developed in the public and private sector, this article explores the barriers within current design cultures to account for the needs and diversity of users. Whereas the constraints on user-centered design are usually described in macrosociological terms, in which the user–technology relation is merely understood as a process of the inclusion or exclusion of users in design, the authors suggest that it is important to adopt a semiotic approach. Moreover, they argue that we need to take into account the gender identity of designers to understand how design practices in ICT prioritize male users. The article shows how configuring the user as "everybody" and the use of the "I-methodology" are important constraints in the development of technologies that aim to reach users in all their diversity.

Keywords: *design cultures; gender; information and communication technologies; users; inclusion-exclusion*

Currently, the role of users in design is receiving widespread attention. Concepts such as "user-centered design" and "design for all" are frequently used by designers and policy makers interested in questions of equal access to new technologies, particularly new information and communication technologies (ICTs). Since the late 1980s, the paradigm in design theory has shifted from technology-oriented design to user-oriented design (Brouwer-Janse 1996; Friedman 1989; Norman and Draper 1986).[1] Recent studies of design cultures in ICT companies in Europe, however, show that this shift in paradigm has not yet been fully integrated into current design practices: users

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seem hardly to be involved in the design process, especially in the smaller ICT companies (European Commission–DG XIII-C/E 1998). Compared to other industrial sectors, large European ICT firms spend only limited resources to investigate the needs and skills of users.[2] One important barrier to user-centered design mentioned in this literature is the speed of production. Due to pressure to bring products to the market as quickly as possible, testing among users is postponed to the marketing phase. In this highly competitive sector, any effort to involve users in the design is considered as a risk that may slow down the speed of development. Moreover, ICT companies are reluctant to test new products among potential users for fear that other firms will become aware of their plans at an early phase of product development (European Commission–DG XIII-C/E 1998, 22; Woolgar 1991).

The constraints on user-centered design can thus be understood in macrosociological terms. Although studies adopting a macrosociological approach provide useful insights into the barriers against user-centered design, they cannot explain how technological artifacts come to incorporate barriers to specific groups of users. As many studies of the introduction of new ICTs have shown, new electronic products and services are often used more frequently by men than women (Sociaal Cultureel Planbureau 2000).[3] These studies thus suggest that although many ICT products are hardly submitted to any systematic user tests at all, the products have nevertheless become more attractive to male than to female users. The failure of macrosociological studies to account for the barriers in design to adjust for the diversity of users can be ascribed to the way these studies conceptualize user-technology relations. In macrosociological analyses of design cultures, users are conceptualized in the sociological sense: that is, as identifiable persons who are included in or excluded from the testing of technologies. In this article, we suggest that it is important to adopt another conceptualization of the role of users in technological development. To understand how technological artifacts come to incorporate barriers against specific groups of users, we need to shift the analysis to users in the semiotic sense: users as imagined by the designers of a technology. We suggest that a semiotic approach to user-technology relations enables us to analyze how, even in cases where users are not formally involved in the design, technologies may become adjusted to certain groups of users because of the incorporation of specific images of the future users. As Madeleine Akrich and Steve Woolgar have suggested, users may figure not only as test subjects in the test phase of the development of a technology. Engineers, and other actors involved in the design process, configure the user and the context of use as an integrated part of the entire process of technological development (Akrich 1992, 208; Woolgar 1991; Oudshoorn 2000, 124). In the development phase of a new technology, innovators define the preferences, motives, tastes, and competencies of potential users and inscribe these views into the technical design of the new product. The inscription of representations of users and use in artifacts results in technologies that contain a script: they attribute and delegate specific competencies, actions, and responsibilities to users and technological artifacts (Akrich 1992, 208). If the user representations incorporated into the artifact fail to match the actual users, it is very likely that the technology will fail.

Although the semiotic approach toward user-design relations provides an adequate framework to understand how technologies become adjusted to certain groups of users and not to others, gender analyses have not been included in these studies. As we have suggested elsewhere, the articulation of gender identities of users is an important but as yet unexplored aspect of the processes involved in configuring the user (Oudshoorn 2003). Technological innovation requires a mutual adjustment of technologies and gender (among other) identities. Actors involved in the development of technologies need to articulate the subject identities of the future users. Users, in turn, need to articulate and perform identities that correspond with the identities anticipated by the innovators. To be sure, recent scholarship in science and technology studies actually addresses the identities of users, particularly the articulation and performance of subject identities in medical discourses on disability and illness (Gomart and Hennion 1999; Moser 2000). Feminist scholars have described the emergence of bodies and subjectivities in relation to biomedical research and medical technologies (Cussins 1998, Heath 1997; Singleton 1996). These studies illustrate how technologies play an important role in constructing the identities of users. Technologies may create new identities, or transform or reinforce existing identities, by delegating and distributing specific responsibilities, skills, and tasks to users. Equally important, domestication processes[4] may result in constructing identities of the self (Lie and Sorensen 1996; Lindsay 2003; Laegran 2003). These studies are, however, restricted to technologies-in-use.[5] In this article, we want to include the design phase of technology to understand the dynamics underlying these processes of configuring the user. Moreover, we suggest it is important to extend the analysis of the relationship between technologies and identities to include the gender identity of designers. In recent decades, feminist historians and sociologists of technology have shown the strong alignments between technology and masculinity, particularly in the world of engineering (Berg 1996; Cockburn 1983; Cockburn and Ormrod 1993; Faulkner 2000; Oldenziel 1999; Wajcman 1991). We will show how a focus on the gender identities of designers and users enables us to understand how technological products come to incorporate constraints for specific groups of users, particularly women.

Based on two case studies of the design of electronic virtual cities developed in the private and the public sector, this article explores the barriers within current design cultures to account for the diversity of users from a gender perspective. We decided to include a case study of a small design community in the public sector because most studies of software development focus on design practices in large firms in the private sector (Quintas 1996, 83). A comparison between the private and the public sector is relevant because the incentive structures to take users into account may be different in each sector. Whereas industrial firms, inspired by economic incentives, may conduct user tests to reach the appropriate segment of the market (see, e.g., Kotler 1994), public sector entities may survey users to make technologies accessible for all citizens in order to realize democratic objectives. Moreover, user tests in the public sector are not constrained by patent rights or competition, which may reveal a different pattern of user tests than in the private sector. First, we describe the design communities in which the electronic virtual cities were developed. The article continues to analyze the user representations that were constructed during the design of the virtual cities and the representation techniques that dominated the design process. We will show how configuring the user as "everybody" and the use of the "I-methodology" are important constraints in the development of technologies that aim to reach users in all their diversity.[6]

Design Communities of Digital Cities: The Digital City of Amsterdam (DDS) and Philips Research

Digital cities in the Netherlands, as in other European countries, are inspired by the American "Freenets": locally bound information and communication systems connected to the Internet. Freenets became very popular in the United States around the 1990s. They were founded to offer free access and a user-friendly connection to the Internet so that citizens could get to know and use the "medium of the future" (Patrick 1997, 74, 75). Moreover, Freenets were intended to bring back a "sense of community" on a local level and to create more communication between citizens and politicians (Stallings 1996; Schuler 2001; Rheingold 1993). This would be realized by giving free and easy access to (governmental) information and by creating public debates on the Internet (Grossman 1995; Bullinga 1995).

DDS, the first publicly accessible digital city in the Netherlands and one of the first in Europe (van Bastelaer 1998), bought its software from a Freenet in the United States.[7] DDS was developed in the public sector and opened in January 1994. Although DDS was to be an experiment of ten weeks, the publicity it generated and the interest it aroused was overwhelming. Within one week, this new "city" comprised more than 3,500 "residents" and drew more than 2,000 visitors a day (Anon.1994). In Amsterdam, modems were sold out within a few days, and the initial twenty modem lines providing access to DDS had to be doubled to cope with the queue outside the virtual city gates.

The first interface of DDS was built to stimulate political discussion in Amsterdam and to make the relatively new Internet technology available to a wider public. Inspired by the metaphor of the "digital town hall," which was being promoted at that time by Ross Perot, then an American presidential candidate, DDS initiators decided to build DDS as a virtual analogue of a city. The perspective to stimulate political debate was of particular interest to the City Council of Amsterdam, which was approached to finance the project. In March 1994, local elections were scheduled to take place, and the city council was highly interested in new ideas to stimulate the involvement of citizens in local politics, since the number of voters had reached rock bottom at the latest elections. The city council thus became one of the major financers of DDS (van Meerten 1993, 1).

As an organization, DDS was founded by the Dutch hackers group "Hacktic-network," and the political-cultural center "De Balie," a club in Amsterdam that organizes activities on the crossroads of culture, politics, and technology. The hackers played an important role in the birth of DDS: they were responsible for hardware and for system management. In the first year of its existence, DDS relied heavily on subsidizes from the City of Amsterdam and several ministries. The organization of DDS was very informal, and the enthusiasm, idealism, and personal initiative of the contributors were indispensable for the survival of DDS. The organizational structure of DDS in its early years can be characterized as a network organization (van der Krogt and Vroom 1989, 122, 123). Diverse organizations and individuals connected with parts of the project on the basis of their own private goals, knowledge, and interests thus helped to give shape to the project. After the introduction of DDS in January 1994, the interface of DDS changed twice. These different interfaces became labeled DDS 1.0., DDS 2.0 (introduced in October 1994), and DDS 3.0 (introduced in June 1995) and were developed by different design teams. The design group of DDS 1.0 consisted of a core group of three people (two men and one woman) and about thirty predominantly male volunteers, including artists, graphic designers, hackers, journalists, and people working on media projects, of whom very few had experience with Internet technologies. The design team of DDS 2.0 consisted of six men and one woman, including people from the Hacktic network and lay enthusiastic users (all male). The interface of DDS 3.0 was built by a project team, consisting of two men and one woman, that was responsible for the graphic design.

As an informal network organization, DDS had many faces. As various groups were drawn to the project, including the City of Amsterdam, the Hacktic-network, and other individuals with diverse backgrounds, the identity and goals of DDS came to reflect this diversity. In this way, organizations and private persons could find their own points of interest within the project, thus making it worthwhile for them to help build or subsidize and making the project viable. Notwithstanding this diversity, all the people involved in the design process shared a fascination with the new technology. In later years, DDS gradually developed into a commercial and more formal organization (van den Besselaar, Melis, and Beckers 2000; Rommes 2002a).[8] These different phases of DDS seem to be exemplary of the different stages of Internet developments in general. As Wyatt has described it, the development of Internet technologies can be characterized by four different phases: the Internet as a scientists' playground, Internet as a community, the broadening of Internet into a general academic resource, and finally, the transformation of the Internet into a commercial information infrastructure (Wyatt et al. 2000, 3). The changes in the organization of DDS typically reflect the second and fourth phases of Internet technologies (Rommes 2002a).[9]

In contrast to DDS, New Topia has been developed by a design community in the private rather than the public sector: Philips Research, the research department of Royal Philips Electronics. Royal Philips Electronics was founded in 1891 in Eindhoven, the Netherlands, as a manufacturer of "incandescent lamps and other electrical products."[10] Nowadays, it has grown into one of the world's biggest electronics companies. Philips is still active in the areas of lighting and consumer electronics, but it has extended its activities into other domains such as domestic appliances, components, semiconductors, medical systems, and information technology services. The role of Philips Research is to improve Philips's global competitive position and the development of new businesses through the creation of technology-based innovations.[11] The New Topia project started in the Information and Software Technology sector of Philips Research but later moved to the New Business Creation (NBC) department, given the nature of the project. The NBC department originated from Philips Research and was positioned between research and product divisions. It aimed to investigate interesting business options.[12]

The New Topia project started at a time when network technologies and services came to be considered as an interesting new business direction within Philips. A feasibility study conducted by the future project leader of New Topia to assess the importance of networks for Philips in the near future led to the development of the project. Philips chose the television, combined with a touch-tone telephone, as hardware technology. The telephone enabled direct auditory contact with other users in New Topia, and users could also hear environmental sounds. The choice of television as the major hardware technology represents a well-known pattern in innovation: path dependence. Economic historians have introduced this concept to emphasize the important implications of history for future developments. Due to previous material, social, and symbolic investments, future technologies will develop very much in line with existing technologies. Over time, stable paths of development, or "technological trajectories," emerge which set constraints on the development of radically new technologies.[13] In the case of New Topia, the fact that Philips's major expertise was rooted in television (Philips is one of the largest color-television manufacturers in the world) shaped the choice of the hardware. In contrast to DDS, Philips Research opted for the television, particularly its function of teletext, rather than the computer as the main technology to develop new communication services. Teletext is an electronic communications system in which printed information is broadcasted by television signals to TV sets equipped with decoders. Moreover, Philips Research expected that the extensive Dutch cable network would enable them to make the new service available to almost every household in the Netherlands.

The design of New Topia represents a technology-driven innovation, which is reflected in the overall goal of the project and in the composition of the project team that developed it. The major goal of the New Topia project was "to create a new business for a metaservice entitled 'Virtual City'" (Kettler 1997). The project team consisted initially only of software engineers, almost all of whom originated from within Philips Research. They aimed to achieve predominantly technical goals, namely, to build a working hardware platform with several implemented services that could be demonstrated to the management and other people within Philips. In a later phase, a graphic designer and a researcher from the Human Behavior Research (HBR) department of Philips Design joined the project team. The HBR researcher was commissioned to evaluate the viability of New Topia from a user's point of view. The commercial aspects became more important after the first prototype was developed and running in a user trial. In that period, people with a marketing and sales background were added to the team. They focused on the marketing communication activities, such as contracting activities with business owners and taking care of promotional materials. The project team consisted mainly of men, except for the HBR researcher, a software engineer, and several marketing employees.[14]

We thus can conclude that DDS and New Topia originated in quite different design communities and organizational infrastructures.

Configuring the User of the Digital City of Amsterdam: Democracy for Everybody

Configuring the user of technologies is a complex process. Design practices are usually characterized by the construction of a wide variety of (sometimes conflicting) user representations that are intentionally (or unintentionally) produced by a variety of actors, including policy makers, designers, producers, marketeers, journalists, and test users (Akrich 1992, 1995; Clarke and Montini 1993; Van Kammen 2000; Oudshoorn 1999; Woolgar 1991). In the case of DDS, the initiators and policy makers of the City of Amsterdam played an important role in constructing user images during the birth of the concept of DDS and the design of the first two interfaces. The "founding mother," Marleen Stikker, a philosopher and program director at De Balie, had become fascinated by the Internet but was disappointed when she discovered that she could not meet "her kind of people" there. Her major objective to create DDS was to make the new technology accessible to "everybody" (Interview Stikker 1996). The initiators aimed to design DDS for people without any experience with computers and emphasized that everybody should participate in building it (Stikker 1994; Flint 1994). The policy makers of the City of Amsterdam articulated similar images of the users. According to the policy makers and the initiators of DDS, it was meant to strengthen democracy by "allowing everybody to communicate and debate in a nonhierarchical space"; to achieve this goal, DDS would become "extremely user-friendly so that also computer-illiterates can participate" (van Meerten 1994, 1, 2). The explicit user representations of DDS initiators and the city policy makers were thus very broad and all-inclusive. Even computer-illiterates were included in the target group of DDS. The birth of DDS was characterized by high ideals about how the new technology could contribute to improving democracy for all Amsterdammers (van den Besselaar and Beckers 1998). The user representation that dominated this period was the idealistic but nevertheless rather abstract category of everybody.

A closer look at what happened during the design of DDS shows, however, that there is a huge gap between the rhetoric and the practice of design. The fact that both policy makers and designers aimed to develop a technology accessible to everybody did not imply that the user was very central in the technological choices that shaped the design of DDS. The representation of the user as everybody guided decisions only on the city metaphor and the supporting hardware. In the design of the hardware, the designers of DDS initially paid close attention to the accessibility of the new technology. One of the most important ways DDS could be accessed was by means of a personal computer (PC) and a modem with a phone line to DDS. The designers anticipated that the installment of a modem would be a difficult job for many citizens. To make access at home easier, DDS therefore decided to open a help desk by telephone. Anticipating that many Dutch citizens had no access to a PC, nor the money to afford one, public terminals were installed. This plan was inspired by the Freenets in America, a project which had even succeeded in attracting homeless people to public terminals (Varley 1991). DDS therefore installed several public terminals in openly accessible locations in Amsterdam. Terminals were placed in the library, in an old people's home, in a public-access area of the city hall, at a hospital, in a museum, and in the cafe of De Balie. The wide variety of these locations reflects the initiators' ideal of access for everybody (Rommes, van Oost, and Oudshoorn 1999, 477).

To further enhance easy usage, the city metaphor, which can also be found in the original FreePort software, was used far more consequently. As a digital citizen, you could go to the post office to send or receive electronic mail; you could visit a kiosk to read electronic newspapers or the central station to start your worldwide Internet trip; in the town hall, you could find information on local politics (see Figure 1). In this way, technical language was avoided. Moreover, the decision was taken to translate most of the software into Dutch. However, due to a shortage of time, the command keys were not changed.

In the early phase of the development of DDS, the designers thus put quite some effort into trying to make an interface that they expected to be accessible for everybody. However, despite these efforts, other criteria than user-friendliness became the guiding principles in the design. The designers decided to change the original software to include a variety of functionalities because of what they called the "not invented here syndrome." The designers' objective to leave their own marks on the program resulted in a design that made the interface far more complicated to use than the original Freeport software.[15] They developed and integrated six different software packages into the original software, which made the interface far more complicated to use since the functions of the keys varied as the user shifted between programs. Moreover, users were expected to find their way around DDS by *trial and error*. The program did not start with the possibility of consulting a help menu; this appeared only at the fourth screen. So users were expected already to know how menus and tree structures work. The decision to incorporate new software packages had far-reaching consequences for the user that

Figure 1. This is the menu structure of DDS 2.0.
SOURCE: Flint (1994, III-2).
NOTE: The menu contained: 1 HELP; 2 The Post Office; 3 Public Forum; 4 The Library; 5 Building for Art and Culture; 6 Town Hall; 7 Office District; 8 A Plaza; 9 Central Station; 10 The Kiosk; 11 A Square; 12 University of Amsterdam; 13 Central Station; 14 Configuration Centre; *X* = Exit; *h* = Main Menu; *v* = Previous Menu; *w* = Who are there?; and finally, at the bottom of the screen: Choice?[39]

became inscribed in DDS, who was ultimately a more experienced computer user than the computer-illiterates, who had been mentioned in the policy documents (Rommes, van Oost, and Oudshoorm 1999, 487).

Second, during the design of DDS 2.0, policy makers of the City of Amsterdam and the initiators of the DDS prioritized incentives of innovation over the objective to make DDS accessible for everybody. Although initially both objectives had been articulated as major goals of DDS, innovation came to dominate the design decisions. Instead of user-friendliness and access for everybody, "experimenting" and "positioning Amsterdam as an innovative city" became the key concepts that shaped the design (van Meerten 1994, 2,3). Due to the public interest DDS attracted in the first weeks of its existence, policy makers and the developers of the DDS became particularly interested in making DDS into a precursor and trendsetter for the development of digital cities elsewhere in the Netherlands. To make DDS into the exemplary model for digital cities, the organization was asked to write a handbook with instructions on how to design a digital city (Rommes 2000, 140).

The emphasis on innovation had a drastic impact on the design of the second interface. Consistent with DDS's goal of innovation, the textual interface of DDS 1.0 was changed into a graphic interface with sound options, using the World Wide Web standard.[16] Designers articulated the need for this new interface in terms of the risk of "lagging behind." Actually, at that time, the risk was not yet high. In 1995, the Web was just becoming known to Dutch programmers. When the new interface was opened on October 15, 1995, DDS was the second organization in the Netherlands to have such an interface (Rommes 2000, 142). The change to a graphic interface had serious consequences for the users. To be able to use DDS 2.0, users needed special software and "a considerable amount of hardware: at least a 386 computer, a color-monitor and a fast modem" (Belangrijke software veranderingen DDS 2.0, 1). This kind of hardware was not yet commonly used by private computer-users, and certainly not by women (Shade 1997). The user who became inscribed in DDS 2.0 was thus not gender neutral: the DDS was predominantly adjusted for certain male users.

Finally, the accessibility of DDS was drastically reduced by the gradual removal of the public-access terminals during the first eighteen months of the digital city's existence. In practice, the public terminals turned out to be rather expensive and time-consuming to maintain. Terminals happened to be very vulnerable and often broke down. The hackers who were responsible for the terminals' maintenance had difficulties finding the manpower to repair them. The decision to remove the terminals was, however, inspired not only by financial incentives. The manager of DDS in that period felt that the public terminals were damaging the image DDS wanted to create. DDS considered the terminals as "not representative": they were not sophisticated enough to show graphic information. Thus, when the new, graphic interface of DDS was introduced, they "gave a wrong image of what DDS was, which was not smart in business terms" (Interview Flint 1998, 10). The decision to remove the public terminals thus reflects the change in the orientation of DDS toward more commercial and innovative goals. DDS had to be in the forefront of developments, which implied that they had to get rid of the old terminals that gave an old-fashioned image of DDS. However, the most striking reason why the public terminals were removed was that the institutions in which they were placed, especially De Balie and the city hall, complained about the people they attracted. Or to quote one of the initiators' reflections on these complaints, "They sat there for hours without ordering anything"; "they gave a tramp-image"; and they made the surroundings look "untidy" (Interview Flint 1998, 11). These complaints by the city hall and De Balie are all the more striking because one of the major stories used to show the success of the public terminals in the first Freenet in Santa Monica, California, was that it was used by tramps. It seems that in Amsterdam, this use of public terminals by tramps was not appreciated. The policy makers went along with the decision to remove the public-access terminals. Consequently, DDS became accessible only for people who owned a computer and a modem or had access to this hardware at work or via family or friends.

The design of the hardware thus shows a pattern similar to the design of the software. Whereas the user representation of everybody dominated the early phases of the design, the criterion of innovation became the dominant principle guiding the later phases of the design. Technological decisions inspired by the latter principle overruled the initial objectives of policy makers and designers to design DDS for everybody.

From Designing for Everybody to Designing for Oneself

Although the development DDS began as a user-centered design practice, the design eventually came to be shaped by incentives of innovation. Although both objectives, developing a user-friendly system and being innovative, are not by nature mutually exclusive, the idea of designing for everybody gradually diminished. This pattern can be largely ascribed to the use of implicit representation techniques, in particular the use of the “I-methodology.” To assess the interests, competencies, and motives of future users, designers can rely on various methods, including explicit representation techniques such as market surveys, consumer tests, and user feedback, and implicit techniques such as a reliance on expert visions and the I-methodology. The I-methodology refers to a design practice in which designers consider themselves as representative of the users (Akrich 1995). Akrich describes the I-methodology as the “reliance on personal experience, whereby the designer replaces his professional hat by that of the layman” (Akrich 1995, x). This is often an unconscious process: the designer is not aware of the fact that the user representation he or she is using resembles himself or herself. In contrast to the images created by designers and what people usually expect, implicit methods are often more powerful than explicit methods in shaping the design (Akrich 1995, 175). This is exactly what happened in the case of DDS. For many choices in the design, designers assumed that their own preferences and skills were representative of those of the user. For example, the learning style that was incorporated in DDS was a style in which users were expected to find their way around DDS by trial and error. This learning style clearly reflected the favorite style of the designers:

> You have to keep things exciting; discovering is important. This has to do with the way in which I discovered the Internet and all its possibilities, you discover

> more and more, and that is fascinating. So you have to let people discover things; that's fun. (Interview Rodriguez 1998, 27, 28)

The design of DDS thus came to incorporate a learning style that matched the preferences and competences of the designers. Simultaneously, it made the lives of users with preferences and skills different from those of the designers much more complicated. A learning style of trial and error requires that one has to feel at ease with computers, and self-confident enough to try things. As Turkle has shown, in our society, this particular style of learning how to use technology and computers is found more often among men than women (Turkle 1991, 48-49).

The users manual of DDS is another example of how designers relied on the I-methodology. The author of the manual described his experiences in writing it:

> It is very much written from my own experience. I have described how I learned it myself. (Interview Flint 1998a, 13)

Moreover, the manual illustrates how the designers no longer aimed to design DDS for computer-illiterates. The image of the user as everybody was replaced by users with computer experience. The DDS manual addressed users with computer experience rather than computer-illiterates:

> Both XS4ALL as well as DDS are advanced systems. They offer very much and are therefore, at first sight, maybe not so simple as you would want them to be. You will, however, discover that all the basic actions are fairly easy to learn for anyone who has worked with a computer before. (Flint 1994, II-3)

This drastic transformation of the targeted user implied, again, a gender bias. In Dutch society, as elsewhere, the percentage of men with computer experience exceeds that of women, so the consequences of this image of the intended user have been particularly negative for women.

The development of DDS 1.0 and 2.0 did not include any systematic, formal testing of the interfaces among users and nonusers of DDS. The only tests that took place were the occasional, informal tests performed among designers of DDS (Interview van Eeden 1998). If one of the other designers accidentally dropped in and had some time to spare, they would in some cases be put behind the computer to try out applications. Although this is not literally the I-methodology, it is very similar. Other designers are, of course, not representative of the potential users the DDS envisioned. Moreover, these tests were merely technical tryouts to investigate whether the functionalities of DDS worked and not trials to test the user-friendliness of DDS. To quote one of the designers,

> It was, of course, not theoretically based or tested at all. Software-tests, of course, we did not do that at all. For us, the users were just a bunch of testers. (Interview van Eeden 1998)

The only exception to the neglect of user tests was a small-scale test of the interface of DDS 3.0, which had only a minor impact on the eventual design. Moreover, this user test was not initiated by the designers themselves; the designers were asked to perform user tests by people interested in the relationships between women and the Internet. When one of the designers of DDS 3.0 attended a conference about women on the electronic highway, the discussants suggested that the designers should pay more attention to the users. Following this discussion, the designer invited nine women and two men present at the conference to take part in a user test. However, the test-group happened to be not representative of the computer-illiterates the designers originally wanted to attract. Not surprisingly, all test users were very interested in using the Internet, and most of them had experience both with computers and with the Internet. Moreover, the test users were placed in a position different from what actual users would encounter. They could ask for help during the test and were given much information beforehand. Last but not least, the interface was tested only on marginal points. Since the tests were performed in a rather late phase of the design process, the test users were asked questions only about things that could be changed at this stage, such as minor aspects of the graphical design.[17] No tests were performed about the contents of DDS or the metaphors used. As a result of the test, the designers made several minor changes in the interface, including changes in the names and the colors of the functionalities. Due to a lack of time, not all the remarks of the test users were taken into account (van der Haar 1995, 21).

Although this user-test thus played no important role in the design of DDS 3.0, it had an important function for the designers: they considered the user-test as a proof of the user-friendliness of their design. This is in line with Akrich's suggestion that explicit user-representation techniques more often function as tools to legitimate the design process so that designers can claim that they have taken the needs of users into account as tools to guide technological decisions (Akrich 1995, 175). One of the designers of DDS 1.0 and 2.0 acknowledged that, in the end, they were not interested in the needs of users at all:

> What users themselves would like? [laughing] Well . . . the system of course was not built because people needed it so badly; the system was built because we thought that a social function was connected with it. We thought the Internet was important, that it needed to be introduced, and that we would show all the possibilities of the technology. . . . These people had to get free e-mail to discover the rest [of the Internet]. (Interview Rodriguez 1998, 30)

This reflection illustrates the major incentive of the designers of DDS. As described above, the designers shared a fascination with the new technology of the Internet: they considered DDS as a way of introducing people to the Internet with all its potential for communication and information. Instead of designing DDS to meet the interests of future users, they expected the users to share their own fascination with the Internet. Consequently, they did not consider it necessary to assess the needs of users.

In sum, we can conclude that the design practices of DDS have been dominated by implicit representation techniques. The dominance of the I-methodology in particular resulted in a gender script: the user who came to be incorporated into the design of DDS matched the preferences and attitudes of male rather than female users. As almost all designers were male[18] and technologically highly competent, they made DDS into a masculine technology. In the end, the designers developed a system according to their own preferences, technical capabilities, and learning style. It will come as no surprise that the users attracted to DDS were by no means representative of the population of Amsterdam. Although the percentage of women has increased slightly over the years, the virtual city has been "inhabited" primarily by young, highly educated, white males. The user survey of 1994 showed that only 9 percent of the users of DDS were female In 1996, this percentage increased to 18 percent (Schalken and Tops 1994).[19]

Configuring the User of New Topia: Entertainment for Everybody

The design of DDS exemplifies the design practices of a small organization in the public sector. From this, we may be tempted to conclude that the dynamics of user configuration that we have described thus far are illustrative of only design practices in the public sector. We therefore decided to undertake a similar analysis of a design community in a private-sector company: Philips Research. The two case studies presented in this article are different not only with respect to the context in which the design took place, but they also represent two different technological approaches to the design of virtual cities. Whereas DDS exemplifies a virtual city based on computer and

Internet technologies, New Topia is a virtual city based on television and the telephone. Actually, New Topia can be considered as the precursor of DDS in the Netherlands.[20]

Notwithstanding these differences in contexts and technologies, DDS and New Topia show strikingly similar patterns in configuring the user. Again, *everybody* functioned as a key concept in representing the user. In contrast to DDS, the aim of designing for everybody originated from the technologies chosen for the virtual city and not from idealistic motives. As we noted above, Philips Research chose TV and touch-tone phones as hardware technologies. The choice of these technologies shaped the first user representations constructed for New Topia. The user was configured as someone who owned or had access to a (cable) television and a touch-tone telephone. At that time, 1993, this was almost everybody in the Netherlands (Interview van der Weij 1999). With the choice of television and telephone, the project team implicitly emphasized that New Topia would be simple and easy to use: not only were the television and telephone available to a very large group of people, but both products also had a low threshold of use. At the beginning of the project, the team consciously decided to aim at a broader public than just the young male computer fanatics. Or as the designer of the software described it,

> [If] the functionality that would be implemented on the system was used purely for games, only the typical target group of young male computer fanatics would be reached. . . . But we aimed at normal people who don't have a Silicon Graphics machine at home. (Interview van der Weij 1999)

Therefore, despite the fact that New Topia was not computer based, computer users were rhetorically enrolled for contrast to emphasize that the virtual city was meant for everybody, for "normal people." The user representation of "young male computer fanatics" played an important role here, setting boundaries on what New Topia should not become. So instead of "making an Arcade Hall,"[21] a service strongly connected with computer games and young male computer fanatics, the project team searched for a solution where different types of services could be presented. Like DDS, they chose the city metaphor because of its clear associations with daily life. They expected that it would be easy to understand for most people because the actions within New Topia would be the same as those you would perform in reality. If, for instance, you want to meet people, you could go to a pub, just as you do in the real world. And if you were interested in houses for sale, you could "walk" into a real estate office for more information. This direct connection with the real world should make it easy and simple to use, especially for people with no, or only limited, computer experience. Although the visualization of the city was constrained by the possibilities of teletext—the designers could use only a limited amount of colors and rectangular building "blocks"—the result resembled an abstract image of a Dutch town. The graphic interface of New Topia (see Figure 2) consisted of a city with streets, houses of different sizes, small town parks, fountains, and even a barrel organ, all with familiar features to make an easy connection between the real world and the virtual world. Within the city of New Topia, several types of services were offered to the user, ranging from informational services to social activities (including the Pub), or games like Bunny Hunt, and there was also a service where one could post a message on a public message board (see Figure 2). New Topia also provided houses for commercial activities. These were maintained by the service providers who advertised their commercial services in New Topia.

Another user representation articulated during the design of New Topia was the "couch potato." This representation was used internally within Philips Research to "visualize" the typical television watcher. The term *couch potato* portrayed the user as a person sitting on a couch in the living room, watching television, and wanting to be entertained. This representation emphasized the user's passive attitude, and this category of users was contrasted with the more active computer user. The construction of this user representation shows how users can have many, sometimes even contradictory, faces in design. Whereas users were represented as passive inside Philips Research, the public documents of New Topia represented the user as active. In leaflets and interviews for newspapers and television, the users were called "citizens," "New Topians," or "Visitors." These New Topians were characterized as "active TV-watchers."[22] New Topians would visit New Topia to meet there with friends, look up some information, and stroll through town, "curious about new developments."[23] This representation differed drastically from the couch potato: instead of passive viewers who wanted to be entertained, it emphasized the active attitude of the New Topia user. New Topians were configured as people curious to know all the new developments in the city. This double articulation shows the different roles user representations can play in design practices. Whereas the couch potato functioned as a convenient image for communication among the Philips's project team members, the active TV-watcher was used as a tool to emphasize the novelty of New Topia to the outside world.

In contrast to the DDS, the user configuration of New Topia also included groups other than the end user. The success of the first user trial, which we will describe in greater detail below, resulted in a turn toward a more professional and business-oriented approach to the project: the team made a start to

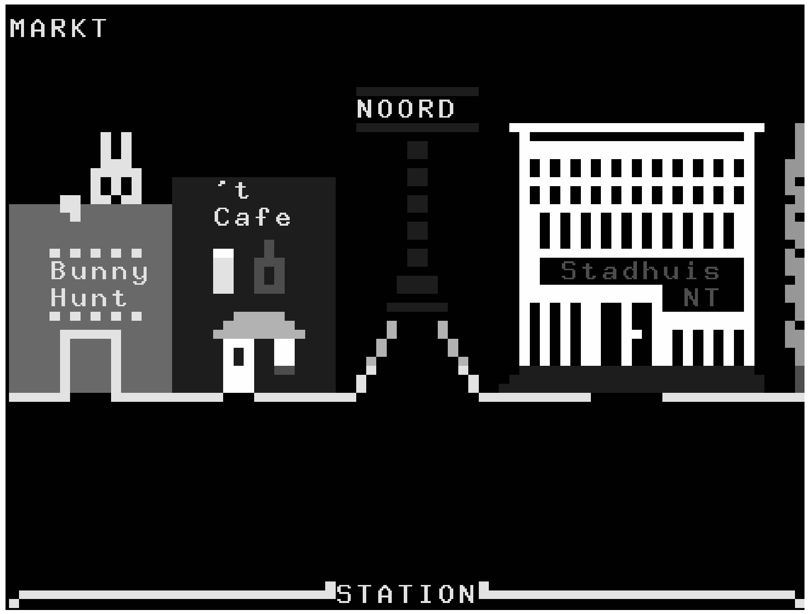

Figure 2. **New Topia's central market place facing north, including the Pub, the Bunny Hunt house, and the City Council.**

convert the prototype into a business-ready version. In this process, the New Topia team made a distinction between different categories of users, corresponding with the different parties in the business chain. In addition to the already existing group of *end users*, the team configured *shareholders* and *service providers* as new categories of users. The stakeholders were configured as users who should create and maintain the overall system provided by New Topia, while the service providers were represented as people who should supply the services within New Topia.

Secrecy as a Constraint on Formal User Tests

As had happened with DDS, the I-methodology played an important role in the design of New Topia, particularly in the early phase of the development of this virtual city. Among the important motivations of the first team members to join the project was their experience in playing networked computer games. They knew "how much fun it was to play with real people, instead of against the computer" (Interview van der Weij 1999). Consequently, entertainment and socializing became the key concepts shaping the design. New Topia should provide entertainment for everybody. The preferences of the team members also shaped the decisions about the infrastructure of the virtual city, particularly the choice of the services that should be included in the system. All decisions were based on the team members' expectations about what users would like to do in the virtual city. Or as the graphic designer put it,

> We have not involved any users. My approach has been more general: what are the needs of users, what, in my point of view, do users like or consider as important? What is required to make users feel at home in the virtual city? In doing this, I relied on my own experience. (Interview van der Haar 1999)

The procedure for designing New Topia was simply that every team member who had a good idea was encouraged to turn it into a service (Interview van der Weij 1999).

However, the project team of New Topia not only relied on the I-methodology to configure the user but also applied explicit representation techniques. However, the first user trial was very restricted in terms of the users who were enrolled in the trial. The graphic designer of the project, who was actually a student doing his internship at Philips Research, was allowed to test the usability of his interfaces only among Philips employees (Interview van der Haar 1999). It goes without saying that Philips Research employees were not representative of New Topia's target population, that is, everybody. At Philips, people without much experience with computers and telephones, "true novices" as Steve Woolgar (1991) calls them, were not easy to find. Pragmatism led the graphic designer to have secretaries and colleagues, people with extensive experience in using computers and telephones, but also some people without this experience, including gardeners and canteen employees, "the coffee ladies" (Interview van der Haar 1999), to participate in the usability trial. The major reason for this restricted composition of the test population was that the project team was afraid that information leaking to the outside world might cost the project its lead over possible competitors.

Once a working prototype was available, a more extensive trial was organized. As soon as the patents of the new technology were filed, the organization of the trial was no longer constrained by secrecy and could include people from outside the Philips community. The project team approached the local Eindhoven cable operator, KTE, and asked them to provide a list of names and addresses of a random selection of their subscribers. About two hundred people replied that they would like to participate in the trial. The test lasted for several months. The aim of this trial was to test the technical performance of the system and, because the idea was to conduct it with real users, to obtain a sense of the characteristics and behavior of these users. In practice, the test functioned as a technical tryout of the prototype. The major conclusion of this trial was that there were no serious technical problems (Interview Kettler 1999). No official records were kept on data about the test users. The results of the trials confirmed the project team's images of the users as *couch potato* and *everybody*. Other implicit methods used in this period to find out more about the users of the first prototype of New Topia largely confirmed these images. In this period, the project team used two methods to obtain more information and impressions about the users: the "mayor" and the "mister X" method. One of the members of the project team acted as mayor of New Topia. Users could visit him at special consulting hours with questions or to exchange remarks. This service was used very frequently by the visitors to New Topia (Interview De Winter 1999). The more anonymous mister X, a role performed in turns by one of the project team members, would stroll in New Topia to talk with users, to play games with them, and so on. The mayor and mister X kept notes about their experiences during these visits, which were made available to other project members (New Topia Archive). Based on these implicit methods, the project team had the impression that the users consisted of a rather broad variety of people, although there seemed to be more men than women among the visitors to New Topia (Interview van der Weij 1999).

When the project team began to explore the potential business partners of New Topia, they initiated more formal user trials. Experts from within and outside Philips were enrolled to perform trials to assess the experiences of a wide variety of potential users.[24] The second user trial, conducted by the Human Behavior Group of Philips Design, was performed with one thousand test users and lasted for one year. The trial consisted of a quantitative part, which monitored actions of users within New Topia during a given period, and a qualitative part, including in-depth interviews with three selected groups of three people.[25] The results of these investigations showed that a serious mismatch existed between the target group the project team had in mind and the actual trial group. In contrast to what the informal representation techniques had revealed—that is, that New Topia was used by a very broad range of people—the formal surveys among users showed that New Topia was used predominantly by men. The largest group within New Topia's population consisted of lower educated men, aged eighteen to thirty-five (Intromart 1996). Moreover, New Topia mainly attracted single people who did not own a computer. The services provided within New Topia showed a similar mismatch. Whereas the project team had expected that the services would be of interest to everybody, the surveys showed that the services catered especially to the needs of younger men. Women, and particularly housewives, declared that they were not interested in the entertainment services and socializing activities provided by New Topia. They disliked the games within New Topia because in their view they resembled computer games. Instead, these women articulated the need for information services, particularly information about regional and local events. Pensioners showed a similar dislike of the entertainment services and a preference for a regional information service. In the end, only young men and teenagers shared the designers preference for entertainment and socializing activities. The second user trial constructed several new user images. First, the project team distinguished a category of people that was not yet represented among the users of New Topia: users with free time at home during the day. The user trial had indicated that New Topia was mostly visited from 7 p.m. to 12 p.m. To prevent rush hours during the evening and all the ensuing consequences—slower performance, crashing of computers, and so on—the team wanted to achieve a better distribution of users across the day. The users with free time during the day were divided into three groups: housewives, pensioners, and unemployed people (Ramakers 1996). This was based on research done by the Dutch Social Cultural Planning Office (SCP) on how people spend their leisure time. Second, teenage girls were added as a new group of potential users. Teenage boys were already well represented in the user trials, therefore *teenage girls* became articulated as new potential users. The girls formed an interesting group because they spent their afternoons at home, and they were interested in "social contacts, television, audio and computers" (Ramakers 1996), all of which New Topia could offer them.

Based on this user survey, recommendations were made to change the types of services provided by New Topia. The focus should not only be at entertainment and socializing, but it should also include the provision of regional information. This information should be about products, ordering and reservation services, and community and cultural information.[26] Philips thus prioritized the interests of adults over the preferences of teenagers. This decision was made because it was "the only way in which New Topia could be economically interesting for Philips" (Ramakers 1996). Teenagers were considered as a less interesting target group because they had problems with the frequent use of New Topia due to high telephone costs (Ramakers 1996). This more systematic information about the users, however, became available only in the later phase of the development of New Topia. By that time, the prototype was already stabilized, which constrained any further adaptations to the preferences of users.

Equally important, the choices of the hardware, made during the early phase of the design, incorporated a user profile that prioritized specific groups of users. As we have described above, configuring the user as everybody was strongly related to the choice of the TV as major hardware device. In reality, however, New Topia used the teletext function of televisions. The implicit assumption that "everybody uses television" did not hold true for the use of teletext. The results of the user research performed by the external research institute indicated that men used the teletext function significantly more often than women, in general, and that housewives used it even less. It also indicated that many elderly people did not have their living rooms furnished in a way that the telephone was positioned near the television (Intromart 1996). The position of the telephone near the television was a necessity because the telephone functioned as the input device and direct feedback on the input was given via the television. Moreover, older telephones were not suitable for sending the number codes necessary for interaction, which also may have excluded specific groups of users, including elderly people. Finally, the required connection to the cable network excluded people living in remote areas who use antennae or satellites to watch TV. The technologies which were supposed to be accessible to everybody thus prioritized specific user groups over others.

Conclusions

Reflecting on the practices of these two design communities involved in the development of virtual cities, we can conclude that despite the fact that DDS emerged in the public sector and New Topia in the private sector, there are remarkable similarities in the development of these technologies. Both design communities aimed to develop a virtual city for everybody, and they both failed to accomplish this aim. We suggest that the constraints underlying the design for everybody can be understood only if we take into account the dynamics at play at the macro as well as the micro level. The macrodynamics that shaped the design of DDS included the policy of the City of Amsterdam and the initiators of DDS to make it into a tool to contribute to the image of the city as a center of innovation. The design of a digital city that incorporated the latest developments in hardware and software, that could function as the model for the design of digital cities in the Netherlands, and that would be one of the first digital cities to be developed in Europe, provided an excellent tool to create and reinforce this image. The incentive to be innovative gradually overruled the objective to make the digital city into a tool to improve local democracy by being accessible and interesting for everybody. The case study of DDS shows how, in contrast to what we expected, public-sector organizations are not more inclined to do user tests than private-sector organizations. In contrast to private firms, DDS would have been able to survey users because they were not hindered by patent rights or competition. In practice, however, the designers of DDS refrained from any extensive user tests because of their fascination for the new technology: they simply were not interested in users. DDS could afford such a neglect of users because their position was already secured by the financial support of the local government.[27] Most crucially, the local government did not take any responsibility to control whether the democracy objectives had been implemented in the design of DDS. We therefore conclude that an a priori distinction between the public and the private sector in terms of being more or less inclined to adopt user-centered design is not tenable. We agree with Rachel Weber's (1997) argument that the notion of public interest obscures the politics involved in deciding what counts as public needs. As Weber suggested, "The 'public interest' is likely to be captured by powerful interests" (p. 374). From this perspective, we can conclude that DDS's potential to contribute to the image of Amsterdam as an innovative city represented more powerful interests than its potential to make Internet accessible for everybody, which would have required more extensive user tests.

The macrodynamics that shaped New Topia represent constraints on users tests already familiar in design practices in the private sector. Due to fear of alerting the competition, designers were not allowed to use formal procedures for user tests. Consequently, information about a mismatch between the intended target group and the eventual users became available only once the technology was already stabilized. Another already familiar pattern is visible in the New Topia's project team's choice of TV as a major hardware technology for the development of a virtual city, which exemplifies path dependency. Since the television is part of Philips's core business, it also became the hardware of choice for the design of a virtual city. Although the decision to use TV enabled Philips to reach a wider audience than a computer-based technology, the addition of teletext seriously limited the potential users of New Topia because teletext was used less frequently by women.

Both case studies also show how the design of electronic services cannot be understood in terms of isolated events. Technologies have a life history that goes beyond the design trajectory of any specific ICT product. This well-known process has been described extensively in the literature of economics and S&TS. What is new in our analysis is that path dependency shapes not only the choice of specific technologies but also the process of configuring the user. Designing DDS for everybody was seriously constrained by the fact that the virtual city was based on computer technology. Since the computer has a history of being a machine with strong male connotations, it was no surprise that men were overrepresented among the users of DDS (Lie 1995; van Oost 2000; Brosnan 1998; Rommes, van Oost, and Oudshoorn 1999). Making New Topia accessible for everybody was constrained by the fact that this electronic service relied on teletext, which was also used more frequently by men than by women. The hardware of DDS as well as New Topia thus already incorporated a specific user profile in which women were underrepresented. The design of electronic services based on computers and television therefore requires an extra effort to overcome the gender-biased user incorporated in this hardware. This did not happen. Although the designers of DDS and New Topia put some effort into trying to make the virtual cities accessible for everybody, for example, by introducing public terminals for DDS, our analysis shows the paradoxical situation in which designers who intend to design for everybody hardly try to assess the needs, preferences, and competencies of their users. The macrodynamics we described above partly account for this.

However, to understand how the design practices prioritized specific groups of users, we need, in addition, to take into account the micro dynamics that shaped the design. Both case studies illustrate how the processes of configuring the user were dominated by the I-methodology. Instead of assessing the interests and competencies of users by formal procedures, designers of DDS and New Topia generally took their own preferences and skills as major guides in the design. Since the project teams of New Topia and DDS consisted mainly of men, and the few women involved in the design of the DDS largely adopted a masculine design style,[28] the interests and competencies inscribed in the design were predominantly masculine. The fact that DDS and New Topia failed to attract the audience they intended to reach must therefore also be understood in terms of the gender identity of the designers. Whereas recent studies of the relationship between technologies and identities largely focus on identities of users, our case studies indicate that the identities of designers are equally important in understanding the dynamics of technological development.

This conclusion triggers the intriguing and politically relevant question concerning the extent to which the functions and interfaces of the digital cities, and technological artifacts in general, would have been different if more women were involved in the design process. Given the strong alignment between hegemonic masculinity[29] and specific technological values, it seems likely that female designers can make a difference, at least if they are represented in equal numbers. As feminist scholars have described, technology is one of the most stable and powerful symbols of masculinity (Connell 1987;

Wajcman 1991; Faulkner 2000). In the twentieth century, technology has become part of "what it means to be a man" (Connell 1987, 141) and technological competency has become an important aspect of hegemonic masculinity.[30] Our research confirms Pacey's (1983) idea that love of and mastery over the latest technology is a major incentive for men's involvement in design.[31] The design practices we described reflect a world in which using technology for excitement and adventure, and designing it for its own sake, emerged as dominant technological styles. Interestingly, Pacey described the user and need values of technology as feminine values. From this perspective, we might expect that the incorporation of more women in design communities may change technological styles toward paying more attention to users. The emergence in the United States of computer-game companies owned by women and aimed at the design of computer games for girls indicates that female designers are more sensitive to the needs of users, in this case girls (Cassell and Jenkins 1998, 19).[32] However, the gender issues involved in design are too complex to be solved by just "adding women and stir" (Harding 1986). They also require a transformation of the dominant cultural image of technology, a drastic change of the technology push oriented routines and practices of current design communities, and a renegotiation of gender identities in relation to technology.[33]

Finally, our study suggests that configuring the user as everybody is an inadequate strategy to account for the diversity of users.[34] Both case studies show how designers failed to operationalize this user representation into more specific design requirements. Our reconstructions of the design practices of DDS and New Topia show a huge gap between the objective to design for everybody and the actual design strategies, which did not adjust for differences in interests and skills among users. Due to this lack of differentiation and the use of the I-methodology, the virtual cities were designed not for everybody but primarily for men.

Of course, one may wonder just how important it is for designers to build users into the final technology. Will users not simply find ways of appropriating the technology to suit their own purposes? The script approach we have developed in this article can be criticized for adopting a technological determinist view on human action which does not grant the users much agency: the users have to live with whatever the designers give them.[35] In the last decade, scholars in the fields of gender and technology studies, cultural studies, and media studies have emphasized that users play a crucial role in shaping technologies (Cowan 1987; du Gay et al. 1999; Lie and Sorensen 1996; Oudshoorn and Pinch 2003; Saetnan, Oudshoorn, and Kirejczyk 2000; Silverstone and Hirsch 1992). In this body of literature, users are conceptualized as codesigners of technology. In using technologies, users do not necessarily have to adopt the scripts constructed by the designers. Users may slightly modify the scripts, they may drastically transform them, or they may even completely reject them and create new meanings and uses of the objects or become nonusers.[36] For feminist scholars, one of the crucial questions is how domestication processes may be different among women and men, and how both technology and gender are negotiated when technological objects are integrated into daily life. As we described elsewhere, in the case of DDS, there were important differences in the ways in which men and women reacted to the script of this new technology. Whereas male users of DDS predominantly adjusted the technology to their liking, many female users had to adjust their lives to be able to use DDS (Rommes 2002a). Moreover, the use of the metaphor of a city as well as the learning style of "playing around" turned out to be highly problematic for women who used DDS for the first time.[37] For most of them, the "inclusion work" they had to put into adjusting themselves to the script of DDS simply was too much. The frustration, self-doubt, and anger they experienced while they got acquainted to the interface were not matched by the attraction DDS offered them (Rommes 2002b). We thus can conclude that we should be careful not to replace a technological determinist view by a romantic voluntarism which celebrates the agency of users.[38]

Notes

1. This shift in paradigm is reflected in a redefinition of the concept of "interface" in design studies. Prior to the 1990s, the concept of interface was defined in terms of hardware and software that facilitate human-computer interaction. Since the early 1990s, research and development of interfaces has been extended to include cognitive and emotional aspects and experiences of users (Laurel 1990).

2. In some, but not all, big firms, users are involved in the last phases of the design: the testing of prototypes and the so-called usability trials. Philips Design and the Dutch telecommunication firm KPN are the only firms with specific departments for user-oriented research (European Commission–DG XIII-C/E 1998, 21). Moreover, Philips Research is also involved in user-oriented research (personal communication Maddy Jansse).

3. In addition to gender, age and education are also mentioned as important factors in shaping the acceptance and use of information and communication technologies (Sociaal Cultureel Planbureau 2000). In this article, we restrict our analysis to gender and, if relevant, to age differences in competencies and preferences of users. Recently, Philips Design has acknowledged the importance of investigating age differences in the use of electronic consumer products (Docampa Rama 2001).

4. The concept of domestication has been introduced by Roger Silverstone to describe how the integration of technological objects into daily life literally involves a "taming of the wild and a cultivation of the tame." New technologies have to be transformed from being unfamiliar, exciting, and possibly threatening things to familiar objects embedded in the culture of society and the practices and routines of everyday life (Silverstone and Hirsch 1992; Lie and Sorensen 1996).

Domestication processes include symbolic work, where people create symbolic meanings of artifacts and adopt or transform the meanings inscribed in the technology; practical work, where users develop a pattern of usage to integrate artifacts into their daily routines; and cognitive work which includes learning about artifacts (Lie and Sorensen 1996, 10; Sorensen, Aune, and Hatling 2000). In this approach, domestication is defined as a dual process in which technical objects as well as people may change.

5. For an exception to the neglect of identities in technological development, see Van Kammen (2000), Ploeg (1998), Klinge (1998), and Rommes, van Oost, and Oudshoorn (1999, 2003). There are only a few studies that study the use as well as the design of artifacts. The most comprehensive biographical study of an artifact including both design and use is the study of Cynthia Cockburn and Susan Ormrod on the microwave oven (Cockburn and Ormrod 1993). They studied the whole "circuit of gender and technology," by following it from design, manufacture, marketing, sale, purchase, and use to maintenance. Other exceptions include Rachel Weber's analysis of the gendered design of cockpits; Anne Jorun Berg's study of the life trajectory of various artifacts, including the smart-house; and Paul du Gay's biographical study of the Walkman (Weber 1999; Berg 1996; du Gay 1997).

6. We would like to thank the two anonymous reviewers of *ST&HV* for their valuable comments on an earlier version of this article.

7. This description of the the Digital City of Amsterdam (DDS) and parts of the analysis of DDS 1.0 and 2.0 were previously published in Rommes, van Oost, and Oudshoorn (1999) and Rommes (2000).

8. In June 1995, DDS shifted from being a publicly to a privately financed organization (Rommes 2002a).

9. In this article, we will restrict our analysis to the design practices of the DDS preceding the commercialization phase. See Rommes (2002a) for an analysis of the development of the DDS as a commercial organization.

10. Mission statement of Philips Research, found at http://www.research.philips.com (accessed on March 16, 2000).

11. This is realized, among other things, through close collaboration with the business units. Output is generated in the form of options for new and improved products, processes, and patents in various fields. Interesting and potentially valuable options are then further developed by the product business units before they reach the market (mission statement of Philips Research; http:\\www.research.philips.com).

12. The department's approach consisted of investigating interesting business directions. Consequently, new projects were started to explore and develop new business options that would be of interest for Philips but too exploratory in nature to be exploited by the product divisions.

13. The concept of "path dependence," first developed by economic historians in the 1970s, has received increasing attention from many social scientists since the mid-1990s (see Hirsch and Gillespie 2001).

14. The only female software engineer was described by her male colleagues as a designer with a "male" interest in technology and a disinterest in users (Interview van der Haar 1999).

15. Actually, this software program was chosen not only because it was considered to be user-friendly but also because it enabled DDS designers to make changes to the original program because the sourcecode of this software was available. The sourcecode of software is the original programming in the programming language in which it is written. Having access to the sourcecode means that the programmer is able to rewrite the original program.

16. The second interface, DDS 2.0, was based on Lynx, an early version of the World Wide Web (WWW), and Mosaic (one of the first search engines). DDS 2.0 consisted of a graphic interface for information and a textual interface for communication, with the option to use the textual

interface (for slow computers). The interface of DDS 3.0 used WWW and consisted of a graphical interface using hyperlinks, with the option to use textual interface (for slow computers).

17. The questions asked during the user tests were about navigation and the clarity of the words used in the interface. Most questions were about the graphic design and none of them about what kind of information users would like to receive or what kind of functionalities for which they would want to use DDS.

18. The interface of DDS 1.0 was built mostly by Felipe Rodriquez (Hacktic) and Marleen Stikker (a philosopher and program director of De Balie). Stikker wrote most of the texts, whereas Rodriques developed the technical parts. Joost Flint, a political scientist and activist, wrote the manual. The design team of DDS 2.0 consisted of six men and one woman. The interface was built by Felipe Rodriguez, Michael van Eeden (a former user), people from Hacktic, and enthusiastic users (all male). The graphic design was made by a woman. The interface of DDS 3.0 was built by a project team consisting of two men and one woman: Michael van Eeden (programming/system building), Rob van der Haar (overall and interaction design), and Marjolijn Ruijg (graphical design). Both van der Haar and van Eeden can be portrayed as hackers, fascinated by computers and programming from a very early age. Whereas van der Haar and van Eeden recalled the fun they experienced in using computers, Ruijg remembered how scared she felt when she first started using networks. Ruijg described herself as a beginner, though she had worked with computers before starting to design DDS. Although the design team of DDS 3.0 thus shows a more balanced composition than the previous design teams in terms of men and women participating, the culture of the design of DDS 3.0 remained dominated by a masculine design style.

19. In 1996, this percentage increased to 18 percent (Schalken and Tops 1994). This increase reflects the rising number of women on the Internet in general. See Rommes (2002a) for an explanation of the increasing popularity of DDS and the Internet among women.

20. New Topia started just before the DDS was initiated. Rob van der Haar, a graphic design student who had an internship position at Philips Research as a member of the New Topia project, later moved to the DDS. In addition, there have been contacts between initiators of the DDS and members of the New Topia project team (interview Kettler 1999).

21. The metaphor of an Arcade Hall refers to a physical hall where video games can be played.

22. Characterization given in a promotional leaflet distributed by Philips.

23. Characterization given in a promotional leaflet distributed by Philips.

24. The investigations on the New Topia users were carried out by the Human Behavior Research group of Philips Design and Intomart, an independent research institute.

25. Linda Vodegel Matzen (1995), "New Topia. Second User Trial: A Quantitative User Survey." Philips Corporate Design, Human Behaviour Research Centre, report no. 95-05; Linda Vodegel Matzen (1995), "New Topia. Second User Trial: In-depth Interviews," Philips Corporate Design, Human Behaviour Research Centre, report no. 95-06.

26. This recommendation was also based on the expectation that the Internet would not provide regional and local information for some years to come (Ramakers 1996).

27. At least, this was the situation before DDS became a commercial organization, which was the period we described in this article.

28. Except for the first graphic interface, which was designed by the project leader's wife, most of the women involved in the New Topia project team had little impact on the design because they were only involved in user research and marketing activities. Although women were involved in the design of DDS, they largely adopted a masculine design style (Rommes, van Oost, and Oudshoorn 1999; Rommes forthcoming).

29. The notion of hegemonic masculinity has been introduced by Connell to refer to the dominant cultural ideal of masculinity. Connell suggested that the cultural ideal of masculinity does not necessarily correspond to the actual personalities of individual men. Alternatives may exist, but they are subordinated in the dominant cultural narratives (Connell 1987, 1995).

30. For a detailed historical analysis of the emergence of the strong alignment between masculinity, men, and technologies, see Oldenziel (1999).

31. Arnold Pacey has suggested that technologies often represent a specific set of values. Whereas some may prioritize the values of virtuosity, others may emphasize user or need value. According to Pacey, the latter are linked to feminine values, and the former express hegemonic masculine values (Pacey 1983, 146; 1999, 147). For an early account of engineers' love of technology, particularly automation, see Noble (1984). See Faulkner (2000) and Kleif and Faulkner (unpublished) for a more extended analysis of the relationships between masculinity and love of technology.

32. A reflection on the field of science and technology studies shows a similar picture. The importance of looking at users to understand technological development was first articulated by feminist scholars, including Ruth Schwartz Cowan. For a more extended analysis of the role of feminist scholars in studies of the relationships between users and technologies, see the introductory chapter of Oudshoorn and Pinch (2003). For a more extensive discussion of gender differences in styles of engineering, see Faulkner (2000).

33. See Faulkner (2000), Sorensen (1992), Rommes (2002b), and Rommes (forthcoming) for a more extended analysis and reflection on the problematic relationships between women, femininity, technology, and design practices.

34. Although this study was largely focused on gender, our research indicates that age and education can play an important role in the process of configuring the user.

35. We thank one of the anonymous referees for drawing our attention to this issue.

36. See Wyatt (2003) for a discussion of the notion of nonuser. To be sure, the idea that users can modify or change scripts has been discussed by Akrich (1992) as well. In this context, Akrich and Latour (1992) use the notion of "de-inscription." At first sight, the concepts of domestication and deinscription may be considered to be synonymous, but there is an important difference. Whereas the concept of domestication takes the world of users as point of departure, the concept of deinscription prioritizes the design context to understand how technologies become inscribed with norms and values (Oudshoorn and Pinch 2003).

37. In her study of the domestication of DDS, Rommes studied how the access that male and female users had to economic, social, and cultural capital affected their domestication of DDS (Rommes 2002a). Rommes also confronted people who had no previous experience with DDS (first-time users), with the interface of DDS to deconstruct the script of DDS. First-time user experiences make particularly visible what kind of technological frames people use as they try to make sense of a new interface and how these frames are different from the designers' frames (Rommes 2002b).

38. See the introductory chapter of Oudshoorn and Pinch (2003) for a more extensive description of this argument.

39. We have included a representation of the textual version of DDS 2.0 here because DDS 1.0 is no longer available. The two interfaces are nevertheless very similar.

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