NEEDS, ROLES AND PARTICIPATION. A REVIEW OF SOCIAL SCIENCE STUDIES OF USERS IN TECHNOLOGICAL DESIGN

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CHAPTER 1. INTRODUCTION

This report is an effort to review relevant social science literature concerning users in the design of technology. The review is made as part of the SMARTBUILD project, which aims to contribute to the development of smart, energy-efficient buildings. The role of future users is considered an important prerequisite of the design of such buildings, however, it is by no means clear how the concern for users and user needs may be taken care of. Thus, the intention of this review is to look at different approaches that may be helpful in realising the aim of integrating user concerns into the overall project.

It should be noted that this integration is by no means trivial. First, the concept of the user is notoriously unclear. In some circumstances, it signifies end-users, consumers or workers in a rather broad manner. However, there are special user categories, for example related to management or operation of a building. Second, the category of user may be a label that covers such a great variety of needs and practices that it is difficult to represent in a singular fashion. Third, there is neither a well-established methodology to map users' needs and practices, nor any standardised instrument to represent these needs and practices in a way that allows an easy transformation into design criteria.

A fourth problem emerges from the curious nature of energy as an object of consumption. While we tend to talk about consumption of energy in the same way as any other good, people do not consume energy like they use food or artefacts. In fact, in most circumstances related to buildings, we have to look at the consumption of energy as a derived demand. Energy is not devoured for itself, but rather because it is needed to make other things work. In buildings, people consume light, heat, fresh air, coffee, computers and copies. The consumption of energy is derived from these other goods or activities.

Thus, when we conceptualise users in relation to energy-efficient buildings, we have to be conscious about the particular mediated relationship that exists between humans and the consumption of energy. To users, energy has no value outside its ability to make things happen.

Nevertheless, there is a considerable research literature exploring the social and cultural dynamics of energy consumptions in buildings, above all in private dwellings or homes. We will return to this literature in chapter 3, but already at this point, we will emphasize that social science research about users is not specialised to the extent that it is meaningful to do a review of particular technologies related to energy efficiency. Thus, in this report we have chose to approach the user problem as a generic issue of technological design.

There are good reasons to do so, not just because the research literature tends to be generic as well. Many, probably most, of the challenges related to the user issue are very similar, independent of the kind of technology one is concerned with. While designers are engaged with technological particularities, users are basically engaged with applications of a given artefact and how it may be productive in the

performance of tasks or cultural activities. Of course, there may be clear relations between tasks and artefacts, but the analysis of these relations may nevertheless be performed from more generic theories and models.

This assumption has clear consequences for the way this review has been made. First, the generic approach implies a broad coverage of relevant literature. Thus, this report has become quite comprehensive and lengthy. Second, we are more concerned with general features of users in technological design than particular issues related to energy efficiency, even if we have tried to be conscious of such issues and will comment upon them when pertinent.

A third consequence is that this review has a particular focus upon issues of methodology. However, this focus is not just a matter of the generic strategy of exploration. We believe that the issue of integrating the concern for users into technological designs above all raises methodological challenges since we need to develop a workable practice that allows this integration.

The design guru Donald A. Norman states that:

> "The proper way to design anything is to start off understanding the tasks that are to be done and the needs of the users. In a kitchen, don't start with the appliances and the counters, start with the people and their needs. This is how all things should be designed, not just kitchens.
>
> What do we do in the kitchen? It isn't hard to discover: just observe some families. Patterns probably differ depending upon the kind of family, but I suspect that there are that many different kinds of usage patterns – a dozen perhaps? That wouldn't be too hard to study and catalog" (Norman 1992: 45).

While Norman is making a very important point about the importance to understand users as a fundament of a proper design practice, he may be interpreted to trivialise what we need to do to provide the knowledge base of doing so. However, observation is no trivial matter and the establishment of needs even less so. Needs are dynamic, not static, and they may come to vary through interaction with new technological options. In this report, we will explore these dynamic qualities and their implications.

Chapter 2 is an effort to unpack the concept of user and to identify some general features of the user-design relationship. This forms a backdrop of chapter 3, which reviews literature concerned with establishing theoretical models of users and the links between users and technological artefacts. Chapter 3 also examines social science research particularly focussing upon energy consumption and issues of energy efficiency.

The concern for methodological approaches is pursued in chapter 4, which reviews more practical experiences of getting users integrated in technological development. Here, we look particularly at experiments of user participation and similar strategies of involvement in design and change management. Chapter 5 is an effort to summarise main findings.

Given the generic strategy of our inquiry into the user issue, we believe that the report may have a more general interest besides serving as a point of departure for further work in the SMARTBUILD project.

CHAPTER 2. THE USER PROBLEM

The patent archives contain many technological designs that never made it to the outside world. Some of the examples are quite puzzling. For example, we know that the QWERTY keyboard originally was designed to slow down typewriting in order to avoid technical failure. Today, there are available alternatives that would make writing easier and more efficient, but they never made it. Clearly, the evaluation of this technology is not made from of its technical merits only. The decisions made to stick with the QWERTY keyboard has been based on assumptions that users would prefer the keyboard they know and master, rather than a new one that would demand retraining and change of habits, given the fact that the relative improvement of efficiency is not that large.

In a way, this story represents a potential engineering nightmare – to have the better idea, without being able to realise it. However, it could also be the basis of a user nightmare – getting new versions of a well-known technology where improvements are marginal compared to the hassle of continuous replacements. The better idea is frequently not good enough to merit its pursuit into realisation. In fact, "better" may only be decided from the point of view of its potential users, since there is no such thing as technology for its own sake.

Thus, as a first approximation, we may describe "the problem of the user" in relation to the development and design of new technologies as providing solutions that are sufficiently attractive to a sufficient number of people, to grant sufficient interest or demand. But what kind of challenge is this?-

The obvious answer is that designers need knowledge about users' needs and that this knowledge should form the basis of the consequent design. From this point of view, the problem of the user is a knowledge acquisition problem. When sufficient knowledge is at hand, design seems to be a matter of transforming knowledge into matter in a way that also satisfies professional standards.

However, design seldom starts with an open search for user needs; it begins with an idea or a design concept. A search for knowledge about user needs is normally not undertaken to radically change the idea or concept, but rather to make minor adjustments. When we think about it, we may quickly recognise that the designer-user issue resembles the matter of the hen and the egg – it is not very meaningful to ask who came first, but often we nevertheless need to do so. In practice, when designing new technologies, the inquiry about user needs may nearly always be replaced by a search for relevant users. Most, if not all, new technologies are not intended for everybody; frequently they are designed for a small segment, a group of especially interested pioneers or an audience of experts. From this perspective, the user problem is rather an exercise in identifying the relevant group of people that presumably is interested in the new artefact. Often, this is what marketing research aims to do, although in the case of intended mass market products, it may be more extensive and complex (see, e.g., Chabaud-Rycther 1994).

Woolgar (1991) shows that an important consequence of this way of thinking may be efforts among designers to configure users, rather than to adopt technology to

people. Usability trials made to test a particular design proved rather to be a test of who would be the relevant users for the new technology. When analysing the results of the test, designers frequently entered into discussions about how "real" users would act, doubting that the people participating in the usability trials could be considered a relevant sample of individuals.

This points towards a third version of the problem of the user. Successful design should provide products that work according to specifications, however, normally this presumes that users operates the artefact in particular ways. If they choose different procedures, the design may fail or act in a way it was not supposed to.

In fact, there are many examples where users corrupt or circumvent the intensions of designers, misuse the technology or simply are unable to operate it in a sensible way. Næsje (2000) retells such a story about some home users of a heat pump that used running hot water to cook potatoes, which was not exactly what they were supposed to do to increase the energy efficiency of the household. Næsje claims more generally that the lack of success of heat pumps in Norway to a considerable extent was due to failure to understand the needs and the practices of potential users.

Thus, the third version of the problem of the user may be labelled the problem of instruction or training: How to make users act and react properly to a given design. How may things be shaped to guide users, and what other guidance, e.g. instruction manuals, is needed? To cope with this challenge, designers need not just knowledge about user needs, they do in fact need to understand user practices and the mental models users may apply when utilising technology.

Too often, designers assume that users have the same mental models as themselves. However, this is a rather doubtful conjecture. For example, Kempton (1987) argues that there are two different folk models of how thermostats work. The first, the feedback theory, is the scientifically correct one: Thermostats turn off heating when they register a given temperature. The second model, called the valve theory, assumes that the higher the thermostat is set, the more energy will flow from it.

In terms of control theory the latter model is incorrect. However, Kempton found than many laypeople find the valve model more adequate and more functional than the correct feedback model as the basis of their management of home heating. Thus, they would turn the thermostat up when they wanted to increase the speed with which a room was heated. There is nothing in the design of thermostats that effectively guide users to think differently, since designers assume that everyone acts according to the feedback theory model.

Norman (1988) strongly emphasise this need to be aware of the mental models of users, as a resource as well as challenge to designers. A lack of understanding of how users think may lead to bad design, because it turns them off or make them use things in different ways or with different purposes than originally intended. An interesting aspect of this challenge is highlighted by Bruno Latour's (1992) concept of programmes and anti-programmes as a way of describing how the relationship between designers and users may become a struggle of who is in control. When designers pursue a programme where a particular design is used to make users behave in a certain prescribed way, users may try to circumvent the design through the development of anti-programmes if they disagree with designers about what kind of behaviour that is preferred. This may lead to a new programme from the design side, which is turn is met by a new anti-programme, and so on.

This points to what we call the fourth version of the problem of the user, namely the usability of designs. The usability problem implies a shift of perspective, to analyse design from the point of view of users rather than from designers' side. Norman (1988) argues that much design has low usability because it renders unclear how the artefacts should be used. A main challenge is to provide things consciously with what Norman calls affordances, which are material aspects that facilitate certain actions and impede others. The ideal is to exploit the possibilities of construction affordances of things in such a way that users clearly may see how the artefacts should be operated.

From this way of thinking, Norman (1988:51-52) puts forward four main principles of good design:

1. *Visibility.* By looking, the user can tell the state of the device and the alternatives for action.
2. *A good conceptual model*. The designer provides a good conceptual model for the user, with consistency in the presentation of operations and results and coherent, consistent system image.
3. *Good mappings*. It is possible to determine the relationships between actions as results, between controls and their effects, and between the system state and what is visible.
4. *Feedback*. The user receives full and continuous feedback about the result of actions.

These principles lead to the following design questions. How easily can one:

- Determine the function of the device?
- Tell what actions are possible?
- Tell if a system is in desired state?
- Determine mapping from intention to physical movement?
- Determine mapping from system state to interpretation?
- Perform the actions?
- Tell what state the system is in?

(Norman 1988:53).

Norman's ideas about usability and principles of good design are very important, but they are confined by his strong emphasis on instrumentality of artefacts. The importance of aesthetics is of course acknowledged, in particular as a designer's ideal and an important impetus to designers' creativity, the latter linked to need to make new designs look different from old ones. However, as we will analyse in greater detail in the next chapter, users' relationship to artefacts are more complicated. As emphasised for example in the domestication model (Silverstone et al. 1992, Lie & Sørensen 1996, Sørensen, Aune & Hatling 2000), when they appropriate new technologies, users need to develop routines for use and to learn about the artefact. However, in addition, they will provide the artefact with meaning and relate it to their identity and their efforts to project this identity to the outside world.

To summarise, we have discussed four versions of the problem of the users:

- *the attractiveness problem*: providing solutions that are sufficiently attractive to sufficiently many users through knowledge of what they want or need.

- *the identification problem*: finding the group of users or the market segment that is relevant through knowledge about differences in terms of needs.
- *the problem of instruction or control*: providing designs that make users act in a relevant manner, utilising options of shaping affordances.
- *the usability problem*: designing user-friendly artefacts by making design understandable and in line with users' mental models of the artefacts.

These are not incompatible ways of defining the problem; rather, they help to highlight different aspects of the challenges.

Another way to understand the challenges of good design is to not that the most common perception of the user is as a costumer with a free choice of products made available through the market mechanism. This *costumer model*, provided by economics, accentuates the user as a fully informed, rational decision-maker who freely chooses the best available product. Its main weakness is its singular emphasis on the act of buying. What happens afterwards is only relevant to the extent that it provides new information to be used next time one buys a similar product.

The limitations of this model is very well shown in Hirschman's (1970) classical contribution where he shows how dissatisfied consumers basically only have three options – exit, voice or loyalty – to just stop to use the product, to protest or to be loyal. The user may be passive or active, communicative or silent, powerful or powerless, but the possibility of communication is under most circumstances of the mass market severely limited.

This inherent communication problem of the costumer model often leads to a situation where designers acquire knowledge by seeing themselves as users. In this way, they do knowledge acquisition by applying some kind of introspection as the basis of design. This so-called I-methodology is surprisingly widespread, and it tends to result in design for technological enthusiast – "collegial products" (see, e.g., Berg 1994). The I-methodology highlights the challenges of providing appropriate solutions to people's needs, of involving users – be they homeowner, workers, customers, or clients – to provide the information needed to make technology work in line with intentions.

Innovation theory has recognised this problem by conceptualising the relationship between designers/producers and users/costumers as a learning economy. A well-working learning economy is found in a situation where forward and backward linkages between users and producers provide users with knowledge about producers' intentions and producers with access to users' experiences through their application of the product and/or similar products. To innovate successfully, producers may depend critically on information from users, and vice versa. This is the basis of the idea of *learning-by-interacting* (Andersen & Lundvall 1988).

Learning-by-interacting is affected by systemic qualities of a given regional or national economy, even by international relations. Channels of communication, codes of conduct, and conceptualisations may develop over time and may also be the object of public policy. Some stability in inter-firm relations is also needed, in order to provide necessary preconditions for the stable forward and backward linkages needed to perform learning-by-interacting (Andersen & Lundvall 1988). While these insights are very important, they tend to be conceived too abstractly to be applicable as a guide to how the user problem may be managed in concrete design situations. Their main audience is policy makers (see, e.g., Archibugi & Lundvall 2001).

However, there are also legal approaches to the problem. The Norwegian Work Environment Act and in particular in most tariff agreements in Norway state that employees have a legal right to participate in the development and decision-making related to the introduction of new technologies in the workplace. In the design of computer systems, which arguably is the most important example of such new workplace technologies, user involvement or participation is strongly advised in the design literature (Sørensen 1998). In fact, such ideas of participation, which resonate strongly with democratic ideals, may be found in many professional fields, including planning and architecture. As we shall see in chapter 4, there is much to be learnt from the experiences from such efforts at workers' or citizens' participation.

Under most circumstances, the most obvious way to formulate the user problem is as a challenge of providing information and requirements that allow designers to formulate appropriate and attractive solutions. From this perspective, the issue is to produce such information and make it available to designers, preferably in a way that allows a rational translation into design specifications. Often, this is seen as a task for social scientists since it is believed that social science methods are suitable to elicit information and requirements from users.

However, there are some very profound difficulties that one may encounter when undertaking such information mining. First, it may be quite difficult to get people to formulate future needs in such a way that it provides a fruitful input. Future users may not know what options that are available, they have little or no experience with these options, and they may tend to answer in ways that they believe may be proper rather than what they really want. The situation may make informants feel that they need to give responses consider rational and logical, which may impose serious limitations on creativity. This may be one of the reasons why computer systems designers frequently complain that users are conservative and anxious about change (Hatling & Sørensen 1998).

Second, people often change their mind, and they may decide to act differently from assumptions just because they like to be unpredictable or different. There are no scientific tools or methods that allow you to predict with a high degree of certainty and robustness what people will do in a given situation. You may make reasonable assumptions that often will turn out to be correct, like how people will vote or how much money they will spend on food the next half year, but even to predict with certainty something so simple as election results has proved to be impossible.

Giddens (1976) has located this inherent instability in what he calls the double hermeneutic circle that exists between producers of knowledge and the people they produce knowledge about. Knowledge producers interpret statements and actions of the group of people they study, while this group in turn interpret the descriptions that are made of them. Thus, one interpretation is interacting with the other, creating something like a positive feedback loop, a technological icon of instabilities.

Thus, we cannot approach the problem of the user as a simple exercise of mapping needs and wishes. We need to approach the issue in a more reflexive manner, through a composite strategy:

- First, we should try to understand users in the best possible way. This may imply efforts to map needs and wishes, but it is as least as important to understand how relevant users approach new technologies and what mental models of the issues at hand that they draw upon.

- Second, we need to try to understand in the best possible way the dynamics of needs and wishes: How may they vary among different groups of users, and how may they change over time?
- Third, and foremost, we need to approach the user problem in an interactive fashion that allows exploration of changes in a concrete manner. Given the fact that one of the most important sources of instability of needs and wishes may be a lack of experience of using the new artefact, this points to the potential fruitfulness of conducting some form of experiments involving users. Above all, it is essential to pursue an open, flexible design strategy that allows for much possibility of change, not just during the development stage but also after the artefact has been brought onto the market.

Because of such consideration, this review of relevant state-of-the-art research has been organised to cater above all for a methodological concern. By looking at different theories of and approaches to the analysis of users, we want to develop a methodological framework for doing better and more relevant studies of how to manage the "user problem" in relation to design of new technologies, in particular technologies related to smart, energy-efficient buildings. There is no ready-made package to be applied; rather we should expect to have to develop a kind of composite approach that draws from several traditions of studying use and users.

Chapter 3 summarises research that is relevant for the way users may be conceptualised, with emphasis on the strategic problem of appropriating new technology. As a part of this, we have provided a summary of research into energy consumption, not the least because this research may illustrate the challenges we are facing. Chapter 4 approaches more explicitly the methodological problem in front of use by digesting a wide variety of experience from involving users in design, development and implementation of new technologies.

CHAPTER 3. THEORETICAL AND EMPIRICAL STUDIES OF USERS

Social sciences were absent from the energy research field until the oil crisis in 1973. The fact that there could be an energy shortage and that the end-users or customers perhaps had to face a future with limited access to energy, resulted in research on many aspects of energy consumption. In this chapter, we will summarise this research and discuss the importance of the role of the user in these studies. However, these studies of energy consumption do not develop any theoretical understanding of the user as such. Thus, the last part of the chapter will address theories about users developed as a part of more general theoretical models emerging from the research into innovation and development of technology.

3.1. Social studies of energy consumption

The main theme within the early psychological research on energy consumption was attitudes towards energy consumption and saving. Research until 1985 focussed on the connection between attitudes and behaviour, using the Fishbein-Ajzen model (Fishbein and Ajzen 1975; Fishbein and Ajzen 1980; Olsen 1981). Several studies were conducted, but the results were contradictory. It proved to be very difficult to predict the linkage between attitudes toward energy savings and actual behaviour, also when one controlled for knowledge and income (Stutzman and Green 1982), and local versus global problems (Brown and Macey 1983). The hypotheses about such correlations were challenged from many areas of research (Ritchie, McDougall et al. 1981; Curtis, Simpson-Housley et al. 1984; Palmborg 1986). Efforts to to measure "energy consciousness" through education, knowledge, information and attitudes did not lead to any established connection between energy consciousness and energy saving behaviour. This type of research faded out in the mid 1980s.

Another area of analysis was evaluation of the effects of different energy prices, different billing systems, the feedback and different governmental actions. Feedback, for example more precise and more frequent electricity bills, proved to have a positive effect on the customers' energy awareness (Blocker and Koski 1984; Stern and Aronsen 1984; Blocker 1985; Hennessy and Keane 1989; Colton 1990; Lövstedt 1993; Wilhite and Ling 1995; Arvola 1996).

Within the same area of research, we find projects evaluating energy costs. Several studies showed that higher energy prices would affect low-income groups more than other groups. The argument was that these groups did not have the money to invest in better houses or better equipment. In addition, these groups rent instead of own their dwellings and thus have less possibility to upgrade their homes (Pfaffenberger, M et al. 1983). The conclusion was that low-income groups would be forced to a reduction in comfort in times of high prices (Dillman, Rosa et al. 1983; Klein 1987).

Another strong trend in the 1980s was surveys of specific energy-related behaviour. Quite a few studies showed significant variation in energy consumption within houses of the same type and standard. How could this be explained? The early studies focussed on socio-demographic variables like income, education and family size, in addition to some everyday life routines. Gaunt (1985) identified indoor temperature and water consumption as the most important drivers of energy consumption. Several other researchers supported her findings (Ilstad and Lund 1983; Jensen 1984; Ilstad and Lund 1985; Palmborg 1986).

To summarise, the period from 1973 until 1990 was dominated by quantitative research, which was based on rather simplistic and problematic assumptions. The research was explanatory rather than explorative. There was little interest in the more symbolic aspects of energy consumption or in developing a general understanding of the user. The latter area of research was in other words poorly developed theoretically. Research was rather fragmented, looking at parts of the problem field like building standards, some everyday life habits, the effect of some specific technologies, the effect of information, the effect of prices, and so on.

Among the results from this period that still hold interest, is that information campaigns are less effective than expected, that the link between attitudes and behaviour concerning energy use is weak, and that low-income groups have few other possibilities than to pay, in times of high energy prises.

There was little research with a lifestyle focus, but the few contributions gave some interesting results. Wilk and Wilhite (1985) analysed retrofitting activities and the effect of these activities on energy consumption. They found that cheep actions like weatherising, were less interesting than doing more extensive retrofitting, even if this would result in less energy saving. Their point was that activities creating "cosiness" and related to the symbolic activity of creating "a home" were more important than saving (Wilk and Wilhite 1985). Their focus on the symbolic aspects of energy use influenced the lifestyle projects that emerged in the 1990s.

Lee Schipper et al. presented in 1989 the article "Linking lifestyle and energy use: A matter of time?" This was a great inspiration for social scientists in the Nordic countries. Also, the importance of social studies of energy policy and energy consumption was gaining more political support (Læssøe 2000). In the late 1980s, the American sociologist Loren Lutzenhiser introduced a theoretical perspective to the field of lifestyle and energy consumption. As he puts it:

> "While it seems obvious that, in the course of everyday life, actors in modern societies are continuously engaged with "energy using" technologies, with the energy systems of buildings, and the social institutions that have grown up around energy use, there are no theoretical treatments of these commonplaces. And, in fact, very little empirical work has been undertaken on the subject" (Lutzenhiser 1988, 1).

As mentioned above, it was during the 1990s that a "lifestyle focus" combined with qualitative methodology became more prevalent in social studies of energy use. There was also a growing interest in the symbolic aspects of energy use and in the need for a differentiation of user groups. To study this, energy consumption had to be studied in an every day life setting, preferably also with a focus on the appropriation and use of energy technologies.

One early attempt to characterise users in a more marked oriented manner was done by Ljones and Doorman (1992). Through a survey registering socio-

economic aspects, housing standard, attitudes and media usage etc, they constructed seven "energy-cultures" (see also Haugland and Ljones 1996):

- the Value Seeker
- the Life Style Simplifier
- the Nest Builder
- the Trouble Avoider
- the Resource Conscious
- the Toiler
- the Idealist.

This type of characterisation of consumers is common in marketing research, but it represented something new in the field of studies of energy use. Still, this study was primarily a "practical" analysis, like the ones conducted in the 1980s. The main purpose was to improve the communication between the energy customers and actors in the energy marked and to advance knowledge about costumers.

A similar Swedish study identified four "energy characters" from a survey examining socio-economic factors, energy saving activities, environmental attitudes, energy knowledge etc. The following groups were identified (Olsson, Wiberg et al. 1991):

- the Moralist
- the Competent traditionalist
- the Collectivist
- the Yuppie.

As mentioned, Wilk and Wilhite discussed energy consumption in the context of lifestyle as early as in 1985. In later studies, Wilhite et al. have done comparative analysis of the meaning of "the home" in Japan, California and Norway. They found a similar interest for retrofitting in California and Norway and that lightning was important in creating what the different inhabitants perceived as "hominess". Wilhite et al. emphasises the importance of understanding private energy consumption and end-user habits in the context of the home. The patterns of consumption are really quite complex. Although technology and economy matters, one has to avoid a deterministic view because cosiness, comfort and aesthetics have greater impact on consumption (Wilhite and Ling 1995; Wilhite, Nakagami et al. 1996). However, these studies did not contribute to a better theoretical understanding of the user.

Another study with a lifestyle focus is Hansen and Læssøe`s (1995) analysis of Danish "green families" and their everyday life activities and experiences. This empirical project discussed barriers and possibilities to construct a "green lifestyle". How policy and technology may support the development of such lifestyles was one of the important questions in the project. The results showed that there are many different ways of constructing a green lifestyle. However, the most common one was to start changing smallish everyday life habits, for instance reducing garbage, and then expand this behaviour in order to establish a special lifestyle. More women than men were active in these processes. Their findings also showed that a green lifestyle was linked to a rural lifestyle. Thus, the paradox emerged that green families developed a more energy intensive transport pattern (Hansen and Læssøe 1995).

These studies were important in setting energy consumption, everyday life and lifestyle on the agenda, but as mentioned, they provided little significant improvement in developing a theoretical basis for social studies of energy consumption and users. This has begun to change, as more recent research have had more explicit theoretical ambitions. These contributions analyse users more thoroughly, and some also systematise user patterns by constructing user typologies.

Susanne Kuehn (1998) has used the theoretical framework of the French sociologist Bourdieu to conduct a qualitative analysis of Danish households, their energy use and their transport behaviour. She states that energy consumption does not play an important role in Danish everyday life. However, there are significant differences within the population, and she has identified a relationship between different lifestyles and patterns of energy use. Her analysis indicates that "the use of energy is related to complex and deep-rooted social dynamics" (Kuehn 1998, 332).

Both upbringing and later experiences are important factors that shape these lifestyles. Working from Bourdieu's theories on the establishment and change of lifestyles, she states that changes in energy use require changes in lifestyles. This is difficult and takes time. She also emphasises the need to focus on the "material" frames, for instance location and size of our homes. An interesting aspect of her research is that what we have thought of as typically Norwegian pattern of energy consumption also is a Danish phenomenon. Maybe it is a myth that the Danes are more concerned about their energy use. They use less electricity, but this may probably be explained by a different heating system.

Aune's (1998) analysis of Norwegian energy consumption patterns came up with similar results. This is a study of "the home" as well as of everyday life. The research showed that Norwegian everyday life generally is performed without much reflection about energy consumption. Energy consumption, stationary as well as non-stationary, may be viewed as dependent on our understanding of comfort. However, comfort is interpreted in many different ways. Thus, as people's views of comfort differ, so do their patterns of energy consumption. A way to systematise and illustrate these differences is by constructing a taxonomy of "energy cultures". According to Aune, the following energy cultures characterise Norwegian consumption pattern:

- "The self-indulgent", who do not reflect on energy-consumption at all and let everyday life activities direct their consumption pattern.
- "The soberly indulgent" who have no thoughts about energy use, but still represents a low consumption pattern mainly caused by small apartments.
- "The hesitant environmentalists" (could also be called the "shameful indulgent") who really are engaged in energy and environment issues in many ways but who do not use less than the group that do not care, often because they live in a big detached house.
- "The environmentalists" who show an engagement towards environmental questions and/or have a clear opinion against consumption waste (however not always explicitly towards energy questions). Their attitudes and behavior are relatively coherent.

This taxonomy of energy cultures illustrates how practical, symbolical and material conditions are woven together in the frame of everyday life, and how energy consumption is a result of this web of activities, values and material conditions. It is

important to communicate with the consumers when developing strategies for changing/reducing the private energy consumption (political action as well as technological development). Traditional socio-demographic variables like income and education do not seem to explain much of the differences in energy consumption. To act as if consumers are rational actors and thus mainly focus upon the price of energy is thus a mistake.

A recent Danish study supports the findings from these two projects (Jensen 2002). This research combines quantitative and qualitative methods, and its theoretical point of departure is strongly inspired by Bourdieu's theory of lifestyles and taste. The analysis shows that there is a significant variation in energy consumption between different housing areas. The size of the houses and the age and number of the inhabitants explain much of the differences. The same variables also explain the considerable variation between the inhabitants within the same area. A conclusion is that variation in energy consumption is not significantly correlated to traditional social variables as income and education. The effect of income is through the size of the house (as in Aune 1998). The project also supports previous findings that the connection between practice and attitudes is weak. A main conclusion is that to reduce energy use, it is efficient to support actions that raise the standard of buildings through retrofitting and by offering relevant energy saving technologies.

Another area of research concerned with energy use and everyday life is projects dealing with energy technology and end-users. These projects belong within a "social studies of science and technology" (STS) tradition and have a theoretical as well as an empirical ambition. These projects have interested in the impact of different strategies of appropriating and integrating various energy technologies or energy services into everyday life. They have in particular focussed on water-based floor heating, systems of ventilation and a technology for managing electrical panel heaters.

Economical factors are believed to be very important when households invest in energy technology. However, a study by sociologist Gry Kongsli (2000) shows that end-users are motivated by a number of factors when they decide to invest in a water-based floor-heating system. In her investigation, the end-users emphasised the pleasant and comfortable warmth that water-based floor heating supposedly could provide. They also stressed the fact that water-based floor heating systems provide a healthier indoor climate than other heating systems. Energy flexibility was also important. The end-users considered water-based floor heating to be flexible, in relation to choice of energy source as well as to controlling temperature. The cost of the system was of less interest.

Another finding was that the installation and use of such systems proved to be considerably more complicated than initially indicated by available information and advisory services. End-users found that specialists and professionals had poor knowledge about the subject matter. However, end-users were satisfied with the results, and in many ways they felt that their expectations had been met. Still they felt that the process had been difficult and quite challenging. It should be noted in relation to this that all end-users in the study were technically interested and had considerable technological competence. This interest and competence were very important as a resource to make the initial decision as well as to carry through the tasks of implementing water-based floor heating (Kongsli 2000).

Rohrachers study of the integration of balanced ventilation systems in buildings is also a contribution to the understanding of end-users. In his project, the

integration is analysed as a transfer of a well-known product into a new cultural and technical context, which implies the shaping of a socio-technical system. The analysis shows that the functionality of the technology depends on how it is integrated by the end user. The project also focuses on the importance of communication and learning among all the different actors in this process (Rohracher 2001).

In Aune's (2000) study of the Ebox, a technology developed to monitor and administer residential electrical equipment, the focus is both the integration process as well as the network of actors, represented by the utilities, which is created in the process. The Ebox involves two parties; the house owner and the network owner. The house owner has, through the Internet, control of every technological device that is connected to an Ebox. This gives him/her the possibility to plan and manage the use of electricity, for instance indoor temperature. Because the electrical devices are accessible through the Internet, the owner of the electricity network may monitor the details about as well as the total amount of electricity used in a certain area. In agreement with the customer, the network owner may control the load factor by taking over the private energy management for a short time.

The users' experiences are analysed as different domestication strategies. This study is also exemplifies a way to characterise user groups, or modelling users. Analysing previous habits, attitudes, age, technology interest and competencies, users are differentiated into three groups:

- The enthusiast
- The sceptic
- The democratic participant.

The Enthusiast thinks it is important to make an effort for the environment. She has always been conscious of using electricity in a sensible way and has either controlled the indoor temperature manually or with a timer. The Enthusiast thinks that the Ebox represents something new and interesting. She does not need a 'reward' for using the Ebox because she finds that the environmental argument is sufficient. She is however sceptical about paying for it, since it also represents an advantage for the utility. The Enthusiast will not experience significant changes in energy costs or temperature by using the Ebox, because consumption has also been controlled previously. She may however, obtain a higher comfort-level. She does not necessarily have computer skills.

The Sceptic may participate in a project like this, but wants something in return for using the Ebox. She either wants reduced grid-access costs or other compensations. And of course, she thinks that the Ebox should be for free. The Sceptic has not controlled the indoor temperature earlier, but is willing to try. However, it is very important that the Ebox works according to the aims, and she demands to see specific results. The Sceptic may get significant advantages by using the Ebox, if it is used and works according to the intentions. Thus, she may develop into a loyal user if the advantages are evident and the technology works as intended. The Sceptic has computer skills and Internet access.

The Democratic Participant does not think that the Ebox or the project is useful as such, but she participates because others do. After examining the project for a while she thinks that it is all right to participate, but the Ebox remains a foreign element in the house. She is not particularly concerned with new technologies and has no computer skills or Internet access. She is of course unwilling to pay for the

Ebox. If she has not controlled the temperature previously she may experience reduced electricity costs.

The results exemplify the possibilities of a flexible understanding and use of a specific technology. This means for the Ebox as well as for other energy technologies marketed towards the household sector that information, supervision and support must be tailored to fit various user groups. Different users need different levels of information and support.

Trust and functionality also proved to be important to achieve a successful domestication in the Ebox project. The users that mistrusted the intentions of the utilities were negative from the start. Many of the users were positive, however, for different reasons such as responsibility for the environment, curiosity or just a general interest in energy saving. As for functionality, the experience was that the device itself as well as the network that is part of the technology must be easy to operate and work as expected. This is necessary to maintain a positive attitude and the necessary amount of enthusiasm amongst the customers (Aune 2002).

The understanding of users' contact with and the function of utilities is further developed in Ketola's (2000) study of the Swedish electricity market. This is a cultural analysis of energy use and the end-users' relationship with electricity utilities in a re-regulated market. The project demonstrates that the re-regulation of the market has created new attitudes towards the end-users within the industry. The customers experience a "bombardment" of information and advertising from various suppliers of electricity and other actors in this market. The results also show that customers have problems in understanding the new organisation of electricity supply, and only a few bother to change their supplier. The attitude towards electricity amongst end-users is that this is not an ordinary commodity, but something that should 'run by itself' (Ketola 2001).

The last decade of research efforts has provided us with new insights into the dynamics of energy consumption, above all a more differentiated picture of energy consumption in relation to lifestyle. One way to illustrate this variation is through the segmentation of users or construction of different user groups. Even if the different models of users presented above are closely related to the actual empirical studies, this represents an effort to provide a more general conceptualisation of the user in energy research. However, these projects demonstrate as well the lack of a "theory of users". To get a better theoretical understanding of use and users, we need to turn to different contributions.

3.2. Conceptualising users. Contributions from the sociology of science and technology

Research on innovation in the 1960s and 1970s perceived the process of innovation as a linear process that began in basic research, continued through applied research and development work, to end in a more or less unproblematic phase of diffusion. It was assumed that a product was used in accordance with its design, and that this use had the anticipated consequences. In a manner of speaking, the consequences were inherent in the product.

The new sociology of technology that emerged in the 1980s, corrected this view through empirical analysis of concrete cases of development of new technologies. Innovation proved to be a much more messy business, and diffusion was shown to be a rather misleading metaphor for the complexities related to the

appropriation of new technologies. In the following, we will give a short outline of how three of the most important theoretical perspectives that have emerged from this effort, treat the role the user: the SCOT (social construction of technology) model, the translation model and the script model (Bijker and Pinch 1987; Latour 1987; Law 1988; Akrich 1992).

The SCOT model grants the users an important role in the innovation process (Bijker and Pinch 1987). It states that a successful innovation depends on its acceptance from a sufficiently powerful user group, also labelled as *a relevant social group*. SCOT operates with a multidirectional innovation model. Its basis is that a given technology may be interpreted differently by different user groups and that controversies may emerge around a technology in an early phase of its innovation, related to the meaning and function of the technology. The *closure of such controversies* takes place when the stronger or more powerful relevant social group define and accept a given idea as the basis of further development of the technology. From a SCOT perspective, we know that the artefact in principle could have been imbued with a different meaning and thus followed a different path of development and consequent use. Further improvements of the technology are directed towards the requirements of this specific relevant social group. To understand this process, one has to study non-successful as well as successful innovations in the making and consider the reasons for success or lack of it. When technologies are readymade, the controversies are closed and the outcome appears as a "natural" development because the "best" solution had succeeded. Thus, it is important to study innovation in its early stages (Bijker and Pinch 1987).

The translation model has the same non-deterministic perspective but emphasises other aspects of the innovation process (Latour 1987). The concept of *translation* refers to the processes were actors seek to get support for an intended technological development. The idea is that technological innovation is *socio-technical*, in other words a social as well as a technological process. According to Latour, the success of a technology depends on the ability of the developers to recruit a *network* of supportive actors. The stronger the position of the actor the better it is. Translation is performed by using different strategies to enrol and mobilise these different actors, based on defining a common challenge and interest in finding a solution. This gives the engineers an entrepreneurial role in the innovation process, a role that cannot be fulfilled unless users of the innovation somehow are brought on board.

Latour has also tried to conceptualise the "meeting" of users and artefacts. Here, he suggests the concept of *delegation* as important to confirm the role of technology in social arrangements. Many innovations occur through initiatives to delegate routine actions to technology, and this may be a way to manage human behaviour and relations. Technology is often rendered invisible, and users do not have the impression of co-acting with a technological artefact. This makes technology even more effective in its affordances of human action (Latour 1988, 1992).

The script model is a related way of analysing the user. Akrich (1992) has developed a theory based on the need to analyse design as *scripts.* Through the design the producer try to guide or force the user towards a certain way of approaching a technology and developing a user pattern. As Akrich puts it: "Designers thus define actors with specific tastes, competencies, motives, aspirations, political prejudices and the rest, and they assume that morality,

technology, science and economy will evolve in particular ways. A large part of the work of innovators is that of inscribing this vision of (or prediction about) the world in the technical content of the new object" (Akrich 1992, 208).

The script describes how a potential pattern of behaviour is tied to the design of the technology. A strong script suggests a certain kind of use, while a weaker script suggests a larger degree of flexibility. A washing machine is for example provided with a quite strong script. You choose a specific programme, and the machine takes care of the laundry, if you know how to operate it.

The three models presented here all represent a dynamic non-deterministic view of technological development and diffusion. However, the main focus in these models is technological design and how users interpret and choose to accept or reject an artefact. To get a better understanding of the processes that takes place when the user develops a user pattern we will in the last section of this chapter introduce one more model that try to capture the processes going on between an artefact and its user; the domestication model that was briefly introduced in chapter 2 (Silverstone et al. 1992; Aune 1992; Berg 1996; Lie and Sørensen 1996; Aune and Sørensen 2001).

Domestication is on the one hand an analytical perspective that reminds us to include the 'social innovation' in a study of technology in society. On the other hand, it is a practical concept linking the practical, symbolic and cognitive processes that take place when a product is integrated into a household. In other words, people actually domesticate a technology—they place it, learn to use it, fit it into their routines and give it meaning—or they reject it. These activities may vary from person to person, from group to group. Thus, the discussion is not about effects of technology, but of the development of different user patterns in 'negotiation' with the technology.

However, the concept of domestication captures more than the practical actions and symbolic meanings related to an artefact. By studying participants and processes, it is possible to achieve insight into the possible changes that take place in relation to the technology: "What is constructed through domestication may be understood as micro-networks of humans, artefacts, knowledge and institutions (Sørensen, Aune & Hatling 2000: 241). The challenge to be pursued through the application of the domestication model is to conceptualise users in such micro-networks, in the details of everyday life activities.

3.3. Consumption studies

A related approach to the study of users but with a different emphasis is found within consumption studies. Consumption has been researched in particular within the framework of cultural studies (Keat, Whitely et al. 1994). Early efforts in the late forties and early fifties had a distinct class perspective on consumers. Mass production was providing people with cheap goods, thus creating mass consumption. The result of this enormous growth in consumption resulted in a homogeneous mass culture, which was threatening individuality and creativity (see, e.g., Adorno and Bernstein 1991). From this perspective, consumers were perceived as passive and without a will of their own. In short, they were victims of market forces and seduction.

This pessimist view has been superseded by approaches that emphasise that consumption also should be seen as a creative act, whether or not you deal with a

mass product. Even a mass-produced good will, through the process of appropriation and use, be transformed into something personal and private:

> The most important such mechanism in modern society is the control of meaning. The authority of the producer is sustained by the capacity to define the meaning of the objects and transactions involved, and is correspondingly lost as consumers acquire that capacity. Such an outcome is especially likely in a society in which consumption is organised around images and life-styles, and where active consumers perpetually re-work the meanings of what they consume (Keat, Whitely et al. 1994, 7).

The perception of consumers as active and creative is dominant in recent theoretical studies of consumer culture (McCracken 1988; Fiske 1989). McCracken (1988) have analysed the procurement of things and described different phases that the user and the product go through together. In the end, a product is what we would call domesticated. Consumer studies also emphasise the links between consumers and producers, links that affect the domestication but also further designs. To designers, it is important to be informed by new ways of producing content, meaning and practice among consumers because this has to be taken into consideration when making new models or products. The swift changes related to products made for adolescents, such as clothes, mobile phones and computer-games, highlight the importance of such links.

Research shows that artefacts change in the hands of consumers. They do not relate passively to the products they buy; rather, they are active in both procurement and use (McCracken 1988; Keat, Whitely et al. 1994; Berg 1996; Lie and Sørensen 1996). These changes have symbolic as well as practical sides. Design of new technologies cannot ignore the importance of this dynamic situation. In fact, on the one hand, this dynamic shows the problem of trying to describe user needs as something stable. On the other hand, it emphasised the need to provide users with designs that they may experience as malleable and able to develop together with users.

3.4. Summary

The user problem has become an object of interest in energy studies the last 30 years, but with changing emphasis in terms of the way that users are understood. This research has provided us with insights into the effects of different energy saving measures, about the effects of energy related behaviour, the effect of diverse prising systems, but especially the complex network of habits, attitudes, behaviour, comfort, and material frames that construct private energy consumption. One way to grasp this complexity is to summarise these different aspects into ideal-types as "energy cultures" or "lifestyle groups". This can be clarifying but somewhat inflexible. Life changes, kids grow, you buy a new house, you retrofit, energy prices double, new and better technologies reach the market, etc. All these social and structural changes will effect everyday life and modify energy cultures. Thus, theoretical models of the user may give better insights when we approach the "problems of the user".

In this chapter, we have presented four such models. The SCOT model perceives the user in collective terms as a part of a relevant social group that shapes the dominant interpretation of a given technology and, consequently, the shaping of the technology itself. The translation and the script models view the user as an entity that designers try to direct, but also as an active actor that sometimes is opposing

designers' efforts to control use. Finally, in the domestication model, the user is seen as an active agent in the process of making social innovations – innovations that are supposed to cater practical as well as symbolic needs.

A common feature of these models is the emphasis upon the fact that users' requirement and actions cannot be identified once and for all. They are dynamic properties. Thus, when searching for user-friendly and user-attractive designs, we need so-to-speak to invite the user into the innovation and design process. We may benefit from updated knowledge about users every time a new technology is being developed or a new building is being built. However, when we know that users' needs and wants are dynamic, we need to consider possibilities of engaging in a more interactive relationship between design and use. This may be pursued through social experiments and efforts to get users to participate in development and design. Therefore, we now turn to this literature.

CHAPTER 4. USING DESIGNS AND DESIGNING USES. MOTIVES, EXPERIMENTS AND EXPERIENCES FROM THREE DECADES OF USER INVOLVEMENT IN DESIGN

Linear models of technological innovation and diffusion are still going strong. However, it is safe to say that more complex conceptions represent the state of the art. These include user activities and stress the manifold mutual influences between use and design. As we have seen in the previous chapters, particularly within the field of inquiry of energy supply and consumption the end-user as actor is conspicuously absent.

For a while, we will now leave both energy studies and theoretical discussions on use and design to look at approaches in several fields that seek to achieve user involvement into design at a practical level. Their initiators, often practitioners, are convinced that user involvement yields 'better' results, both in terms of function (usability, productivity) and ethics (democracy, justice, aesthetics). Accordingly, the motives to use such methods are also related to the experience that a particular piece of technology simply does not work, as it should. Users resist, are just rejecting the use or even destroying the technology, be it deliberately or unintentionally through wrong operation.

Above all in Scandinavia, but scattered throughout the world, as early as in the 1950s, the first experiences were accrued in practical trials and theoretical considerations drawing on a broad variety of sources and setting different accents. In this chapter, we present lessons from some fifty years of user involvement in software systems design, architecture and city planning, technology assessment, and action research.

To being with, it is important that these practices all along have been fuelled by a democratic concern. The main idea has not been to improve the conditions of designing new solutions, but rather to empower users, be they workers, citizens, inhabitants or what social role they may have. Under some circumstances, efforts to facilitate or increase participation have been made in collaboration with social movements, like trade unions, citizens' initiatives, or environmental organisations.

In this effort to provide a methodological overview, we will not enter into a discussion of the political issue related to participation and the role that political considerations have played in the development of such practices (see Sørensen 1998). However, we should not forget that that participation, to the extent that it empowers users, may have political effects, and that the ideals behind participatory practices do have political roots, either in ideas of participatory democracy or in the labour movement.

4.1. Software systems design

How the user is conceived within system development can roughly be categorised by the degree to which s/he is granted influence. This has far-reaching consequences for the whole process of design, construction, and implementation of the system. We may distinguish between three groups of, respectively, restricted, weak, and strong involvement. The first bundle of approaches restricts user influence to clear-cut 'stages' of the process, whereas the other two groups because of pragmatic or political reasons assess user involvement as vital for large parts or even the whole process.

Within the first group of approaches with the weakest level of involvement, the user is mainly present as customer and/or as a human factor. The customer has to be satisfied, which nowadays in every design methodology means that at least some kind of "enhanced user performance" (Microsoft White Paper) as outcome of the system design has to be secured. This is often presented as trade-off, because customer satisfaction is defined as "to meet budget and time goals" (Microsoft) as well as to sell a working system that is usable.

A common characteristic of user involvement in this group is its limitation to clearly defined stages of the design process, often at the beginning, like in the Application Development Methodology (ADM) "The User Design stage produces a detailed system area model, an outline system design and an implementation plan"[1] or at the end as "user acceptance testing".[2]

Joan Greenbaum and Morten Kyng call this formalised involvement the reduction of human actors to "'cut-and-dried' human factors" (Greenbaum and Kyng 1991, 4). With Winograd and Flores (1986), they refer to deeply rooted rationalist practices of Cartesian problem isolation and objectivation to explain the persistence of approaches, which largely rule out user intervention (Greenbaum and Kyng 1991, 8).

Above all pragmatic arguments lead to a critique of approaches introduced in the first section (Greenbaum 1993, 34). Its most important motive is the diagnosis of too many failing systems. After thirty years of experience, still a startling number of projects turn out to be complete failures (Greenbaum and Kyng 1991, 7). A Microsoft White Paper from 1999 refers to a study, which reports about 30 percent of complete failures. Weak involvement implies the accept of the necessity of at least some 'sensitivity' for user concerns, which reaches out of the confines of formalised stages of the design process:

> The system building professional must initially develop a sensitivity for these concerns, and then later, form a strategy for reducing their effect. In many cases, this can be achieved through continual, sustained client involvement through each phase of the development process.[3]

Jonathan Grudin (1993) lists four forces, which besides this need for an enhanced awareness of user needs contribute to increased involvement of users. First, new user groups from cultures different from the system engineers increasingly use

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[1] http://sysdev.ucdavis.edu/WEBADM/document/stage11rad.html

[2] Princeton Development Methodology, http://webware.princeton.edu/dms/public/methodology/-dev/routebos.html

[3] Vision Based Methodology, http://www.itmweb.com/essay007.htm

computer systems. Second, application areas are maturing, which means that among many competing products fine-tuning becomes more important. Finally, with increased implementation of systems in collaborative environments (keyword: groupware), the social context of the system use becomes more important. These developments together with the urge to enhance the overall success of system development already in the mid-1980s leads to approaches, which accept the importance of a systematic study of human-computer interaction (HCI) and an appraisal of usability and user friendliness.

The outcome of the concern for the 'cognitive interface' is the implementation of functions, which are not directly related to the primary aims of the system, for instance command confirmation, undo functions, the correction of misspelled commands, 'your turn' signals, 'forget it' commands, 'enough' commands, default keys, and help facilities (Nickerson 1986, 149-51). At this time also new design principles are stated, like that designers must understand who the users will be, that a panel of users has to be involved, and that simulations and prototypes should be tested early by the users in iterative designs (Gould and Lewis 1983). With the keyword usability, aspects like learnability, efficiency, memorability, errors, and satisfaction (Lund 1997) are introduced, which are way beyond mere functionality and reach out into the life-world of the users and the 'situatedness' (Greenbaum and Kyng 1991, 9) of their experiences using the system, because usability is not a characteristic of the system but a function of users employing the technology (Holtzblatt and Jones 1993).

In weak involvement, it is accepted that users have to be provided with feasible functionalities that support them. These functions interfere with other functions of the system. In contrast, strong involvement focuses on the whole system as an area of user involvement. In addition to pragmatic arguments similar to the ones presented above, when we have strong involvement, democratic motives play an important role. Joan Greenbaum and Morten Kyng stress the importance of the concern for the quality of work affected by software systems, above all de-skilling of work is feared (Greenbaum and Kyng 1991, 10-13). This leads to an explicit concern for questions related to the control over design, which is seen as equivalent to control over work organisation (Greenbaum 1993, 28). Common convictions in this strand of 'strong involvement', which is rooted in the Scandinavian tradition of participatory design, are summarised by Joan Greenbaum and Morten Kyng (1991, 3) as:

- Design with full participation of the user (requires training).
- Enhance workplace skills rather than degrade.
- Systems are tools that have to be under control of those that are using them.
- Enhance quality of output instead or additionally to quantity.
- The process is a political one and involves conflict.
- Use situation as fundamental starting point, integrate the user into the system or translating between the worlds.

A broad range of problems is connected to this far-reaching programme. They evolve from the redefinition of expertise within the system development process. The users become experts not replacing the developers, but being equally important (Schuler and Namioka 1993). Awareness for the difficult mutual transfer of knowledge is the result as the developer has to find ways to learn about the unique knowledge of the user in his or her use context and in turn, the user requires support

in understanding system development. This not only touches a well-known problem of user interface design, the question how users can understand the 'designer model' inscribed in the interface (Norman and Draper 1986; Lund 1997). Moreover, a common practice has to be invented, translating both worlds with their languages into each other. Practical methods were tested to achieve this, like future workshops (Kensing and Madsen 1991) and the simulation of systems through mock-ups (Ehn and Kyng 1991). The techniques tested here were meanwhile successfully introduced into methodologies that rather belong to the weak involvement camp. Above all the need for constant iterations of user tests and 'tailoring in use' (Henderson and Kyng 1991) may be found in mainstream approaches.

The strong programme presented here can be used to show the external restrictions of user involvement into system design. Above all the insight that power structures frame the possible degree of participation is important. For instance, Joan Greenbaum (1993, 31) stresses the importance that one from the very beginning fosters an environment where users are encouraged to express their ideas and needs. However, an environment in which users (e.g., as workers) keep their ideas and needs to themselves in a rational reaction to the conditions under which they use (work), immediately rules out any benevolent effort of participatory design. This crucial precondition becomes out of reach of the design process.

Another open issue concerns the complexity of power relations, which is not sufficiently captured when opposing managers, developers, and users. Although proponents of the strong programme acknowledge that users are a heterogeneous group with specific competences (Greenbaum and Kyng 1991, 3), the differences in access to power resources outside the development process are not taken into account. Similarly, one might argue that the group of developers might be extraordinarily heterogeneous as well, consisting of persons from different backgrounds reaching from the retrained social worker to the trained engineer. The appraisal of conflicts *within* the participating groups – among managers, users, and developers – leave a blurred notion of participation. Who exactly should be empowered against whom in order to be able to participate?

Finally, the creativity of users may be underestimated in approaches that focus on the increase of user participation. Manifold practices of appropriation of technologies are creatively reshaping systems without any methodology or involvement of designers. The 'exit' option – the quiet denial of the use of a system, maybe also of participation in its design – as extreme case of 'redesign' might be a viable strategy, which is at least partly responsible for high rates of failures in system design indeed.

One answer to this threat, which acknowledges the heterogeneity of the contexts and individuals involved, consists in so-called 'agile' or 'light-weight' methodologies. They are marketed for instance as XP (Extreme Programming), DSDM (Dynamic System Development Method), FDD (Feature Driven Development), Scrum, or ASD (Adaptive Software Development) and became increasingly popular during the second half of the 1990s. A common ground of these approaches may above all be found in their focus on adaptability, which includes explicitly the unique characteristics of all individuals that are in play. In agile system development, ideally a minimal system goes productive in an early stage of development. From there, in dense iterations of testing and developing these 'people oriented processes' (Fowler) provide the customer with finer-grained control over the product. This concurrency of use and development was perfected in the so-called

Open Source software development that after all resulted in the only operating system that really challenges Microsoft's quasi-monopoly with Windows. The crucial principle 'release early and often', first practiced extensively by Open Source software engineer Linus Thorvalds, might be the future of user involvement. Another important principle of Open Source methodology summarised by Eric S. Raymond (1999), states that:

> The development starts from a 'common itch' of all involved parties. Both prospective users and developers are unified in the wish to achieve a certain goal. This motivation is the key to an understanding what keeps the participants to stay with the process and taking responsibility for the outcome.

If we follow Gisle Hannemyr (200x) and consider Open Source development to be a system development methodology, then an extraordinarily successful involvement strategy is described. Users are highly motivated to join and are in turn rewarded with participation in a dense net of testing and feedback.

4.2. Participative Architecture

In 1986, a seminal contribution to the emerging discipline of the study of human-computer-interaction (Norman and Draper 1986) was introduced by Kristina Hooper (1986) who extensively used the metaphor of user interfaces as buildings. To compare fabricated physical environments with immaterial ones is in fact compelling. Hooper maintains that learning from efforts to create functional and pleasant buildings may inform designers of computer interfaces, mostly by introducing awareness for complexities, which otherwise may be naively dismissed. It is true that within the profession of architects and city planners, experiences in user-friendly design exist that reach back into the beginning of the 20th century, has resulted in a rich depository of lessons that we may draw on.

However and perhaps not surprisingly, when we have a closer look at efforts to create 'user-friendly' dwellings and cities, this reveals different scopes in terms of the involved persons and institutions, the material conditions of the design process, and the guiding principles. In this section, I will discuss two of these groups, architects and city planners and their respective perspectives on the user of buildings and cities. Like in the section on systems design, how users are conceived and the efforts to involve them into the design process, is particularly emphasised.

The way in which the history of architecture is written, resembles in many respects art history. Outstanding buildings and their architects are celebrated in their 'auratic singularity' (Walter Benjamin). Even though the building of dwellings is a collective enterprise that involves a broad range of actors, the architect and his or (very seldom) her name is the one connected to the quality of the building(s). Thus, in the first place, a search for user-images in architecture leads to these outstanding architects and their ideas.

In a traditional view on the end-user, s/he may appear as a costumer, very much in the way critiqued in Allan Jacobs and Donald Appleyard's 'New urban design manifesto' from 1987: "Quick surveys are made, instant solutions devised, and the rest of the time is spent persuading the clients" (Jacobs and Appleyard 1996, 168). More often these clients are intermediary bodies, sponsors and investors or, in

public housing, the authorities. Then the end-user plays no role at all or only in an aggregated form as a market that has to be studied by employing market research.

However, a handful of architects programmatically define their role completely different. Architects like Christopher Alexander, Ralph Erskine, or Lucien Kroll seek beauty through participation of the end-users. Their guiding principles are similar and so are the consequences they encounter when trying to realise their far-reaching goals.

One common trait of their programmatic writings is the struggle to achieve 'the quality without name', which is "some essential ingredient missing from artificial cities" (Alexander 1996, 119), and which they claim to find in grown communities of pre-industrial times. Newly built environments shall become "complete and proper 'places for living': useful, compassionate places" (Erskine 1982, 647), characterised by "'belonging' or possession in the true emotional sense" (Alexander 1992). A design principle to achieve this end is for instance Kroll's 'architecture of complexity', which seeks to respect the daily needs of the inhabitants by reintegrating spheres, which were torn apart in rationalising architecture (Erskine 1982).

But most importantly, the participation of the future inhabitants is considered as useful in order to reach 'the quality without name'. This has far-reaching consequences for the whole design process; above all the complete redefinition of the architect's role becomes necessary. S/he becomes someone providing a service. In the famous case of the reconstruction of a former slum area at Byker in Newcastle upon Tyne, Ralph Erskine even relocated his office to the site. With the inhabitants looking over the shoulders of the architects the possibility was offered to immediately influence the process. Christopher Alexander (1992) recounts another participatory episode from a project located in Nagoya, Japan:

> I had a remarkable experience with some of the families .... I gave a group of about 7 or 8 people a piece of paper and told them: Here's 6 meters by 12 meters. Put what you want on it. It didn't take very long for them to put down what they thought would be an ideal world. This was not for the real thing -- it was just to make sure it would work out comfortably for people. Two of them were openly weeping while they did it. These were people who had been living in mass housing in Nagoya. It was unthinkable to them that their ordinary necessities could be put into a building in such a direct way ....

From this initial impact on future users a long way is to go to the finished building. Lucien Kroll describes the attitude necessary in this process, which

> … receives and transmits, not wanting to master everything, but to allow some things to remain obscure, apparently irrational ... . It is not rational, but it is reasonable. It promises then, a much better understanding of a reality that is fluid, moving and unknowable. To allow things to happen themselves is much more efficacious than to prescribe everything (Lucien Kroll quoted in Ellin 2000, 178-9).

The particular rationality of the expert is confronted with crying future tenants and 'obscure', undeterminable parts of the otherwise rational process. This fundamental change of the role of the architect, which is described and demanded here, bears a strong resemblance with the critique of rationalist practices of Cartesian problem isolation and objectivation, which was voiced by Greenbaum and Kyng

(1991, 8) in favour of participatory software design. The special about the critique in architecture is that the architects try to reconstitute 'the quality without name', a transcendent beauty, which in their view was lost in the rationalisation of their trade.

Besides this, a strong 'pedagogic Eros' is driving the architects presented here. The common conviction is that in the process of participation the users identify themselves with the resulting physical environment, which then in turn improves their everyday life after they move into their new homes. Democratisation as a motive for participation, with which we became acquainted in participatory software design as well, here comes as national education, with a strong emphasis on the "exceptional responsibilities for all who partake in building our environment" (Erskine 1982, 643). Ralph Erskine summarises the virtues of user involvement:

> ... the pedagogic aspect of the exercise [of participation] is most important. This is especially so with the underprivileged who need exercise in the process of abstract thinking, of analysis, problem solving, and decision making, if they are ever to free themselves from their position of underprivilege and become truly valuable and valued citizens who make effective contributions to a modern society and thereby moreover gain in self-respect (Ralph Erskine quoted in Collymore 1994, 14).

Similar to other areas of participatory design the redefinition of the expert's as well as the user's role is a problematic venture. In the case of architects, the gulf between users and designers is maybe even broader. It is in fact difficult to find independent evaluations of buildings and settlements designed in a participatory manner. More often, the architects themselves revisit the sites and praise their achievements. Taking their judgement as accurate, at least some successful instances exist (e.g. Fisher and Alexander 1991; Hester 1993).

However, there are also appraisals based on more objective grounds. For instance, Nan Ellin's (2000) evaluation of the participatory experiment in Vignes Blanches close to Paris relies on in-depth interviews both with the architect Lucien Kroll and the inhabitants. She concludes by referring to two sets of 'crossed purposes' in Kroll's work, which can be considered as being representative for the kind of architect described here. First, Kroll wants to include inhabitants into the design process and build what they want. At the same time, he is seeking to achieve a particular aesthetic impression of grown older villages. What if the inhabitants do not share his aesthetic ideas? Indeed, there has been disagreement and the rhetoric of participation then immediately changes into the pedagogic attitude when he justifies authoritarian decisions with the future inhabitants' repressed 'urban instincts'. They were spoiled while they have been living in poorly designed places and the instincts have to be exhumed (Ellin 2000, 181).

A self-critical assessment by Ralph Erskine refers to another problem of participatory architecture: "These projects are largely 'dead' during weekdays and become weekend places at weekends and the essential richness of life has not arisen" (Erskine 1982, 647). The impact of physical environments on everyday life may be extraordinary, however, there are structures and framing conditions, which in this example turn out to be even stronger. Evoking visionary places filled with the 'essential richness of life' then becomes impossible because of work-hours and their structuring force.

Besides architects, another professional group has stakes in participatory architecture. Since the early 1960s, city planners and cultural critiques increasingly

voice their concern about liveable cities. Kevin Lynch's 'The image of the city' (1960) – inspiring generations of city planners – discovers the 'legibility of the city' as most important feature of a 'beautiful city'. This 'legibility', he maintains, determines the well-being of the inhabitants, who should be able to orient themselves using landmarks and basic shapes (lines, angles). Here the users come in both as most important source of first-hand knowledge about liveability, and as changing agent: "He [the observer] should have the power to change that image to fit changing needs" (Lynch 1960, 6). This has implications for the way a city is conceived. City planning becomes a work in progress: "... what we seek is not a final but an open-ended order, capable of continuous further development" (ibid.).

Nearly thirty years later, in 1987, and clearly in line with Lynch's programme, Allan Jacobs and Donald Appleyard published their 'New urban design manifesto' (1996). With this title, they alluded to Le Corbusier's and the International Congress of Urban Architecture, CIAM's, 'Charter of Athens'. Published in 1933, the charter represents the essence of modernist city planning. Jacobs and Appleyard critiqued modernism's gigantism, it's large-scale privatisation that was leading to the loss of public life, fragmentation, and the destruction of valued places.

Instead, they demanded, a city should be liveable, it should provide identity and access to opportunity, imagination, and joy, and it should be authentic, nurturing community and public life. Besides the fallacies of aesthetic modernism, they blamed rootless professionalism: "Too many professionals are more part of a universal professional culture than part of the local cultures for whom we produce our plans and products" (Jacobs and Appleyard 1996, 168). To remedy the situation they call for 'many participants' because it "is through this involvement in the creation and management of their city that citizens are most likely to identify with it and, conversely, to enhance their own sense of identity and control." (Jacobs and Appleyard 1996, 175)

Above all in the United States but also in large European cities in the 1980s, a housing crisis is diagnosed, with deficient supply of decent housing for the poor, dead cities, growing inner city slums, and cheerless suburbs. The increasing attention for participatory experiments of the architects presented in the first section belongs into this context. Together with city planners, new methods of user-involvement are sought. Already Lynch's seminal contribution relies on qualitative material, particularly interviews with the persons affected. Other sources often referred to are Herbert Gans' qualitative studies on "The Levittowners" and "The urban villagers", employing participant observation and interviews. Another genuine approach was used in Randolph T. Hester's redevelopment of the town of Manteo (North Carolina) in the 1980s, a near ghost town with the highest unemployment and tax rates in the state. What Hester and his colleagues called 'behaviour mapping', basically consists of observing and recording the activities of the population over a period of several weeks. The resulting sketches and maps of place-based activities were condensed to a map of Manteo's 'sacred structure', a map of seemingly mundane places (a restaurant, a parking lot ...), which then in the redevelopment of the town were treated as immune to any change. Hester notes that conserving this structure had a major impact to the success of the project, enabling the far-reaching change of the city maintaining it's special characteristics (Hester 1993). During the years of construction work and planning, the 'sacred structure' according to Hester even became part of the locals' vocabulary, contributing to their local identity, which is a clear case of successful action research.

Besides these examples for more or less top-down approaches to user involvement in city planning and town redevelopment, during the 1980s another bundle of user-activities was emerging. Manifold grassroots movements came forth ranging from self-help (Kolodny 1986) and squatter campaigns (Turner and Mangin 1968) to violent protests against large building projects like for instance airports (Peattie 1991). These movements often arose in open opposition to city planners and were more often than not denounced and violently combated as illegal. Physical environments are conspicuous arenas of conflict. Paternalistic attitudes, present both in city planning and the writings of architects are about liveable environments, but they are also about control over places and the definition of how these places should be used.

Nan Ellin concludes her critical appraisal of Lucien Kroll's participative efforts with the optimistic diagnosis that in spite the failures of participative experiments the "process itself, however, has infiltrated design practices on many levels" (Ellin 2000, 182). She mentions the growth of public hearings regarding building projects, neighbourhood associations, community land trusts, community design charrettes, and the number of laypersons purchasing architecture journals and books. Resistance and pressure from outside the profession, like the protests against building projects, as well as developments within have led to a more modest image of the designer as facilitator, which is maybe best represented in the 'New Charter of Athens' drafted by the European Council of Town Planners in 1998. They wrote:

> The city of the 21st century will be created not so much by the master plan, but more by the process of negotiation, centred on the welfare of the citizen (European Council of Town Planners 1998).

As main tool to achieve this process they recommended to make 'widespread consultation on plans and development' more participative and stated that it is "now accepted practice that city plans must be monitored and reviewed regularly." (European Council of Town Planners 1998) Thus, in accordance to lightweight methodologies presented in the previous section, we encounter newer developments in city planning that stress feedback loops and finer-grained process management (instead of 'master plans') closely linked to user participation.

4.3. Technology assessment (TA)

There is a far-reaching agreement that TA describes an effort "to reduce the human costs of trial and error learning in society's handling of new technologies, and to do so by anticipating potential impacts and feeding these back into decision making, and into actor's strategies" (Shot and Rip 1996, 251). This includes two fundamental premises, first that technology can be harmful to mankind, and second, that these 'human costs' can and should be avoided by some kind of anticipating control.

The establishment of institutions implementing TA, above all the US Office for TA (OTA) in 1972, echoes the declining optimism and the increasing concern of the 1960s and 1970s for the harms done by the unleashed powers of technological progress of modernity. As such, TA is in the first place evaluation of risks (Beck 1986; Beck 1995) connected to the introduction of a particular technology. As technology related man-made disasters come in many guises, this is not an easy thing to do. We witness spectacular tragedies like Chernobyl or the sinking super tanker

Exxon Valdez, both devastating huge areas, as well as the harbingers of creeping catastrophes like global warming. Other costs of technology, like the daily death toll caused by traffic accidents, are rendered invisible because we are just so used to it. Our everyday life is so deeply pervaded by technologies of all kinds that TA always is also about weighing up the risks and benefits. A missed opportunity for benefit may be as harmful to society as a disaster. This is particularly apparent in the field of health technologies, which are a major area of application for TA studies.

A host of questions arises from the insight that the deployment of technology can do harm and actually does. In literature on TA, most attention has been given to the question of how to value a particular technology and its impacts. Different approaches to TA differ considerably in this respect. Technologies, especially while they are introduced, attract interest from various stakeholders, their producers, their users, the governments, the public, which all may well have their own idea of the value of an innovation. According to Ole Brekke and Erik Oddvar Eriksen (1999) and similarly Randi Søgnen (2002), in the history of TA so far three ways have been practiced to deal with this "inherently political nature of technology development" (Brekke and Eriksen 1999, 95).

TA as scientific product dominates the beginning of TA in the 1960s and 1970s with a focus on early warning. Consequently, the only participants are independent experts who are seen as the only ones competent to assess technology. There were mainly two objections voiced against expert-driven TA. First, the neutrality of technical expert knowledge was questioned. Often these experts are stakeholders themselves, and they tend to represent only one point of view. Second, it turned out that forecasting of future technological impacts exclusively from a technical expert point of view may miss out. Other stakeholders and framing social developments can interfere heavily in the process.

Both critiques led to a second form of TA, in which a negotiation among all stakeholders is the goal. Representatives from all involved parties are invited to deliver their evaluation, and the moderated outcome is considered as accurate and neutral as possible. OTA, mentioned before, represents this type of TA. OTA's methodology at a central point consisted[4] of advisory boards "selected to represent academic, research, consumer, business, educational, technical, policy, and other stakeholders or viewpoints relevant to the study" (Wood 1997, 152). The resulting report then was reviewed by "a cross-section of experts and stakeholders that participated or had an interest in a study" (Wood 1997, 154) resulting in sometimes literally hundreds of participants. The public was included through a press conference and press releases only in the aftermath of a typical TA conducted by the OTA.

In Europe, particularly in the Netherlands and Denmark, the critique of the lack of a broader public involvement in TA led to a third approach. There so-called lay conferences were introduced in order to achieve real public participation. Recruited for instance through advertisements in newspapers, a panel of citizen is invited to discuss a specific subject with experts in a meeting not exceeding two or three days. A statement designed by the citizens and commented upon by the experts

[4] The OTA was closed in 1996 mainly for reasons to do with cost cutting in the congress of the US, which was its exclusive client. However, this might also reflect changes in the way TA is assessed in public. See Bimber, B. and D. H. Guston (1997). "Introduction: the end of OTA and the future of technology assessment." Technological Forecasting and Social Change **54**: 125-130..

is the outcome. Thus, users are drawn in as citizens or more specifically as members of the democratic public sphere. It was critiqued that this presumes that there is *one* public sphere characterised by a set of shared values, which can be involved by the inclusion of arbitrarily chosen citizens. Even stronger reproaches denigrate these conferences as populist stage-managing, which can be directed towards whatever conclusion through careful framing of the setting (Brekke and Eriksen 1999, 103).

This led to suggestions, which are aiming at the improved appreciation of conflicts and consensus building. Deliberative TA (Brekke and Eriksen 1999) for instance follows Habermas' model of a deliberative democracy (Habermas 1996) in order to achieve the 'forceless force of the better argument'. This means to restrict participation to persons that are affected by the technology in question and to stress rather the quality of the discussion than the number of people involved. TA becomes the organisation of a discursive arena, where participants with approximately equal competence and a neutral intermediary party meet. Other requirements for deliberative TA listed by Ole Brekke and Erik Oddvar Eriksen (1999, 110-112) are that the TA has an open mandate, that the problem must require practical judgement, that there are no pre-defined substantial standards, yet that there is a preceding agreement on the procedures governing the interaction. A second approach claiming to enable 'better' participation is known as iterative TA (Reuzel, van der Wilt et al. 2001). There, 'active stakeholder participation and deliberation' is sought in the four principles of what Guba and Lincoln (1989) call interactive evaluation (Reuzel, van der Wilt et al. 2001, 249-250):

- Knowledge injected into the evaluation is derived from the practices of people, because facts are meaningless outside a particular framework of norms and values.
- To escape this subjectivity is impossible. Therefore, these frameworks should be explicated by involving people who are encouraged to forward their claims and concerns (including norms and values).
- The people that are involved set the agenda for evaluation, and finally, following from all this, the most important tool is interviewing.

Practically an iterative TA consists of a circle of interviews, where participants are encouraged to comment on each other's interviews as long as it takes to reach an agreement. The goal is a 'wide reflective equilibrium', which is (Reuzel, van der Wilt et al. 2001, 260) intersubjective, achieved by all people involved, and results in a new equilibrium, not an old one reinforced by one party.

Regarding the user, we can find two common representations in the concepts presented so far. The user is either approached as stakeholder ('costumer', 'user') or as member of the (democratic) public sphere ('citizen') or both. As we have seen even in the methodology of the OTA, which was critiqued for its neglect of participatory issues, there are prominent elements that address users in both forms. However, users actively intervening in technology development have not been a topic for the presented approaches to TA. This is due to the fact that they all share a particular interpretation of the premise of the malleability of technology: Technology is seen as policy problem. Correspondingly, political bodies are the main target group for TA reports. This limits TA to a certain stage of technology development, since at the latest the closure of the policy process marks the end of any TA.

Alternative approaches were first developed and tested in the Netherlands and Denmark. Here evaluation and design are closely connected in participatory processes.

Not at least because of the overall funding of some 100 Mio DKK, one of the most prominent case of constructive TA[5] took place from 1986-89 in Denmark. There, around 50.000 people were involved in pilot projects concerned with the establishment of a 'hybrid network', i.e. a combination of publicly owned, nationwide broadband network and traditional communal aerial systems in housing areas, heralded as the 'Infrastructure for the Information Society'. A unique feature of this huge 'social experiment' was its reflexive nature. Both the experiments themselves and the technology were tightly evaluated. Lessons learnt in this twofold evaluation according to Tarja Cronberg (1991, 18-19) are among others that

- Surprisingly, the technology was not ready at all.
- Three years is too short a period for such experiments.
- Allocation of time for the experiments within existing organisations is difficult.
- Project leaders have to have a broad variety of cultural, technical, social competences.

This touches upon three central aspects of a social experiment as constructive TA: First, the technology is not yet in place, when the TA is commencing. The question is, thus, to which degree the technology design process should already be closed before testing. Evaluating multimedia experiments, Birgit Jaeger and her colleagues conclude in this respect that there may be a "trade-off between the emphasis on technical innovation (in artefacts) and social innovation in (uses)." (Jaeger, Slack et al. 2000). Projects that seek to innovate on both fronts may fail. Second, social experiments require time, both in terms of overall duration and within the respective case. Social contexts, in which these experiments necessarily are placed, are always complex settings of parallel and maybe also competing developments, which are always already going on.

A good illustration of possible pitfalls resulting from a neglect of the context is described by Heckman et al. (2000). They evaluate an influential experiment that shows that the Job Training Partnership Act (JTPA), once the largest U.S. federal training program for the disadvantaged, has a poor performance. However, this study did not consider that dropouts from JTPA funded measures may have found good substitutes and that the control group often does receive training as well, sometimes even the same training, which is just funded differently. They conclude that the comparison of groups trained according to the JTPA and groups that are not does not hold, since this does not take into account that:

> [u]nlike researchers conducting experiments in chemistry or biology, researchers conducting a social experiment have only partial control over the level of treatment actually received by treatment and control group members have only partial control over the level of treatment actually received by treatment and control group members …" (Heckman, Hohmann et al. 2000, 655).

[5] TA is only one, yet one of the most important aims of the Danish 'Experiments into the future', as Tarja Cronberg Cronberg, T. (1990). Fremtidsforsøg, Akademisk Forlag. calls it.

Similarly, any 'treatment' in social experiments is context-bound and has to be evaluated in processes that – depending on this context – may be time craving.

Third, besides demands regarding technology and time, we learn from the Danish experiments that the role of the project leader is crucial. As mediator between designers, users, and other stakeholders within the context, like members of the partaking institutions, s/he has to be able to integrate various and sometimes contradictory demands and backgrounds.

A set of tools may make this task easier. Lay conferences were already mentioned. Similarly, in dialogue or consensus workshops (Agersnap 1989) well-prepared experts, mediators and laypersons are gathered in order to discuss a current problem regarding technology design, its consequences and uses. It results in a final document, which contains both the experts and the laypersons perspectives. Another tried and tested method is called future workshop (Buus and Lund 1989), in which first experiences of the participants are collected. Then, in a second step the partakers speculate freely about a desirable future regarding the topic of the conference. Finally, possible pragmatic options for action informed by experiences, wishes, and conditions are discussed. An action plan should be the outcome.

These tools are not restricted to constructive TA. They may be deployed and have been deployed successfully in any participatory setting. Johan Shot and Arie Rip stress the close circles of feedback and social learning, which render platforms and workshops useful for constructive TA. This is mainly due to the theoretical framing of technological innovation, which is chiefly informed by social studies of science (STS). According to them (1996, 256) there are de facto CTA activities already going on, for instance that recently consumer and social pressure groups have broadened design and implementation processes. Additionally, they identify three main generative CTA strategies, which mainly aim at the creation of extensive feedback loops and enabling of societal learning (Shot and Rip 1996, 258-263):

First, there is technology forcing that is the political regulation of technology outputs, like the clean airs standards set in California in 1988. They prescribed that ten years later two percent of car sales must be zero-emission vehicles. A second generic strategy tries to create strategic niches and to optimise their management. Here technologies, which would not develop on the market, are nurtured in protected niches. In order to really provide the opportunity of feedback and societal learning, finally the establishment of loci for reflexivity represents the third generic CTA strategy.

Questions about the best way to achieve consensus in areas burdened by antagonistic interests, which were raised for instance in interactive or deliberative TA, remain also for CTA. Shot and Rip (1996, 263) maintain that a successful CTA depends on how our societies evolve with respect to negotiation processes in general.

The main advantage of CTA is that it frees TA from the difficult task to do forecasting. Ideally, permanent feedback and social learning accompany the whole process, which renders this approach unfortunately also the most ambitious one regarding time, organisation, and funding. However, even limited applications of CTA should be capable of increasing knowledge about avoiding risks and accruing societal benefits from technologies. In this sense, CTA differs from other approaches because it does neither take for granted that we already know how technologies develop and how they affect societies, nor that this always follows the same rules in every instance.

4.4. Action Research

The origins of AR are manifold – as manifold as there are overviews over this history. Daniel Selener (1997) lists four of them and classifies four different sets of traditions, main objectives, and methods. Even though the unity within the four sets may be challenged; when different motivations and motives merge, this is a good starting point to sketch the varieties of AR since it in fact designates different areas of application.

First, he mentions AR in community development. It reaches back to Friedrich Engels' involvement in the English class struggles in Manchester around 1835 and Karl Marx' Enquete Ouvriere with French factory workers conducted at the same time. Their participation in the social struggles they are describing is in line with the famous passage from Marx' Xth Feuerbach-thesis, that philosophers should not only try to understand the world but to change it. Not surprisingly this is a tradition Marxist researchers refer to.

In the second group of AR studies identified by Selener, he locates Kurt Lewin's studies of the 1940s, maybe the reference mentioned most often when it comes to founding fathers of AR. Bjørn Gustavsen reminds us that these origins of AR are grounded in the idea of doing experiments that resemble experiments in 'exact' sciences:

> "He [Lewin] required that an action research experiment must not only express theory but it must express theory in such a way that the results of the experiment can be fed directly back to the theory" (Gustavsen 2001, 17).

Lewin's approach to theories of social change is empirical in a strong sense, as these theories have to prove that they are not only able to describe change, but also to achieve it. The social scientist, who is involved in social change in the field, leaves the position of an outsider and becomes directly exposed to the manifold resistances and forces supporting and inhibiting change, which in turn enables him/her to theorise these factors.

The diffusion route from Lewin's work is reconstructed by William Pasmore (2001) first to England and the Tavistock Institute of Human Relations. From there, links lead to the Norwegian Industrial Democracy project and further on to experiments taking place in the whole world engaged in a more effective and/or more human organisation of the work place (Greenwood and Levin 1998).

Selener locates the third application area of AR within the classroom. Educational AR often turns to John Dewey's pedagogical writings from the 1930s. Main protagonists of this kind of AR are teachers themselves trying to bridge the gap between pedagogical research, theory and practice.

Finally, Selener lists 'farmer participatory research', whose origins can be found in the critique of top-down approaches to the diffusion of technology in agricultural settings. It is held here that the needs of above all small, resource poor farmers (often in the Third World) are only met if their indigenous knowledge systems and their capacity for experimentation is respected in participatory processes.

Following Peter Reason and Hilary Bradbury (2001, 2-3), even more traditions can be added to this list. They refer to Aristotle's work on praxis and phronesis, non-European cultures and their importance for 'grass-roots post-modernism', feminism, and psychotherapy.

Despite this widespread and heterogeneous ancestry, there is a set of common concerns of AR studies as well as their theoretical underpinnings. According to Ernest Stringer (1999, xvii) these are that

- it is rigorously empirical and reflective,
- it engages people that otherwise have been seen as subjects as active participants in the research process, and
- it results in practical outcome related to the participants.

Particularly recent contributions furthermore have a genuine post-modern attitude in common. In the words of the American post-modernist Leslie Fiedler, they are unified in a struggle to 'bridge the gaps and to cross the borders'. In the first place, there is the gap between the researcher and the research object, which is at stake. The researcher is expected to partake in the community, organisation, life-world or whatever of the researched. Simultaneously the research objects – in social research often humans – is involved in the research process.

This kind of involvement always is present, however, it can mean different degrees of participation. David Deshler and Donald Sock (1989) distinguish four different forms of participation. They maintain that outcome of lowest degree of involvement is domestication of the research objects, manipulating, giving therapy or just informing them. They call the next step assistentialism, for instance in consultation and placation. The second highest degree is represented by cooperation between researcher and research object, and they conclude that research projects that are under citizen control lead to empowerment.

Daniel Selener (1997, 206) presenting examples of AR shows that there is no congruence between these different levels of participation and the respective AR tradition. It is obvious that a high degree of participation alters the role of the researcher. Some action researchers maintain that only significant possibilities of active involvement lead to effective participation (Stringer 1999, 35), assigning the position of a 'facilitator' or 'catalyst' to the researcher. This may for instance take the form of the action researcher as someone who provides an arena of democratic discourse leading to social networks (Gustavsen 2001).

The status of the researcher as expert in his/her field becomes questioned. This becomes indirectly apparent in chapters of monographs on AR, which are at pains to prove that commonly accepted criteria of quality in social research, like reliability of the tools and validity of the results, are either fulfilled in AR or have to be replaced by other measures (e.g., Greenwood and Levin 1998, 81; Stringer 1999, 190). Besides the convergence of researcher and research objects, two more crossings between traditionally separated domains are usually mentioned when it comes to these different measures of good research.

First, there is the gap between scientific knowledge of the expert and mundane knowledge stocks. This split is questioned in several ways. In an action research study involving participants with high degrees of formal education, Mona Skaret, Grete Sen and Hanno Roberts (2001) experience that the unity of scientific as opposed to non-scientific knowledge does not exist. The lack of 'the other' – the research objects – confronts them with the heterogeneity of different kinds of expertise and worldviews within their own research team raising questions of interdisciplinary knowledge creation. Fossen (1994), in line with Luhmann's systems theory, describes different knowledge systems as fundamentally isolated from each

other. Therefore, he concludes, it is necessary for the researcher in order to create new knowledge to conduct AR 'jumping into completely different discourses'.

We encounter a similar idea, however without the systems theory background and its rigorous assumptions, in arguments in which the local or situated knowledge possessed by the non-professionals involved in the research project, is reappraised. Far from assessing this mundane knowledge as invalid, action researchers try to create a "process of bridging local knowledge and scientific knowledge, a process that will create both new local knowledge and new scientific understandings." (Greenwood and Levin 1998, 111)

This bridging activity is closely related to the second split AR is seeking to overcome: the one between theory and practice. The researcher becomes a practitioner and as such, s/he is able to achieve local knowledge. As member of both worlds the researcher then creates 'credible' knowledge, which is the term Greenwood and Levin (1998, 80-85) suggest to use instead of traditional measures like reliability and validity. These only make sense within scientific discourses, whereas knowledge created by AR is ideally credible both for the group involved in the research process – local knowledge – and for outsiders – trans-contextual knowledge.

During the last ten years or so AR explicitly claims similarities between social constructivist research and its own methodological and theoretical concerns. According to Lincoln (2001), this regards above all the preference of qualitative methods in 'face-to-face work' and ontological and axiological beliefs. In fact, positivist research functions as common counterpart to both traditions. So, Peter Reason and Hilary Bradbury (2001) recently declared AR as partaker in a more general shift from the modernist and positivist worldview to a participative one. They mention for instance the linguistic turn leading to an interest for cognitive structures allowing humans to make sense of the world, which replaces the modern quest for objective truth. This as well as to think in relational, ecological forms rather than in classifications and hierarchies describes common ground of AR and social constructivist approaches.

However, differences identified by Lincoln remain, mainly the "particular relationships between researcher and the researched, and the level, intensity and duration of the commitment to a community" (Lincoln 2001, 131). In practical AR this divergence has repercussions, since to marry 'commitment' to the constructivist critique of social categories can cause problems. So for instance in Britt Marie Berge and Hildur Ve's (2000) educational AR study, which starts out from traditional approaches, in which the empowerment of women in school settings is the undisputed aim. The confrontation with constructivist critiques of gender roles and the ambivalent function of emancipatory pedagogy as reinforcement of alternative, yet not less restrictive models of gender, renders their research – as they put it – to a 'balancing act' between empowerment and the enactment of power. Action Research rather recently discovered post-modern appreciation of a pluralism of strategies and worldviews (Stringer 1999, 202), thus it may collide with the action component of the research. However, it does perfectly match the image of the action researcher as mediator and facilitator.

Though action research in its longstanding history has been dealing extensively with technology development, it is not as closely linked to the actual evaluation or design of artefacts as the practices discussed in the previous sections of this chapter. However, experiences from AR shed light on the role of social scientists

and their possible contribution to participatory practices. This regards above all their expertise in facilitating and moderating social and societal change.

4.5. Summary: Lessons learnt

Summing up, we have seen that there is no recipe, no out-of-the-box method for successful pragmatic user participation in technology design. Still, there is a host of common themes and lessons learnt from successful and failed instances of user involvement.

Recurring topics are to do with the problematic relation between designers and users and other conditions that are framing design and participation. For instance, power relations and routines, motives and wishes of the participants proofed to influence dramatically the outcome. Systems development takes place in a work context with its own routines. Architects, who design 'liveable homes', are involved in routines of daily life taking place in the private sphere. The participatory process fails if these routines, surrounding and pre-existing structures are not taken into account. The redesign of the city Manteo provides an example of how respecting the 'sacred structure' of everyday life prepares the ground even for far-reaching change. As for the relation between experts and laypersons we encountered in every field discussed here a strong need for mediation. Different knowledge stocks, but also different interests and aims do not suddenly disappear in the same moment as they agree to partake in a participatory process.

As we have seen, action researchers recommend themselves for the role of the facilitator, translator, and mediator. But at least as important as the quality of the mediation, are its methods. Be it the use of mock-ups or various kinds of workshops: the deployment of these methods has to be carefully adjusted to the respective field consisting of the technology, the context, and the participants. There is perhaps only one unambiguous lesson from the examples presented here: research for preparation and evaluation should be achieved by means of qualitative research, above all through interviews.

Finally, looking at successful examples of participatory processes a common pattern emerges. Those instances, which do *not* restrict user input to a limited stage of the design process, seem to work better, both in terms of participation and the resulting technology. We became acquainted with iterative models in systems development, city planning, and TA. Also, Ralph Erskine's relocation of the design office to the building site at a very early stage was reported to be a source for continuous user intervention. Constant feedback loops are apparently the key to the design of useful technology.

CHAPTER 5. CONCLUDING OBSERVATIONS

The development of new technologies, like energy-efficient smart buildings, is often fuelled by a belief that the new designs represent an important contribution to the improvement in human life. When users, the supposed beneficiaries of the helpful designs, may complain or even dismiss such progress, this is frequently experienced as painful. The problem of the user, how to make him or her appropriate new, beneficial designs, is supposedly about how we may avoid such pains and direct design activities in a direction that more or less guarantees their success.

However, unfortunately, we cannot offer any such safe strategy of success. In principle, the problem of the user is insolvable. There is no way that anyone ever may be certain that a given design can be realised. In principle, users cannot be predicted.

This does not preclude the possibility of providing insights that may be helpful in achieving success. At least, it is possible to reduce the chances of failure. This report has argued that the strategy to obtain this goal, has to be based on the following premises:

- Users' needs and demands are dynamic features that may be mapped, but with care not to loose sight of the dynamism.
- To manage the dynamic quality of users' needs and demands, it is important to try to understand more general properties of the strategies users apply when they procure and appropriate artefacts.
- More specifically, it is important to map the perceptions users have of the artefacts in question, in our case related to energy-efficient smart buildings, and the mental models they may apply when trying to use the artefacts.
- To manage the dynamic quality of users' needs and demands, it is important to work with relatively open-ended design processes. This may imply the use of social experiments, workshop methods and other of the techniques outlined in chapter 4, but it is also a suggestion to have as a general design criteria that new technologies should be amendable to changes in users' needs and demands. To use a metaphor from the design of personal computers, we should choose 'an open architecture'.

The latter point is related to observations about the importance of user experience to make more efficient use of new technologies and even as a basis for inventing new applications. Such learning by doing or learning by using may have quite dramatic impact; consequently, design strategies should aim to cater for future social learning (Sørensen & Williams 2002).

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