

A Practice Oriented Approach to User Centered Sustainable Design

Lenneke Kuijer,
Delft University of Technology, Department of
Industrial Design, Applied Ergonomics and
Design
s.c.kuijer@tudelft.nl

Annelise de Jong
Delft University of Technology, Department of
Industrial Design, Applied Ergonomics and
Design
a.m.dejong@tudelft.nl

Abstract

This paper describes a method for insight generation for sustainable innovations. The method takes a practice oriented approach aiming for product ideas for practice level innovations. The method was applied in a case study on the practice of bathing. Insights on sustainable bathing innovations were gathered during a two-week period in which sixteen participants were asked to create and execute their own experiment for less resource intensive ways of bathing at home. In a group session these insights were translated into product ideas. It was concluded that it is indeed possible to generate product ideas with a practice oriented approach. The experiments in the home context helped the participants to come up with practice level bathing innovations. As predicted, they turned out to have potential to yield strong reductions in resource consumption and compete with the currently dominant practice of daily showering.

Key words: *bathing, co-design, household resource consumption, practice theory, radical innovation*

1. Introduction

Society is currently consuming resources at a rate that is likely to compromise the ability of future generations to meet their own needs, i.e. society is not sustainable according to the Brundtland definition. In Europe, households account for around 25 percent of the total direct resource consumption of society [1]. Products play an important role in household resource consumption. The notion that designers, through these products, can influence resource consumption is permeating the design world, which increasingly wants to take responsibility for reaching sustainability through design [2]. A specific project that wants to offer new knowledge and tools for

designers to take up this responsibility is the Living Lab design study [3], which the current research is part of.

In the field of Design for Sustainability (DfS), different strategies have been developed to address the issue of high and increasing household resource consumption. Experiences from the past, however, show that reaching sustainability through design is not a straightforward task. In spite of increased efficiency of energy consuming products, overall energy consumption of the household sector has not decreased. On the contrary, electricity consumption of Dutch households for example, has increased by 24 percent in the past 20 years [4].

Therefore, researchers in DfS and related fields are arguing that to reach sustainability, radical innovation is required [5][6]. Traditionally, design has taken a product oriented approach, focusing on the energy efficiency of the product and the way it is used. Often, however, this is not realistic. Product use, and thus the resulting energy consumption, is always influenced by the larger context in which it takes place. To achieve the radical innovation required to shift society in a more sustainable direction, designers need to take a more systemic approach to DfS that looks beyond single products and individual users.

Practice theory, a concept developed within the social sciences, takes daily practices, such as bathing, cooking and doing laundry as the basic unit of analysis [7]. Central to practices are not products, but ‘doings’; actions taken to accomplish the practice [8]. These actions are shaped by the interconnected elements of practice that can be summarized as conventions, competences and material artifacts [9]. Conventions are collective ideas that exist in society of what is normal practice. Competences are skills and knowledge that can be embedded both in products and in people. Material artifacts represent the orchestra of things deployed in the ‘doing’ of the practice. In cooking for example these include pots, pans, stove, tap, counter, food products, microwave, knives, cutting board, and so on.

From a design point of view this means that products play a role in shaping practices, in which resources are consumed. When designers can influence the doings of practice, they can change practices and thus their resource consumption. To illustrate the position of practice oriented design we distinguish different levels of innovation: changes in resource consumption on a practice level i.e. practice level innovations and product level innovations. Product level innovations can be both use behavior innovations and technological innovations. To illustrate these three levels of innovation, an example of making transportation by car more energy efficient is shown in Table 1.

Table 1 Three levels of innovation

Technological innovation	Improving efficiency of car motor to drive further on one liter of fuel.
Use behavior innovation	Giving feedback to car user on when best to change gears to save fuel
Practice innovation	Sharing a car with more people, offering alternative means of transportation

The notion of applying practice theory to DfS problems has been advocated by a particular research group in sociology led by Elizabeth Shove [10][11]. Shove argues that ‘designers have an indirect but potentially decisive hand in the constitution of what people do’ [12]. The question remains how designers can purposefully use this influence to steer practices towards lower resource consumption. This is where the connection between practice theory and design is made. Practice theory is useful for understanding the dynamics of practice as it is. Design is specialized in thinking about potential future scenarios and ways to achieve these through products.

Before continuing, however, another challenge in DfS needs to be mentioned. In the design field it has long ago been acknowledged that if and how products will be used is for designers very difficult to understand, let alone predict it [13]. Experience has learned that when aiming for a specific (radical) effect of products during the use phase, like reduced resource consumption, involving a use perspective in the design process is essential [14][15]. When aiming to achieve practice level innovation, it is therefore particularly important to integrate a use perspective in the design process.

Based on these considerations, a practice oriented co-design approach was proposed by Kakee Scott [16]. Co-design makes users act as experts of their own experience by actively involving them in generating

design insights [17]. Core concept in the method proposed by Scott is ‘innovation in practice’; participants are challenged to come up with new, less resource intensive ways of doing and experiment with those in their own homes.

After testing her method in a case study on the practice of bathing, it was proven to be useful for coming up with new ways of bathing, that were strongly less resource intensive than the currently dominant daily shower, e.g. ‘taking a sponge bath’ [18]. Although Scott did not focus on the role of possible new products, the outcomes did show opportunities for design. It was observed that in changing towards less resource intensive ways of bathing and maintaining these, participants were limited by the possibilities of their own home. For example, when sitting down for a sponge bath, the shower tap is difficult to reach.

Therefore, a second pilot study was conducted, again by having people come up with ideas for less resource intensive ways of bathing in their own home, but this time with a focus on identifying opportunities for design. The execution and outcomes of this second study are described in this paper. Bathing was again chosen as a topic, defining bathing as a collective understanding for all kinds of washing activities at home, such as showering, washing at the sink and so on.

2. Water use of bathing

Before starting the qualitative survey with a small number of participants, more quantitative data was gathered to gain an image of the resource consumption of bathing and developments herein. Because (warm) water is the dominant resource used in bathing, analysis focused on water consumption.

A recent study [19] shows that in the Netherlands the shower and bath together account for 41% of household water use, of which 95% is used for showering. Taking a shower can therefore be assumed to be the dominant form of bathing. To compare the total water use of different ways of bathing, water use per person per week was taken as a unit. The water consumption of showering per week can be broken up into three elements as explained in Table 2.

Over the past years, water use for showering in the Netherlands has increased more than 25%. This is due to the introduction of comfort showers, an increase in shower duration and an increase in shower frequency. These trends are specified in Table 2. Average water consumption for showering per person is now 358 liters per week.

Table 2 Elements of water consumption for showering and trends between 2004 and 2007

Flow	the number of liters flowing out of the shower per minute	8 -> 14,4 l/m
Duration	the average number of minutes the person has the shower water flowing during one shower	+ 2,6%
Frequency	the number of times the person showers per week	+ 9,5%

3. Method

The main research question addressed in the pilot study was whether and how the practice based co-design method could lead to design opportunities for reaching practice level innovation in the direction of radically lower resource consumption.

3.1. Pilot set-up

The pilot study consisted of two main parts. Part one was a homework assignment where participants were asked to describe their bathing practices and come up with and execute ‘experiments’; they were asked to think of different ways of bathing that would reduce resource consumption and still be acceptable or even preferred as daily routines. A period of two weeks was taken with regard to the long term character of developing and establishing new routines. Individual workbooks with assignments and reflective questions guided the participants in the process. An important function of the workbook was to stimulate participants to think about bathing and its resource consumption on a practice level. To explain the elements steering the practice and their relations, the simplified terms image, skill and stuff were used and represented graphically (see Figure 1). Participants were asked to describe their current practice and changes therein according to these elements. To stimulate exchange of ideas, participants were asked to interact on an online blog during the second week of experiments.



Figure 1 Simplification of interrelated elements of practice

The second main part of the pilot was a group session at the end of the two weeks, in which the participants developed product ideas. To track the development of

the types of ideas, participants were probed for their ideas on three different points in time: once at the start of the study, once after the first week and again at the end of the two weeks. This probing was done with ideas forms: digital forms on which the participants were asked to individually describe ideas they had for new products, technologies and services to enable less resource intensive bathing routines. The ideas of Ideas Form 1, 2 and 3 and the final group session were compared on their levels of innovation (technology oriented, user behavior oriented or alternative practice oriented).

In addition, participants were interviewed prior to the study to find out if and to what extent they had already been experimenting with their bathing practice. Three months after completion of the study, participants were contacted again to assess the long term effects of the study on their bathing routines. The set-up of the study is depicted in Figure 2.

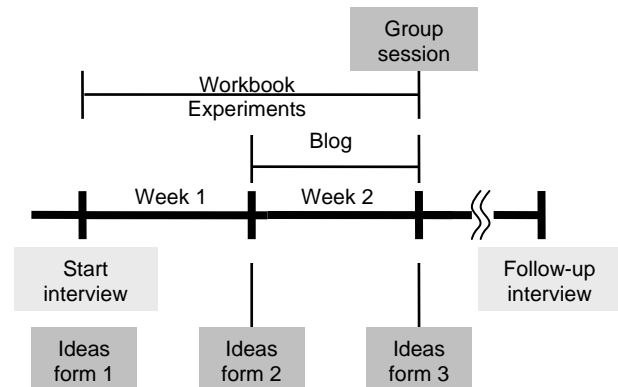


Figure 2 Set-up of the study

3.2. Participants

Sixteen people were recruited for participation in the pilot. Due to the explorative and privacy sensitive character of the study, the participants were recruited from the researchers’ own network. Fourteen were female and two male. They resided in five different countries in Europe (Belgium, Germany, Netherlands, Spain and Switzerland) and had various backgrounds in design, bathing industry, architecture and hotel management. Five of the participants were members of the Living Lab project. Thirteen participants completed the workbook, including reports on their bathing experiments. Seven of which took part in the final group session where they were joined by three researchers. The session was led by a professional facilitator.

4. Results

The results of the study will be described according to three topics, being the current bathing practice, the bathing experiments and the resulting product ideas.

4.1. Current bathing practice

The participant's current bathing practices serve as a benchmark for the level of resource reduction and as a departing point for change. The average shower duration varied from 5 minutes to a weekly pampering shower of about 40 minutes. The number of showers per week varied from 6 to 10. On average, a consumption of 616 liters per week was reported.

Showering consists of a sequence of actions or 'doings' in which many similarities were found between the participants. For all participants showering was a daily activity. It starts with setting the shower's temperature. When reached, people stand under the shower to wet their body and usually their hair. Soaping and rinsing the body is part of practically every shower, while shampooing and rinsing hair is done less frequently. Some participants indicated to turn the shower off when soaping or shampooing. Washing hair is usually followed by applying and rinsing conditioner. After these standard actions, the shower can be extended with a number of actions like scrubbing the skin, shave, or just stand under the shower to get warm, relax and enjoy the water.

Participants described the elements of image, skill and stuff forming this practice. For example the properties of the tap can make it easier or more difficult to set the desired temperature. This is also related to skills, like the experience with your own shower tap of which setting is the 'right' one. Skills were often referred to as stemming from childhood, or having been learned from friends or magazines. The expectations the shower had to live up to differ per situation, for example, when preparing for a date, the expected end-result and thus the bathing process was different when preparing for bed.

4.2. The experiments

Two main strategies can be distinguished in the approach participants took to reduce their (warm) water use. One was to reduce their shower duration, the other to reduce their shower frequency. Examples of experiments in the first category are: collect the water flowing away while setting the shower temperature to later flush the toilet; use a stopwatch in the shower to be more conscious of the shower time; turn off the shower when soaping and; change the shower time from evening

to morning to have more time pressure. This strategy was engaged in by seven participants. The shortest reported average daily shower time was four minutes. Experiments to reduce shower frequency all sought to replace showering by some other form of washing the body. Two types of experiments were engaged in, each by two participants independently from each other. They were: replace part of showers with washing at the sink and; replace all showers with washing from a bucket

Water saving of both types of experiments was high, ranging from approximately 35% to 90%. An overview of the estimated water consumption of the three types of bathing compared to the benchmark is given in Table 3.

Table 3 Water use per week of different types of bathing

Bathing style	Estimated water use
Current shower	616 liters/week
Short shower	224 liters /week
Shower (weekend) & sink (weekdays)	196 liters/week
Bucket wash	55 liters/week

The follow-up interviews three months later, however, established that none of the participants had completely adopted their experiments as new routines. Reasons they mentioned were related to time and effort, comfort missed or discomfort experienced. For example, extra time and effort were needed to get and store a bucket to collect water when setting shower temperature.

A distinction can be made between participants that shortened their shower duration and the ones that replaced them. When shortening shower duration, participants reported stress due to the time pressure they imposed on themselves. To reach the level of relaxation they were looking for, they felt they needed longer showers and missed just standing under the flowing water. One participant said: "I want to relax a bit more while bathing than I do in this experiment." The participants that experimented with washing at the sink or from a bucket did not experience stress or time pressure. They did experience other discomforts, of which the most important was getting cold. The participants who washed at the sink also felt that washing at the sink with a washcloth (without a full body rinse), was not enough to feel clean. Or in the words of one of the participants: "Whenever I have an appointment during the day I take my shower [instead of a quick wash at the sink]. I want to be safe that I am clean!" The two participants that washed from a bucket, while squatting down in the shower cabin and applying water to the body with a cup or cloth, were mostly positive about their experience. Although getting cold

and feeling a bit uncomfortable squatting, they reported to enjoy the new practice.

4.3. Product ideas

In Ideas Form 1, collected before the start of the experiments, most ideas were directed at either technological or user behavior level innovations. Examples are immediate hot water flow and time feedback in the shower. A remarkable number of ideas referred to the bathtub, while none of the participants reported to take baths regularly.

During the experiments and especially in the final group session, the connection of ideas to the participants' experiments became more and more apparent. In the second ideas form, one quarter of the ideas could be considered practice level innovations. In the final session the majority of ideas (seven out of nine) abandoned the current practice of showering by adopting the new practice concepts of 'washing at the sink' and 'washing from a bucket', clearly based on the sink wash and bucket wash experiments.

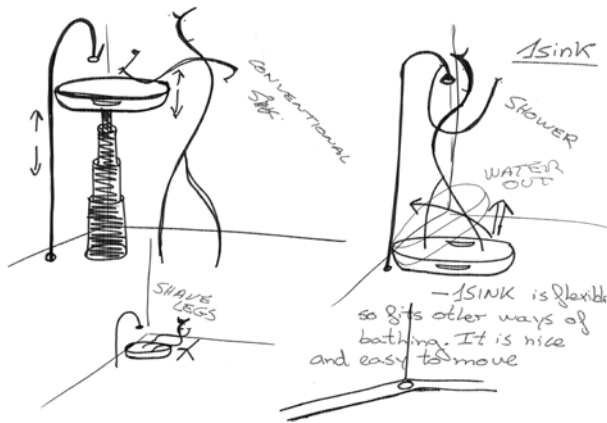


Figure 3 Sketches of the '1Sink' concept

An example of one of these final ideas is the '1sink' concept (see Figure 3), replacing both shower and sink in the bathroom. It was developed by a participant that did not try out the 'washing at the sink' concept himself, so he picked up on the idea during the session. The sink is flexible in height and has no drain to make the user more aware of the amount of water used and to stimulate reuse of water. The tap is detachable and connected to a flexible hose. When in the lowest position the sink forms the basin for a more or less regular shower set-up. It is placed in a large wet space and has drainage along the wall.

5. Conclusion

The main research question was whether and how the practice based co-design method could lead to design opportunities for reaching practice level innovation in the direction of radical lower resource consumption. The results of the study indicate that the practice based co-design method can indeed lead to design opportunities. Although only part of the bathing innovations was on a practice level, these innovations were estimated to have large gains in terms of reduced resource consumption. Moreover, these concepts of new practices are expected to have a potential to compete with the current dominant practice of showering, because they came into existence out of people's own preferences in the contexts of their daily lives. The ideas that came out of the pilot study are based on changes in the practice that go beyond the shower as a product and are expected to result in a consumption of water for bathing per week that is radically lower than the current Dutch average.

6. Discussion

Although the outcomes of the study show promising directions for bathing innovations that support less resource intensive forms of bathing and a method to develop this type of innovations, some limitations of both these outcomes should be mentioned. For each limitation, suggestions are offered to improve the method.

One of the basic assumptions of the study was that if people come up with new ways of bathing themselves in their own home environment, these are options that people are willing and able to engage in and thus form feasible alternatives for the current practice. What we can really say is that the *participants of this study* were willing and able to engage in those experiments *during the two weeks of the study*. From the follow-up interviews we know that none of the participants have completely adopted their experiments as routines.

When applying the method again, several other sources of inspiration for less resource intensive ways of doing could be considered. The most important ones are: looking at lead users, looking at the different cultures or lifestyles or look at how things were done in the past. Another possibility to obtain data that is less temporal is simply to extend the duration of the study. Time spans suggested by the participants to provide more time to adapt to changes, but still acceptable in terms of workload ranged from three to six weeks.

In the pilot the choice of experiments was shaped entirely by the participants themselves and efforts were made to influence them as little as possible. Looking back on the study, and the fact that only four out of thirteen participants engaged in experiments letting go of the

showering practice, the scope of ideas for alternative practices may have been broader if more participants had been steered or stimulated at least a little. The most resource intensive aspect of showering, for example, is the continuous flow of warm water. In order to make the study more effective this information may have been used as input to direct the experiments.

The outcomes of the study show possibilities for bathing practices with a much lower resource requirement than the current practice of bathing. However, it must be noted that the value of these numbers should be carefully interpreted, because they were based on self reported data of participants and rough estimations by the researchers.

The present pilot study resulted in two spin-off projects. One investigates the possibilities of deriving practice level insights from different cultures [20] and another worked out the insights developed in the study into new products. To verify the assumption that the products designed with these insights have a potential to bring about large gains for sustainability in households, the next step will be to test these prototypes in households for a longer period of time to see what their effect will be on the bathing practices of the household members and ultimately on their water consumption.

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