CHALMERS

HOW TO DESIGN FOR SUSTAINABLE BEHAVIOUR?
- A Review of Design Strategies & an Empirical Study of Four Product Concepts

Master of Science Thesis in the Master Degree Programme Industrial Design Engineering

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Cover: [The model for categorisation of design strategies for sustainable behaviour developed and illustrated by Karin Lidman and Sara Renström, see section 3.2.4. for further information]

ABSTRACT

For many products, the use phase stands for the greatest environmental impact and there are many examples of how the impact can be reduced through ingenious ecodesign. Nevertheless, the focus has been directed at matters beyond the user's control, e.g. improvement of energy efficiency. To further reduce the impact of the use phase matters within the user's control should be addressed as well. To achieve this, researchers have suggested applying design strategies for sustainable behaviour to products and services. Therefore, the aim of this project was to identify and categorise promising design strategies for sustainable behaviour and thereafter to evaluate four different strategies on the basis of long-term acceptability and effectiveness in inducing sustainable behaviours. A literature review was carried out and a compilation of strategies was made. In addition, a model for categorisation of strategies was created with five categories called *Enlighten*, *Spur*, *Steer*, *Force* and *Match*. Four design strategies for sustainable behaviour, one from each of the four first categories, were implemented in prototypes to achieve moderate dosing of washing detergents. The prototypes were then distributed to sixteen households and a combination of 'within' and 'between' subject study design was applied. The results indicated that three of four strategies were both effective and accepted. Oftentimes, low acceptability did not seem to stem from an aversion towards the design strategies per se; rather to flaws of the specific prototypes. A smaller study on four existing products that make use of the same four strategies was executed to supplement the findings of the main study. The results of both studies indicated that product design can be a feasible way to induce and maintain sustainable behaviour.

Keywords: design strategies, sustainable behaviour, behaviour change, ecodesign, washing detergent.

EXECUTIVE SUMMARY

When trying to reduce the environmental impact of products and services the whole lifecycle should be addressed. For many products, the use phase contributes the most to the total environmental impact and many ways to reduce the impact from this phase have been suggested, e.g. increased energy efficiency and lightweight constructions. Yet, mostly matters beyond the user's control have been investigated and Tang and Bhamra (2009) commented that efficiency gains accomplished do not always make a great difference due to unsustainable use patterns. To further reduce the impact of the use phase matters within the user's control could be addressed as well. It has been suggested that designers can reduce the impact of use by applying design strategies for sustainable behaviour (Lilley, 2009), where the term 'sustainable behaviour' denotes using a product or service in a way that has less impact on the environment

than conventional ways of using similar products or services. This project was divided into two parts. The aim of Part I – Strategy Review was to identify and categorise promising design strategies for sustainable behaviour. The aim of Part II – Empirical Study was to evaluate four different strategies on the basis of long-term acceptability and effectiveness in inducing sustainable behaviours. The complete aim and the research questions can be found in sections 1.2. and 1.3.

PART I – STRATEGY REVIEW

Academic work from the fields of psychology and design was reviewed to identify promising design strategies for sustainable behaviour and ways to categorise the strategies. Based on works by e.g. Bhamra, Lilley, and Tang (2008) and Wever, Kuijk, and Boks (2008) a model for categorisation of design strategies was created.

The model includes five strategy categories called *Enlighten*, *Spur*, *Steer*, *Force*, and *Match*. All strategies were arranged into one of these strategy categories (figure 1). The first four categories – *Enlighten*, *Spur*, *Steer* and *Force* – require from the user to change his or her behaviour, and the two basic influencing
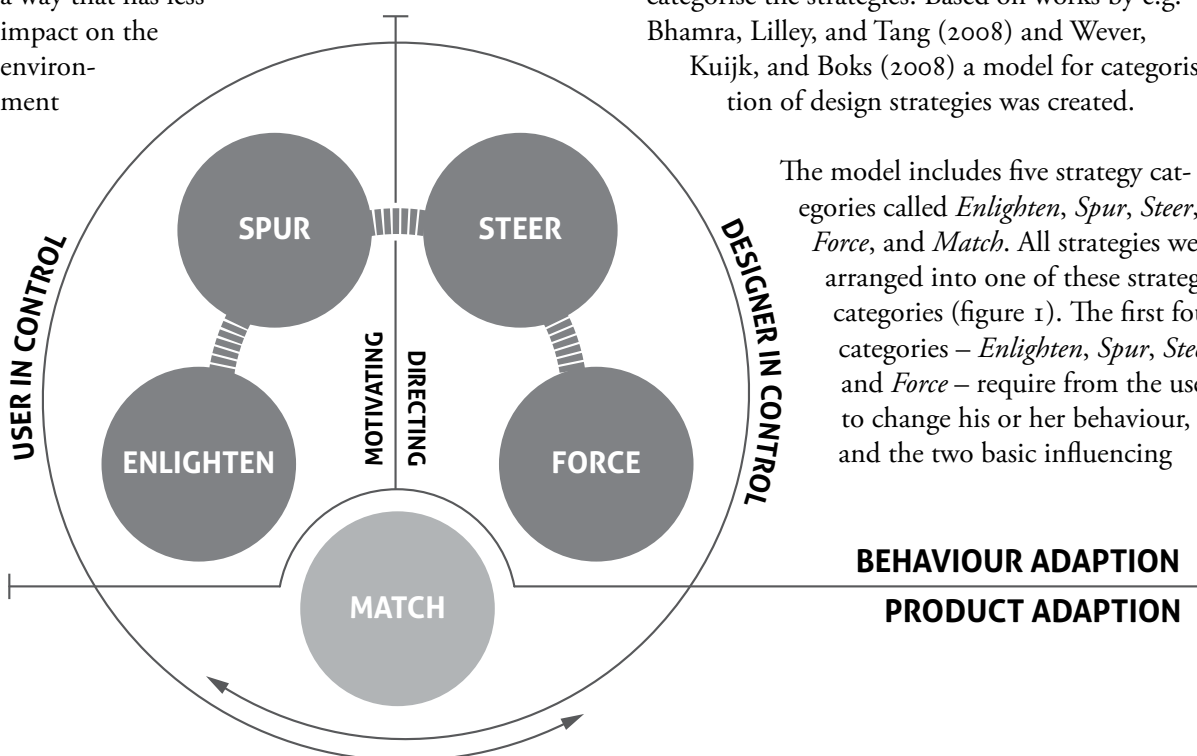

Figure 1. The model created by the project duo for categorisation of design strategies for sustainable behaviour.

Figure 2-6. Examples of products in which different design strategies for sustainable behaviour are implemented. Photo of escalator by KJ Vogelius. Photo of sorting bins by Bob Davis (Shiroi).

techniques are to motivate the user, or to direct the user. These four categories are placed with respect to the level of user control versus designer control. The fifth category, *Match*, differs from the other categories, as it requires none or little adaptation from the user. Instead the product or service is adapted to the user's original behaviour, or to a behaviour already desired by the user. In the category *Match*, both the user and the designer are in control since the user controls his or her behaviour, but the designer controls the outcome of the behaviour. The model is explained further in section 3.2.4.

The purpose of the design strategies brought together in the category *Enlighten* is to motivate people to perform sustainable behaviours by influencing their knowledge, values, attitudes and norms. This can be done through e.g. information, feedback or means for reflection. An example of such a product is a toilet with a transparent water basin with a scale that shows how much water is used for each flush (figure 2). In this toilet, the flushing of water can be stopped when the user sees fit and the transparent water basin together with the scale will hopefully motivate the user to use as little water as possible for each flush. All design strategies placed in the category *Enlighten* are presented in section 3.2.5.

In the category *Spur*, all design strategies have in common that they encourage and tempt the user to perform the desired behaviour by means apart from the positive environmental consequences of the behaviour. The focus is either on other positive

consequences of the behaviour or on the behaviour itself. This can be done through e.g. incentives or competition. Another example is an attempt to promote the use of stairs instead of escalator my making the stairs fun to use. Each step is turned into a giant piano key that emits sound when stepping on it (figure 3). All design strategies placed in the category *Spur* are presented in section 3.2.6.

The design strategies in the category *Steer* have in common that they guide the user by making sustainable behaviours the evident choice. This could be done physically or cognitively by e.g. constraints or affordances. An example is a litter-bin where sorting of waste is guided by the shape and size of the openings to each container (figure 4). All design strategies placed in the category *Steer* are presented in section 3.2.7.

The basic idea of the design strategies in the category *Force* is to compel the sustainable behaviour upon the users, through limited functionality or by restraining the undesired behaviour. In some toilets with the possibility to choose between a small or large flush the undesired behaviour of wasting water is restrained as it is impossible to press in the middle of the button as one usually does (figure 5). Instead, the user has to make a conscious choice of what type of flush to choose. All design strategies placed in the category *Force* are presented in section 3.2.8.

In the category *Match*, the basic idea of the design strategies is that products and services should be adapted to behaviours that the user already

performs, to the user's behavioural intentions, or to a behaviour already desired by the user. An example is a lamp switch that can be used only to turn on the lamp as the lamp after a while turns off automatically (figure 6). In this way, the lamp switch is matched towards the behaviour of forgetting to turn the lamp off. All design strategies placed in the category *Match* are presented in section 3.2.9.

The number of design strategies found in each category varied and for many of the strategies there were no information on their acceptability and effectiveness in inducing sustainable behaviour.

PART II – EMPIRICAL STUDY

In this part of the project, four design strategies for sustainable behaviour were tested, firstly, by testing concepts designed in accordance with the strategies and, secondly, by studying existing products that make use of the same four strategies. To do so, an area of application for the concepts had to be determined. Overdosing of cleaning agents was chosen as it causes unnecessary strain to the wastewater systems and may pollute watercourses. To begin with, the topic of dosing of detergent was explored to establish possible barriers towards moderate dosing. This is explained in chapter 5. and the barriers are presented in section 5.2.2. As a result of the identification of barriers, three different consumer profiles were identified: the convenience prone user, the independent user and the emotional user. Overdosing of washing detergent was found to be common and therefore moderate dosing of washing detergent was set as the target behaviour. Four design strategies for sustainable behaviour were chosen to match the respective profiles and applied in prototypes:

» *Eco-Affective Design* (from the category *Enlighten*) – a measuring cup with a plastic frog on a stone where the frog's feet represent a suitable dose for most washes. If more detergent is used, the frog drowns in detergent. The design was intended to evoke negative emotional reactions to overdosing.

» *Competence and Autonomy* (from the category *Spur*) – a dosing kit with a wheel chart, a

measuring cup and a laundry basket with a scale in its handle. By weighing the laundry the user can set the wheel chart and dose accordingly. The aim was to make the user feel competent and autonomous.

» *Scripting* (from the category *Steer*) – a package where pouring of detergent is constrained as only a predetermined amount of detergent will come out. The package has to be tilted back and forth again for a second dose.

» *Habit Intervention* (from the category *Force*) – tablets of washing detergent in a tube. The intention was to make the previous habit to dose by estimations of the size of the washing powder pile impossible and to facilitate formation of a new habit.

The design process and the prototyping are described in chapter 6. and 7.

The prototypes were produced and delivered to sixteen households, one prototype per household. Altogether, sixteen females and thirteen males participated. A combination of 'between' and 'within-subject' study design was chosen. No control group was used. The participants documented their dosing behaviour themselves by weighing the package of washing detergent before and after dosing and noting the weight in a booklet. This was done at three periods during a total test period of four months; prior to receiving the prototypes, during an obligatory use phase in which the participants were obliged to use the prototypes and during an optional use phase in which use of the prototypes was optional. The obligatory phase lasted one month, the optional phase approximately three months. The study was completed with interviews. The evaluation is further described in section 8.1.

The results showed that when in use, the effectiveness of the frog cup was high. Nevertheless, the frog did not evoke negative emotions regarding overdosing to the extent that was intended. Instead, the frog served as a reminder to dose moderately and guided the participants in this endeavour. All participants except one wanted to continue with a low consumption of detergent also after withdrawal of the prototype. The participants' acceptance seemed to remain unchanged or
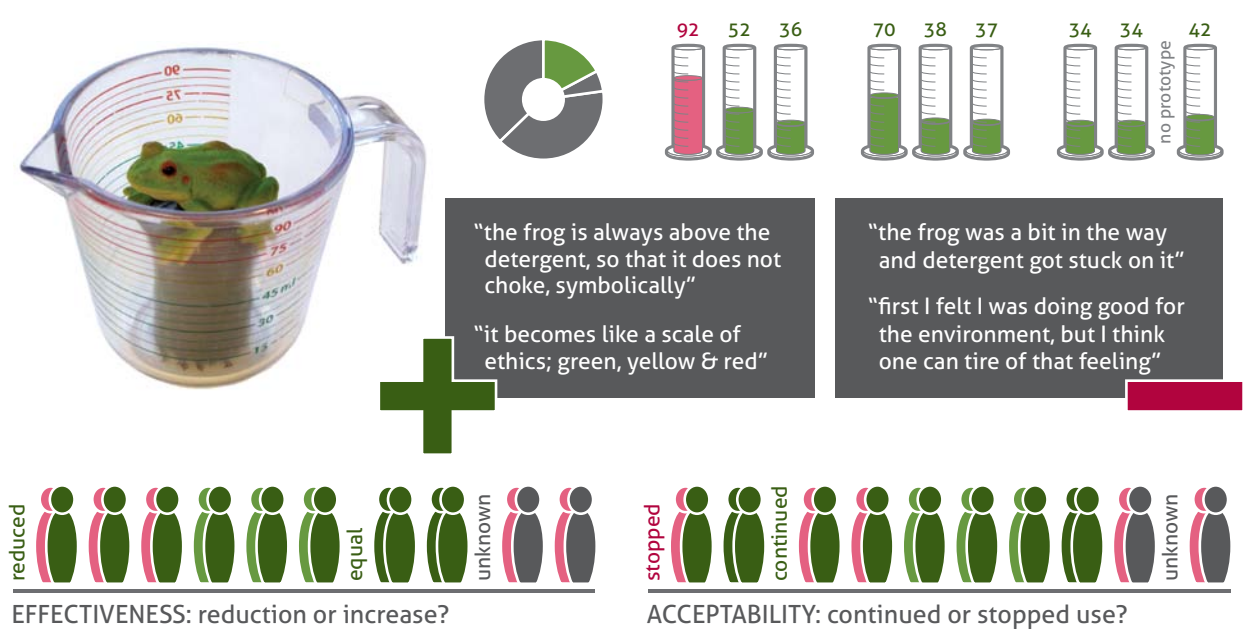
Figure 7. The result for the frog cup. The pie chart visualizes the share of participants that during the closing interviews were positive towards using this prototype instead of the tested one. The measuring glasses visualize the mean values (in millilitres) attained for three different participants in their three documentation booklets. The figureines represent the number of participants that tested the prototype. Their colour indicates the detergent consumption in the last booklet, while the colour of the shadows represents consumption in the first booklet. Pink indicates overconsumption. The quotes originates from the closing interviews and they represent commonly experienced advantages and disadvantages with the prototype.
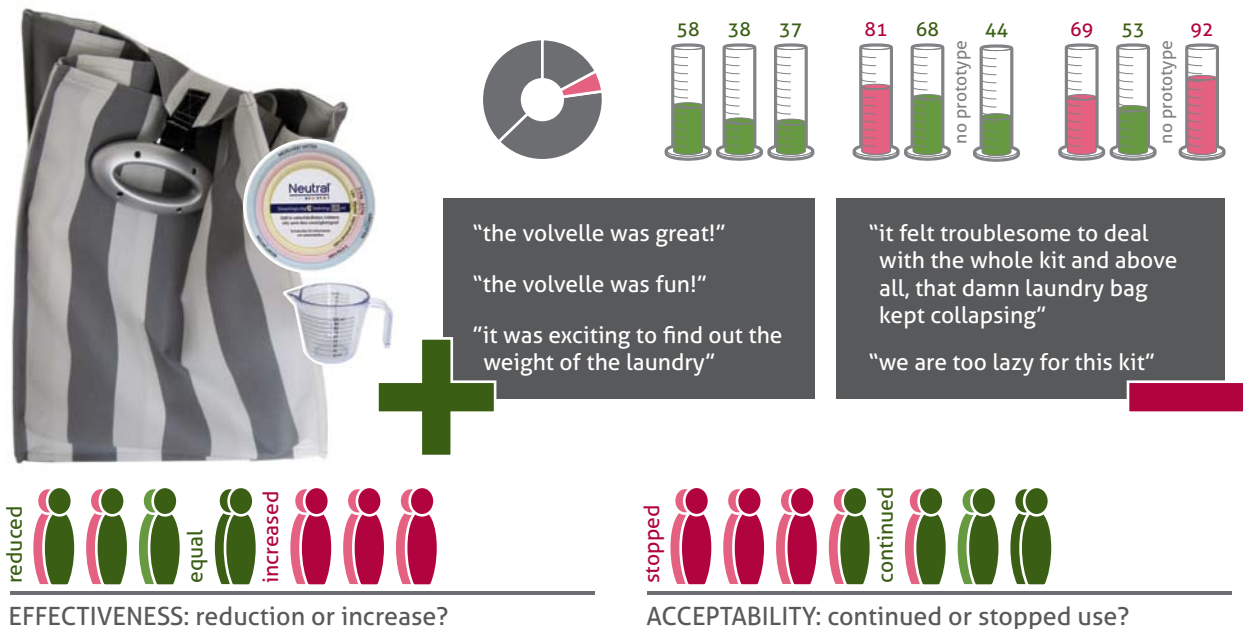

Figure 8. The result for the dosing kit. See figure 7 for an explanation of the different elements.

even grow stronger during the study. The result is presented further in figure 7. Also the effectiveness of *Competence and Autonomy* was high as long as the prototypes were in use. Nevertheless, the acceptance of the kit was very low and only one participant out of seven continued to use the entire

kit during the optional phase. Three participants reported very high doses at the third documentation. The result is further described in figure 8. The effectiveness of *Scripting* was high as all four households dosed according to the recommendations or even lower. The acceptability was fair. The result is
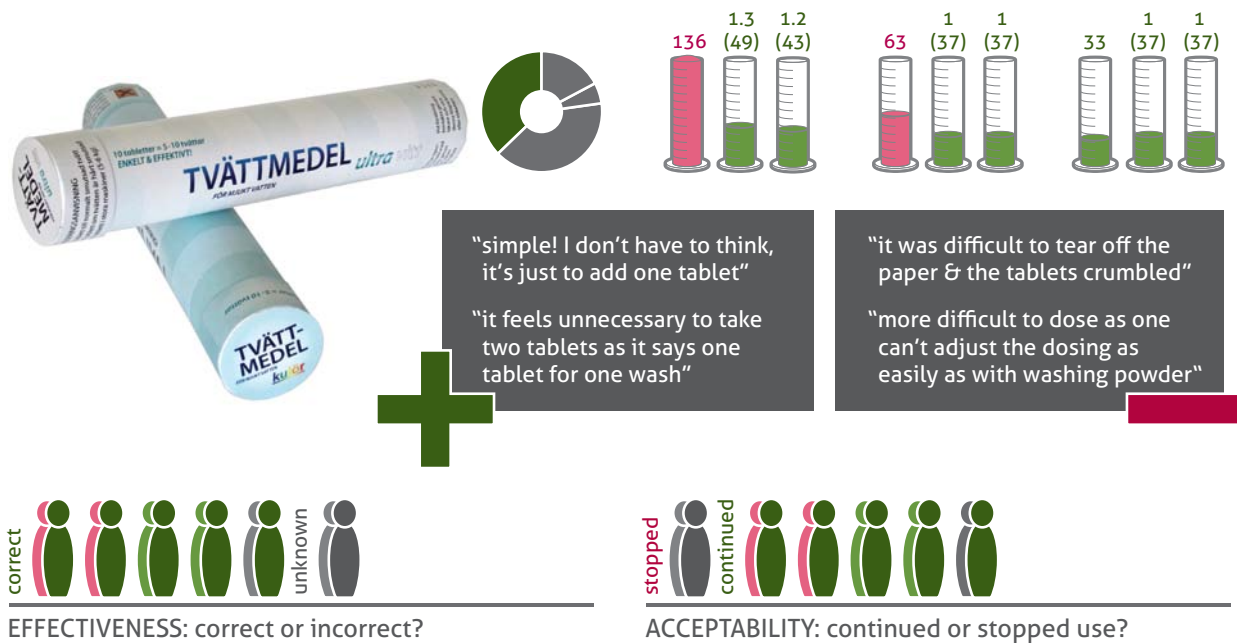
Figure 9. The result for the washing detergent tablets. See figure 7 for an explanation of the different elements.
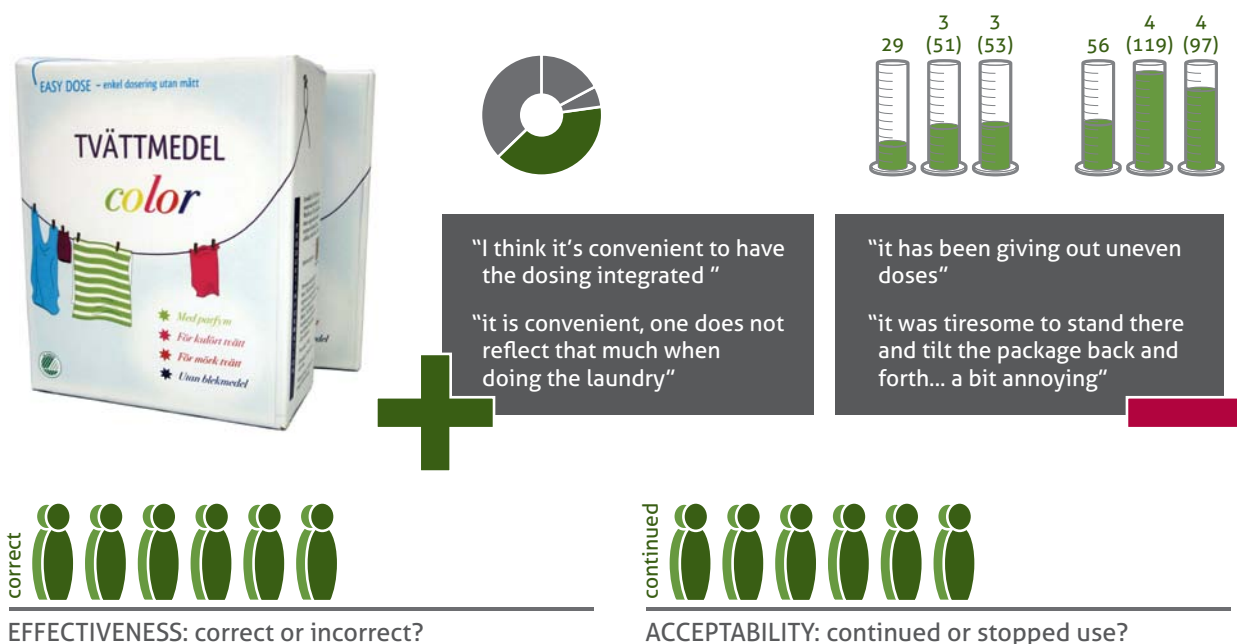
Top figure values/labels:

136 1.3 (49) 1.2 (43)   63 1 (37) 1 (37)   33 1 (37) 1 (37)

"simple! I don't have to think, it's just to add one tablet"

"it feels unnecessary to take two tablets as it says one tablet for one wash"

"it was difficult to tear off the paper & the tablets crumbled"

"more difficult to dose as one can't adjust the dosing as easily as with washing powder"

correct — unknown

EFFECTIVENESS: correct or incorrect?

stopped — continued

ACCEPTABILITY: continued or stopped use?

Figure 10. The result for the detergent package w. See figure 7 for an explanation of the different elements.

Top figure values/labels:

29 3 (51) 3 (53)   56 4 (119) 4 (97)

"I think it's convenient to have the dosing integrated"

"it is convenient, one does not reflect that much when doing the laundry"

"it has been giving out uneven doses"

"it was tiresome to stand there and tilt the package back and forth... a bit annoying"

correct

EFFECTIVENESS: correct or incorrect?

continued

ACCEPTABILITY: continued or stopped use?

presented in figure 9. Finally, the effectiveness of *Habit Intervention* was very high. Two out of six participants reported very low acceptance while the other four reported high acceptance. If accepted, the dosing quickly became habitual. The result is described further in figure 10. The acceptability of the two prototypes of *Scripting* and *Habit Intervention* was related to the fact the participants did not have to decide how to dose by themselves.

In summary, all of the strategies, except *Competence and Autonomy*, were both effective and accepted by a majority of the participants. Oftentimes, low acceptability did not stem from an aversion towards the design strategies; rather it was connected to flaws of the specific prototypes. A few participants had learnt how to dose moderately and could later manage also without the prototype, while the others had not. For those who had not learnt, sustained access to the prototypes was a necessity to maintain moderate dosing. This implies that behavioural interventions may require the design solution to be present in everyday use in order for the desired behaviour to be maintained.

The complete findings from the evaluation of prototype are presented in section 8.2.

A smaller study on four existing products that make use of the same four design strategies was executed to supplement the findings of the main study. Users of the products were invited to group interviews. The results showed that the product that made use of the strategy *Eco-Affective Design* fail to evoke emotional reactions and instead functioned as a discussion starter. The products that made use of the strategies *Competence and Autonomy* or *Scripting* were highly accepted but the effectiveness could not be established properly. The product that made use of the strategy *Habit Intervention* was well accepted and efficient for some users but not at all for others. All the key findings are presented in section 9.2.

IMPLICATIONS

The findings from the strategy review and the empirical study showed that there are several promising design strategies for sustainable behaviour. But also promising design strategies may fail and the recommendations to start with a user study in order to identify barriers toward the sustainable behaviour (presented in section 3.2.2.), and to combine different design strategies (presented in section 3.2.10.), are vital for success.

Product design can be a feasible way to induce sustainable behaviour. Furthermore, high effectiveness can be achieved together with high acceptance. This implies that designers can motivate and direct sustainable behaviour beyond the possibilities of laws and regulations.

AKNOWLEDGEMENTS

TERMINOLOGY

Acceptability (of artefacts developed from design strategies for sustainable behaviour) – the extent to which the users appreciate the artefact and approve of the way the artefact influences the user.

Contextmapping – a method for collecting rich information about the context of product and/or service use.

Design strategy for sustainable behaviour – a way to design artefacts in order to induce a sustainable behaviour.

Effectiveness (of a design strategy in inducing sustainable behaviour) – the extent to which users carry out the sustainable behaviour.

Long-term acceptability (of artefacts developed from design strategies for sustainable behaviour) – a level of acceptance that has been stable for some time and is unlikely to change in the near future.

Long-term effectiveness (of design strategies for sustainable behaviour) – a level of effectiveness that has been stable for some time and is unlikely to change in the near future.

Product service system – a combination of material and immaterial artefacts, i.e. products and services, providing the user with a result or a function rather than with a product (e.g. clean clothes instead of a washing machine).

Strategy category – a group of design strategies that all induce sustainable behaviours in a similar way.

Sustainable behaviour – either to use an artefact in a way that have a smaller impact on the environment than conventional ways of using the artefact (e.g. to unplug the mobile phone charger when the mobile phone is fully charged), or to use an artefact that by default has a smaller impact on the environment than a conventional artefact (e.g. to go by bike instead of by car).

Target behaviour – a specific sustainable behaviour that an artefact should induce.

TABLE OF CONTENT

1. INTRODUCTION

1.1. BACKGROUND

Ecodesign is a growing design field where several strategies and techniques for reducing the environmental impact of products have been developed. The focus has traditionally been on reducing the impact from the phases before and after the use phase of the product life, e.g. manufacturing with recycled materials and design for disassembly. The attempts of reducing the impact resulting from the use phase have mostly been directed at reducing consumption of energy through e.g. improving energy efficiency and using lightweight constructions. However, efficiency gains accomplished through ecodesign do not always make a difference due to unsustainable use patterns (Tang and Bhamra, 2009). Furthermore, the environmental impact due to a product's or a service's use phase has been less studied, and therefore there may be unexplored possibilities for reduction of products total environmental impact. Thus, further exploration of the field of design for sustainable behaviour is important. This field has recently started to gain attention; a number of strategies for how to design for sustainable behaviour exist and there are products designed with the purpose of promoting certain behaviour. However, neither the strategies' and their corresponding products' effectiveness in inducing target behaviour and in reducing environmental impact, nor the acceptability of the techniques used for influencing behaviour, have been evaluated enough. Especially, the question of how to ensure long-term effectiveness of design for sustainable behaviour has not been satisfyingly answered. The acceptability on the other hand is interesting as most consumer goods are chosen and bought by the consumers themselves, hence the products developed from design strategies for sustainable behaviour need to be commercially viable to have an impact.

1.2. AIM

The aim of this thesis has been to identify and categorise promising design strategies for sustainable behaviour, and to evaluate them on the basis of long-term effectiveness and acceptability.

To specify the project aim further, it can be divided into five objectives:

» to understand how it is possible to influence an individual's behaviour

» to review and compile design strategies for sustainable behaviour suggested by research or by designers

» if needed, to supplement the compilation of design strategies for sustainable behaviour with suggestions for new strategies

» to create a comprehensive model that categorises design strategies for sustainable behaviour

» to evaluate the potential for long-term effectiveness and acceptability of a selection of design strategies for sustainable behaviour, by applying them into prototypes and test these in an everyday life context.

1.3. RESEARCH QUESTIONS

The main questions addressed in this project were:

» Can sustainable behaviour be induced on a long-term basis through product design?

» If so, what mechanisms are employed within the identified design strategies for sustainable behaviour in order to accomplish this?

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» Which design strategies for sustainable behaviour seem promising?

» In the evaluation of design strategies for sustainable behaviour, what level of potential long-term effectiveness in inducing the target behaviour will the prototypes (developed from the design strategies) reach, and why?

» In the evaluation of design strategies for sustainable behaviour, what level of potential long-term acceptability will the prototypes (developed from the design strategies) reach, and why?

» In the evaluation of design strategies for sustainable behaviour, to what extent will the design strategies be accountable for the level of acceptability and effectiveness reached by the prototypes?

1.4. PROJECT LAYOUT

The project ran over a complete year and the work was divided in two main parts. Part I – Strategy Review, was theoretical and provided an academic background, whilst Part II – Empirical Study, was mainly empirical and included testing of long-term effectiveness and acceptability of a selected number of design strategies for sustainable behaviour. The project was carried out by the two authors, in this thesis referred to as the project duo or the duo.

1.4.1. Part I – Strategy Review

Investigation of Strategies

A literature review on the topic of how to influence behaviour was carried out. Design strategies for sustainable behaviour was sought after and compiled into a model for categorisation of design strategies.

1.4.2. Part II – Empirical Study

Exploration of Context

An interesting area for behaviour change was selected, and in order to gain knowledge of this area a literature review and a user study were made. Based on the findings, a decision was made of what target behaviour to promote in the study.

Concept Development

Four strategies were selected, primarily based upon their estimated match with the desired target behaviour. Product concepts inducing or promoting the target behaviour were then developed in accordance with the chosen strategies. Different brainstorming techniques and concept evaluation techniques were used as additions to the strategies. For one of the strategies, an existing product inducing the target behaviour was selected, as it was considered interesting to investigate how well a product already adjusted for the market can induce a sustainable behaviour.

Prototyping

When satisfying product concepts were developed, working prototypes were built for the concepts.

Evaluation of Prototypes

To evaluate the long-term effectiveness and the acceptability of the product concepts, and thus also of the strategies, a study in which households received the prototypes was performed. Both a within subject and a between subject design was chosen for the evaluation. The initial behaviour in the households was documented. During the testing of the prototypes the participants' behaviour was documented additionally two times in order to monitor any behaviour changes. In the end of the evaluation period interviews were held with the households to investigate why the targeted behaviour was or was not changed.

Assessment of Products

To gain further insights in why the selected strategies succeed or failed, a minor study of existing products was done. One product corresponding to each of the chosen strategies was identified and users of these products were recruited to group interviews.

2. METHODS

In this master's thesis the methods used will be explained throughout the report and in connection to where the method is introduced for the first time. The methods are still numbered 2.1., 2.2. etc. and they are marked with a grey background for quick identification, as can be seen in figure 11 below. In this way the description of a method will appear just when an ignorant reader needs it, at the same time as it will be easy for the informed reader to skip this chapter.

Methods presented in this thesis are:

X. Method number x

If you see text with a grey background like this one, then the text is describing a method used within this master's thesis.

Figure 11. An illustration of how the methods will be presented througout this thesis.

3. INVESTIGATION OF STRATEGIES

This chapter summarises the theoretical basis within this project. Presented are both relevant theory from the psychology field and a compilation of design strategies for sustainable behaviour. Additionally, a model for categorisation of such design strategies is suggested.

3.1. PROCEDURE

The investigation of design strategies for sustainable behaviour consisted mainly of a literature review. Additionally, a model for how to categorise design strategies for sustainable behaviour was created and the strategies found in the literature review were complied in accordance with the model for categorisation.

3.1.1. Literature Review

In the literature review, information concerning five topics was searched for; (1) a theoretical background of how design strategies for sustainable behaviour induce behaviour, (2) ways of categorising design strategies, (3) design strategies suggested in literature, (4) studies of the effectiveness and acceptability of design strategies, and (5) examples of implementation of design strategies in products and services.

For the four first topics above, academic work was searched for through electronic databases provided by Chalmers Library and search engines on the internet. In addition, literature recommended in a course in psychology of sustainable behaviour at Gothenburg University was extensively used. Furthermore, the project duo read literature recommended by the supervisor and classmates. In all material used, interesting references were followed if possible.

For the fifth topic, design blogs and common search engines on the internet was utilised in order to find examples of implementation of design strategies created by companies or independent designers. In addition, interesting examples was looked for in books, magazines and everyday life.

3.1.2. Creation of Model for Categorisation of Design Strategies

Different ways of categorising design strategies for sustainable behaviour were identified in the literature review. The benefits of using one of the categorisations within this project were judged upon how well it corresponded with the theoretical background and whether all identified design strategies would fit into it. As none of the identified categorisations was found suiting, these considerations became the starting point for the creation of a new model for categorisation of design strategies for sustainable behaviour. In addition, the project duo wanted the categorisation to describe different influencing techniques for inducing sustainable behaviour at the same abstraction level to ensure internal coherence. Furthermore, the duo envisioned that the model should be usable both in design theory and practice.

3.1.3. Compilation of Strategies

The compiled strategies originated from four different sources. Firstly, some design strategies were explicitly suggested in literature as ways to induce sustainable behaviour. Secondly, other strategies were suggested to induce behaviour in general, and thus thought to be applicable also for sustainable behaviour. Thirdly, a number of strategies were derived from theories of human behaviour, and thus got more speculative in nature. Finally, possible strategies were identified in existing products or services, or concepts of the same.

The compilation of strategies was a continuous work performed throughout the project and over time the number of relevant strategies continuously grew. Therefore, the project duo viewed the compilation of strategies as a tentative collection, in which some strategies got well-defined and

explained in detail, whilst others were left more undefined and less supported by research. An additional reason for this inconsistency was the fact that the project duo had little previous knowledge in the field of psychology. As the compilation of the design strategies was initiated by reviewing strategies with an evident connection to this field, a lot of time was spent searching information on and understanding e.g. the strategies Information, Value and Attitude Reminder and Incentives. Yet, the summaries of such strategies could be extended. As a result of this initial attempt of thoroughness, other design strategies that would require a review of the same magnitude had to be described less comprehensively due to difficulties in accessing relevant information given the time available. Moreover, possible overlapping elements within the compilation were left to be, as the time for creating coherence and stringency was limited. Still, identified strategies that clearly acted upon the same mechanisms were combined into one unified strategy.

The majority of the design strategies suggested in literature had an accurate denomination, which thus was kept in the compilation. When similar strategies were combined, one of their denominations was chosen. If no denomination existed, e.g. if the strategy was defined by the project duo, an appropriate name was formulated. In a few cases, an existing denomination was thought less suiting, and thus a new one was formulated. Still, the denominations were not allotted too much time and effort.

3.2. KEY FINDINGS

3.2.1. Introduction to the Theoretical Background of Behaviour Interventions

There are numerous reasons for why people behave as they do, and often these reasons are obscure even to the actors themselves. However, theories about fundamental physiological and psychological needs, personal values, attitudes, incentives, regulations and habits can all be used when attempting to explain, predict or change behaviours. In this

review, a couple of well-known theories on behaviour and behaviour change are accounted for. The theories and mechanisms presented overlap each other to some extent and therefore, there may be some contradicting elements. However, this is not problematic since the theories are compiled on the basis that they provide an understanding of the mechanisms employed within design strategies for sustainable behaviour and not to serve as a complete theory of human behaviour.

Values, Attitudes, Norms, and Sustainable Behaviour

Values, attitudes and norms all influence behaviour. Norms are expectations of how to behave in certain situations (Schwartz, 1977, cited in Nilsson, 2007) and thereby influence behaviour. Values influence attitudes that influence behaviour, but the link is often weak. Nonetheless, there is a link and therefore, it is relevant to understand these concepts, their interrelations and how they can affect behaviour.

Values

Through a compilation of several researchers' view, Nilsson (2007) explained that values express what people find important in their lives and represent ideas of a goal. Furthermore, values are often thought to be a foundation for motivation, and as such it can influence attitudes and behaviour (Nilsson, 2007). For a value to influence attitudes and behaviour it needs to be salient and active (Verplanken and Holland, 2002), meaning that people have to be reminded that their values are important in this particular situation (Nilsson, 2007). Additionally, competing apprehensions, or social norms must not be stronger than the value, and the situation itself must not constitute an obstacle (Nilsson, 2007).

Attitudes

An attitude is an evaluation of anything a person discriminates or holds in mind, called an attitude object (Bohner and Wänke, 2002). The attitude object can be concrete, e.g. a product, or abstract, e.g. an idea. There is not always consistency between the values and attitudes a person holds. One reason for this is that attitudes have more functions than just expressing values (Nilsson,

2007). Therefore, only when a person adopts attitudes in order to be consistent with their values, the correlation between values and attitudes should be significant (Nilsson, 2007). Furthermore, the value-attitude-behaviour link is strengthened if a person is reminded of the importance of his or her values in the present situation (Nilsson, 2007). The Theory of Planned Behaviour, as elaborated on below, presents one model for how attitudes influence behaviour.

When a behaviour becomes a routine, i.e. is highly automated and performed with minimum cognitive effort and often limited awareness, a change in attitudes does not guarantee a change in behaviour (Jackson, 2005; Verplanken and Wood, 2006). This is one of the reasons for why unsustainable behaviour is common, even though many people express concerns about the environment. The role of habits will be discussed further in the corresponding paragraph below.

Norms

Unlike values that transcend situations norms give directions for how to act in specific situations (Schwartz, 1977, cited in Nilsson, 2007). There are both social and personal norms. For social norms, possible rewards or sanctions come from a social group. The social norms are either descriptive or injunctive. Descriptive norms describe what most others do while injunctive norms describe what most others approve or disapprove of (Cialdini, Reno and Kallgren, 1990). For personal norms, the sanctions or rewards come from within the person, either as feelings of self-appreciation and pride or as feelings of guilt and self-depreciation. Personal norms include both moral norms, which are in line with an individual's values, and internalised social norms. According to the Norm Activation Theory (Schwartz 1977, cited in Nilsson, 2007 and in Gardner and Stern, 2002) moral norms have to be activated in order to influence behaviour. A moral norm is activated on the condition that a person is aware of the consequences of the behaviour, and that he or she accepts ascription of responsibility of the behaviour. Only under these conditions, the person perceives the behaviour as moral.

Personal norms are often formed through values, and since norms give directions for how to behave in specific situation, they are good predictors of
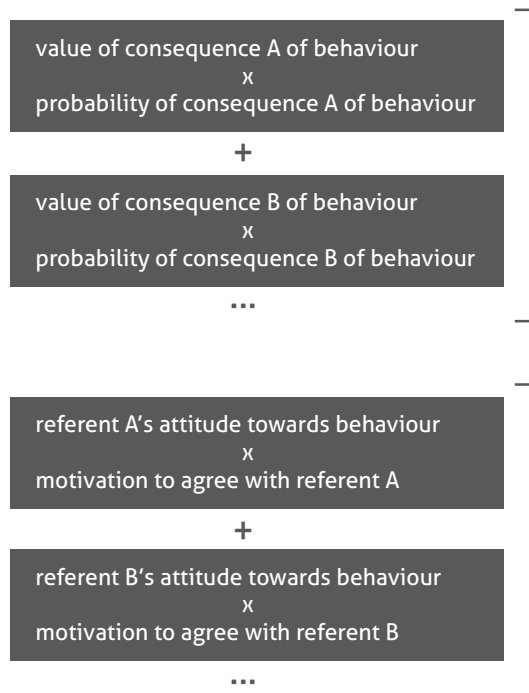
Figure 12. Model of TPB, modified from a figure in Bohner and Wänke (2002)

behaviour (Nilsson, 2007). But, this is only true for personal norms that are consistent with social norms, i.e. when the social norms are internalised. When personal and social norms are conflicting, the social norm weakens the link between values and behaviour.

The Theory of Planned Behaviour

One theory for understanding how attitudes influence behaviour is the Theory of Planned Behaviour (TPB), proposed by Ajzen (1991) as an extension of the Theory of Reasoned Action (TRA) developed by Fishbein and Ajzen. According to TPB (figure 12), behaviour is caused by a decision to engage in the behaviour, called a behavioural intention. The intention indicates how much effort a person is willing to put forth, in order to perform the behaviour. In general, the likelihood of a behaviour to be performed is determined by the strength of the intention, as long as the decision to perform the behaviour is under the person's control. The intention is formed by the person's attitude towards the behaviour, the perceived behavioural control over it and the person's subjective norm towards it. The subjective norm can be described as the perceived social pressure to perform the behaviour (Nilsson, 2007). The perceived behavioural control can be described
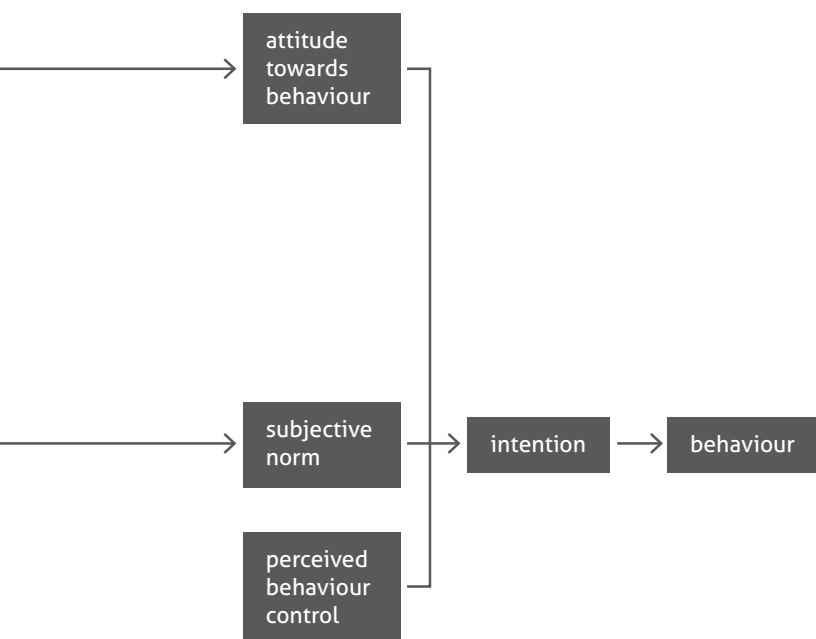
as the perceived ease with which a behaviour is performed. It is thought to be based on past experience as well as anticipations of difficulties. The attitude towards the behaviour is described by the Expectancy-Value Model (Ajzen, 1991). Bohner and Wänke (2002) described this model as follows. The attitude is determined by the sums of the subjective values of the consequences of the behaviour multiplied with the subjective probabilities of the consequences of the behaviour. The subjective norm is determined by the perception of other persons' or groups' attitudes towards the behaviour. These persons or groups are called referents. More specifically, the subjective norm is directly proportional to the sum of products of the referents' perceived attitudes towards the behaviour multiplied with the subjective motivation to agree with those referents.

Motivation – Ability – Opportunity – Behaviour Model

The Motivation-Ability-Opportunity-Behaviour Model (figure 13) is a modification of The Theory of Reasoned Action, suggested by Ölander and Thøgersen (1995). The added features are the concept of ability and the concept of opportunity. For consumer behaviours related to environmental issues prediction of behaviour has proven more accurate when ability, including habit and task knowledge, and opportunity has been added to the link between attitudes and behaviour (Thøgersen,

1994). The dashed feedback arrows in figure 13 indicate that the beliefs about, or evaluations of, an action often change with gained experience.

Cognitive Dissonance

Leon Festinger presented in 1957 a theory of what happens when a person holds two or more related, but incompatible, beliefs or pieces of knowledge at the same time. Festinger called this uncomfortable psychological conflict for cognitive dissonance (Harmon-Jones and Harmon-Jones, 2007). According to Festinger's theory, the cognitive dissonance is uncomfortable enough to motivate people to try to reduce the inconsistency (ibid.). The belief or knowledge that is the least resistant to change will then be adapted, often through a change in attitude. Knowledge of recent behaviours is typically resistant to change, because it is not possible to undo behaviour (ibid.). Hence, a change of attitude, as discussed earlier, can also be induced by a change in behaviour (Bohner and Wänke, 2002).

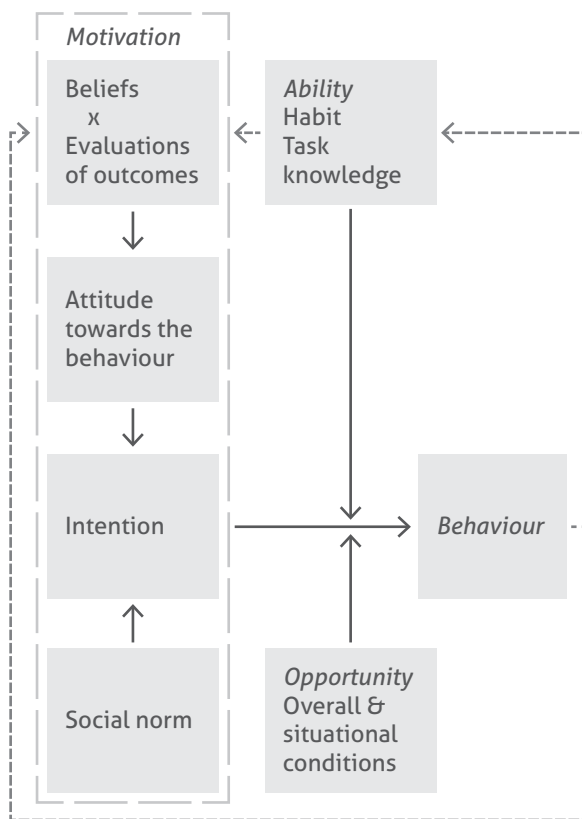In a state of dissonance a person may avoid information that increases the dissonance or seek

Figure 13. The Motivation-Ability-Opportunity-Behaviour Model (Ölander and Thøgersen, 1995).

information that decreases the dissonance (Frey, 1982). If a person has formed a habit and thereafter is confronted with new information that conflicts with the habit, trivialisation or rejection of the information may occur in order to avoid the cognitive dissonance (Jager, 2003).

Motivation and the Self-Determination Theory

Motivation is a driving force for human behaviour and it can be either intrinsic, when the behaviour is engaged in out of free will and the act itself is the reward, or extrinsic, when offered or imposed by the surrounding.

According to the Self-Determination Theory every human has three fundamental psychological needs; the need for autonomy, competence and relatedness (Deci and Ryan, 2000). Intrinsically motivated behaviours are related to these needs, particularly to the two first ones, as there are individual activities such as playing solitaire that people are intrinsically motivated to perform. Intrinsic motivation can be forestalled by extrinsic motivation. When for example monetary rewards are offered for an intrinsically motivated activity, people tend to perceive the locus of the motivation as shifted and thus feel controlled, and subsequently less motivated. Extrinsic motivation can consist either of rewards or punishments and seldom causes permanent changes in behaviour, unless it becomes internalised and thus self-regulatory.

The process of internalisation of regulations can be divided into four steps, describing how far the process has reached; external regulation, introjection, identification and integration (figure 14) (Deci and Ryan, 2000).

When a regulation is introjected it is rather similar to the external regulation, but the consequences

are administrated by the individual herself and can be manifested in for example pride or shame. This step can be compared with internalised social norms, see previous paragraph on norms. Identification occurs when a person acknowledges the worth of the regulation and its corresponding behaviour. Finally, when the regulation becomes integrated, a person not only identifies the importance of the regulation, but also integrates it with her values and other aspect of the self. However, to fully integrate an external regulation and create a corresponding inner motivation takes time (Deci and Ryan, 2000).

Green-Demers, Pelletier and Menard (1997) as cited in Pelletier, Dion, Tuson, and Green-Deme (1999) observed that intrinsic motivation, integrated regulation and identified regulation exhibited the strongest connections to the frequency of different pro-environmental behaviours. When the motivational type grew less self-determined, this connection weakened and eventually became negative.

Habits

Having a habit is a way to use the limited cognitive capacity more efficiently, as no cognitive capacity is spent on a repeatedly occurring decision making situation that will render the same result anyway (Jager, 2003). A person might be aware that he or she is acting according to a habit, even though the behaviour is automated and requires little cognitive effort. A habit's strength depends on how fully automated the behaviour is and the strength predicts how difficult the habit is to break (Jager, 2003). However, a behaviour is not necessarily habitual just because it is performed regularly (Verplanken and Wood, 2006).

As mentioned in the paragraph on attitudes, habits

Type of Motivation:	Extrinsic				Intrinsic
Type of Regulation:	external	introjected	identified	integrated	intrinsic
Locus of Causality:	external	somewhat external	somewhat internal	internal	internal

Figure 14. Different types of motivation with the corresponding type of regulation and the locus of causality.

partly explain the gap between pro-environmental values and pro-environmental behaviour. According to two diary studies by Wood and Quinn (2002), between one third and half of the respondents' everyday activities were habitual, in the sense that they were performed almost daily in the same location. With that in mind, the importance of breaking unsustainable routines and introducing new more sustainable habits becomes evident.

3.2.2. Identify Barriers Prior to Choosing a Design Strategy

When designing for a sustainable use of products, Tang and Bhamra (2009) suggested that a deep understanding of actual use behaviour is essential. Tang and Bhamra (2009) performed two pilot studies in order to improve energy efficiency of fridges and freezers. In these studies, they applied qualitative user-centred research techniques to investigate daily practices, needs, attitudes, intentions and actions of users. Their findings showed that understanding of use behaviour gained through the pilot studies did give directions for ways to design for sustainable behaviour. Furthermore, Manning (2009) stated that sustainable behaviour is most likely to arise when people encounter few barriers towards the sustainable action. Such barriers can be a lack of infrastructure, an extra expense, lack of knowledge, the difficulty of breaking a habit, psychological or social issues, etc. Consequently, a precondition for a successful sustainability campaign is that it should start with an analysis on what barriers people face regarding the subject of the campaign (Manning, 2009). Gardner and Stern (2002) strengthen this statement further in their recommendation that when creating an environmental programme, the numerous and varying barriers towards a pro-environmental behaviour should be identified, and that the best way to do this is by observing or interacting with the people whose behaviours are to be influenced.

As a conclusion, every attempt to design for sustainable usage should begin with a user study in which barriers towards the target behaviour are identified. This will enable designers to choose design strategies that have the potential to deal with the identified barriers, and that will suit the

target group well.

Common Motivational Barriers

When searching for barriers towards sustainable behaviour, a designer can be helped by keeping in mind the Amotivation Toward the Environment Scale (AMTES) (Pelletier, Dion, Tuson, and Green-Deme, 1999) and four common excuses used to justify unsustainable behaviour identified by Hult (2008). These concepts can be important for the designer to consider as they include motivational barriers commonly used when a person has the opinion that the environment needs to be protected but still does not act upon this conviction.

The AMTES purports to measure amotivation towards environmental protective behaviours due to four categories of beliefs:

» Helplessness beliefs – when a person is overwhelmed by the extent and severity of the environmental problems, and therefore is unable to see how his or her actions could affect the environment in a positive and significant way.

» Strategy beliefs – when a person expects actions or strategies to be ineffective in producing the desired outcome.

» Capacity beliefs – when a person lacks faith in his or her aptitude to perform a certain behaviour.

» Effort beliefs – when a person doubts that he or she will be able to sustain the effort needed and integrate the behaviour in his or her lifestyle.

In their study, Pelletier, Dion, Tuson, and Green-Deme (1999) found that helplessness beliefs appeared to be a direct consequence of capacity beliefs and strategy beliefs, whilst it had no significant relation to effort beliefs. However, amotivation due to effort beliefs was a strong predictor of amotivation due to capacity beliefs.

Four common excuses for a lack of pro-environmental behaviour were identified by Hult (2008) in line with the theory of cognitive dissonance. These excuses allow people to view themselves as

environmentally friendly, even though they do not perform pro-environmental behaviour. The four excuses are:

» I want to, but I do not have enough time, or I do not manage it

» I want to, but it is not my responsibility

» I want to, but it turns out wrong anyway

» I actually do some things

(translated from Swedish by the project duo).

In the first excuse, the current life situation is thought to cause an unsustainable behaviour. The life situation is found to be too difficult to change, and thus it serves as an excuse not to perform the sustainable behaviour. In the second and the third excuses, the responsibility is thought to be someone else's. Thus, if the person using one of these excuses would behave in an unsustainable way, it is not his or her fault. Therefore the behaviour is not inconsistent with a pro-environmental attitude. Additionally, a person using the second or third excuse is probably more receptive to information that is consistent with these excuses, thus making them more and more firm. In the fourth excuse, the sustainable behaviour that the person actually does engage in are emphasised, and thereby the dissonance is decreased.

3.2.3. Reviewed Categorisations of Design Strategies

Dwyer et al. (1993) presented a categorisation of intervention strategies based on whether the strategy have an antecedent or a consequence condition, whether it is directed to an individual or to a group and in the antecedent condition, whether the persons are active or passive. This categorisation was extended and visualised in a comprehensive model by Blindh Pedersen and Selvefors (2009). Their main categories are presented below.

» Increase Knowledge – including the strategies feedback, information, supervision and showing next move.

» Exhort – including the strategies punishment, reward and guidance.

» Draw Attention – including the strategies feedback, notice information and visualise connections between action and outcome.

» Engage – including the strategies commitment, competition and goal setting.

However, as the strategies in this assembly, according to Blindh Pedersen and Selvefors (2009), all aim at creating initial motivation for behaviour, strategies aiming at maintaining behaviour cannot be fitted into their categorisation.

Lockton, Harrison and Stanton (2010a,b) created a toolkit, called Design with Intent, for guiding designers and others when using design to influence behaviour. The toolkit consists of a set of cards with suggestions, provocations and examples together with a toolkit wiki (a website that allows for its users to be co-creators). However, all of the measures described in the cards do not aim at inducing sustainable behaviour specifically, but any behaviour desired by the designer. The cards are divided into eight groups, or lenses, that represent different fields of research. Yet, Lockton, Harrison and Stanton themselves mentioned that this categorisation is not rigorous and many cards would fit into several lenses (2010b). The lenses are as follows:

» Architectural Lens – techniques for influencing behaviour used in architecture, urban planning, etc.

» Errorproofing Lens – design in a way that facilitate behaviour that do not deviate from target behaviour or make deviation impossible.

» Interaction Lens – techniques for when users' interaction with a product or system influence the way the product or system respond, including techniques from persuasive technology.

» Ludic Lens – influencing use behaviour with playful techniques stemming from games.

» Perceptual Lens – techniques based on how users see meaning, through e.g. products semantics and Gestalt psychology.
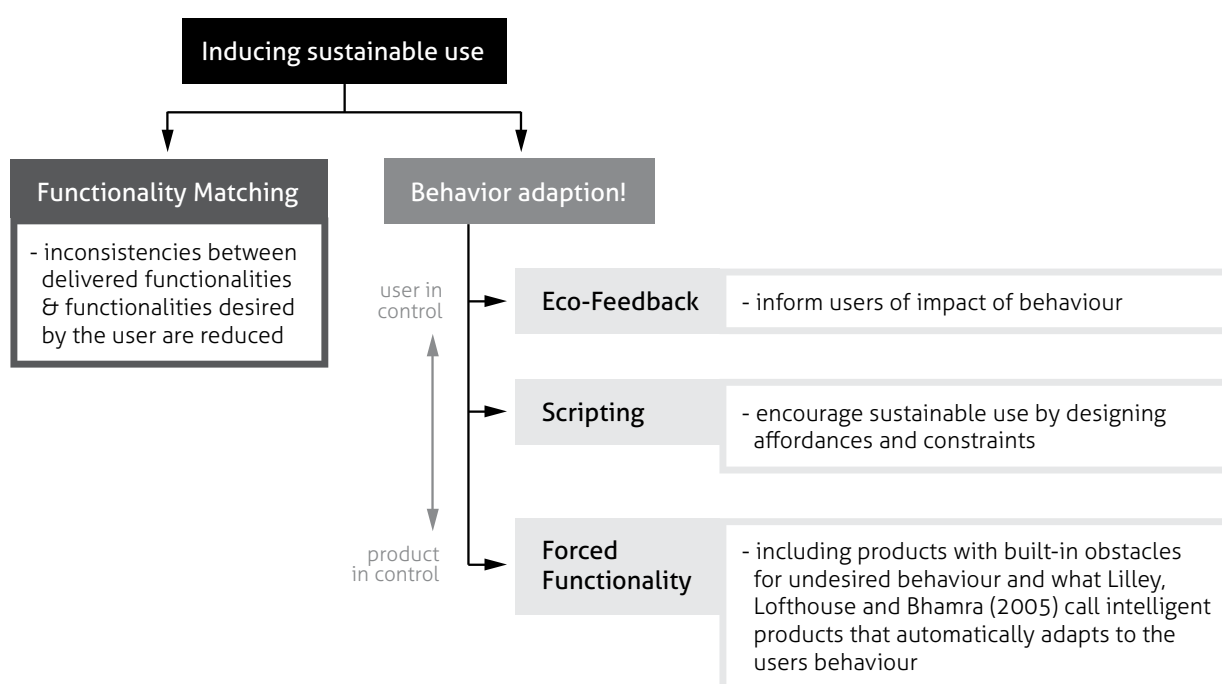
Figure 15. The categorisation of design strategies for sustainable behaviour suggested by Wever, Kuijk, and Boks (2008).

» Cognitive Lens – techniques based on how people make decisions, originating from behavioural economics and cognitive psychology.

» Machiavellian Lens – severe and sometimes unethical techniques to both influence and control use behaviour.

» Security Lens – techniques based on the idea that the undesired behaviour should be prevented, even if the intervention can be seen as unfriendly or even unethical.

Since the categorisation represent different research fields, it is not surprising that it does not correspond well with the theoretical background in this project. Still, Lockton, Harrison and Stanton's (2010a) eight lenses are an example of how to assemble design strategies in a way that suits design practice.

For some intervention strategies the user is in control whilst in others the product is in control. Wever, Kuijk, and Boks (2008) as well as Lilley (2009) have made visualisations of this. Lilley (2009) listed three strategies with respect to who has the power in the decision-making:

» Eco-Feedback – remind and inform – the user is in control.

» Behaviour Steering – encourage desired use by affordances and constraints – the user is somewhat controlled by the product.

» Persuasive Technology – change people's thoughts and actions with or without their knowledge and consent – the product is in control.

Wever, Kuijk, and Boks (2008) suggested a similar categorisation but with a clear distinction between functionality matching and design strategies where a behaviour adaption is needed (figure 15). Functionality matching is in their categorisation defined as when inconsistencies between delivered functionalities and the functionalities desired by the user are reduced.

The labels within these two categorisations are rather limiting as several intervention strategies would not be possible to place in them, e.g. the strategies information and competition used by Blindh Pedersen and Selvefors (2009) in their categorisation of strategies.

Bhamra, Lilley, and Tang (2008) identified a collection of seven intervention strategies for behavioural change and put them in relation to user control. The seven strategies has a fair spread, even if some overlapping regarding influencing

techniques occur, e.g. for Eco-Information and Eco-Feedback that both aim at informing the user. Hence, the project duo thought that the strategies had potential to be expanded into categorisations and thus this assembly was reviewed as well. The seven strategies are presented below.

» Eco-Information – visualising use of consumables in order to encourage users to reflect on their behaviour.

» Eco-Choice – providing users with options and as a consequence encourage users to take responsibility for their actions and to be aware of their use behaviour.

» Eco-Feedback – facilitate for users to make environmentally sound decisions by giving feedback about use behaviour.

» Eco-Spur – using rewards or penalties to encourage sustainable behaviour.

» Eco-Steer – facilitate sustainable use with help of prescriptions of use and constraints.

» Eco-Technical Intervention – using advanced technology to restrain undesired behaviour and persuade desired behaviour.

» Clever Design – decreasing environmental impact through innovative design solutions instead of changing user behaviour.

When viewed as categories these seven strategies were found to be somewhat incoherent, as some of them are quite specific while others are more vaguely formulated. The category of eco-technical intervention was thought to be too narrow, as hindrance for desired behaviour does not have to include the use of advanced technology. Finally, the social and societal aspects of sustainable products use were missing.

3.2.4. Proposed Model for Categorisation of Design Strategies

The categorisations reviewed in the previous section all had their positive aspects, but also their flaws. The most common shortcoming was a too limiting labelling of the categories, which would make it difficult to sort different design strategies into the categorisations. Thus a more inclusive categorisation would be beneficial. Furthermore, the project duo envisioned a categorisation that describes different influencing techniques at the same abstraction level. Hence, with inspiration from the categorisations reviewed above, the project duo created a new model for categorisation of design strategies for sustainable behaviour (figure 16).
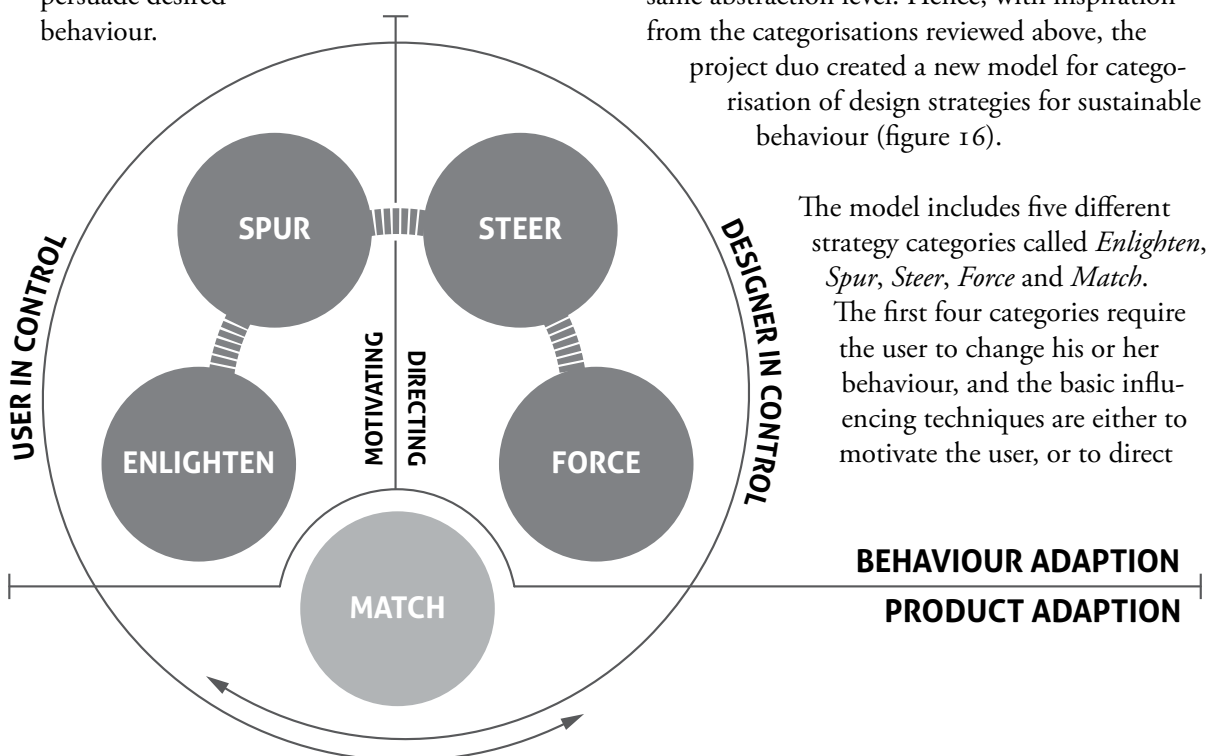
The model includes five different strategy categories called *Enlighten*, *Spur*, *Steer*, *Force* and *Match*. The first four categories require the user to change his or her behaviour, and the basic influencing techniques are either to motivate the user, or to direct

Figure 16. The model created by the project duo for categorisation of design strategies for sustainable behaviour.

the user. Sometimes the borders between these four strategies are less evident, and this is illustrated by a dashed line in the model. The fifth category, *Match*, differs from the other categories as it requires none, or little adaptation from the user. Instead the product or service is matched with the user's initial behaviour, or to behaviour the user would like to perform. In the model, the first four categories are placed with respect to the level of user control versus designer control. In the category *Match*, both the user and the designer can be viewed as in control since the user controls his or her behaviour, but the designer controls the outcome of the behaviour.

The circular appearance of the model was chosen as this makes the strategy categories equal in value, at the same time that it represents the relationship between them. A linear model would implicitly have suggested one strategy category as a starting point.

The five categories and the corresponding design strategies are described in the following five sections.

3.2.5. Design Strategies within the Category Enlighten

The purpose of the design strategies brought together in the category *Enlighten* is to induce sustainable behaviour by informing the user, either through information or by means of reflection (figure 17). The topic of the information or the means of reflection may differ. Firstly, the topic can be environmental issues which help the user to form a positive attitude towards performing the desired behaviour. Secondly, the users can be informed about the behaviours of others in order to form a positive subjective norm and attitudes

Figure 17. The carachteristics of the cetegory *Enlighten*.

towards the behaviour. Thirdly, if a positive attitude and subjective norm already exist, the aim can be to remind people of this and to educate people about behavioural possibilities for acting in line with these attitudes and norms. All strategies in *Enlighten* concern the users' values, attitudes, norms or knowledge.

Below, all the design strategies in the category *Enlighten* are described. For some strategies there are subheadings to make it easier to distinguish the different variations possible for the strategy. For the two strategies *Information* and *Feedback* there are several variations.

Information

The strategy *Information* is widely used in many areas of the society to influence people. In suggestions and attempts to use information to induce sustainable behaviour there is variations in what to give information about and these two are here called *Information Concerning Environmental Issues* and *Instructions for Sustainable Behaviour*. In addition, there are several variations of how to give the information, e.g. *Emotionally Triggering Information* and *Simple Information*. In this compilation *Information* refers to all different ways of informing users about a matter, e.g. with text, pictures, video etc.

Information Concerning Environmental Issues

The variation of the strategy *Information* called *Information Concerning Environmental Issues* aims at educating people about environmental issues in order to induce an attitude change and thus a potential behaviour change. There have been many attempts by e.g. governments and non-governmental organisations to educate people in order to induce an attitude change resulting in a desired behaviour, related to environmental issues as well as other issues, e.g. AIDS prevention and prevention of the use of tobacco. Nevertheless, the efficiency of education alone is questionable (Gardner and Stern, 2002). Examples collected by Gardner and Stern (2002) show that education often results in a minor attitude change, while no behavioural changes are detected. Yet, there are also examples of when education work. When the Americans from media learnt that products such as aerosol hairsprays and deodorants could

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cause environmental problems and constituted a health risk, the sale of aerosol products decreased significantly, even before the aerosol ban of 1978 (Morrisette, 1989). Furthermore, to educate people is one of few strategies to induce an attitude change; therefore it can be essential when there is a negative attitude towards certain behaviour. Few examples of product or service design making use of this strategy have been found, but on the other hand there are no indications that the strategy could not be successfully applied in product or service design.

In order for information to influence the construction of attitudes, a person needs to retrieve a certain piece of information from the memory. What information will be retrieved depends on its accessibility, e.g. the ease with which a specific piece of memory comes to mind. The accessibility depends on whether the piece of information had qualities that made it memorable, such as being surprising or vivid, if it is frequently accessed, how it is organised in memory and the recency of its activation (Bohner and Wänke, 2002). Thus, these factors influence the impact a certain piece of information can have on attitude construction. Unnoticed information will never influence attitudes, therefore to be attention-drawing is a necessary quality of effective information.

Information is more successful in changing people's attitudes, if these attitudes are in line with people's values (Gardner and Stern, 2002). Therefore, information must be given in such a way that people understand that they do not have to change their values along with the attitude change. Maybe this can be as simple as rephrasing or renaming (Lockton, Harrison and Stanton, 2010a). This has been done in promotion of energy saving, by referring to it as "energy efficiency" instead of "energy conservation" (Gardner and Stern, 2002).

Another important aspect for successful persuasion can be understood through the Attribution Theory. The core assumption in this theory is that a recipient of information may infer reasons to why the communicator sends a specific message, and these conclusions will affect the recipient's attitude towards the message (Bohner and Wänke, 2002). If a product should transmit a specific message to a user it must thus be perceived as if it reflects the reality and not the goals of the producer of the

product. In other words, the transmitter's credibility is important for attitude change. Credibility could be achieved through certification of the information by independent organizations, e.g. with eco-labels or, as often used in marketing, by celebrities or, as suggested by Gardner and Stern (2002), to be given by a trusted friend. Furthermore, to present both arguments for and against an attitude when giving information is another way to be perceived as credible. In addition, to provide a person with a few counter-arguments have been found to increase resistance to future counter-argumentation (Bohner and Wänke, 2002). By using the principle of evaluative conditioning, which states that a person may start to like something because the exposure to it was paired with a positive experience stemming from another source, attitudes can be altered. This is a principle used in advertisement where e.g. beautiful people and good music serve as the positive experience with which the product becomes connected (Bohner and Wänke, 2002).

Instructions for Sustainable Behaviour

The success of information in overcoming barriers to actions primarily depends on whether lack of information was a barrier to sustainable behaviour. For many actions, the barriers are rather high, for example insulating the house in order to reduce energy consumption which is an action that may be difficult and is connected with high initial costs. In this case, lack of information is not a major barrier and therefore, information alone is inefficient (Gardner and Stern, 2002).

When the barriers for the promoted behaviour are low, e.g. easy to perform and of low-cost, well-designed information can induce a change in behaviour (Gardner and Stern, 2002). A good example is a brochure, designed in a way that it appeared to originate from the New York State Public Service Commission, distributed to households in New York during the summer of 1976 with information about how to reduce energy consumption of air conditioners. The brochures proved to be successful in inducing a significant reduction of energy consumption used by the air conditioner compared with a control group. Interestingly, the same brochure, but instead appearing to originate from the energy company Con Edison was significantly less successful in inducing

behaviour change (Craig and McCann, 1978). The failure in the latter part of the experiment might be caused by the difference in credibility of the sources of information as the sources were chosen for their inherent credibility difference (Craig and McCann, 1978). Yet, as the households regularly received bills from Con Edison, the brochure may easily have been unnoticed and thus reducing the success of the brochure (Gardner and Stern, 2002). Most likely, the households were not used to get information from the New York State Public Service Commission, thus the brochure appearing to originate from them was more attention-drawing.

If a person that drives a petrol car holds a positive attitude towards pro-environmental behaviour and a self image consistent with that attitude, there should be a cognitive dissonance. In this situation, the person might use one of the four common excuses for pro-environmental behaviour (section 3.2.2., paragraph Common Motivational Barriers) and think that "I do not want to drive on ethanol until they stop devastating the Brazilian rain forest in order to grow sugar for the production of ethanol". Given that the person would be provided with proof that his excuse is not valid from a source the person trusts, the person would find him or herself in dissonance once again. The person is then motivated to either change his behaviour, his attitude or to come up with yet another excuse. According to the theory of cognitive dissonance, the element least resistant to change will change. If the person in this situation is provided with information about how to change his or her behaviour, that element might be changing. The risk is of course that the person is receptive to information that proofs the validity of the original excuse and sceptical of information that questions it. A possibility is that the excuses people use for not acting in a pro-environmental way were formed several years ago, when pro-environmental behaviour was harder to perform because there were less environmentally friendly products on the market. Due to avoidance of information that questions their behaviours, their knowledge might be out-of-date and subsequently easier to disprove.

According to the Theory of Planned Behaviour, perceived behavioural control influences both behavioural intention and behaviour itself, where the perceived behavioural control can be explained as the ease with which the promoted behaviour

can be performed (Bohner and Wänke, 2002). With clear information about how to perform a task, the perceived behavioural control may increase. Thøgersen (1994) reviewed several studies on source separation of waste and concluded that deficient task knowledge can cause both sorting failures and defections from the program. In these studies, well-designed information about how to source separate might have been successful in inducing correct sorting. Another example is online public transportation travel planners, for example the one provided by Västtrafik the public transport company for West Sweden. For a person that usually goes by car, a barrier to travelling with public transport might be that it is difficult and time-consuming to find out what buses or trams to take, how long time the travel will take etc. With online public transportation travel planners the car-driver would only have to type the addresses of the starting and end points together with desired departure time or desired time of arrival (Västtrafik, 2010). Then the car-driver gets suggestions of how to travel with public transport, information about how long time the trip will take, information about the price of the trip etc. Thus, the barrier for the car-driver to go with public transport is lowered.

Highlight Benefits of Sustainable Behaviour

In information about sustainable behaviours the benefits a behaviour might have on a personal level could be highlighted instead of the environmental benefits. This is already used in for example marketing of ecological food where it is described as healthier than non-ecological alternatives. Similarly, Ecoride, a company selling electrical bicycles, describes on its webpage not only the environmental benefits of their products but also the personal benefits of using the electrical bicycle, e.g. that you will easily pass by the morning congestion of the traffic, that you will not have to pay congestion taxes (if any) and you will get exercise, yet not being sweaty at arrival (Ecoride, n.d.). This relates to the strategy *Value-Added Design* in section 3.2.6.

Highlight Negative Environmental Impact

In an experiment by Grankvist, Dahlstrand and Biel (2004) the effect of negative versus positive environmental labelling on everyday products was investigated. They found that participants with an

intermediate interest in environmental issues were more affected by the negative eco-labels than by the positive. Participants with a strong interest in environmental issues were as affected by negative eco-labels as by positive. Participants with weak or no interest in environmental issues were not affected by any of the labels. This is supported by Nilsson (2007) who found individuals to be more willing to donate to a common good in a prevention context (willingness to accept, i.e. the minimum amount a person is willing to receive to accept something undesirable) than in a promoting context (willingness to pay i.e. the maximum amount a person would be willing to pay to avoid something undesired). Grankvist, Dahlstrand, and Biel (2004) argued that differences between prevention and promotion can be linked to social and personal norms, where a personal norm gave a promotion focus and a social norm a prevention focus. These findings correspond with earlier research by Kahneman and Tversky (1979) who concluded that people are more sensitive to the risk of losing something than to the possibility of gaining something of equal value. A possible

design strategy in line with these research findings is to highlight the negative environmental impacts of an undesired behaviour or the negative environmental impact of not performing a desired behaviour rather than the positive environmental impact of a desired behaviour.

Emotionally Triggering Information

If information is presented in such a way that it evokes strong emotional reactions, it will be attention-drawing and vivid, which are factors that according to Bohner and Wänke (2002) make information memorable and easily accessed. Furthermore, when a piece of information is tied to an emotional experience that experience provides a contextual memory prompt that facilitates future access to the information in similar contexts (Sylwester, 1994). Thus, emotionally triggering information is more likely to be memorised and later recalled.

Findings from studies on education programs for children by Ballantyne, Fien and Packer (2001) as

Figure 18. An example of *Emotionally Triggering Information*. Photo by Banksy.

cited in Ballantyne and Packer (2005) indicated that emotional engagement was an important factor for changes in knowledge, attitudes, values and behaviour concerning environmental issues. They also pointed out that even though further research is needed, there is some evidence suggesting that the impact of an experience lasts longer if the experience involved an emotional component. Ballantyne and Packer's research concerns children, yet there is no obvious reason why the findings would not be applicable also for adults. Therefore, emotional components in information may help in inducing long-lasting attitudes and behavioural changes.

People tend to underestimate the risk of environmental problem they have not witnessed (Gardner and Stern, 2002). Gardner and Stern suggest that a way of coping with this is to show frightening, vivid and concrete visualisations of actual or possible scenarios. A contemporary example is the British street artist Banksy's visualisation of the oil spill caused by BP in the Mexican Gulf in 2010 (figure 18). Banksy's work consists of a dolphin kiddie ride covered in a fishing-net and placed over a leaking oil drum with BP's logotype (Banksy, n.d.). Unfortunately, experiences from health and traffic security promotion show that these types of visualisations may succeed in conveying severity of risks but often fail in communicating the probability of risks (Gardner and Stern, 2002).

Engaging Information

There are attempts of making information engaging. The Interactive Institute designed and tested the learning effect on energy consumption in homes of a computer simulation game providing information (Katzeff and Torstensson, 2006). The game was designed to be engaging and thereby to motivate learning. Four pairs of teenagers were asked to play the game at one occasion. However, the findings indicated that the game did not increase the teenagers' knowledge of energy consumption, yet Katzeff and Torstensson (2006) stated that the game triggered thoughts on the topic of electricity.

Simple Information

Information that is experienced as easy to process is more likely to be accepted as valid in comparison with information that is difficult to process (Bohner and Wänke, 2002). Therefore simple information can be more persuasive and more likely to affect attitudes than complex information. Subsequently, if a product provides information, then making it easily processed e.g. with metaphors, increases the chances for successful transmission. Although information often fails in inducing a change in habits, some positive results have been seen when the information is clear, unquestionable, visible and presented at the time when the habit is performed (Jager, Boers, Eckringa and Westerhof, 1996, cited in Jager, 2003).

As explained earlier, when in a state of dissonance a person may avoid information that increases the dissonance or seek information that decreases the dissonance (Frey, 1982). When information requiring a low cognitive effort is unavoidably presented and quickly understood, there could be a possibility that it gets through even to people in a state of cognitive dissonance. Nevertheless, rejection of the information may still occur, especially since the information may be oversimplified, and thus exaggerated to the extent that it appears untrustworthy.

With clear and simple information about behavioural choices different actions could be presented as either 'good' or 'bad'. When an external regulation is being introjected i.e. when the consequences become administered by oneself through feelings of pride and guilt (described in section 3.2.1. paragraph Motivation and the Self-Determination Theory) it may be effective to present behavioural choices as either 'good' or 'bad' as it could increase these feelings.

A design concept by David Veldkamp seen on the webpage Designboom (2010) shows how information can be visualised in an easily understood manner in the design concept Local Plate (figure 19). On the plates, there is a text saying "33% local food equals 25% less greenhouse gases" or "66% local food equals 50% less greenhouse gases" etc. The information is supplemented with a pie chart in a cheerful colour on white, where the coloured part represents the percentage of locally produced food mentioned in the text. The plates give simple information on the effects of choosing locally produced food that may influence people's attitudes towards this type of food and increase the consumption of it.

Figure 19. An example of *Simple Information*. Picture by David Veldkamp.

Figure 20. An example of *Preview of Behavioural Consequences*.

Figure 21. An example of *Design for Reflection and Discussion*. Photo by Zhang Jian and Ma Lian Lian.

Bodily Attitude Influences

A perhaps surprising way to influence people's attitude is to manipulate their bodily state. At the moment there is no theory explaining all related phenomena, but it has been shown that body posture and facial expressions can affect one's attitude. For example, if a product makes a person take on a posture that corresponds to a happy mood it is likely that he or she feels happier and thus forms more positive attitudes (Bohner and Wänke, 2002).

Preview of Behavioural Consequences

Lockton (2009) suggested in his Design with Intent Toolkit that giving previews or simulations of consequences of behaviour can be used when trying to induce certain user behaviour. In addition, the consequences of a behaviour choice should be comparable with the consequences of other choices, thus clarifying the link between cause and effect (ibid.). An example of such a product is the stove Cylinda 600 from the early 1980's where the knobs regulating the heat of the hot plates are marked both with heat level (raging from 1 to 6) and the power used for each level, in watt (figure 20). For the oven, the power used for different modes, e.g. heat from above, heat from below, fast heating, is marked on the knob. Thus, even before starting using the stove one gets information about how much energy it will consume, the difference in energy consumption between different hot plate sizes, heat levels etc. Unfortunately, it is not clearly stated that the numbers on the knobs stand for power and even if this was the case, not all users have a clear understanding of the terms "power" and "watt".

Design for Reflection and Discussion

The strategy of *Design for Reflection and Discussion* includes all products and services designed with the aim to create an awareness about environmental issues and evoke reflection on and discussion about our behaviours in relation to sustainability. Bohner and Wänke (2002) explained that thinking about a specific attitude object may influence the attitude towards that object. In other words, providing means for reflection may result in stronger attitudes as well as a change in attitude.

There are many clever examples of products that have made use of this strategy, e.g. a toilet paper roll with the cross section of a tree printed on the top and bottom, called the Tree Ring Web (figure 21, designed by Zhang Jian and Ma Lian Lian (Designboom, 2009)). Design projects employing this strategy often have similarities with art. Holmes (2007) described a project that combines art and visual feedback in a building to raise awareness of the building's carbon footprint in which visualisations of trees were used to represent the carbon footprint. Holmes called this eco-visualisation and identified three primary functions of the project: environmental agitprop, visualisation of information and aesthetic experience.

Design for Reflection and Discussion may be aimed at an individual as well as to a group of people. The latter was done by Arroyo, Bonanni and Selker (2005) when developing WaterBot, an attachment to the faucet designed to motivate water conservation. One of the product's features was that it gave indications of the current user's water usage in comparison with the prior users' usage. The idea was that users in this way would be encouraged to discuss their use of water with one another.

The efficiency in inducing a specific behaviour only through *Design for Reflection and Discussion* may be limited and no studies on the efficiency have been found. Yet, the primary purpose of this strategy is to raise awareness.

Eco-Affective Design

Eco-Affective Design is a strategy aiming at evoking negative emotional reactions about an undesired behaviour's environmental impact or positive emotional reactions regarding the target behaviour's reduction of environmental impact. An example of this is a design concept for Word Wildlife Fund by Saatchi and Saatchi Denmark (Saatchi and Saatchi, 2007) that can be seen at several online design blogs, e.g. at Inhabitat (Fehrenbacher, 2007). The concept is a white paper towel dispenser filled with green paper towels. These are piled and visible through a window shaped as South America. As you take paper towels the initially green continent of South America becomes black, as a visualisation of deforestation.

No research studies on the effect of *Eco-Affective*

Design in inducing desired behaviour have been found, but the project duo's own findings on the effectiveness and acceptability of this design strategy are presented in section 8.2.1. and 9.2.1.

Enhancing Resource Value

Some of our most precious resources are in many modern societies brought to people with a remarkable convenience. For many, this is the case with both water and electricity. Arroyo, Bonanni and Selker (2005) suggested that this could result in wasteful use, as when leaving water running. They commented that this would not have happened when water had to be carried to the point of use. Arroyo, Bonanni and Selker (2005) furthermore proposed that the perceived value of resources can be increased through design. An example is filters that can be attached to the faucet in order to enhance the water quality (Moen, 2010) or provide carbonated water directly from the faucet (Mora Armatur, 2011).

Individual Power Awareness

Thøgersen (2005) emphasised the importance of empowering consumers to adopt a more sustainable lifestyle. He pointed out that empowerment is a feeling and hard to quantify objectively. Nevertheless, it is important as feelings of empowerment may contribute to people's motivation to make an effort (Pelletier, Dion, Tuson, and Green-Demers, 1999). This goes in line with findings made by one of the members in the project duo prior to this work. In a study on perceived efforts and benefits of recycling of food packages she found that feelings of being powerless and irresponsible for recycling programs seemed to reduce motivation to make an effort to recycle. The awareness of the individual power and behavioural possibilities seemed to be low. As a result, a design concept was created aiming at raising the awareness of the power, thus creating a feeling of empowerment. The result was a biodegradable herb package containing herb seeds within its cardboard structure (figure 22.) The package can be planted when emptied and the enclosed seeds will grow as the package itself will start to biodegrade. In this way, users are made aware of their responsibility for the recycling process and their control over it, which may result in feeling of empowerment.

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Enlightenment through Interaction and Experience

The aim of the strategy *Enlightenment through Interaction and Experience* is to increase people's knowledge of their behaviours' environmental impact. This is done by providing people with means to interact with and experience the effect of their behaviours. Through interaction and experience people could increase their understanding of behavioural possibilities and be able to form strong positive attitudes towards the sustainable behaviour. The latter is supported by Regan and Fazio's (1977) findings concluding that direct behavioural experience with an attitude object gives a more clear, confident and stable attitude than a similar attitude formed in a more indirect way. Furthermore, a greater attitude-behaviour consistency can be seen with attitudes formed through direct behavioural experience (ibid.).

The Power-Aware Cord from the Interactive Institute is an example of a product designed to enlighten people through interaction and experience (figure 23). Illstedt Hejlm, Gyllenswärd and Gustafsson (2005, p. 4) expressed "With the Power-Aware Cord, users' actions, such as plugging or unplugging electrical devices into sockets, immediately result in a response from the cord, giving the user direct feedback and the feeling of both seeing and interacting with electricity. This approach might inspire users of the Power-Aware Cord to explore and reflect upon the energy consumption of other electrical devices in their home". An evaluation of the Power-Aware Cord was done by Löfström (2008). The cord was introduced to a couple of households and the evaluation showed that the cord did manage to invite users to experiment. According to Löfström (2008) the participating households gained a greater understanding of the electricity consumption of electronic devices in their homes even though their understanding of the energy system as a whole was not influenced. The example of the Power-Aware Cord shows that product design trying to enlighten through interaction and experience can be a successful way of giving information and feedback. Nevertheless, it is not established how the increased knowledge achieved through interaction with the Power Aware Cord can contribute to actual behaviour change.

Feedback

Feedback is information about a behaviour given after the behaviour is performed, either informing that an action has been carried out or informing about consequences of the action (Jordan, 1998). The latter type of feedback will here be examined further. According to Gardner and Stern (2002) feedback is a way of teaching people what behaviours are beneficial when trying to achieve a certain goal. As long as a person is motivated to achieve the goal, the behaviour that caused the positive feedback will be repeated. Fischer (2008) reviewed 26 different studies of feedback as a tool for energy saving. She concluded that implicit or explicit motivation to conserve energy is a prerequisite for feedback to work. Regarding the efficiency of feedback Fischer (2008) found that feedback often was effective with energy savings from one to twenty percent and often between five and twelwe percent. Yet, Kluger and DeNisi (1996) refer to feedback as 'a double-edged sword' as they in their historical review and meta-analysis of feedback interventions found that feedback under certain conditions decreases performance.

For a person that is not motivated to adopt sustainable behaviours due to lack of strategy beliefs according to the AMTES scale in section 3.2.2., paragraph Common Motivational Barriers, feedback may be useful as it could convince a person that an action does lead towards the desired outcome. Through feedback, sustainable actions become highlighted and consequently the effort sneeded are easily judged. Persons suffering from amotivation due to effort beliefs, according to the AMTES scale, could with feedback get a correct understanding of the effort of reducing environmental impact with different sustainable behaviours. Manning (2009) pointed out that feedback is most efficient when relating to something people are concerned with. Therefore, the feedback should be tailored to fit the users' interests. Furthermore, feedback should be presented in a way that is understandable and relevant for the user, e.g. by presenting electricity consumption in percentage of consumption for the same month in the preceding years as proposed by Hayes and Cone (1981).

Dwyer et al. (1993) reviewed several studies on feedback where some of them reported follow up data after withdrawal of the feedback. In none of

Figure 22. An example of *Individual Power Awareness*: a biodegradable herb package. Photo by Magnus Renström.

Figure 23. An example of *Enlightenment through Interaction and Experience*: the Power Aware Cord. Photo by Carl Dahlstedt.

these studies, the sustainable behaviour during the feedback had been maintained after the feedback intervention ended, even though some feedback interventions lasted over two years. Yet, feedback given under a long time could contribute to the formation of a habit that may be strong enough to resist feedback withdrawal (Fischer, 2008).

Manning (2009) gives three examples of how to describe the behavioural consequences in feedback: usage feedback, cost feedback and feedback about impact. Usage feedback shows the amount of resources used or resources collected, e.g. energy used or the amount of reusable bottle collected. An example of this is the car Toyota Prius where the current fuel consumption is displayed to the driver when driving (Toyota, n.d.). The advantage of usage feedback is that this type of information is open for interpretation. A person motivated to

behave environmentally consciously will see it as feedback on reduced environmental impact and a person motivated to reduce the cost, will interpret feedback on reduced fuel consumption mainly as cost reduction. Furthermore, a person who enjoys competing may see it as a measurement on hers or his driving ability and consequently support competition. Usage feedback should of course be presented in a unit of measurement that is understood by the users (Gardner and Stern, 2002).

Cost feedback shows the reduction of cost as a result of the behaviour. An example of this is the electricity bill, where both usage and cost feedback are given. In this case, the economic motivation to perform the sustainable behaviour is emphasised. When employing this strategy, one should have in mind that cost savings are not always followed by a reduction in environmental impact. This is the

case when the money saved is spent on products or services with a higher environmental burden per cost unit than for the original product or service. Hendriks, Vogtländer and Janssen (2006) called this the rebound effect. They assumed that this is a growing problem. When households get richer more money is spent on products with a high environmental impact per cost unit, such as intercontinental flights, in comparison with food, health, clothing and housing. Energy consumption is an area where monetary savings are followed by reduced environmental impact, as the environmental impact per cost unit is high for energy (ibid.).

The third type of feedback suggested by Manning (2009) is feedback about impact. This type of feedback reflects the environmental impact of a behaviour, the positive impact as well as the negative. The impact could be presented in carbon dioxide, number of trees etc. Preferable, the feedback format should be matched towards the users' principal environmental concerns.

Based on a review of studies of feedback as a tool for energy savings Fischer (2008) provided guidelines for effective feedback. In the project duo's opinion a few of these are applicable also in other areas. Feedback should be frequent i.e. given daily or more often, be provided during a long time, involve interaction and choices, be understandable and appealing, and be sufficiently detailed. Furthermore, historical or normative comparisons are appreciated by households even though the effect is not clear (Fischer, 2008).

Negative feedback has been found to forestall feelings of competence, thus undermining intrinsic motivation, whereas positive feedback may enhance feelings of competence and intrinsic motivation (Deci and Ryan, 2000). An example of negative feedback is puzzles that are very difficult to solve (Deci and Cascio, 1972). Negative feedback only gives directions of what not to do and no indications of what one should do instead. Therefore, negative feedback does not support adoption of the desired behaviour. The effects of negative feedback correspond with the effect of punishment, presented in section 3.2.4, strategy *Incentives*.

Feedback can be provided externally, by means other than the action itself, as in the examples of

the electricity bill and the Toyota Prius. Feedback can also be task-generated, meaning that the feedback is a consequence of an action, e.g. over flowing milk as feedback on the act of pouring milk (Kluger and DeNisi, 1996). There are more types of feedback that are less applicable in product design, e.g. personal feedback.

Immediate Feedback

The use of immediate or real-time feedback is suggested by several authors (Fischer, 2008; Lockton, Harrison and Stanton, 2010a). An advantage is the clear connection to the behaviour due to proximity in time. It facilitates learning and experimentation as one immediately gets to know if an action is beneficial or not.

Delayed Feedback

Delayed feedback with low frequency is seldom suggested in literature. In Fischer's (2008) review of studies on feedback as a tool for energy saving, this type of feedback is found to be less effective than frequent feedback. Yet, delayed feedback with low frequency is often easy to administrate and is inexpensive. Hayes and Cone (1981) experimented with monthly feedback on electricity consumption. Every month a group of non-volunteers received a letter presenting last month's electricity consumption in percentage of consumption for the same month in the preceding years. In the households that received the letter the consumption dropped 4.7 percent compared to previous years while households in the control group increased their consumption with 2.3 percent. This indicates that delayed feedback presented in a way that is easily interpreted may improve behaviour.

Emotionally Triggering Feedback

Just as *Emotionally Triggering Information*, *Emotionally Triggering Feedback* can be used to draw attention to the feedback, make it easy to memorise and to later recall. A small study by Dillahunt, Becker, Mankoff and Kraut (2008) tested this in a small study by comparing the effects of high and low attachment to a virtual polar bear on the number of sustainable actions performed. The participants were divided into two groups, a high attachment group and a low attachment group. The participants in the high attachment

group were asked to name the virtual polar bear and to read a story known to elicit sadness about the effect on polar bears of climate change. The participants in the low attachment group were not asked to name the polar bear and they did not read the story. Then, all of the participants were asked to commit to different sustainable actions. The actions were e.g. "turn off lights if you are leaving a room for more than 10 minutes" or "wash only full loads of clothes". While deciding whether to commit to the actions or not, the participants were shown a virtual polar bear standing on an ice floe. The ice floe grew or decreased depending on the number of actions the participant promised to do. This can be seen as *Emotionally Triggering Feedback* on the environmental impact of the number of actions the participants promised to do. After this, the participants were asked how many of the actions they committed to they later completed, and if they were willing to donate to a zoo. The researchers were not able to get in touch with all of the participants but they managed to reach some of them. The group that read the sad story promised to do more actions than the others, did perform the actions to a higher extent and were more willing to donate to a zoo, with the difference in number of performed actions being significant. Even though this was a small study with few participants, it indicated that *Emotionally Triggering Feedback* could induce sustainable behaviour.

Simple Feedback

Simple Feedback is feedback designed to be easily noticed and understood. An example is a green light indicator in Honda Civic VTEC 98. When driving in a fuel-efficient manner, the light turns on (figure 24). Another example is the Flower Lamp (figure 25) designed by Interactive Institute in collaboration with Front Design (Interactive Institute, 2011). At a high level of energy consumption in a household the lamp is cylindrical, but when the energy consumption decreases the lamp opens up, just as if it blossomed.

Being so easily interpreted, one manages to consider this type of feedback while engaging in other activities, e.g. while driving. As it is so easy to notice, it may get through also to people not looking for feedback on their behaviours. For further insights into this type of feedback, see paragraph on *Simple Information*.

Figure 24. An example of *Simple Feedback*: in this Honda Civic a green light turns on when you are driving in a fuel-efficient manner.

Figure 25. An example of Simple Feedback: a lamp that opens up as the energy consumption in a household decreases. Copyright: Interactive Institute.

Exact Feedback

Fischer (2008) saw in a review of studies on feedback as a tool for energy saving that detailed, appliance specific breakdown of feedback increased energy savings. This is an example of how to use exact feedback. The main advantage of detailed and exact feedback is that there is no doubt of what behaviour caused the feedback and thus what

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behaviour to repeat. It facilitates experimenting with different behaviours, self monitoring and competition as also small differences in outcomes of behaviours are observable.

Feedback for Self-Monitoring

With feedback for self-monitoring, users are allowed to review their previous performance. The feedback could consist of average results from previous usage periods, preceding top performances, average performance with compensation for a change in weather for feedback on heating, etc. The aim is to make feedback on current performance more relevant and interesting by relating it to preceding performances. Furthermore, it may stimulate users to experiment in order to improve result and it facilitates competition and goal setting. Froehlich (2009) states that possibility for comparing current performance with past performance is essential for feedback systems aiming at energy conservation. Lockton, Harrison and Stanton (2010a) suggest summary feedback, i.e. accumulated feedback of what users have been doing, as a way of inducing behaviours.

Interactive and Engaging Feedback

In a review of 26 studies of feedback as a tool for energy saving, Fischer (2008) found that feedback with interactive elements that involve the user was effective. The essence was that the user finds the feedback engaging and is encouraged to interact with it. This can be done in many different ways. One could use computerised feedback with possibility of choice, historical comparisons over various time periods, additional information or activities like self-meter reading.

Normative Feedback

Descriptive normative feedback informs users of what they do and relates it to what others in the same situation do. This strategy was tested by Schultz et al. (2007). They provided households with weekly feedback on energy consumption together with information about the average consumption in their neighbourhood. As expected, the households above the average decreased their consumption while households below the average increased it. This boomerang effect occurs because people tend to strive for meeting the

norm regardless of their current behaviour (ibid.). When testing descriptive normative feedback the researchers also tried to include an injunctive norm reminder, i.e. a reminder of what others approve or disapprove of. They did this by adding a happy or sad emoticon (simple illustration of a happy or sad face) depending on whether the household performed above or below the average. This simple addition did decrease the boomerang effect (ibid).

Hypothetical Feedback

Daily savings in a household on e.g. electricity often have limited impact on the household's total cost, total environmental impact etc. A way to improve the desired behaviour's perceived importance is to generalise it and present a preview or simulation of the impact it would have if the behaviour would be maintained over a long time period, if several people would perform the behaviour, etc. The Swedish Society for Nature Conservation (2009) uses this on its webpage in a guide called "What if..." (in Swedish "Tänk om...") (figure 26). Here the savings in carbon dioxide for a sustainable behaviour is shown, e.g. the reduction in impact when replacing the average consumption of bottled water with tap water during a year (3 kilo carbon dioxide). A slider allows the user to alter the number of people thought to perform this action up to 9.2 million (corresponding to the whole population of Sweden and savings of 27600000 kilo carbon dioxide).

Exhort Behaviour

The strategy *Exhort Behaviour* includes exhortations of behaviour through notes, signs,

Figure 26. An example of *Hypothetical Feedback*. "What if…" shows what would happen if a lot of people would adopt a sustainable behaviour. Source: www.naturskyddsforeningen.se.

information messages on loud speakers, etc. Exhorting of behaviour is primarily done in order to remind and urge people to act upon norms and attitudes they are assumed to have. The exhortation does not aim at educating people or inducing attitude changes. The use of exhortations is common in public and semi-public places and they may originate from someone responsible for the place as well as from co-users of the space, e.g. a note in the kitchen of a workplace exhorting kitchen users to do the dishes. A couple of studies of exhortation reviewed by Dwyer et al. (1993) show varying result. Yet, it seems as exhortation under the right circumstances can induce desired behaviour. Durdan, Reeder and Hecht (1985) studied the efficiency of signs exhorting cleanliness on littering in a university cafeteria. They found that all signs reduced littering. Positive worded signs were more efficient than negative, e.g. "Please be helpful" vs. "Please don't litter", while the level of specificity in the message resulted in no difference. Nonetheless, other strategies are oftentimes more efficient then the strategy of Exhort Behaviour. An example is that a clean environment prevents littering more efficiently than an exhorting sign (Reiter and Samuels, 1980).

Guidance from Authority

To have authorities or celebrities promoting products or behaviour is widely used, e.g. in marketing. Erdogad (1999) concluded in a literature review on celebrity endorsement that it was more successful in generating purchase intentions and execution than endorsement expressed by a non-celebrity, as long as the celebrity has not endorsed any product before and if the public image of the celebrity matched the products promoted as well as the target market. Nevertheless, finding the 'right' celebrity is often difficult (Erdogan, 1999). In line with celebrity endorsement, Lockton, Harrison and Stanton (2010a) suggested showing users what choices experts or authorities would do if they were in the users' situation. Celebrity endorsement can also be used for promoting pro-environmental behaviour. Recently, Papperskretsen, a Swedish organisation aiming at reaching the goals set in the producer responsibility regulation for waste paper, launched a campaign together with the Swedish musician Oskar Linnros (Papperskretsen, n.d.). The campaign constituted of a commercial movie in which Oskar Linnros 'recycles' his first

hit single, i.e. plays a remix of it, and a specially designed paper bag for collecting waste paper that can be bought via SMS (figure 27).

Another example of inducing behaviour through guidance from authority is a speech broadcasted on radio and television on the 2nd of February 1977, by the American president Carter. In this speech, he urged the Americans to lower their thermostats to 65 degrees Fahrenheit in daytime and 55 during night in order to save energy (Woolley and Peters, n.d.). A study by Luyben (1982) as cited in Dwyer et al. (1993) on the effect of the president's plea showed minimal response.

In the examples above, the authorities were guiding the user through mass media, i.e. without social interaction between information sender and receiver. Thus, guidance was provided without adaptation to the specific contexts in which the target behaviour was intended to take place.

Figure 27. An example of *Guidance from Authority*: a paper bag for collecting waste paper for recycling, endorsed by the musician Oskar Linnros. Copyright: PappersKretsen/Pressretur AB.

Modelling

In the strategy *Modelling*, the desired behaviour is shown to a person, e.g. through a video or in person. Winnet et al. (1982; 1985) did several studies on video modelling of energy conservation in homes, both during winter and summer. Both of the studies showed promising result. As the earlier study also included feedback and group meetings only the latter will be explained further here. Participants in the study of 1985 were asked to watch a 20 minute video broadcasted on the local television channel where no-cost or low-cost measures for conserving energy in the summer were shown, such as trapping cool air in the mornings by closing windows, blinds and shades. The video showed homes similar to the participants' and the actors in the videos were at the average age of the viewers. During the first summer after the viewing Winnet et al. (1985) noted a ten percent decrease in overall energy use and almost one fourth decrease of the energy used for cooling.

As reported in paragraph *Guidance through Group Belonging* the strategy *Modelling* may have contributed to high participation in a recycling programme.

Value and Attitude Reminder

Even though it might seem reasonable that behaviour decisions are based on attitudes that are formed upon values, there is no evidence of a reliable and distinct link. Nevertheless, there are ways to strengthen the link between values and behaviour. Verplanken and Holland (2002) showed in a couple of studies that for values to influence behaviour, the values have to be activated and further that the value itself should be important to the person's self-concept, i.e. a self-central value. Nilsson (2007) concluded that people have to be reminded that their values are important in this particular situation. A specific behaviour often relates to several values, which can be either congruent or incongruent (Bardi and Schwartz, 2003). In the case of incongruent values, the decision to engage in the behaviour can be seen as a trade-off between competing values. Therefore, activation of one of these values might increase the likelihood of a decision that is congruent with the activated value. As a result, a promising design strategy could be to remind people of the relevance of

pro-environmental values they already have when deciding to engage in non-sustainable behaviour or when not engaging in sustainable behaviour. The efficiency of such a strategy might be related to the pro-environmental values' centrality to the self-concept, i.e. how important the value is for a person's self-definition and consequently to what extent the value contributes to the person's sense of identity (Verplanken and Holland, 2002). An example of the strategy *Value and Attitude Reminder* is found in some of the toilets at Chalmers. A sign on the paper towel dispensers show the text "Use only one paper towel! Think of the environment!" (figure 28).

Just as for values, attitudes have to be active in order to guide behaviour (Bohner and Wänke, 2002). Therefore it might be that reminders of attitudes strengthen the attitude-behaviour link, just as reminders of values strengthen the value-behaviour link.

The studies by Verplanken and Holland (2002) showed that if a value is activated there is an increased awareness of information relevant for

Figure 28. An example of *Value and Attitude Reminder*: a sign on a paper towel dispenser urging people to take only one paper towel and to think of the environment.

the value. Therefore, pro-environmental value reminder could be a way to increase efficiency of pro-environmental information.

Social Norm Reminder

One way to enlighten people about behavioural possibilities is to focus their attention on descriptive norms, e.g. norms concerning what others usually do (Cialdini, Reno and Kallgren, 1990). Cialdini, Reno and Kallgren (1990) found that littering is less likely in a clean environment compared to a fully littered one due to the descriptive norm communicated through the clean or dirty environment. Even more surprising was that the lowest likelihood of littering was found when there was a single piece of litter. This was due to the salience of the descriptive norm in this condition compared to the clean environment (ibid.).

Nevertheless, the strategy of activating descriptive norms must be used wisely. An activated descriptive norm may also decrease occurrence of the desired behaviour because people tend to strive for meeting the norm, also if their current behaviour is above the average (Schultz et al. 2007), a phenomena called the boomerang effect. As previously mentioned Schultz et al. (2007) managed to reduce this effect through giving feedback on energy consumption that included both descriptive norms, i.e. the average consumption, and injunctive norms, i.e. a happy or sad emoticon (simple illustration of a happy or sad face) depending on whether the consumption was below or above average. However, the boomerang effect did not disappear completely (ibid.).

Yet another way is to only activate injunctive norms. In studies on littering by Cialdini, Reno and Kallgren (1991) as cited in Gardner and Stern (2002) injunctive norms were slightly more successful in inducing the desired behaviour than descriptive norms, if made salient in the same environment as the littering took place. If the injunctive and descriptive norms were made salient in another environment close to the environment in which the littering took place, the injunctive norm was far more successful in inducing the target behaviour. Furthermore, Cialdini, Reno and Kallgren (1991) as cited in Gardner and Stern (2002) recommend that the norm reminders should be subtle enough not to seem coercive.

An idea is to implement norm imposing changes in a person's surroundings. For example, if a person one day notices a glass recycle bin next to his or her house, his or her perception of the norms of recycling might be altered. It might be possible to impose norms through product as well. If several products in the same product category all of a sudden have a feature that renders certain behaviour possible, that might change people's perception of the norm connected to that behaviour.

Personal Norm Reminder

Even though personal norms are regulated by oneself through feelings of pride and guilt, it may be beneficial to activate these norms in order to steer behaviour. De Kort, McCalley and Midden (2008) tested the effect on littering of different litter bins designed to implicitly or explicitly activate personal norms. The personal norm was activated either with a sign with the text "Do you leave your litter lying around?" across the litter bin, i.e. an explicit activation, or by placing a mirror above the litter bin, i.e. an implicit activation. A combination of explicit and implicit activation was also tested, as well as no norm activation. De Kort, McCalley and Midden (2008) found that all three norm activation conditions did reduce littering in comparison to the no activation setting.

Guidance through Group Belonging

The idea behind the strategy *Guidance through Group Belonging* is to combine information, modelling and norm reminders in a group context. As a result from this strategy a person could ideally form a positive attitude towards the behaviour, get personalised information on how to perform the behaviour, be able to mirror other group members' behaviour and activate social and personal norms. Additionally, in a group setting the group norms can be internalised, i.e. social norms are turned into personal norms (Gardner and Stern, 2002). Furthermore, the other group members may remind a person to perform the behaviour and give rewards consisting of e.g. social incentives (see section 3.2.6., paragraph *Social Incentives*). In an explanatory study by Scott, Quist and Bakker (2009) on co-design and co-creation as a tool for designing sustainable everyday practices, a group of people were asked to explore their own bathing routines. The researchers found that the

participants were willing to use shampoo less often because of the new group context they were introduced to. The other group members legitimised these shampoo experiments that questioned the norms of cleanliness.

Another study, where one of the intervention techniques used can be viewed as something between *Guidance through Group Belonging* and *Guidance from Authority* was made by Hopper and Nielsen (1991) on the effect of three different behavioural intervention techniques to increase participation in a recycling programme in a neighbourhood. The neighbourhood was divided into three groups and one control group. The first group was given information about the recycling programme before and half-way through the seven months study. The second group was initially informed about the recycling programme and throughout the study they received monthly reminders of the programme. In the third group, leaders for the blocks were chosen. These block leaders were then instructed to inform about the recycling programme and to give monthly reminders to their neighbours. In all three groups, participation in the recycling programme increased. The block leader condition was most successful followed by the information and reminding condition, but also the information-only condition increased participation in the recycling programme. Still, it was only in the group with block leaders that changes in personal and social norms and attitudes could be detected. In addition, Hopper and Nielsen (1991) noted that the change in behaviour in the block leader condition exceeded the change in norms among the participants, and suggested that also the strategy *Modelling* may have played an important role.

PROMISING RESULTS **+**	SPLIT RESULTS **+/-**	LESS PROMISING RESULTS **—**	LITTLE OR NO RESEARCH FOUND **?**
Feedback Exhort Behaviour Modelling Personal Norm Reminder Guidance through Group Belonging	Social Norm Reminder	Information Guidance from Authority	Bodily Attitude Influences Preview of Behavioural Consequences Design for Reflection Design for Discussion Eco-Affective Design Enhancing Resource Value Individual Power Awareness Enlightenment through Interaction and Experience Value and Attitude Reminder

Table 1. The table shows all the strategies within the category *Enlighten* and what potential to induce sustainable behaviour each strategy appears to have.

3.2.6. Design Strategies within the Category Spur

In the category *Spur*, the design strategies have in common that they encourage and tempt the user to perform the desired behaviour by means apart from the behaviour (figure 29). Here, the focus is not primarily on the positive environmental consequences of the desired behaviour but on the behaviour itself and on other positive consequences of the behaviour. This is achieved through designing products or services in a way that makes people intrinsically or extrinsically motivated to use them in a sustainable way. The latter can be done in the form of rewards, social incentives etc.

Figure 29. The carachteristics of the cetegory *Spur*.

Public Commitment

Even if it is seldom to be seen, it is possible to incorporate an opportunity for public commitment both in products and in product service systems. In accordance with the theory of cognitive dissonance, to publically commit to an action without seeing obvious external forces behind it, will make a person believe that he or she herself has chosen to perform the action. When people believe their actions to be based on internal motives their behaviour is more likely to persist even after the commitment is due (Gardner and Stern, 2002). A summary of studies on how commitment influences participation in different pro-environmental programmes such as recycling or energy saving, showed that individual public commitment can work well, and that commitments perceived as strong, e.g. signing a pledge, led to improved results (Dwyer et al., 1993). In all studies reviewed, the commitments included a time limit, often a couple of weeks, but follow-ups up to twelve weeks after the commitment period still showed a change in behaviour.

The Fun Theory

The Fun Theory was launched by Volkswagen in 2009 (Volkswagen, 2009a) and the idea is to design products in a way that makes the desired pro-environmental behaviour fun to perform. Volkswagen used the theory, examples of it and a worldwide design competition on the theme, as a way to market themselves. No theoretical background can be elicited from their website on the subject, but as the goal is to make a behaviour fun to do, the strategy can be interpreted as aiming at facilitating for intrinsic motivation to arise (see section 3.2.1., paragraph Motivation and the Self-Determination Theory, for an explanation of intrinsic motivation). Design solutions may contain features from other strategies, such as *Lottery Incentives*, *Competition*, or *Support Competence*. One example of how Volkswagen applied the strategy is a bottle bank which borrowed features from arcade games. The bottle bank had several holes for inserting bottles and above each hole there was a lamp. When you started the game one lamp at a time lit up for a short while and if you inserted a bottle in the hole under a lit up lamp you scored a point. The bottle bank arcade machine kept the high score on display, so people returning bottles could compete with the current high score. Almost 100 persons used the bottle bank arcade machine during the evening it was put out on the street, while only two people used the normal bottle bank situated nearby (Volkswagen, 2009b). However, Volkswagen did not account for how the presence of the bottle bank arcade machine influenced the use of the conventional bottle bank.

Support Autonomy

The aim of the strategy *Support Autonomy* is to facilitate the formation of intrinsic motivation for a behaviour through making the user feel autonomous. As mentioned in section 3.2.1., paragraph Motivation and the Self-Determination Theory, motivation can be either intrinsic or extrinsic, where intrinsically motivated behaviour happens when the act in itself constitutes the reward, and the behaviour is thus engaged in out of free will. Intrinsic motivation is closely linked to the needs for autonomy, competence and relatedness, and without these factors, in particular the two first ones, intrinsic motivation is less likely to arise (Deci and Ryan, 2000). For this reason, *Support*

Autonomy is preferable combined with the strategy *Support Competence*. Furthermore, as suggested by Pelletier, Dion, Tuson, and Green-Demers (1999), a pressing control of people's behaviour exerted by government or the social environment, seem to give rise to amotivation in form of strategy beliefs (see 3.2.2., paragraph on Common Motivational Barriers), whilst a support for autonomy can encourage maintenance of efforts toward sustainable behaviours.

Unfortunately, no studies on how well this strategy works were found, but sections 8.2.2. and 9.2.2. contain the project duo's own findings on the effectiveness and acceptability of *Competence and Autonomy*, which is a combination of the strategies *Support Competence* and *Support Autonomy*. Still, in a study concerning visualization of energy in households, one participant stated that it felt good not to be dependent on expensive non-renewable energy sources, as her neighbourhood shared a local heating system based on renewable energy (Löfström, 2008). The heating system was a pilot project and had not been functioning flawlessly, but the feeling of autonomy seemed to help the participant in keeping a positive attitude towards the system.

Support Competence

The strategy *Support Competence* is similar to the strategy *Support Autonomy* and is also preferably used together with that strategy. To support competence is about facilitating for intrinsic motivation to arise through providing sufficient challenges for the user in order to support his or her feelings of being capable, and if possible, increase the challenge as the user becomes more competent. As in the case of *Support Autonomy*, no studies were found on how well this strategy works, but sections 8.2.2. and 9.2.2. contain the project duo's own findings on the effectiveness and acceptability of the strategies *Support Competence* and *Support Autonomy*. Yet, in the study on energy visualisation mentioned in the previous paragraph, two participants, before moving into a new house, thought of the technical control room, which controls the heating system for the house, as their playground. These participants were engineers and expected that they would master the technical control room, thus displayed intrinsic motivation to use it. When they had moved into the house they did use the

control room in order to adjust settings for the heating system, but as the response was slow their expectations got dashed and they gradually used the room less and less (Löfström, 2008).

One way of designing for competence is to design for maintenance, as being able to repair or recondition a product can make a person feel skilled. Additionally, this can strengthen a user's attachment to a product as he or she is caring for it, and thus make him or her keep the product longer. In general, a skill-based product, e.g. a musical instrument, can generate increasing levels of pleasure over a long period and thus may prolong the use phase of the product (Woolley, 2003).

Provide Options

The strategy *Provide Options* presents one way of supporting autonomy and competence, as the user will have the opportunity to use his or her competence when choosing between different options and to feel independent when he or she makes the choice. This is also supported by Deci and Ryan (2000) in their statement that choices that are perceived to have an internal locus of causality tend to foster intrinsic motivation. Additionally, in situations where people consciously choose between alternatives, values are likely to influence behaviour (Bardi and Schwartz, 2003). Consequently, if this strategy were to result in a product with several options which all are environmentally friendly, the important factor is the intrinsic motivation to choose or to use this product instead of other products. If the resulting product were to provide one or several eco-options but also conventional options, e.g. a car that runs on either ethanol or petrol, the important aspect would be to remind the user of his or her hopefully positive values concerning environmental issues. Thus one success factor for this strategy is to highlight the user's behavioural control and to show that pro-environmentally behaviour is possible.

Support Relatedness

Support Relatedness could be seen as a complementary strategy to *Support Autonomy* and *Support Competence*, as a feeling of relatedness according to Deci and Ryan (2000) may affect an individual's level of intrinsic motivation. For example, Ryan, Stiller and Lynch (1994) found that students who

experienced their teachers as warm and thoughtful displayed a higher level of intrinsic motivation. Thus, the product or product service system should enable for the user to experience social relatedness when performing the desired behaviour. Unfortunately, no literature on how this approach has been or could be used in design for sustainable behaviour has been found.

Order and Aesthetics

Lockton, Harrison and Stanton (2010a) suggest utilising an individual's desire for order to make him or her act in a predetermined way. One example of this is the conceptual light switch, AWARE Puzzle Switch designed by Interactive Institute, which has a tidy appearance when the light is off and a disordered appearance when the light is switched on. A workshop with potential users revealed that a lot of the participants did get disturbed by the look of the on-mode and expressed that the light switch would encourage them to turn off the light (Linde, 2008). There are other aesthetic properties that could be used in a similar way, with the intent to make the desired behaviour result in an aesthetically pleasing appearance of the product, and the unwanted behaviour to result in a less pleasing visual appearance.

Incentives

To reward or punish someone is a common way to try to influence a person's behaviour. In fact, our whole society is in many ways built on this strategy, for example you earn a salary for working and receive a fee or get sent to prison if you break the law. However, behaviour theorists favours rewards as they are more effective, i.e. a reward does increase the occurrence of the desired behaviour, but when it comes to punishments, the resulting behaviour is highly unpredictable (Gardner and Stern, 2002). A specific cell phone charger (figure 30) has a strong blue light which always is on when the charger is plugged into a socket. If you like to charge your cell phone in your bedroom this can be seen as a punishment for not unplugging the charger as the light is annoying when it is dark and you are about to sleep. The desired behaviour is to unplug the charger when it is not in use, but a resulting behaviour could be to cover the LED with black insulation tape. One example of a product which instead has an integrated

reward is the Saab cars that run on either ethanol or petrol. When filled up with ethanol, the car gains up to 30 extra horsepower (Saab Sverige, 2010).

When applying the strategy *Incentives* there are several factors to take into account in order to succeed. The first one is to make sure the incentive is large enough. This does not imply making the incentive as large as possible but to find the level where people start to view the incentive seriously (Gardner and Stern, 2002). If an incentive like receiving € 0,05 per returned bottle is enough for the vast majority, increasing it to € 0,1 will not add much to the effect except that people might appreciate the incentive more. Additionally, there is a danger with high incentives as they can undermine possible initial intrinsic motivation towards a behaviour. For example, children that have been engaged in a playing activity knowing they will be rewarded for it, are less motivated to engage in the activity again once the reward is withdrawn, compared to children who did not expect a reward for their activity (Lepper and Greene, 1975).

If the incentive is something to strive for, a future reward, it can be good to combine it with feedback. Either the individual needs to be reminded of the sheer existence of the incentive, or he or she needs feedback on the progress towards the reward, much like when striving to reach a goal (see paragraph *Goal Setting*).

The chance of creating an effective incentive increases if the incentive is matched with the barriers towards the target behaviour (Gardner and Stern, 2002). One example is a bonus system applied by SJ (figure 31), the government owned railway company in Sweden. It is free to become a member of the bonus system and you get bonuses depending on how much you travel. For a frequent business traveller one barrier toward travelling with train might be the perceived inefficiency compared with taking a flight. At the highest bonus level, which you would reach when travelling a lot for work, one reward is free internet access during the travel. For the business traveller, this incentive is probably more spurring than a small reduction in ticket price.

As the previous mentioned example with the cell phone charger made clear, it is important to

consider possible ways to evade an incentive. This is also true for positive incentives. In an experiment encouraging litter-free public spaces, monetary rewards where offered for bags with trash. This made the public spaces significantly cleaner, but it also made some people bring garbage from their homes who then got rewarded without having contributed to the cleaning-up. In the end, offering rewards for clean yards was the most cost-effective incentive (Geller, Winett, and Everett, 1982, cited in Gardner and Stern, 2002).

If the reason behind an incentive is little known by the target group it is advisable to combine the incentive with background information. The process of internalisation is described in section 3.2.1., paragraph Self-Determination Theory, and understanding of the motive behind an incentive is a prerequisite for this process. Internalisation of the extrinsic motivation is extra important if the incentive is time-limited, as there is a high risk that a spurred behaviour stops when the incentive is taken away. The many experiments by Skinner, as summarised by Gardner and Stern (2002), showed that animals stop repeating behaviours that no longer get rewarded, patterns also applicable to humans. This conclusion was also apparent in a summary of studies on rewards for pro-environmental behaviour made by Dwyer et al. (1993). However, one exception was a study on carpooling held at a campus, where positive incentives such as reserved parking lots and token rewards worth 25 cents, were given during 19 days. The frequency of carpooling increased somewhat but then failed to drop during the 10-day-follow up after the withdrawn of the incentives (Jacobs, Fairbanks, Poche and Bailey, 1982, cited in Dwyer et al., 1993). A flyer informing on advantages with carpooling were distributed in the beginning of the study, thus it is possible that an internalisation process started within the participants who chose to carpool. It is also possible that the chance to save money became a stronger incentive than the one offered by the study. Other positive consequences, like that it is nice with company in the car, could also have been discovered by the participants during the incentive-period and hence acted as a new and study-independent incentive. Accordingly, if the incentive will be removed after a while, try to make room for other mechanisms to take over after the incentive, for example internalisation of the behaviour, other positive consequences, plain

Figure 30. An example of *Incentives*: a cell phone charger that emits a strong blue light when attached to the socket. If placed in a bedroom, the light may disturb the sleep.

Figure 31. An example of *Incentives*: the highest bonus card in SJ's bonus system. At this level free internet is included for all trips. Photo by Evelina Sundberg.

Figure 32. An example of *Value-Added Design*: a solar driven automatic lawn mower. Copyright: Husqvarna.

habit, or social norms (see section 3.2.5., paragraph *Social Norm Reminder*).

Incentives can also be directed towards a group of individuals. However, few relevant studies comparing the effects of incentives directed to individuals and to groups were found. Yet, in a study on unwanted behaviour of schoolchildren (Axelrod, 1973), and in a study on group productivity (Rosenbaum et al., 1980) the effectiveness of group incentives were proven equal to that of individual incentives.

Lottery Incentives

To surprise the user with a reward or a penalty is a different approach to incentives. According to a compilation done by Dwyer et al (1993) on experiments with lottery based incentives for pro-environmental behaviour, this strategy can be even more effective than regular incentives, as long as the system is sustained. However, as soon as the lottery incentives were taken away, the behaviour usually went back to the initial levels again. One of their examples was a study made by Mayer and Geller (1982-1983) as cited in Dwyer et al. (1993) aiming at increasing bike riding by means of a daily lottery. When the lottery was called off, the number of bikers went back down. One way to increase the persistence of the bikers could maybe have been be to make also the frequency of the lottery random, i.e. not make it daily. The lottery for bike riders would then be similar to the situation in a real-effort experiment conducted by Hogarth and Villeval (2010) where participants spent money during a number of periods in order to gain more money. After a certain, but for the participants unknown, number of periods, engagement would cease to pay off. In total, intermittent reinforcement treatment increased both the persistence and the effort of the participants, compared to the condition with (initial) regular payment. However, randomness had a scattering effect on the effort, resulting in both early drop-outs and long-lived persistence, all according to Hogarth and Villeval (2010).

Value-Added Design

When a product can be used solely in an environmentally friendly way, one can add value by extra functionality, fine materials, beautiful shape etc.,

in order to make a user prefer using that specific product instead of non-environmentally friendly products. This strategy is commonly employed in product design to differentiate between otherwise similar products (Arroyo, Bonanni, and Selker, 2005). *Value-Added Design* can also be compared to *Incentives* as the values added to the product can be seen as rewards (see paragraph on Incentives). One example of a product that acts according to this strategy is the partly solar powered automatic lawn mower from Husqvarna (figure 32). Instead of just getting a lawn mower that utilises a renewable energy source, you get a lawn mower that saves you time and effort as it operates the lawn mowing process on its own once all settings are done (Husqvarna, 2008-2009).

Convenience

Thirty percent of the homeowners in the Province of Ontario composted their organic waste whilst eighty percent participated in curbside recycling (McKenzie-Mohr, 2006-2010). McKenzie-Mohr (2006-2010) suggested that the reason for this was the inconvenience in getting and maintaining a composter in comparison with curbside recycling. Consequently, high inconvenience can act as a barrier for sustainable behaviour. In many cases, clever design solutions can reduce this inconvenience and thus increase peoples' motivation to perform the more sustainable behaviour. One example is food waste disposers that allow the user to dispose organic waste in the sink. The waste is grained and disposed with the sewage water (Avfallskvarn AB, n.d.). Of course, to make this a sustainable act, the sewage water works has to be adapted for the increased amount of organic waste.

Enhance Benefits

Sometimes a pro-environmental behaviour naturally brings on positive consequences for an individual, e.g. having time to work or relax on the train when commuting, compared to when driving to work. These benefits have the potential to influence people who are on their way to reach the identification phase in the internalisation process (see section 3.2.1., paragraph Motivation and the Self-Determination Theory), as it provides further arguments to use in the self-persuasion process. However, the benefits are not always visible enough for the individual to discover, or large

enough for the individual to overcome barriers towards the behaviour. Thus these benefits could have the potential to act as external motivation, but they might need to get enhanced. For example, to store newspapers and papers at home prior to recycling them can be viewed as having a short-term archive from which it is possible to retrieve articles or important papers if you revaluate them, and this benefit could be enhanced in the design of a wastepaper collector for home usage.

Goal Setting

To set a performance goal for pro-environmental behaviours has been proved to be efficient. McCaul and Kopp (1982) as cited in Dwyer et al. (1993) studied the effects of goal assignment and found that students who were given a goal on a number of aluminium cans to collect each day, collected 37 percent more cans than students without a goal, during a two week period. Similar results appeared in a study on school children and the collection of newspaper. A box was placed in a classroom with a sign saying that money earned from the collected newspapers would go to the school. The study tested the result of feedback, self-recording, and assigned goals, but only the goal-setting period gave a significant result. However, when the three-week goal period was over, the amount of returned papers dropped to previous levels (Hamad, Bettinger, Cooper, and Semb, 1980-1981, cited in Dwyer et al., 1993,). This suggests that, as with other external motivators, the motivational factor, in this case the goal-setting, needs to be sustained in order for the behaviour to last. Naturally, there are other factors to consider when using this strategy, e.g. how difficult it should be to reach the goal. According to Locke (1996) the more difficult a goal is, the greater the resulting achievement will be, assuming that the user is committed to the goal, and has the ability and the knowledge needed. Additionally, the more particular a goal-setting is, the more accurate the performance will be. Thus, goals that are both difficult and explicit will yield the highest performance. However, with this type of goal, a high commitment is vital as this will generate high performance. If a goal is easily reached it does not take much commitment to attain it, and a vaguely described goal is easy to adjust so that it suits a low performance. A high commitment to a goal is achieved when an individual believes in the importance of a goal,

and in that he or she can reach it or at least make a valuable progress towards it. Locke's (1996) last important statement for this strategy is that goal setting works best when accompanied by feedback on the progress.

An example of a product stimulating goal setting is the mobile phone Sony Ericsson J10i2 Elm. It has an integrated pedometer called Walk Mate Eco that displays the text 'health goal 10000' in the upper right corner of the screen, which indicates that a healthy goal is to walk 10000 steps each day. Next to this text, a leaf starts to appear when the user is walking, and when the goal is reached the leaf is completely green. The pedometer does also display the user's daily average and the number of steps he or she has taken during the current day (figure 33).

Competition

During a competition several strategies can be active, and common elements are *Goal Setting*, *Incentives*, *Feedback*, and *Social Incentives* (see corresponding paragraphs). The strategy of *Competition* could either be employed in an individual game-like design, or in a social competition in which other people also take part. The participants can compete alone or in teams. As a competition can be designed in numerous ways, the outcome can be different for different individuals depending on the prerequisites. In a study on the enjoyment of playing video games the competitive aspect was found to be important, both in individual and in social games (Vorderer, Hartmann, and Klimmt, 2003). Furthermore, if the players were losing too often, the enjoyment was rated as lower, even if the motivation could remain relatively high. In a study on how different incentive system affects worker's productivity, a tournament-like setting with competitive teams was found to be advantageous as it rendered a high mean effort as well as little variation amongst the workers (Nalbantian and Schotter, 1997). However, long-term effects on the productivity of the workers were not explored. As with *Incentives*, a competitive setting may thwart intrinsic motivation (Vallerand, Gauvin and Halliwell, 1986b). In a study on children, containing an ability-focused competition were an award for best performance was offered as reward, the losing individuals displayed less intrinsic motivation compared to the winning individuals. Additionally,
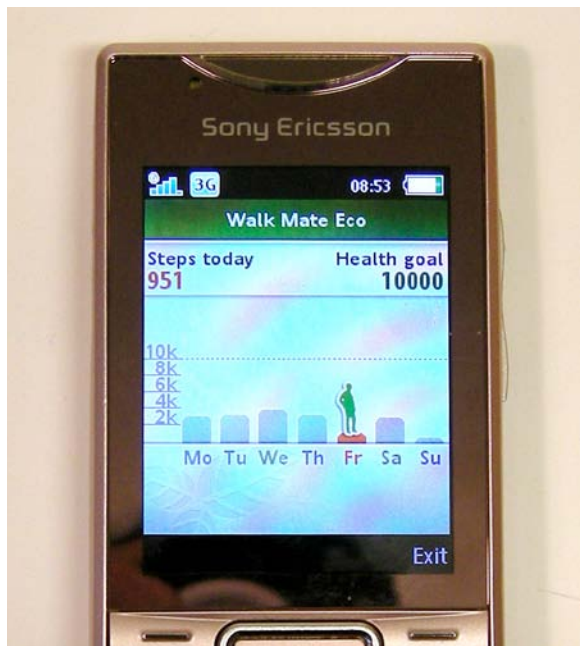
Figure 33. An example of *Goal Setting*: a cell phone that encourages the user to set the goal of walking 10000 steps each day.

Figure 34. An example of *Affective Design*: a litter bin in the shape of a chick that can be fed with litter. Photo by Amberol.

the losing individuals perceived themselves as less competent (Vallerand, Gauvin and Halliwell, 1986a). As *Goal Setting*, *Incentives* and *Feedback* has been shown to most often result in a behaviour change that is limited to the time the strategy is employed, it is reasonable to believe that this goes for *Competition* as well. In a summary of studies made by Dwyer et al (1993), one example where students in residential halls at a collage recycled aluminium cans, contained elements of competitions between different dormitories. Additionally, the study setting included a lottery incentive, information and initial exhortations. The intervention resulted in a significant increase of collected cans, and also an increase of bought cans from the dormitories' vending machines. However, when the lottery and competition were discontinued, the levels went back down again. Additionally, a reintroduction of the incentive system resulted in only a small increase of cans recycled. Thus, this experiment appears to support the assumption that the behavioural effects of competitions do not continue after the end of the competition. Yet, in a study on teenagers who for a week played a mobile phone game directly connected to the energy use in their homes, some post-game effects were indicated (Gustafsson, Bång and Svahn, 2009). These effects were a partly sustained reduction of energy consumption, a significant positive attitude change and the formation of new energy saving habits like e.g. turning of the computer during night time. The game design contained both elements from *Emotionally Triggering Feedback* and *Enlightenment through Interaction and Experience* as well as a competition between the participating teenagers. Thus, the post-game effects cannot be attributed only to the competitive element. Nevertheless, as competitions often contain different elements, these tentative findings imply that the strategy *Competition* may have potential to induce a target behavior that will continue also after the competition.

Affective Design

Affective Design is just as *Eco-Affective Design* a strategy aiming at evoking positive or negative emotional reactions regarding behaviours. Positive emotions should be connected to the desired behaviour or negative emotions to the undesired behaviour. The difference between *Eco-Affective Design* and *Affective Design* is that in the latter case the emotions are not related to the environmental

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impact of the behaviour. Instead, it could e.g. be guilt for not engaging in a behaviour for a long time as with Tamagotchis, digital pets first sold in 1996 that needs care in order to become well-mannered (Wikipedia, 2011). Lockton, Harrison and Stanton (2010a) suggested a similar approach called Emotional Engagement, with the aim of engaging people's emotion. A product that makes use of this was shown by Lockton, Harrison and Stanton (2010a). It is a litter bin in the shape of a chick that can be fed with litter through the open beak (figure 34).

Social Incentives

As explained in section 3.2.1., paragraph Norms, and in section 3.2.5., paragraphs Social Norm Reminder and Normative Feedback, people's behaviour can be influenced by social norms. If a person acts against a social norm he or she is likely to be punished socially, with means ranging between small facial expressions and total dissociation. This social pressure could be utilised for inducing sustainable behaviour as a designer could facilitate for unsustainable behaviour to be monitored by others. It is also possible that it does not have to go as far as to the user receiving social penalties, since the knowledge of possible discovery of one's unsustainable behaviour can be a sufficient motivator for behaviour change. Furthermore, to design for social pressure can be one way to influence people in the phase of introjection (see section 3.2.1., paragraph Motivation and the Self-Determination Theory), thus utilising the user's feelings and aspiration to act in accordance with a regulation even if he or she does not understand the importance of it. One example of the effect of monitoring and social punishment is the case were a shopkeeper in a small community in the United Kingdom disapproved of the littered streets and therefore started to write children's names on the snacks they bought from her. In that way everyone could see who the litter belonged to. Children who were detected to litter got a temporary ban from the store or were forced to pick up litter. This method reduced the litter on the streets with up to
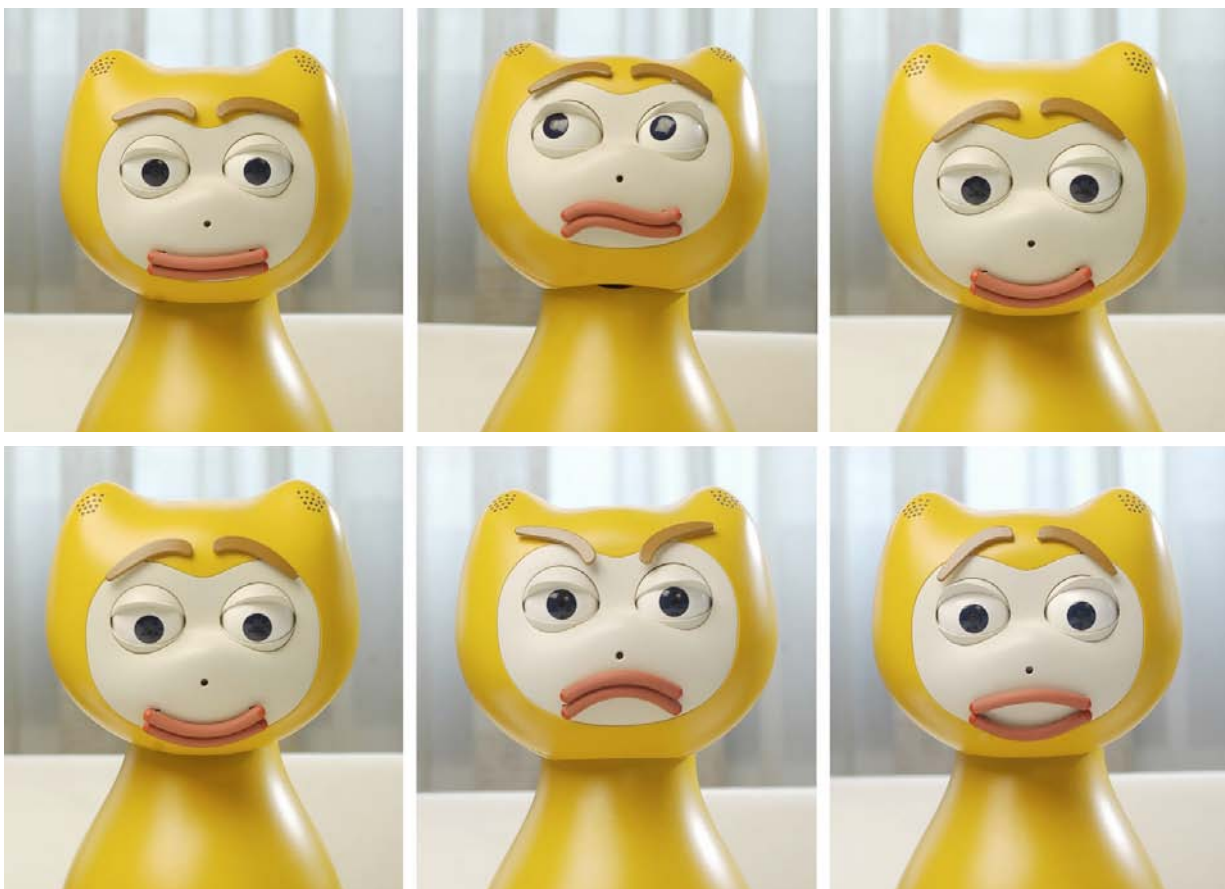

Figure 35. An example of *Social Incentives Offered by Products*: a robotic cat giving positive and negative feedback on the choice of washing programme on a washing machine. Photo by Philips.

40 percent, all according to MailOnline (2009).

Social incentives can of course be of a positive nature as well, with support and approval from peers. For example, if a person receives positive social feedback, e.g. a smile, for putting an empty package in the correct recycle bin, his or her brain will notice the reward and the will to repeat the behaviour increases (Manning, 2009). One way to design for social validation and confirmation of feelings could be to enable people to share stories and thoughts, much like in internet forums, which also goes in line with the strategy *Guidance through Group Belonging* (see section 3.2.5. and the corresponding paragraph).

Social Incentives Offered by Products

Social Incentives can be effective also when not offered by humans. Midden and Ham (2009) showed that positive and particularly negative feedback provided by a robotic animal when choosing washing programme on a washing

machine were more successful than factual feedback in reducing energy consumption (figure 35). The positive or negative facial expressions and utterances of the robotic cat can be seen as injunctive norm feedback as they express approval and disapproval of actions.

Attention Drawing Design

The idea of the strategy *Attention Drawing Design* is to design a product or a product service system in a way that the artefact itself or the actions of the user creates positive attention. In this way it is easy for both the user and the surrounding to start talking about the product or the behaviour, which may facilitate the spread of the sustainable behaviour. In fact, direct social contact with someone who displays a progressive sustainable behaviour increases the likelihood for others to adopt the same behaviour (Manning, 2009). Additionally, the social incentives, i.e. the positive attention the user receives from peers, may ensure a continuation of the behaviour.

PROMISING RESULTS **+**	SPLIT RESULTS **+/-**	LESS PROMISING RESULTS **—**	LITTLE OR NO RESEARCH FOUND **?**
Public Commitment			The Fun Theory
Incentives			Support Autonomy
Goal Setting			Support Competence
Competition			Provide Options
Social Incentives			Support Relatedness
			Order and Aesthetics
			Value-Added Design
			Convenience
			Enhance Benefits
			Affective Design
			Attention Drawing Design

Table 2. The table shows all the strategies within the category *Spur* and what potential to induce sustainable behaviour each strategy appears to have.

3.2.7. Design Strategies within the Category Steer

The main principle in *Steer* is that the user should be guided towards the desired behaviour (figure 36). The purpose is to make the desired behaviour the evident choice, thus increasing occurrence of it. The undesired behaviour can be constrained through making it physically and/or cognitively challenging and the desired behaviour can be encouraged through making it easy to perform, cognitively and/or physically.

Figure 36. The carachteristics of the cetegory *Steer*.

Scripting

The principle of the strategy *Scripting* is to design artefacts in such a way that they trigger sustainable usage either by obstacles for unsustainable use or by making the sustainable behaviour so effortless that it becomes the natural way of using (Wever, van Kuijk and Boks, 2008). The strategy *Scripting* was by Bhamra Lilley and Tang (2008) called Eco-Steer in their compilation of seven intervention techniques. Jelsma and Knot (2002, p. 120) described a product's script as "a product layout guiding the behaviour of the user, in a more or less forceful way, to comply with values and intentions inscribed into the product by its designer". The principle of *Scripting* is similar to the concepts affordances and constraints as explained by Norman (1988), a similarity also noted by Lilley, Lofthouse and Bhamra (2005). Affordances in artefacts are "perceived and actual properties of the thing, primarily those fundamental properties that determine just how the thing could be used" (Norman, 1988, p. 9). Thus, affordances are clues to how products can be used. Constraints are built-in hinders for actions that can be physical, semantic, cultural or logical (Norman, 1988). Physical constraints render certain actions impossible and consequently obstruct unsustainable behaviour,

e.g. a water tap with a built in resistance in the handle. For maximum flow and/or heat, the handle has to be held up and/or held to the left with a constant force. Another example is showerheads in public showers that automatically turn off after a few minutes. Semantic constraints are based on the user's understanding of the situation. Cultural constraints are based on cultural conventions, such as the colours of traffic lights. Logical constraints rely on the user's logical reasoning. Norman (1988) gave the following example of logical constraints. If two switches control two lights the switch to the left control the left light and vice versa. Logical constraints make use of natural mapping, i.e. creation of a relationship between two things with the help of physical analogies and cultural conventions (Norman, 1988). Unfortunately, few studies on if and to what extent *Scripting* can induce sustainable behaviour have been made, an absence acknowledged also by Lilley, Lofthouse and Bhamra (2005). However, one study has been made in which household appliances were designed according to the strategy of *Scripting* (Jelsma, 1999 (unfortunately only available in Dutch) cited in Jelsma and Knot, 2002 and in Lilley, Lofthouse and Bhamra, 2005). Jelsma (1999) as cited in Jelsma and Knot (2002) suggested a two-step methodology for re-scripting products. Firstly, the users' current use behaviour is understood and secondly, a script that constrains the use is designed. The project duo argues that use of *Scripting* should be effective, as long as the constraints are not easily circumvented. Nevertheless, the acceptability of products and services that make use of *Scripting* would be low if the users experience that actions they used to perform become constrained. Sections 8.2.3. and 9.2.3. contain the project duo's own findings on the effectiveness and acceptability of the strategy *Scripting*.

Just-in-Time Prompt

Prompts are visual or auditory reminders to carry out an action that the user otherwise might have forgotten to do (McKenzie-Mohr, 2006-2010). The purpose is solely to remind the user, neither to induce an attitude change nor to motivate the action in any other way (McKenzie-Mohr, 2006-2010). *Just-in-Time Prompts* are prompts given right at the time of the behaviour and seem to be a promising way to induce sustainable behaviour (recommended by e.g. Arroyo, Bonanni, and

PROMISING RESULTS	+	SPLIT RESULTS	+/-	LESS PROMISING RESULTS	−	LITTLE OR NO RESEARCH FOUND	?
Just-in-Time Prompt						Scripting	

Table 3. The table shows all the strategies within the category *Steer* and what potential to induce sustainable behaviour each strategy appears to have.

Selker, 2005; Winett and Neale, 1979; McKenzie-Mohr, 2006-2010). McKenzie-Mohr (2006-2010) and Winett and Neale (1979) reviewed several successful studies on the effectiveness of prompts and concluded that prompts in both time and space should be placed as close as possible to where the action should take place. Furthermore, McKenzie-Mohr (2006-2010) suggested that the prompts should be self-explanatory, simple and encourage desired behaviour rather than discourage undesired behaviour. Winett and Neale (1979) suggested that prompts should be specific to what behaviour to perform, as well as when and who should perform the behaviour.

3.2.8. Design Strategies within the Category Force

The mechanism employed in the category *Force* is to compel the desired behaviour upon the users, through limited functionality or by restraining undesired behaviour (figure 37). Here, the difficulty for a designer lies in developing products and services in such a way that the users accept the hindrance of the undesired behaviour.

Figure 37. The carachteristics of the cetegory *Force*.

Forced Functionality

The strategy *Forced Functionality* was suggested

by Wever, van Kuijk, and Boks (2008) and originally refers to two different approaches. It refers to Lilley, Lofthouse, and Bhamra's (2005) strategy of intelligent products that automatically adapts to the context and also to design products in a way that hinders unsustainable behaviour (Wever, van Kuijk, and Boks, 2008). But, as mentioned in section 3.2.3. Reviewed Categorisations of Design Strategies, the project duo found these two different approaches to *Forced Functionality* to be unclear as intelligent products, as defined by Lilley, Lofthouse and Bhamra (2005), rather is a mean for achieving a certain strategy and not a strategy on its own. Thus, only the latter approach, i.e. hinders for unsustainable behaviour, was found to be relevant for this compilation of strategies. *Forced Functionality* is somewhat similar to the strategy *Scripting*, the difference is that *Scripting* is more or less forceful whilst *Forced Functionality* forces the user (Wever, van Kuijk, and Boks, 2008). An example of *Forced Functionality* analogue with the example of showerheads described in *Scripting* would be that every user of a public shower would have a limited showering time. Another example is interlocks, as described by Lockton, Harrison and Stanton (2010a), where one action cannot be performed as long as another action is completed. An example is cash machines that dispense cash only after the card has been taken (Lockton, Harrison and Stanton, 2010a).

Habit Intervention

As mentioned earlier, people that have habits might be aware of new information regarding the behaviour on an attitudinal level, but that knowledge alone does not change the behaviour (Jager, 2003). Therefore, it is hard to break a habit through information or persuasion. Instead, interruption of the habit is a prerequisite for information to influence the habit (ibid.). Therefore, the

most effective way to break a habit is to make the habit impossible, to change the outcome of the habit or to avoid the situation that triggers the habit (ibid.). The challenge is to break the habit in a way that the users approve of. The idea of the strategy *Habit Intervention* is to break an unsustainable habit in a way that is accepted by the users and thereafter to facilitate formation of a new sustainable habit.

When a person has no previous habits tied to a product there is no habit that needs to be interrupted. Therefore, an idea is to introduce a new product to a person and by doing so replace a product that has unsustainable use-habits tied to it. Hence, the interruption of the undesired habit would be masked by acquisition of a new product where new habits naturally are needed. In addition, to buy or to receive a new product is something many people enjoy. To hand out free samples is common in e.g. grocery stores and could be one way to convince a user to try out a new product. A second way could be through the use of the strategy *Value-Added Design* (see section 3.2.6.). Another alternative is to introduce a sustainable habit when people have naturally occurring changes in their lives that disrupt their unsustainable habits e.g. moving, change in occupation or change in family situation (Verplanken and Wood, 2006). This idea was supported by Thøgersen's (2009) study of transportation habits. A group of car drivers in Copenhagen were given a free month travel card for public transportation. In comparison to a control group the participants given a free travel card increased their use of public transportation and the effect remained also after four months. Nevertheless, the difference was significant only for the participants that recently had moved or changed workplace. Apart from Thøgersen's study little research on the effects of *Habit Intervention* have been found, but in section

8.2.4. and 9.2.4. the project duo's own findings on the effectiveness and acceptability of *Habit Intervention* are presented.

Verplanken and Wood (2006) pointed out that it is vital not only to disrupt the undesired habit but also to create a new habit in order to ensure maintenance of the new behaviour. Creation of habits involves repetition and reinforcement of the behaviour (e.g. Jackson, 2005). The reinforcement must occur at least in the beginning of the habit formation (Verplanken and Wood, 2006). Furthermore, the user has to be able and motivated to repeat the behaviour. Jarger (2003) pointed out that experiencing a direct positive outcome from the behaviour increases the motivation to repeat the behaviour. Subsequently, a direct negative outcome is thought to decrease motivation to repeat the behaviour. When a positive outcome is associated with the behaviour and the behaviour is repeated, a cognitive script is developed (Jackson, 2005). The cognitive script ensures that the same behaviour is performed in the same context with little cognitive effort (Jackson, 2005), i.e. the behaviour has become habitual. The project duo has found few examples of how habit formation can been facilitated with product or service design. Yet, the description of habit formation above gives a few ideas for how it could be done. Firstly, not all behaviours have direct positive outcomes. In order to ensure repetition of behaviour external reward could be used during the habit formation and withdrawn as the habit is established. Of course, the reward must not be so essential that retrieval of it disrupts the habit and gradual withdrawn of the reward might be useful. Some habitual behaviours have positive outcomes that become evident after a while, e.g. cycling to work will eventually result in better condition. An external reward may be given and withdrawn when the delayed positive outcome becomes evident. Secondly, in order to repeat

PROMISING RESULTS ➕	SPLIT RESULTS ➕/➖	LESS PROMISING RESULTS ➖	LITTLE OR NO RESEARCH FOUND ❓
Habit Intervention			Forced Functionality

Table 4. The table shows all the strategies within the category *Force* and what potential to induce sustainable behaviour each strategy appears to have.

the behaviour a person must be able to repeat it, indicating that the behaviour cannot be too complex. Furthermore, the project duo suggests that making use of the strategy of *Scripting* is a way to facilitate establishment of a habit. The reason for this suggestion is the nature of a habit, a behaviour that is highly automated and performed with little cognitive effort. If certain behaviour is scripted for in the product or service design, the desired behaviour can be performed with little cognitive effort and therefore the habit development may be faster.

3.2.9. Design Strategies within the Category Match

For many products and services a decrease in environmental impact from the use phase can be attained without motivating or directing the users to change their behaviours. Instead, products or services can be adapted to the users' behaviours or to their intentions. This is done by designing product and services in such a way that they either minimise the environmental impact of the users' initial behaviours or facilitate sustainable behaviours that the users already want to perform but consider themselves unable of doing. The strategies for achieving this are collected in the category *Match* (figure 38).
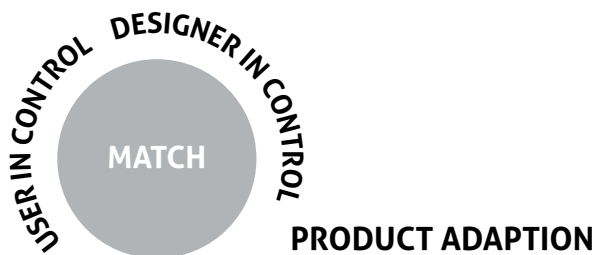

Figure 38. The carachteristics of the cetegory *Match*.

Functionality Matching

When using the strategy of *Functionality Matching* a designer adapts the product to fit with already existing behaviour of the user. This can be done to reduce mismatches between the delivered functionalities and the by the user desired outcomes, as such mismatches may lead to unsustainable outcomes of the behaviour (Wever, van Kuijk and Boks, 2008). One example of such a situation is when taking a towel from a towel dispenser in a

bathroom. When the dispenser is filled up with towels it sometimes happens that the user receives two towels instead of one when pulling out one towel. In this situation *Functionality Matching* would make sure the user always receive only one towel when pull. Another example is a lamp switch that only provides the option of turning the lights on, and after a while automatically turns the lights off again. This product is common in e.g. offices and hallways in apartment buildings, where users and visitors may forget to turn off the lights. More advanced design concepts resulting from *Functionality Matching* could contain intelligent systems that interprets what the user is doing, for example through communication with other products, and adapts its mode to the current situation e.g. in order to save energy. One example mentioned by Lilley, Lofthouse and Bhamra (2005) is Honda's integrated motor assist that turns the engine off and on at traffic lights, thus saving energy and reducing emissions without engaging the driver.

A negative aspect of this design strategy is that once a user starts to take the changed outcome of his or her behaviour for granted, it can lead to less favourable outcomes with similar products. Take the example of the automatic light switch; when a user has got accustomed to never having to turn off the lights in e.g. the toilets in an office building, it is possible that this habit will transcend and that the user will stop thinking about turning off the lights in other toilets as well.

Ecodesign

A second strategy that requires little effort from the user is the design strategy *Ecodesign*. This strategy focuses on energy efficiency, environmentally sound materials, reduction of emissions and waste, efficient production, etc. Thus, the outcome of a user's actions with a product designed via principles for *Ecodesign* may be better for the environment compared to the same use of a similar but conventionally designed product. There are several methods available for this design strategy, e.g. Life Cycle Analysis, Recycling, Biomimicry, Design for Disassembly, and Cradle to Cradle. Naturally, there are also many definitions of this well-known strategy. For example, Hundal (2002, p. 201) defines *Ecodesign* in the following manner:

"Ecodesign is a process with the purpose of

arranging technology and organization in such a way that, through intelligent use of all available resources with minimum environmental impact, the greatest possible benefit is obtained for all the individuals involved, and consumer satisfaction is also guaranteed."

Enabler

Sometimes a user may have an initial desire to perform a sustainable action, but factors such as social norms or physical obstacles hinder him or her from carrying it through. One example of such a situation could be a user that wants to cycle to work, but does not want to feel sticky and smell of sweat during the whole office day as the first is uncomfortable and the latter not appreciated by colleagues. Here, a designer has the opportunity to, by reducing the obstructing circumstances, create a product that enables the user to perform the sustainable action. In the case with cycling to work, a ventilating jacket or an electric bike could be solutions.

3.2.10. Mix Strategies for Successful Interventions

A concise, but nevertheless important finding is the advice to combine strategies for a greater effect. For example, a number of researchers have found that goal setting combined with feedback is more influential than only goal setting (Abrahamse, Steg, Vlek and Rothengatter, 2005). Gardner and Stern (2002) took the recommendation one step further, proclaiming that to combine intervention strategies is one of the most important lessons to be learnt from successful environmental programme. A programme with a mix of strategies will have a better chance to succeed as it deals with the fact that there can be numerous barriers towards a behaviour, active in different situations and unequal in importance for different individuals, additionally, when one barrier is taken care of, another one may reveal itself (Gardner and Stern, 2002). Moreover, as Manning (2009) stated, what one person finds motivating can be repelling for someone else.

PROMISING RESULTS **+**	SPLIT RESULTS **+/-**	LESS PROMISING RESULTS **—**	LITTLE OR NO RESEARCH FOUND **?**
Functionality Matching Ecodesign			Enabler

Table 5. The table shows all the strategies within the category *Match* and what potential to induce sustainable behaviour each strategy appears to have.

4. DISCUSSION PART I

4.1. PROCESS

Two major obstructions were encountered in the procedure of the strategy review phase and these were the project duo's initial ignorance within the psychology field and the partly related difficulty to quickly find and understand information on the theoretical background of behaviour change. This was apparent for the writing of section 3.2.1. Introduction to the Theoretical Background of Behaviour Interventions, where the research field seemed endless, but also for some of the design strategies, as mentioned in section 3.1.3. Compilation of Strategies. The difficulty of finding relevant literature was sometimes a question of access, as Chalmers Library foremost provides literature on engineering topics and not psychology, and sometimes a question of not finding pertinent research at all. As mentioned in section 3.1.3. Compilation of Strategies, an initial attempt for thoroughness in addition to the limited time set aside for this compilation resulted in a varying level of detail between the strategy descriptions. Perhaps consulting professors or researchers at the psychology department at Gothenburg University could have helped the project duo to speed up both the information search and the learning process. Communication with researchers within the field of design for sustainable behaviour could perhaps also have helped in this process.

The construction of the strategy model was far less troublesome, compared to the literature review. After having read a lot of literature from the field of design research that suggested different ways of grouping design strategies for sustainable behaviour, the final categorisation gradually became clear to the project duo. Yet, it was sometimes difficult to sort the design strategies into the five different categories, as some of them seemed to fit into more than one group. Additionally, when searching for existing products or concepts to use

as illustrative examples within the different strategies, it happened that a product could belong to more than one strategy depending on how the user's initial behaviour would have been. However, if the strategy model and the compilation of design strategies would be used to inspire and facilitate design practice, these difficulties would be a minor problem.

4.2. FINDINGS

The literature review implied that it is possible to induce sustainable behaviour on a long-term basis through product design, but few or no explicit product related examples were given. In general, few studies investigated long-term effects, and studies with a design perspective contained even less information on long-term effects. However, the strategy *Information* seemed to have potential for long-term effectiveness in inducing target behaviour, if it led to any behaviour change in the fist place witch seldom happened. *Feedback* and *Incentives* are examples of strategies that seemed to have a better chance at inducing behaviour change, but for the new behaviour to continue, the feedback or the incentive had to be sustained. One example of a successful sustainable product service system working with both incentives and information campaigns is the Swedish deposit system for aluminium cans, plastic bottles etc., where 87 percent of the comprised cans and bottles are recycled (Returpack, n.d.).

The mechanisms employed within the strategies are many and varying, but the model for categorisation of design strategies created by the project duo indicates the two basic influencing techniques, motivate and direct. For *Enlighten*, the idea is either to change or activate the user's values, attitudes or norms in order to increase the

motivation for a certain behaviour, or to inform on behaviour possibilities and thus increase the motivation or, if motivation already exists, make the user form a behavioural intention (see section 3.2.1., paragraph The Theory of Planned Behaviour, for an explanation on intentions). For *Spur* the employed influencing techniques are intrinsic or extrinsic motivation. In *Steer*, the influencing technique is of less motivational nature, as it is to guide the user physically and/or cognitively to a certain behaviour. The same goes for *Force*, but in a more intrusive way, as the user more or less gets forced into a behaviour. For *Match*, no mechanism is employed as the idea is for the product to be adapted to the user and thus no motivation or direction is needed. The names of these five categorisations can also be seen as the influencing techniques employed to reach motivation or direction. Then, on a third level, the strategies within the category are also elements of mechanisms, such as reflection, feeling competent, being just-in-time-prompted, etc. (figure 39). The strategy model created by the project duo is in this way more comprehensive compared to the reviewed categorisations (see section 3.2.3. for the review) as they lacked this internal consistency with the employed influencing techniques. In addition, the new model portrays who is in control of the behaviour change, whereas prior categorisations doing this were less considerate of the influencing techniques behind the strategies.

As the research on design strategies for sustainable behaviour found by the project duo varied in scope and set-up, it is difficult to compare the potential of the different design strategies. For example the strategies *Information* and *Feedback* are well accounted for, whilst for e.g. *Scripting*, a strategy with

extensive opportunities for different design solutions, the project duo found less research on its potential to induce sustainable behaviour. Additionally, in the reviewed research, few studies were done on strategies implemented in real products, which further made it difficult to judge what design strategies that seem more promising than others. An additional aggravating circumstance was that design details can play an essential role in a user's experience of a design strategy, e.g. as with *Feedback* (see section 3.2.5., paragraph Feedback). This is also something that the project duo could verify from their experiences from various user studies. As researchers within the psychology field seldom acknowledge this importance of design, at least according to the reviewed literature, it is possible that results in their studies would have been different if a designer would have been consulted. With all this in mind, it is apparent that more research is needed on design strategies for sustainable behaviour. However, the tendencies in the reviewed literature was that *Feedback*, *Exhort Behaviour*, *Modelling*, *Personal Norm Reminder*, *Guidance through Group Belonging*, *Public Commitment*, *Incentives*, *Goal Setting*, *Competition*, *Social Incentives*, *Just-in-Time Prompt*, *Habit Intervention*, *Functionality Matching* and *Ecodesign* all appeared to have some potential (table 6), but for most of them, the method of inducing the behaviour needed to be sustained in order for the behaviour to be maintained. Even if some strategies seem more promising than others, an important finding is that also these strategies can fail in their attempt to induce target behaviour. The recommendations on conducting user studies and identifying barriers toward sustainable behaviour, and thereafter chose strategies in accordance to these barriers (see section 3.2.2.) thus appeared vital. So did the recommendation to combine different strategies in order to attain a successful intervention (see section 3.2.10.).
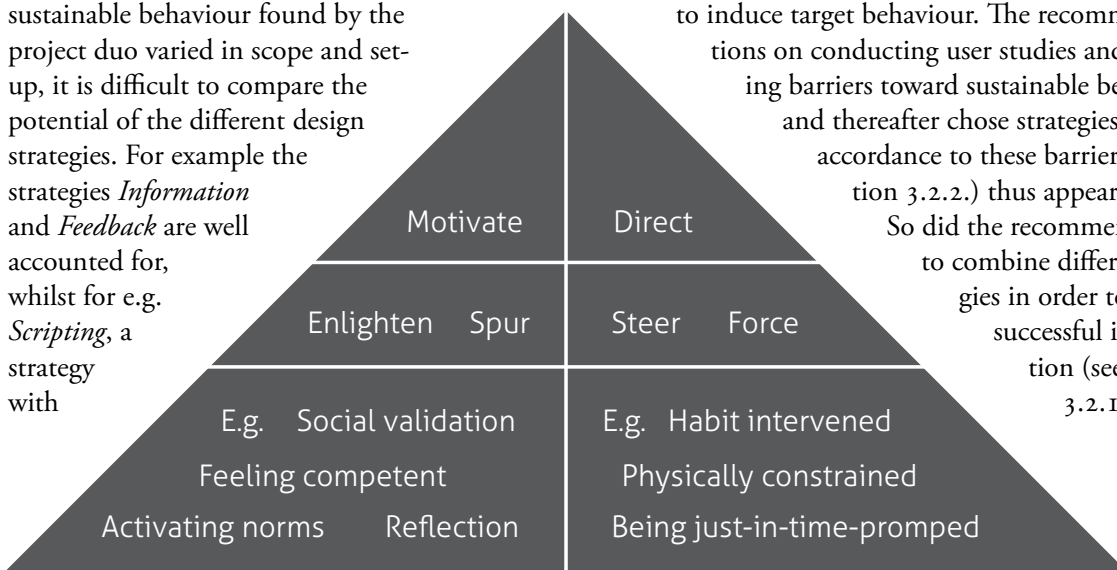

Figure 39. A visualisation of the mechanisms for behavioural change that are employed within the identified design strategies.

PROMISING RESULTS **+**	SPLIT RESULTS **+/-**	LESS PROMISING RESULTS **—**	LITTLE OR NO RESEARCH FOUND **?**
Feedback	Social Norm Reminder	Information	Bodily Attitude Influences
Exhort Behaviour		Guidance from Authority	Preview of Behavioural Consequences
Modelling			Design for Reflection
Personal Norm Reminder			Design for Discussion
Guidance through Group Belonging			Eco-Affective Design
			Enhancing Resource Value
			Individual Power Awareness
			Enlightenment through Interaction and Experience
			Value and Attitude Reminder
Public Commitment			The Fun Theory
Incentives			Support Autonomy
Goal Setting			Support Competence
Competition			Provide Options
Social Incentives			Support Relatedness
			Order and Aesthetics
			Value-Added Design
			Convenience
			Enhance Benefits
			Affective Design
			Attention Drawing Design
Just-in-Time Prompt			Scripting
Habit Intervention			Forced Functionality
Functionality Matching			Enabler
Ecodesign			

Table 6. The table shows all the identified strategies and their potential to induce sustainable behaviour.

4.3. RELEVANT CONSIDERA-
TIONS FOR PART II

Some of the findings in Part I – Strategy Review were particularly important to consider in the following phase of the project, Part II – Empirical Study. Firstly, as also details in the design solutions may play a significant role in a strategy's success or failure in inducing sustainable behaviour it was important to put an effort into working through all the details of the design concepts suggested in Part II – Empirical Study. Secondly, since strategies for inducing a certain behaviour should be chosen so that they have the potential to overcome the barriers for that target behaviour, Part II – Empirical Study should start with a user study to identify possible barriers. Another suggestion identified in the literature review was to mix different strategies. Yet, this could not be done in the empirical study as the aim was to evaluate single strategies. In addition, very few studies in the literature review presented comparisons between different strategies and to mix strategies in Part II – Empirical Study would preclude comparisons also in this project.

In the literature review the project duo found few studies where strategies have been implemented in product design and especially long-term studies. This further emphasised the relevance of Part II – Empirical Study.

5. EXPLORATION OF CONTEXT

A first step towards evaluating design strategies for sustainable behaviour was to select a target behaviour, as that was needed for the development of testable product concepts. Secondly, as found in Part I - Strategy Review, it was essential to understand the barriers towards a target behaviour in order to choose suitable design strategies for overcoming these barriers. Thus, Part II - Empirical Study, that aimed at investigating the long-term effectiveness and acceptability of design strategies for sustainable behaviour, begun with a user study in the form of a context-mapping and a selection of target behaviour.

5.1. PROCEDURE

As mentioned above, Part II - Empirical Study had to start with the selection of a target behaviour. However, the project duo felt that a target behaviour could be chosen more wisely if barriers first were identified for a broader application area. Thus the working order for this process was set as to first select an application area, thereafter perform a literature review and a contexmapping study in order to identify barriers towards sustainable behaviour within the application area and then to finally decide upon a suitable target behaviour.

5.1.1. Selecting Application Area

The process of selecting an application area was initiated by the creation of a mind map covering a great variety of products and behaviours possible to address (figure 40).

The character of the project limited the choice of application area. Firstly, as the aim of the empirical study was to identify and evaluate the long-term effectiveness and acceptability of a selection of design strategies for sustainable behaviour, the evaluation period should be as long as possible. The project ran over a complete year starting in

Figure 40. Amongst others, the project duo found these to be suitable areas: energy consumption of refrigerator and freezer e.g. through more efficient usage; energy consumption of household appliances e.g. through apply manual power; reduce energy consumption of washing machines e.g. through washing in lower temperatures; energy and material consumption due to individualisation of technology; water consumption; over dosing of cleaning agents; recycling; waste of food.

February and including a summer holiday of three months. The holidays provided possibilities for a longer evaluation period. Therefore the intended behaviour change must concern a behaviour that stays the same during spring and early summer (when the current behaviour would be monitored), summer (when change would be induced) and autumn (when the possible change in behaviour would be monitored). Secondly, in order to evaluate the design strategies, product prototypes had to be produced. Therefore the prototype concepts had to be possible to produce in a short series with simple manufacturing procedures. The desired sustainable behaviour should therefore be chosen wisely, so that prototype manufacturing would be made possible. Thirdly, the behaviour should be suitable for testing, meaning that behavioural changes must be measurable; that observing and documenting the behaviour changes should demand a reasonable workload and that suitable participants should be easily found. Fourthly, the behaviour's resistance to change should be taken into account as the result of the strategy testing would not be generalizable with a behaviour with too low or too high resistance to change, thus would not give justice to the tested design strategies. Finally, within the application area, there must be opportunities for introducing sustainable behaviours that contribute to actual reductions in environmental impact.

Overdosing of Cleaning Agents

One interesting application area listed in the mind-map was dosing of cleaning agents. Cleaning agents cause discharge of chemicals into the wastewater systems that may pollute watercourses. Furthermore, overdosing causes unnecessary use of energy and other resources as more detergent than there is an actual need for will be manufactured, transported and handled at the sewage works. Gryaab (n.d.), the regional sewage works of the Gothenburg region, plead on their website for their customers to use the lowest recommended dose of different cleaning agents in order to help them in the wastewater treatment process.

This application area did meet the limiting criteria derived from the character of the project. Cleaning oneself and one's surroundings can be assumed to be rather similar over the year. Furthermore, concepts aimed at promoting correct dosing could

for example be different packaging solutions that could be produced with simple manufacturing procedures at a low cost. With cleaning agents, it is possible to measure the amount used, and consequently to measure the effect of the behaviour intervention. In addition, overdosing of washing detergent is common (Unilever HPC Europe, 2000) and the project duo had noticed that overdosing occurs when using other cleaning agents as well e.g. soap. Thus, finding participants who could test the prototypes was judged to be a relatively straightforward task. Finally, overdosing of cleaning agents was considered to have an appropriate resistance to change since it on the one hand often is habitual, yet on the other hand has a limited influence on other areas of everyday life, compared to e.g. switching from commuting with car to bicycle where choice of clothing, grocery shopping routines etc. could be affected as well.

As overdosing of cleaning agents was evaluated to be a behaviour that both had an important environmental aspect and that fulfilled the criteria set by the project layout, this application area was chosen.

5.1.2. Literature Review

The project duo searched for literature on the topic of possible barriers for correct dosing of cleaning agents through electronic resources provided by Chalmers Library and other publications available online. Both academic work and publications from relevant companies were reviewed.

5.1.3. Contextmapping

Through observations, focus groups and questionnaires, an understanding of what people do, say and think can be achieved (figure 41). Yet, as was discovered during the literature review (see section 5.2.1), this may not reveal all the barriers to correct dosing. Instead, with generative techniques, where the participants create things, insights in thoughts, feelings and dreams can be gained (Sanders and Dandavante, 1999). Contextmapping is a method where generative techniques are employed and therefore, it was chosen for the exploration of the application area. The method of contextmapping is further explained in section 2.1.
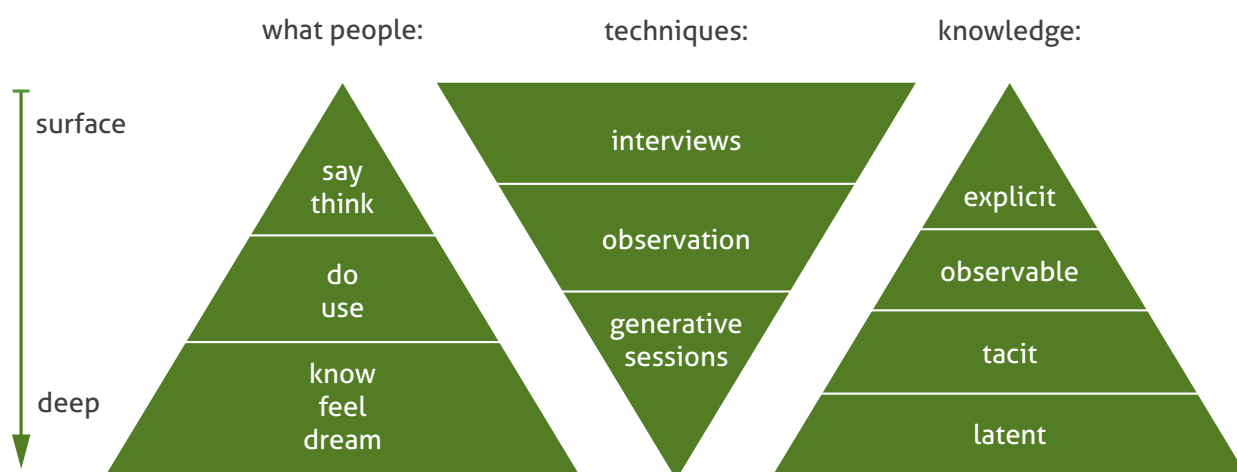
what people: techniques: knowledge:

Figure 41. Different levels of knowledge about experience are accessed by different techniques. Figure adopted from Sleeswijk Visser, Stappers, van der Lugt and Sanders (2005).

2.1. The Method of Context-mapping

Below, contextmapping is described in accordance with Sleeswijk Visser, Stappers, van der Lugt and Sanders (2005) and Sleeswijk Visser, Stappers and van der Lugt (2007).

The purpose of a contextmapping is to gain rich understanding of the context of product use, where 'context' refers to all factors that influence the experience of product use. This is done through generative techniques, in which participating product users step by step are assisted in expressing their product experiences, including their tacit knowledge and latent needs, where 'tacit knowledge' refers to knowledge not easily expressed in words and 'latent needs' refers to needs that users are not yet aware of. Consequently, important insights in users' product experiences are gained.

In generative techniques, the participants create artefacts, e.g. collages, drawings, and models concerning their experiences and tell about their creation. The participants "think and feel their experiences while creating things" and that is why they "are able to access and express their experiences" (Sleeswijk Visser, Stappers and van der Lugt, 2007, p. 28). In contextmapping, the generative techniques are used in a generative session, a gathering with one or more product users and one or more user researchers. Prior to the generative session, the

participants should be sensitised in order to be well prepared for the session. After the session, the rich material of artefacts and told stories are analysed and the findings communicated. The steps of a contextmapping study are further explained below.

Preparation

As with all user research, a contextmapping study should be appropriately planned, including selection of participants, choice of generative technique etc. Furthermore, since contextmapping may appear to be less formal than traditional user research, it is even more important to formulate the research goals carefully.

Sensitising

The purpose of the sensitising as described by Sleeswijk Visser and colleagues is to encourage the participants to reflect over their experiences on the topic of the study prior to the session. This serves as a preparation for accessing experiences in the group session. The sensitising is done by giving the participants exercises or activities to be done in their own environment during a couple of days or a week. These assignments should be free and playful enough to inspire the participants to wonder, reflect and improvise, yet at the same time professional, in order for the participants to feel that they are taken seriously. Often, the topic of the sensitising is broader than the topic of the generative session.

Generative Session

The aim of the generative sessions is to penetrate further in the participants' thoughts, feelings and dreams by using generative techniques, as explained above. Some generative techniques, as collage making and modelling, are oftentimes suggested in literature, yet, there are endless possibilities.

A generative session should start with a warm-up, followed by the generative technique segment, in which the participants make artefacts and tell about them, followed by a group discussion. The generative technique segment takes approximately forty minutes can be repeated two or three times, with different generative techniques employed. In group sessions, four to six participants are advisable and approximately two hours should be scheduled for the meeting.

If using an image collage toolkit in the generative session, Sleeswijk Visser and colleagues suggest that:

» it should have a diverse content

» people in the images should be diverse

» balance between positive and negative images

» balance between abstract and concrete images

» not too beautiful images

» some, but not necessarily all, images should be ambiguous

» a minimum of subject-related images, yet a few, in order to help the participants to get started.

Analysis and Communication

The generative session is usually recorded on video or audio and transcribed. All collected data are then explored with an open mind in order to note impressions and insights. Thereafter, notes and data are organised and re-organised in order to identify recurring and striking themes. Preferably this is done on a large wall, thus facilitating creation of an overview as well as revealing interrelations between themes. The data can be communicated through workshops or personas.

Participants

For the contextmapping study, a total number of 17 participants were recruited, divided into three groups with four to six participants. Two of the participants did not show up for the meeting. There were nine women between 26 and 60 years old, with a mean age of 42 years, and six men ranging from 25 to 63 years old, with a mean age of 34 years.

Sensitising

A sensitising booklet was created by the project duo and sent out to all the participants via mail, approximately one week prior to the first meeting. The booklet consisted of a couple of self-reflective exercises on the topic of cleaning and personal hygiene to be made each day the week before the meeting. The participants were told to bring the booklet to the meeting. The sensitising booklet can be found in appendix 1.

Generative Session

In total, three generative sessions were held at Chalmers, scheduled for approximately one and a half hour each. All sessions were tape- and video-recorded with the participants' consent and the project duo took turns in leading the sessions. The theme of the sessions was dosing of cleaning agents.

Each meeting started with an introduction of the participants and the project dsuo. Thereafter, the participants teamed up two and two and read each other's sensitising booklets. The most interesting findings were then presented to the rest of the group.

Prior to this work, one of the members in the project duo had made a contextmapping study on perceived efforts and benefits of recycling. From that study, mostly external factors for not recycling were found, which contradicts a meta-analysis of 67 different research studies on recycling by Hornik, Cherian, Madansky, and Narayana (1995). The discrepancy was suggested to be related to the easiness in expressing external

factors as the hindrance for recycling in comparison with internal factors, since internal factors are elements you have control over, thus admitting internal factors implies that you are not trying your best, which could be seen as an unfavourable personality trait. Not all barriers to correct dosing of cleaning agents were thought to be favourable for the participants, thus, there were a risk of not identifying all barriers, as happened in the study on recycling. Therefore, a slightly different take on the generative phase of the session was tried. The participants were presented with four statements regarding dosing, e.g. "I do not know the hardness of the water, so I dose in accordance with the hardest water – just to be sure."; "I often do the cleaning just before my guests arrive, therefore, I'm very stressed and I just pour out cleaning agent so it will be clean quickly!" "If the laundry smells of washing detergent, then it feels clean." All the statements can be found in appendix 2. The participants were then asked to react to these statements with pictures chosen according to the recommendations for generative sessions (Sleeswijk Visser, Stappers and van der Lugt, 2007) and thereafter to explain their reactions and choice of pictures to one another. In this way, the participants got a chance to express attitudes they had regarding unflattering dosing behaviour, without having to claim them to be their behaviour. The idea was that if a participant recognised themselves in a slightly less favourable statement they would feel more comfortable in expressing an accepting attitude towards the behaviour mentioned in the statement, or even describing their own behaviour, as the behaviour was presented by someone else and without judgement.

The last part of the meeting was a group discussion. All participants got a note with comprehensive questions on dosing of cleaning agents. The project duo posed the questions on the note and additional attendant questions. See appendix 3 for the questions asked.

Data Analysis

All the meetings were transcribed and quotes representing a barrier towards correct dosing of cleaning agents were identified. The quotes were then sorted into groups through a KJ-Analysis, where one group represented one barrier to correct dosing.

2.2. The Method of KJ-Analysis

A KJ-Analysis, as described by Karlsson (2006), is a tool for structuring and communicating sizeable amounts of data, e.g. verbal data from user studies. During the analysis, the data is clustered and interrelations between the clusters are revealed.

In order to perform a KJ-Analysis, the data must be transcribed and every piece of data should be put on slips of paper. These are thereafter placed one by one on a board. For every slip of paper, one should consider whether it is related to any other piece of data already on the board, and if so, place the new slip of paper next to it. This procedure continues until all slips of papers are placed on the board. Then, names should be given to the shaped clusters.

Preferably, the analysis is made in a group of three to six persons with different backgrounds, e.g. from different departments of a company.

5.1.4. Selecting Target Behaviour

After analysing the result from the contextmapping the project duo decided upon what specific target behaviour, within the application area, to focus on in the rest of the empirical study.

5.2. KEY FINDINGS

5.2.1. Findings from Literature Review

Stamminger, Elschenbroich, Rummler and Broil (2007) saw in their observations of manual dish washing a large variety in the techniques used for washing up. Furthermore, they noticed great differences in the amount of cleaning agent used, yet no correlation between amount of cleaning agent and cleaning performance.

Järvi and Pavoliita (2007) conducted with help of students in 2004 and 2005 interviews in Finland

with the aim of understanding if dosing instructions for washing detergent are read, understood and followed. They found that around 40 percent of the respondents did not know if their washing water was hard or soft. Additionally, even though almost all water in Finland is soft, only 19 percent of the interviewees in the study in 2004 and 27 percent of the interviewees in the study in 2005 thought that their washing water was soft. This ignorance was seen as the most prominent problem for understanding washing detergent dosing instructions. Note that for all commercial washing detergents found by the project duo, the hardness of the washing water had a great impact on the dosing recommendations. According to the respondents of Järvi and Pavoliita's study, packaging information and the participants' own experiences were the main sources of learning how to dose. Järvi and Pavoliita (2007) called the participants that trusted their own experience 'estimate users' and commented that estimating may cause overdosing. Packaging information was read particularly when changing washing detergent brand.

Kovacs, Small, Davidson and Fischhoff (1997) found in an experimental study on usage of household cleaning agents that very few of the

participants in the study read the product labels. Furthermore, they found that whether a product was scented or not influenced the amount used. A smaller amount was used if the product was scented, than if the product was non-scented.

Cleanliness and hygiene can have a high cultural value, as seen in a study of women in Bagdad (Habib, El-Masri and Heath, 2006). Furthermore, Habib, El-Masri and Heath (2006) found that overdosing of cleaning agents was common and that the extensive use was related to social pressure of cleanliness from the family, as well as to fear of gossip from other women. These barriers to correct dosing can be seen as tacit knowledge that, as described by Sleeswijk Visser, Stappers and van der Lugt (2007), is knowledge people have but that is not readily expressed in words.

5.2.2. Identified Barriers to Correct Dosing of Cleaning Agents

The generative sessions revealed several important barriers to correct dosing of different kinds of cleaning agents. All barriers were related to
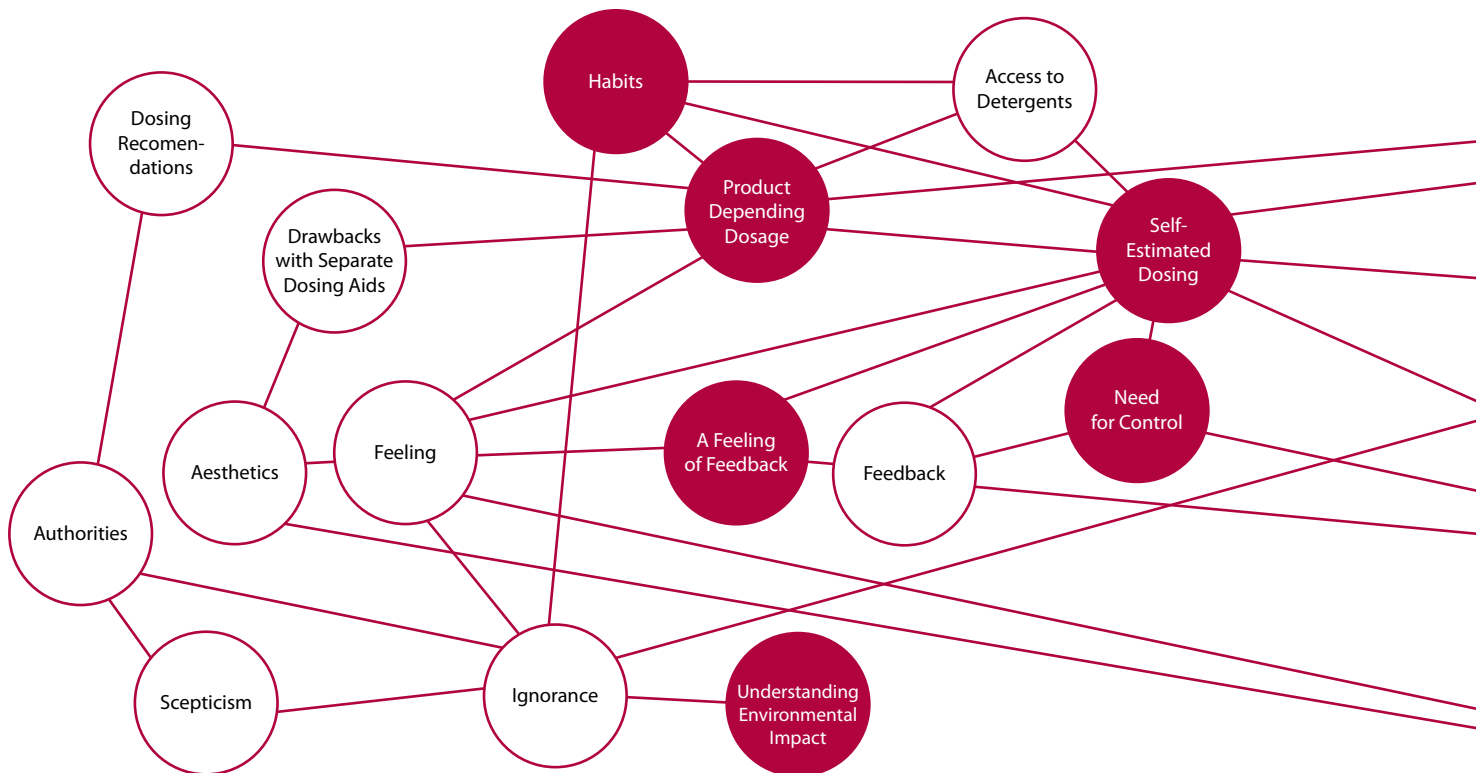

Figure 42. All the identified barriers to correct dosing of cleaning agents. The interrelation between the barriers are visualised by the lines between the circles and the coloured circles represent the most important barriers.

a least one other barrier, as illustrated in figure 42. Some of the barriers did also appear to be of greater importance, as they were either mentioned often or with great emphasis. These strategies are highlighted in figure 42. The barriers are presented further in the following paragraphs.

During the generative sessions it was also possible to detect three different user profiles i.e. three different points of view towards dosing of cleaning agents. In the session, the most common one was the convenience prone user, secondly the independent user and thirdly the emotional user. Some of the identified barriers were more important to one of these profiles, for example the barrier of aesthetics that were expressed mostly by participants with the emotional user profile.

Negative Image of Economising on Cleaning Agents

Some of the participants from time to time expressed that they had a negative image of economising with cleaning agents. For example, when explaining a technique for saving toothpaste, one participant said that she felt very silly when trying to save toothpaste in this way. Other techniques

for economising with cleaning agents were by some of the participants associated with horrible or prim old ladies. Excessive dosing of cleaning agents was by one participant described as macho and to be nicer than economising. Furthermore, people with luxury lifestyles were thought to overdose.

Unnecessary Dosing due to Access to Many Different Cleaning Agents

One of the participants mentioned that she had many different tools for cleaning and several different kinds of cleaning agents. She stated that she used the different cleaning agents only because she had access to them. This did not cause overdosing per se, but with many specialised cleaning agents it is more difficult to dose moderately as every cleaning area has a special cleaning agent and very little of each cleaning agent is needed. Furthermore, as the participant stated that she used them only because she had access to them, she would have very little to gain from moderate dosing since she would not have to buy a new one when emptied.

Ignorance of How Cleaning Agents Work

One of the participants pointed out that cleaning agents often are used without knowledge of how they actually work. Instead they are used because one has been taught to use them. Another participant exemplified this by asking the rest of the participants in the session what fabric conditioner is used for, even though he used it himself.

Habitual Use of Cleaning Agents

The use of cleaning agents was often a habitual behaviour. Some of the participants were aware of that their use of washing detergents and fabric conditioner was a habitual behaviour based on assumptions and feelings rather than on facts and knowledge. One of the participants reported that he used fabric conditioner only because he was accustomed to it even though he actually thought that fabric conditioner was unnecessary. For another participant dosing of washing detergent appeared to be habitual because she dosed as much washing detergent now when living in an area with soft water as when she lived in an area with hard water. The same participant stated that she used approximately the same amount of washing detergents, independent of how dirty the laundry was.
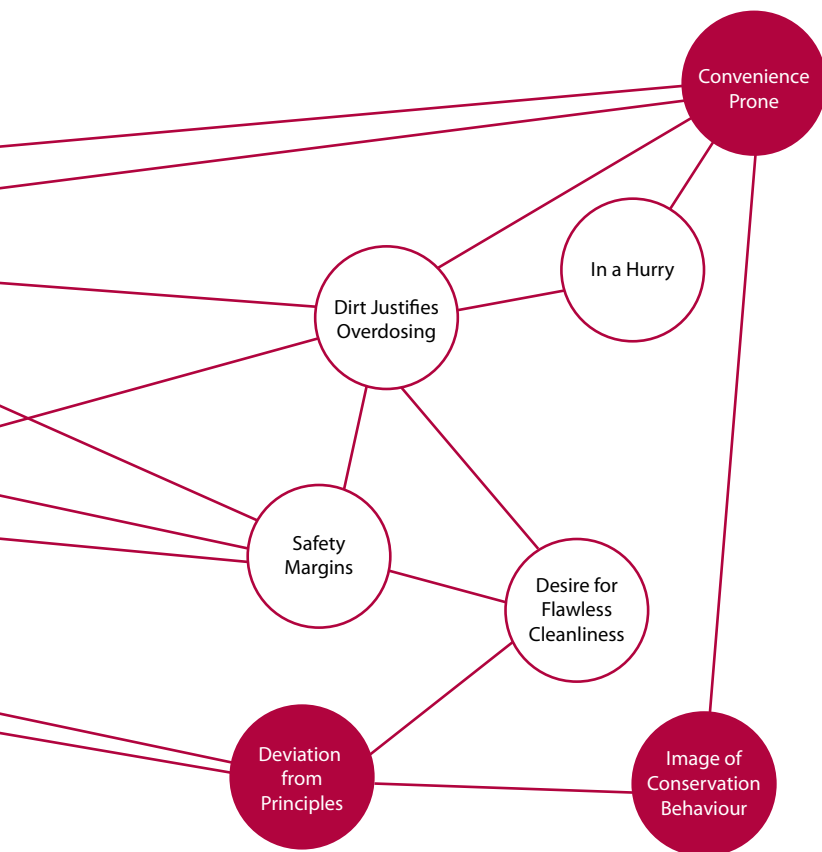
One participant liked to switch washing detergents from time to time. When she bought a new brand she usually read the dosing recommendations because she believed that it could differ between different brands of washing detergent. However, if occasionally neglect reading the recommendations, she might have continued to dose as with the previous brand and that could cause incorrect dosing.

Dosing in Accordance with One's Feelings

Decisions regarding choice and dosing of cleaning agents were seldom based on facts, instead they were often based on feelings. An example of this was a participant that mentioned that he would not feel safe if he used soft soap for cleaning the toilet. The participants were often aware of that they let their feelings guide their dosing decisions, for example one participant mentioned that she overdosed the cleaning agent when she cleaned the toilet because it felt good, even though she at the same time thought that it was unnecessary. Furthermore, one participant said that when it came to cleaning the toilet she preferred stronger cleaning agents because it felt fresher even though she earlier stated that she in general prefers to use the milder soft soap and instead do more scrubbing.

Need for Feedback on Dosing and Cleanness

The foam when using washing-up detergent, washing detergent and soft soap served as feedback on the dosing of the cleaning agents. For washing-up detergent, foam was generally seen as positive. One participant stated that the level of foam indicated when a refill of the washing-up detergent was needed, and another one that she could see on the foam when she needed to refill the washing-up detergent. One participant mentioned that the foam made him more aware of the dishwashing process. In contrast to the many participants that appreciated the foam when doing dishes, one participant said that she disliked foam from washing-up detergent. The reason was that she imagined the cleaning effect to be located in the foam rather than in the water, where the dirty dishes are.

When it came to washing detergent, too much foam was seen as feedback of overdosing. Rather, a scent was preferred as feedback of the cleanness from laundering. Yet, one participant mentioned that the dosing of washing detergent was difficult

since he could not see the amount of foam from the washing detergent.

Regarding soft soap, foam was not appreciated by the participants. One participant pointed out that there is no feedback on the overdosing with other cleaning agents than soft soap. With overdosing of soft soap when cleaning floors, the floor gets slippery and strange – an experience shared by several participants.

For many of the participants, lather from soap, shampoo or washing-up liquid gave them a reassuring feeling. This feeling was related to feedback in the sense that the lather gives visual feedback of the amount of cleaning agent. But the participants also stressed the emotional value of the lather. The participants knew that the lather was not needed for cleanness, but it gave them a reassuring feeling.

Dosing with Safety Margins

Several participants mentioned that they sometimes use a little extra cleaning agent just to be sure about the cleaning effect. Two main reasons for this were identified: either it was a question of hygiene; or it was about not having to redo the cleaning or washing procedure.

Deviating from One's Principles

A few participants mentioned that they deliberately deviated from their principles when using certain types of cleaning agents. These cleaning agents were mainly agents that the participants themselves actually did not approve of.

Trust in Advice from Authorities

Different authorities had different effects on the participants. Dosage recommendations given by companies that manufacture cleaning agents were less trusted than dosage recommendations from manufacturers or vendors of dishwashers and washing machines. Teachers were mentioned both as a trustworthy source and as an authority you want to defy.

Desire for Control over Dosing

Some participants clearly stated that they wanted to be able to decide for themselves what amount

of washing detergent to use, as they wanted to vary the dose.

Estimated Dosing of Cleaning Agents

In general, the participants had an unreflecting attitude towards the way they estimated their doses. Many of the participants stated that they did not measure the cleaning agents when dosing. Instead they poured the cleaning agent directly from the package and they explained that they roughly estimated, guessed or had an intuitive understanding of the amount of cleaning agent needed. One participant claimed that he knew how much was needed, but he also said that he was not completely sure. Another participant mentioned that she used a tablespoon measuring cup, but how many tablespoons needed was just an estimation. Several participants said that they did not read the dosing recommendations on the packages, yet most of them thought that they dosed on the small side.

The Character of Cleaning Agent and Packaging as an Obstacle to Moderate Dosing

Amongst the participants, it was common to dose cleaning agents in bottles with help of the screw cap. If doing so, they usually used one cap and they thought that they might have read dosing recommendations prescribing that. Several examples of packages that make it hard to dose correctly were mentioned. Shampoo bottles sometimes had too large openings, thus giving too much shampoo. Varying size of openings on different bottles made it difficult to press the bottle just enough to get the right amount. When washing up just one item, i.e. one plate, the participants often got too much washing-up detergent from the bottle. Pump bottles give a predetermined amount per pump and one participant mentioned that he then takes just one pump. Another one said that the one pump on her pump bottle for washing-up detergent was too much. Also Dishmatique, a dosing aid with a sponge on a shaft with washing-up detergent in the shaft and automatic dosing (Easy Do Products, 2009), caused overdosing according to some of the participants. Cleaning agents in spray bottles were considered difficult to dose. One of the participants commented an unreflecting use of spray bottles with "there's nothing wrong with that". Maybe the easiness of spraying encourages

this thoughtlessness. Several participants stated that they wanted dosing aids to be integrated in the package. In accordance, one participant said "one tries to choose the alternatives where you don't have to think".

The consistency and shape of the cleaning agent had an impact on the dosing behaviour. Several participants stated that they both use and appreciate dishwasher tablets and that they used only one tablet per wash. One of the participants had soft soap in the form of gel. She stated that she generally use one hand of gel. Even though overdosing could be obstructed with cleaning agent of lower concentration, one participant mentioned that she would not like to bring unnecessarily large amounts of water home from the store.

The size of the package served as a dosing guide, according to one of the participants. He said that based on the size of the package, he decided what constituted a reasonable amount of cleaning agent; the smaller the package, the smaller amount of cleaning agent. In accordance, one participant mentioned that she used less cleaning agent when the package was almost emptied.

Drawbacks with Separate Dosing Aids

The participants mentioned some drawbacks with separate dosing aid. Firstly, it can be difficult to find aids that are suitable for one's dosing procedure. This was the case for one of the participants that had trouble finding a measuring cup with millilitre markings that she needed to following dosing instructions for washing detergent, which were given in millilitres. Secondly, one of the participants expressed that he never had gotten around to buying a dosing aid, even though he knew the benefits of it. Furthermore, the working principles of all dosing aids were not easily understood and that may cause hesitation when deciding to purchasing separate dosing aids. Finally, separate dosing aids are easily lost.

The Importance of Aesthetics in Packaging and Dosing Aids

A few participants clearly stated that they would not use packages or dosing aids that they thought were aesthetically unattractive. Instead, if a package was found to be aesthetically unattractive the

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cleaning agent might be moved to a different container. Then, the dosing recommendations were no longer accessible and in some cases it was more difficult do dose moderately with the new container.

Difficulties with Dosing Recommendations

A number of participants considered dosing recommendations and cues to be deficient. One participant was even unaware of that there were dosing recommendations on washing detergent packages.

Dirt Justifies Overdosing

A more or less general opinion was that dirt justifies overdosing. Several participants stated that if it is very dirty they use more cleaning agent and this attitude can cause excessive dosing.

Desire for Flawless Cleanness

A desire to clean thoroughly was expressed by some of the participants, especially regarding the kitchen and the bathroom but sometimes also regarding textiles. Some of the participants admitted that they used more cleaning agent then recommended because they believed that overdosing was a way to achieve flawless cleanness.

Cleaning when in a Hurry

A small number of participants testified that they from time to time engaged in cleaning activities when they were in a hurry and that this behaviour may cause overdosing. Examples of such situations were when expecting guests or when being hungry and doing yesterday's dishes prior to cooking.

Desire for Convenience

Several participants expressed that they want the cleaning procedure to go quickly. Other participants mentioned convenience and efficiency as important factors when cleaning. These three wishes may affect how people use cleaning agents and also what type of cleaning agents they choose. In accordance, one participant stated that if an environmentally friendly method for cleaning requests a lot of time and effort, it makes her hesitate.

Ignorance of the Environmental Impact of Cleaning Agents

One participant said that she found it difficult to relate her use of cleaning agents to greater environmental issues. The same participant had used significant amounts of cleaning agent at a previous workplace, and at that time she found it easier to understand the effects of her behaviours on the environment. Another participant expressed that she thought about environmental issues at least when she bought cleaning agents, which may imply that she did not always reflect on the environmental impact in the subsequent usage of the cleaning agents. Additionally, cleaning agents perceived as less environmentally friendly or even hazardous felt wrong to overdose for one participant, while the participants indicated that they were more accepting towards overdosing when it came to cleaning agents that they considered to be environmentally friendly. Interestingly, the participants' opinions on whether a cleaning agent was environmentally friendly or not was often based on the expression of the package design and whether or not the cleaning agent had been marketed as environmentally sound. One participant mentioned that he did not know whether a certain cleaning agent that he used was eco-labelled or not.

Scepticism towards Alternative Cleaning Agents

A lot of participants expressed scepticism towards unconventional eco-friendly cleaning agents or washing products. They felt that if an environmentally friendly product really worked they would have heard more about it in the newspapers or via word of mouth. According to one of the participants, there is a great confidence in chemicals in today's society. This opinion was supported by statements from the other participants. Two of them felt sceptical toward the use of soap nuts, even though they had no facts supporting this scepticism. One participant found the washing detergent to be more important than washing in a high temperature.

5.2.3. The Target Behaviour

After analysing the result from the contextmapping, the project duo decided to focus on correct

dosing of washing detergent. The reasons for choosing this behaviour were that:

» overdosing of washing detergent was common among the participants in the contextmapping study and likewise in literature

» many of the participants expressed difficulties regarding dosing of washing detergent

» estimation of the weight of the clothes was found to be difficult

» some of the participants did not understand how to calculate the amount of washing detergent needed given in millilitres into decilitres, which is necessary in order to use a decilitre measuring cup

» the softness of the water in the area was not always known

» few of the participants had any kind of dosing aid, compared to when doing the dishes, where some used a spray bottle with diluted washing-up detergent

» the behaviour is relatively frequently performed, compared to e.g. cleaning windows

» it is clear what correct dosing is, compared to for example bathroom detergent in a spray bottle.
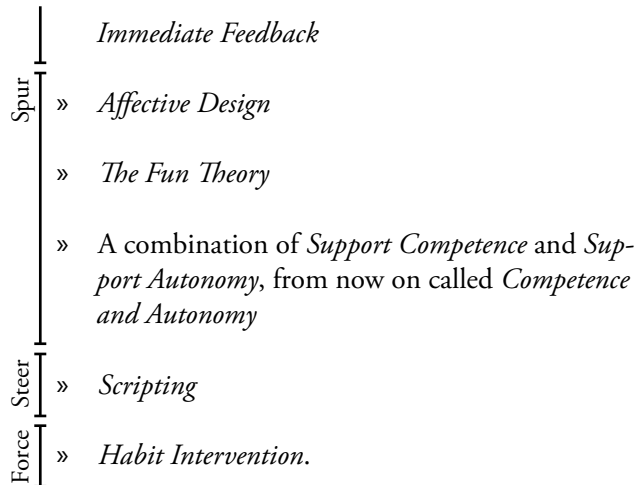
The target behaviour was set to be to dose washing detergent in accordance with recommendations, or to use less washing detergent then recommended, since manufacturers of washing detergent can be assumed to include safety margins in their dosing recommendations.

6. CONCEPT DEVELOPMENT

When the application area had been researched upon and a target behaviour was selected, the next step was to use design strategies for sustainable behaviour in order to develop concepts that promote or induce the target behaviour.

6.1. PROCEDURE

The process of developing product concepts for sustainable behaviour started with an evaluation of what design strategies that could be suiting for which barriers. Through this matching, seven strategies were selected. After a short ideation phase and an evaluation of the ideas stemming from each of the seven strategies, the number of strategies was narrowed down to four. Thereafter the ideation phase continued, but with development only from those four strategies. Finally, one concept for each of the four design strategies was selected.

6.1.1. Matching Design Strategies with Barriers

The first step of the concept development phase was to match the design strategies with the barriers towards the target behaviour. After discarding strategies that would be difficult to implement for correct dosing of washing detergent, or presumably generate concepts too complex to manufacture, an estimation was done on what specific barriers each of the remaining strategies would help overcome. It was decided that four concepts were to be tested in the prototype evaluation phase, as a higher number of concepts would make the study too complex for the timeframe. However, it was not taken for granted that the project duo would have the capability of designing good concepts from every strategy, thus seven strategies, instead of four, were selected based on the numbers of barriers they would tackle and the importance of those barriers. These strategies were:

Enlighten

» *Eco-Affective Design*

» A combination of *Exact Feedback* and *Immediate Feedback*, from now on called *Exact and*

Spur

Immediate Feedback

» *Affective Design*

» *The Fun Theory*

» A combination of *Support Competence* and *Support Autonomy*, from now on called *Competence and Autonomy*

Steer

» *Scripting*

Force

» *Habit Intervention.*

In table 7 the evaluation for these seven strategies is presented.

6.1.2. A Quick Evaluation of Selected Strategies

To get a first hint of the potential quality and quantity of concepts possible to generate from the seven design strategies a regular brainstorming session was held in which ideas were generated for one strategy at the time (see section 2.3. for a description of the method). All promising ideas for each design strategy were compiled, and the potential of each strategy was evaluated, which resulted in that *The Fun Theory* and *Exact and Immediate Feedback* were discarded. The inherent possibility for *The Fun Theory* to prevent overdosing of detergents was considered too low, as it was proven easy to generate concepts that makes dosing in general fun, but difficult to generate concepts that make it fun to dose correctly. One reason for this is that if it is fun to dose in a certain way, it is possible that an individual would repeat the fun behaviour, and thus overdose. However, the concepts were generated with the limitation that they should not make use of electronics in order to facilitate

Design Strategy / Barrier	Affective Design	Eco-Affective Design	Exact and Immediate Feedback	The Fun Theory	Competence & Autonomy	Scripting	Habit Intervention
Negative Image of Economising on ...	X	X		X			
Unneeded Dosing due to Access to Several ...					X		
Ignorance of How Cleaning Agents Work	X	X	X	X	X	X	X
Habitual Use of Cleaning Agents		X	X	X		X	X
Dosing according to One's Feelings	X	X	X	X	X		
Need for Feedback on Dosing and Cleanness			X		X		
Dosing with Margins		X	X		X		X
Deviating from One's Principles	X	X	X				
Trust in Advice from Authorities					X		
Desire for Control over Dosing			X		X		
Estimated Dosing of Detergents	X	X	X	X	X	X	X
The Character of Detergent/Packaging ...						X	X
Drawbacks with Separate Dosing Aids				X		X	
The Importance of Aesthetics ...	X						
Difficult Dosing Recommendations	X	X		X	X	X	X
Dirt Justifies Overdosing		X			X		
Desire for Flawless Cleanness	X		X		X		
Cleaning in a Hurry						X	
Desire for Convenience		X		X		X	X
Ignorance of Environmental Impact ...		X	X				
Scepticism towards Alternative Cleaning ...	X	X	X		X		
In Total (Maximum 21 (6)):	9 (1)	12 (4)	11 (4)	8 (3)	12 (2)	8 (4)	7 (4)

Table 7. The table shows the setimation of what barriers the seven strategies can help tackle. The barriers previously identified as of greater importance are written in bold style.

the prototype building. If electronics would have been considered, it is possible that *The Fun Theory* could have generated concepts that induce correct dosing. *Exact and Immediate Feedback* was also discarded partly due to the limitation of electronics, as this constraint entailed that this strategy gave rise to only a small number of concepts. Furthermore, some of the concepts generated for *Exact and Immediate Feedback* were useful for e.g. *Autonomy and Competence*, and some concepts generated for the other strategies contained elements of feedback. Thus *Exact and Immediate Feedback* was considered less inspiring to work with, compared to the other design strategies.

2.3. The Method of Brainstorming

Brainstorming is a method for generating ideas. Three to five participants are preferable, and it is advantageous if the participants have different background, knowledge, and/or interests. The participants are set to generate ideas, which are noted down or drawn on a big common sketchblock. Brainstorming has one absolute rule, which is that criticism and evaluations are forbidden during the session. Furthermore a big number of ideas should be sought after, wild ideas are welcome, and one should try to combine or to supplement the new ideas. All according to Österlin (2007).

2.4. The Method of Random Words

As a complement to brainstorming, the technique of random words can be used for further inspiration. By chance, two words are picked out from e.g. a dictionary or a magazine. By putting the random words together unexpected and stimulating combinations can appear (Österlin, 2007).

6.1.3. Ideation

When the number of selected design strategies was narrowed down to five, more extensive sessions

of brainstorming were used to generate ideas on how to influence user behaviour with the means of these strategies. The sessions were semi-structured, and the project duo brainstormed on one strategy at the time. During one session, the technique of random words was used to further spur ideation (see section 2.4.). Some of the sketches generated can be seen in figure 43 and 44.

6.1.4. Concept Selection

Through discussion, six concepts from the ideation phase were selected on the basis of prototyping possibilities, and hypothesised effectiveness in inducing target behaviour. Furthermore, one existing product was selected since, as mentioned in the introduction, it can be interesting to investigate how well a product adjusted for the market can induce sustainable behaviour.

The seven concepts were:

1. *Affective Design* - washing detergent in a luxurious packaging with a matching measuring cup that is connected to the package

2. *Affective Design* - a measuring cup with slapstick humour, commenting on amounts of washing detergents that are too high

3. *Eco-Affective Design* - a measuring cup with an animal inside, which will drown if the user uses too much detergent

4. *Competence and Autonomy* - a kit consisting of a laundry basket with an integrated scale, a clear and exact measuring cup, and a good matrix for reading out the dosing recommendations

5. *Scripting* - a pump bottle for liquid detergent, where one pump gives one dose

6. *Scripting* - an existing packaging solution that only gives away a certain amount of washing powder each time it is tilted backwards and then forwards, where three such doses constitute the smallest recommended dose

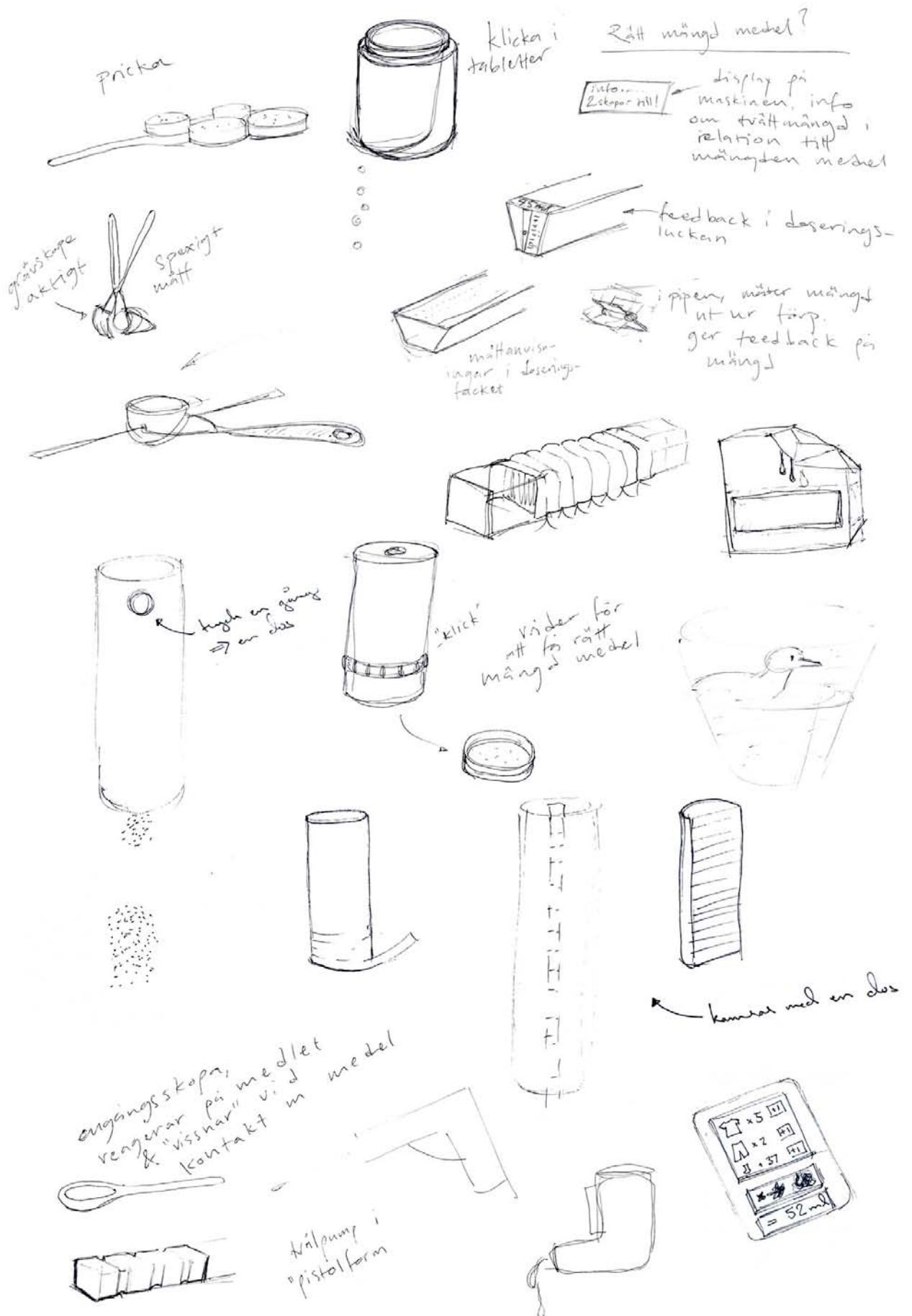7. *Habit Intervention* - washing detergent tablets in a packaging that facilitates correct dosing.

Figure 43. Sketches from the ideation phase.

Figure 44. Sketches from the ideation phase.

To evaluate the prototyping possibilities further, the project duo made a brief exploration of materials and components possible to use, and a cost-estimation of these, as the prototypes would be made in at least four copies each.

The second criterion for the final selection was that the four concepts should make an interesting and versatile quartet in which each concept and the underlying strategy should be distinct from one another and preferably belong to different strategy categories.

The luxury concept, nr 1, fell short on the proto-typing, as the project duo estimated it difficult and expensive to build prototypes with a high enough finish to create the feeling of luxury. The pump bottle concept, nr 5, also failed on the prototyping criterion as the pumps of reasonable cost did not give away enough amount of liquid, thus the user would have had to pump too many times to make this concept convenient. The slapstick concept, nr 2, was rejected as it was similar to the animal-in-measuring-cup concept in the sense that they both use special features in a measuring cup to evoke feelings, and choosing between these two concepts the project duo found it more challenging to try out the strategy of *Eco-Affective Design*. The four remaining concepts were nr 3, nr 4, nr 6 and nr 7.

The concept development phase was completed with developing three of the four selected concepts further. The concept of *Scripting* needed no development as the solution already existed.

6.2. RESULT

6.2.1. Eco-Affective Design

The concept of *Eco-Affective Design* consists of a transparent measuring cup with a frog sitting on a rock inside it (figure 45). The measuring cup has a handle on one side and a flattened side on the opposite side. The flattened side is there to facilitate scooping from a package of washing powder, and for the same reason the flattened side of the cup is higher than the handle side. The measuring lines are coloured green if they are beneath the

frog's feet, and then change into red when they are above the frog's feet. The cup should measure between 40 and 50 ml at the frog's feet, indicating an appropriate dose for medium dirty clothes in a fully loaded machine with the capacity of up to five kilograms, if the washing water is soft, which it is in the Gothenburg region. Ann Wåhlström designed a generic dosing cup for Via that holds 40 ml (Bohm, 2009). Yet, as Via is a concentrated detergent slightly more than 40 ml was thought to be reasonable. (See appendix 4 for the dosing recommendations for common brands of washing powder found in Sweden.) When a user scoops up or pours in 'too much' washing powder into the cup he or she should experience drowning the frog in laundry detergent, which hopefully creates negative feelings, and the red colour of the measuring lines should enhance the feeling of wrongdoing. When using a moderate amount of detergent, the frog will be safe on its rock, and together with the green lines create positive feeling regarding nature. On the bottom side of the cup there is a short text explaining how overdosing of washing detergent affects the environment negatively, this text is aimed at more rational users that may feel a need for more information.

6.2.2. Competence and Autonomy

The concept of *Competence and Autonomy* holds three items (figure 46). Firstly there is a laundry basket with a mechanical scale in its handle. The laundry basket is made out of a sturdy fabric and it can stand upright without support. Depending on laundry sorting habits, a user may need several laundry baskets, e.g. one for lightly coloured textiles recommended to be washed in 40°C, one for light colour and 60°C, one for dark colour and 40°C, and one for dark colour and 60°C. Secondly there is a volvelle with which the user can find out how much washing detergent he or she should use depending on the water hardness, the amount of laundry and the dirtiness of the laundry. Finally the kit contains a measuring scoop that has its measuring scale on its hollow grip, as measuring can be done more accurately in a narrow vessel. Furthermore, the scale for measuring is detailed, with steps of 5 ml. The opening of the measuring scoop is wide, making it possible to use it to pour the detergent into the scoop, as well as scooping with it in the detergent package.
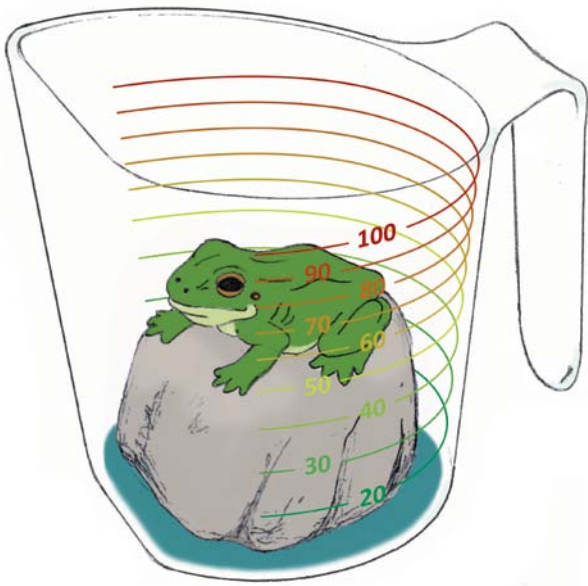
Figure 45. The concept of *Eco-Affective Design*.
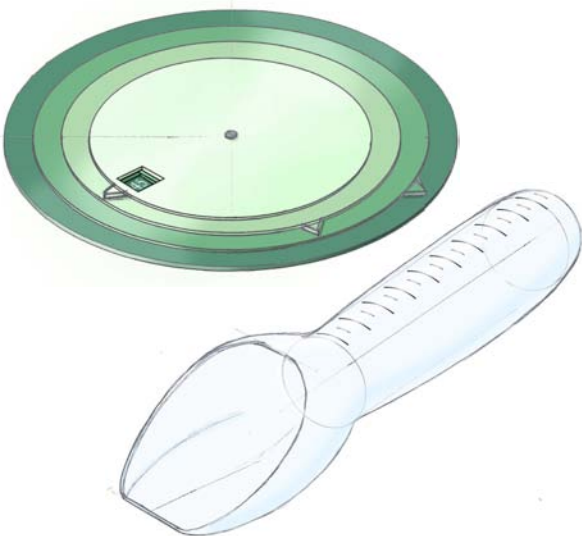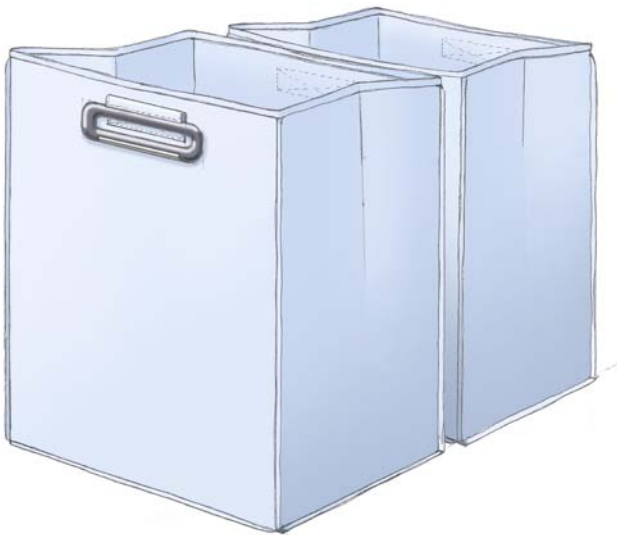

Figure 47. The concept of *Scripting*.

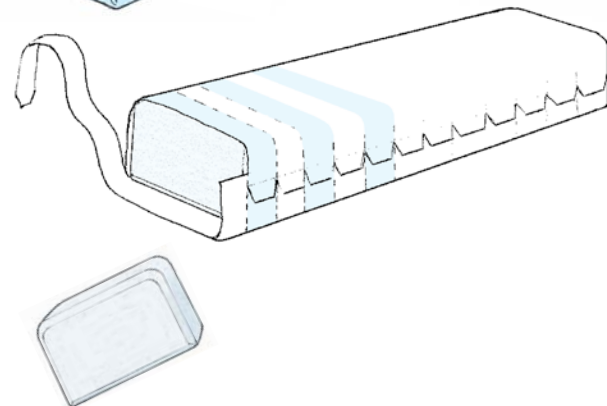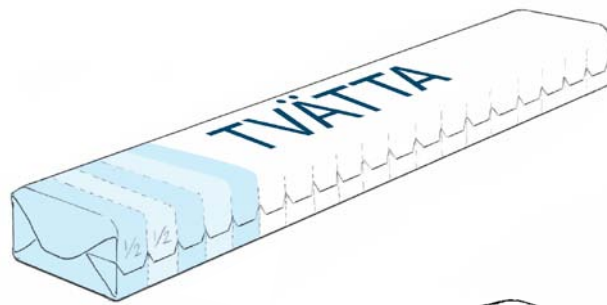**Figure 46.** The concept of *Competence and Autonomy*.

Figure 48. The concept of *Habit Intervention*.

The user measurers the amount of laundry in one laundry basket, uses the volvelle to find out the recommended dose and can then use the measuring scoop to get the amount of detergent needed. This procedure should make the user feel certain that he or she is using the correct amount of detergent, thus creating a feeling of being skilled. Even though the feeling of competence is the most prominent, feelings of autonomy can occur. Firstly, the volvelle will be adapted to a brand of washing detergent that is less frequently seen in Swedish commercials compared to other brands such as Via, Ariel and Grumme. Therefore, the users may feel autonomous from the leading actors of the washing detergent industry. Secondly, it is possible to become autonomous also from the dosing equipment as one can learn from the use of the scale, how to estimate the weight of clothes, and as it is achievable to memorize the most frequently used doses from the volvelle. This learning will also enhance the feeling of being competent.

6.2.3. Scripting

This concept is based on the washing detergent package of Hemköp, a Swedish grocery store (figure 47). The package has an internal cardboard construction that limits the amount of powder possible to pour out of the package in one tilt. The package should be tilted backwards once, and then forwards, and as a result a limited dose will be poured out of the package. This procedure is repeated until the correct number of doses has been poured out. In other words, the package contains a constraint that enables the user to start dosing detergent in a more conscious manner. However, apart from its resemblance of a conventional washing powder package that you normally can pour detergent from, it contains no affordances that explain to the user how to manoeuvre it. Instead the user has to read the instructions for knowing how to tilt the package backwards and how many doses to use. In the original package the dosing recommendations range from three to seven such doses depending on the water hardness and the size of the washing machine. The difference between this concept and the original package is the number of doses a user needs to take. If a user has soft water and a small washing machine, the number of doses needed is one.

6.2.4. Habit Intervention

The fourth concept consists of washing detergent tablets packed in a tube (figure 48). The package has as many flaps as there are tablets inside, and you open it by pulling the first flap, tearing of a strip of paper. When this is done, the first tablet falls out of the package. Furthermore, the package is striped in order to make the individuality of each flap clear, and the paper is perforated between each stripe. On each flap there is information signalling that one tablet is enough for a half full washing machine, and that two tablets is enough for a fully loaded machine. The dosing recommendations are adapted to the water hardness of the region in which they will be used, which in this case is the Gothenburg region that has soft water. This will be visible on the graphics of the packaging and facilitates correct dosing as less instruction is needed.

When using washing detergent tablets it is no longer possible to just pour the detergent from the package, or to estimate the dose by the size of the pile of powder in the detergent compartment. Instead, the handling with the tablets will be more precise, as the amount of detergent will increase in rather big steps. Using tablets will thus break the previous dosing habit. Secondly, the design of the package and the easy guidelines for dosing (one or two tablets) facilitates the formation of a new habit.

7. PROTOTYPING

After developing concepts from four of the identified design strategies for sustainable behaviour, prototypes were built, as these were to be tested in everyday life later on.

7.1. PROCEDURE

The process of finding materials and components for prototype building, initiated during the concept selection, was continued. As the concepts were to be tested during several months, the prototype building had to be quick in order not to shorten the testing period. Thus rapid prototyping were discarded as a prototype method, for e.g. the measuring cups, as it was judged a too lengthy process to create a computer model and find a company with the suiting rapid prototyping machines. Instead, for concepts or parts of concepts where the exact appearance was of lesser importance for its functionality, similar components were bought. Concepts where no suiting replacement product was found were instead handcrafted by the project duo. Concepts were the exact appearance was important were also handcrafted. Regarding the already existing package the project duo decided not to use the original package but to build copies out of cardboard. The brand of Hemköp was considered too likely to affect the users' opinions about the package, and if the original package would have been repainted or covered with adhesive paper, the users might feel offended if the cover would peel off and reveal that their prototype actually was not a prototype.

7.2. RESULT

7.2.1. Eco-Affective Design

The prototype of *Eco-Affective Design* was made from an existing measuring cup and a toy frog, together with graphics printed on a transparent adhesive film, and a rock made from paperclay coloured with water resistant acrylic paint (figure 49).

The prototype is quite true to the concept, with the largest difference being the shape of the measuring cup. This was however viewed as of less importance by the project duo. The graphic design of the measuring lines was developed further, and the text on the bottom of the cup was set to; *'Laundry detergent contains surfactants that can harm water living organisms. Dose correctly and take care of our environment! 45 ml is often enough for one laundry'* (translated from Swedish). The shape of the rock was an adaptation to the flatness of the frog's underside.

7.2.2. Competence and Autonomy

For the concept of *Competence and Autonomy* three prototypes were built (figure 50). The prototype for the measuring cup was made from the same cup as in the previous concept, also here with the new graphics printed on transparent adhesive film. The laundry basket was sewn out of a sturdy fabric and reinforced in its corner seams by spring steel. For the handle an electric luggage scale was used. Finally, the volvelle was made out of cardboard and the graphics were printed on adhesive paper.

Within this set of prototypes, the prototype for the volvelle is most similar to the original idea. The graphics was developed to fit with a specific brand of washing detergent, Neutral, that accompanied this prototype set. This brand was chosen in accordance with the requirements set in the concept development phase, but also as it provided dosing recommendations with regards to the weight of the textiles and not to the size of the washing machine, which was a prerequisite for making the laundry basket useful.

Regarding the measuring cup it has a completely different shape compared to the measuring scoop in the concept, which is due to difficulties in

Figure 49. The prototype of *Eco-Affective Design*. The photo to the right shows the text on the bottom of the measuring cup.

Figure 50. The prototypes of *Competence and Autonomy*.

finding a suitable measuring scoop. The measuring cup used was selected as it was narrow enough to be used as a scoop for most washing detergent packages, and as its design had an air of professionalism to it, compared to other cups considered. Measuring with a wide cup will however be less exact compared to the narrow scoop. To compensate for this, the measuring lines are printed all around the cup, rendering it possible for the user to determine whether the top surface of the detergent is flat or not and thus increasing the correctness of the measuring.

The laundry basket was modified in the sense that the scale in the handle is electric instead of mechanic. A few mechanical scales suitable for this prototype were available on the market, but the electrical scale was selected as it had the most comfortable grip and a shape that would be interpreted as a handle. Unfortunately, the laundry basket is not as stable as envisioned, partly due to the weight of the scale handle. Without the handle, the laundry basked can almost stand upright by itself, but with the handle it needs to be filled halfway with textiles before it stands. Additionally, budget constraints led to that only one laundry basket could be included in one prototype set, instead of a number of baskets corresponding to the users sorting habits. This in turn led to that the size of the laundry basket was adapted to hold more laundry than originally intended, a factor that increased the instability of the laundry basket. Despite these defects the project duo had to accept this prototype as their final, as neither time nor budget were sufficient for creating a second version of the laundry basket.

A measuring ball for liquid detergents was later added to this kit in order to give users of liquid detergent the possibility to put the measuring unit into the machine during the washing, as sometimes customary (see section 8.1.2. for further explanation). The measuring ball had grading between 20 and 150 ml, with steps of 10 ml. This was the most detailed grading on the market.

7.2.3. Scripting

The prototype of the *Scripting* concept was constructed out of cardboard and the graphics were printed on adhesive paper (figure 51). Four

versions of the graphics were made, and the different packages were filled with the corresponding types of washing detergent, these being scented detergent for lightly coloured textiles, unscented detergent for lightly coloured textiles, and the two equivalent detergents for dark textiles.

This prototype is very similar to the original concept, with the difference that the smallest recommended dosage is three doses, instead of one dose as suggested in the concept. This difference was caused by the discovery that dosing recommendations, for all detergents found on the Swedish consumer market, did not increase in steps equivalent to the smallest dose, when increasing the doses due to the water hardness. Regarding the dosing mechanism, two prototype packages filled with the original washing detergent were opened and tested. The exactness and regularity of the amount of washing detergent per dose was found to be equal to the original package.

7.2.4. Habit Intervention

The prototype of *Habit Intervention* constitutes of two parts, a tube filled with washing detergent tablets and a cap (figure 52). The tube was made out of paper with printed graphics on, and an inner layer of wrapping tissue. The tube was manually perforated between each stripe, and the flaps were fastened with rubber glue which made it easy for a user to open them. The cap was made from cardboard and the graphics were printed on adhesive paper.

The prototype of *Habit Intervention* looks a lot like the original concept except that the washing detergent tablets are round and that the package has a cap. Regarding the shape of the tablets the project duo had only two tablets to choose from and they were both round. One tablet came from the only Swedish company found, a business-to-business company, that were selling washing detergent tablets, but their tablets were proven too fragile and crumbly for this concept. The second tablet type was purchased in Norway and was better suited for this kind of packaging solution. Both tablets were only available in a scented version and their dosing instructions regarding soft water were the same; one tablet for a small fully loaded washing machine, two tablets for a bigger fully

loaded machine and one tablet extra if the laundry was extra dirty. This instruction differed from the recommendations in the original concept that offered a dose also for a half full machine. A written dosing recommendation was judged easiest to understand, and thus the standard recommendation, one tablet for one wash, was written on each flap. The additional dosing recommendations were written on the cap, since if written on the package it would be torn away gradually during use. The need for a sealing cap was discovered during the initial experimental prototyping, both for protecting the tablets from humidity and for keeping the package from leaking crumbles once it is opened.

Figure 51. The prototype of *Scripting*. The graphics explains how the package should be used when dosing detergent.

Figure 52. The prototypes of *Habit Intervention*.

8. EVALUATION OF PROTOTYPES

To evaluate the four concepts, stemming from four design strategies for sustainable behaviour, on the basis of long-term effectiveness and acceptability, the constructed prototypes were to be evaluated in the everyday life of different households.

8.1. PROCEDURE

The preparation of the evaluation consisted of recruitments of households, planning the layout of evaluation and preparing material for data collection. Thereafter, the evaluation was initiated and the data was collected. Finally, the collected data was analysed.

8.1.1. Preparation of Evaluation

Layout of Evaluation Phase

For the evaluation phase, six limitations were given due to the nature of the project:

» within the overall project plan, the possible time frame for the prototype evaluation phase was between June and December

» the evaluation of the prototypes should be as long as possible as one the project's aim was to evaluate the long-term effectiveness and the long-term acceptability of the prototypes

» due to this aim, each household should evaluate only one of the prototypes, and not all of them, i.e. a between subject evaluation

» to see if a behaviour change happens, the initial dosing behaviour within the households must be documented, thereafter the behaviour needs to be measured again, after the introduction of the prototypes, i.e. a within subject evaluation

» the number of households evaluating one prototype had to be manageable for the project duo but still render enough result to be valid

» to evaluate the acceptability of the prototypes, there should be a period of voluntary use.

With these limitations in mind the following layout was designed (figure 53). In early June 2010 each participant started to document his or her initial dosing behaviour. When this was completed, each household received a prototype and used it for a couple of times to get used to it, in order not to bias the following documentation phase with any irregularities in behaviour due to first time usage. Thereafter, the second documentation phase started, during which the participants were requested to use the prototypes. After this, use of the prototype was voluntary, and a last documentation phase took place. The prototype evaluation phase ended with an extensive interview with each household.
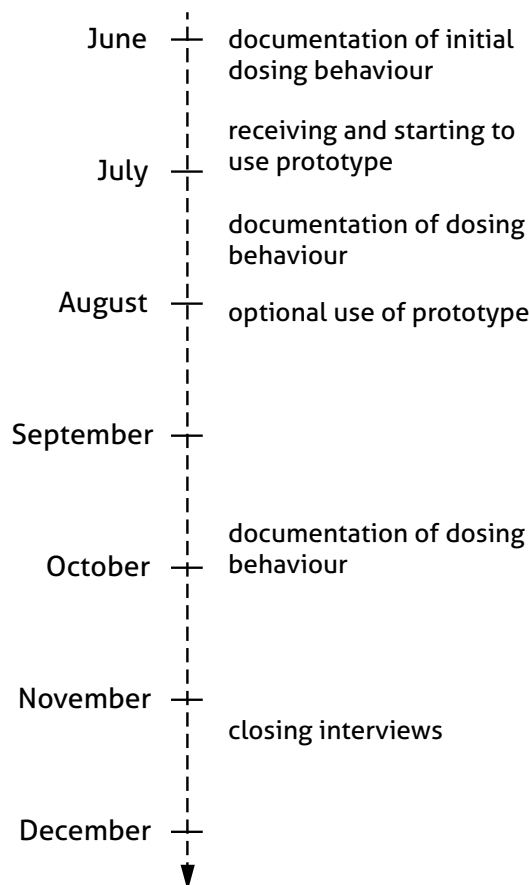

Figure 53. The layout of the evaluation phase.

The number of participating households was set to be 16, four for each prototype, as the project supervisor thought this number to be sufficient for this type of project, yet provide a reasonable workload.

No control group was used as the individual differences between the participants were considered to potentially be greater than differences between a control group and the prototype evaluation groups due to the small number of participants. Furthermore, it would have been difficult to design the evaluation layout for the control group in such a way that the participants in the control group would have been influenced in the same way as the others, except the influence of the prototypes. Finally, having a control group would have increased the workload so that only three prototypes could have been evaluated.

Recruitment of Participants

Recruiting participants was a delicate and time-consuming task. The participants should be motivated to participate in the study as great involvement was needed in the long, complex study and as no monetary reward was given for participation.

Nevertheless, the participants should not be unusually motivated to change their behaviour. Furthermore, they should currently overdose, or be what Järvi and Pavoliita (2007) refer to as 'estimate users', that may be overdosing. They should all live in the Gothenburg area, in order to be visited easily. Additionally, as the project duo was curious to see how well the prototypes would function in different types of households a desired segmentation of the participants was set up:

» single-living individuals (named household E1, C1, S1 and H1, with the letter correlating to the prototype being evaluated)

» young couples (named household E2, C2, S2 and H2)

» couples with small children (named household E3, C3, S3 and H3)

» families with teenagers or young adults (named household E4, C4, S4 and H4).

See figure 54 for an overview of the different types of the households and the distribution of prototypes.
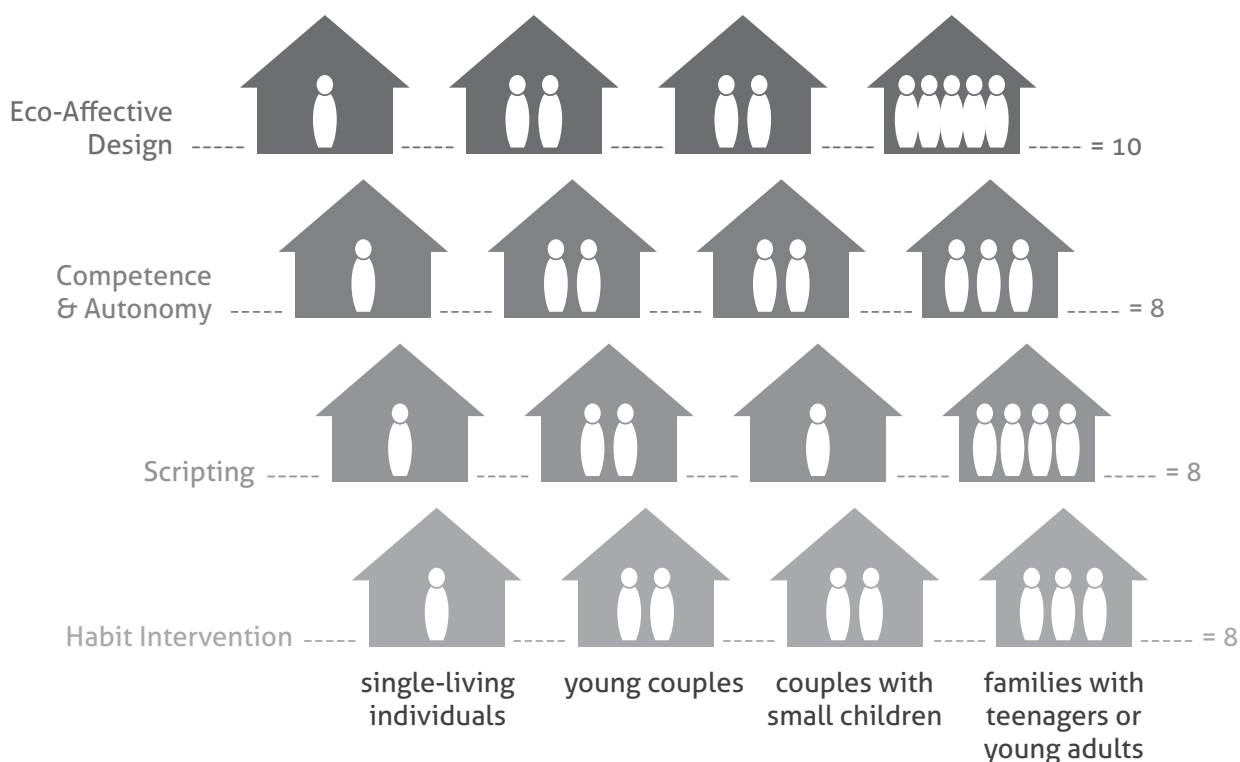

Figure 54. An overview of the different types of the households and the distribution of prototypes. The number of persons theoretically capable of doing the laundry within each recruited household is also illustrated.

At the department of Design and Human Factors, Chalmers, there was a collection of contact information to persons willing to participate in user studies, and persons in a fitting age and with suitable living conditions were contacted. Friends of the project duo were thought to be too willing to adapt their behaviours for the sake of the duo and were thus not considered as possible participants, whereas acquaintances were thought to be willing to complete the study for the sake of the project duo, but not to change their behavioural patterns just for the sake of the duo. Friends of friends of the duo were also thought to be apt for recruitment since the common friend grants an endorsement of participation, yet there is no direct personal link.

Possible participants were contacted through e-mail or by phone. If they showed interest in participation, they were asked to describe their and their family members' current washing detergent dosing behaviour. Only participants that stated that they overdose or seemed to be 'estimate users' were recruited and their description of the households' dosing behaviour was documented.

From the collection of volunteers, six of the participating households were recruited (E1, C1, H1, C3, S4, and H4). In total, four households were acquaintances to the project duo (S1, E2, S2, and S3), and three of them only to one in the duo. Six households were recruited through friends of friends (C2, H2, E3, H3, E4, and C4).

Planning of Documentation Practice

In order to see if any behavioural changes occurred, the behavioural pattern before the evaluation of prototypes and during the evaluation had to be measured. Since the basic idea behind the research was to test the design strategies in real life situations, a way to measure the behaviour without influencing the behaviour too much would have to be chosen. Furthermore, the way of documenting the behaviour should be on an acceptable level of monitoring for the participants and time-efficient for both the participants and the project duo, yet with a high level of accuracy. It should be applicable both before and after the delivery of the prototypes. The information needed to be documented was the amount of washing detergent used per wash and what type of wash it was, i.e. amount of laundry and level of dirtiness, since these factors both influence the dosing recommendations. Furthermore, the hardness of water and the size of the washing machine should be known.

In addition to this measured data it was also important to gather qualitative data about e.g. how the participants used the prototypes, what they thought of them, in what way they experienced a change in behaviour and to what extent evaluation set-up biased them. This information would provide further clues on the long-term acceptability and effectiveness of the prototypes.

Creation of the Initial, the Second, and the Last Documentation Booklet

The project duo decided to let the participants themselves document their initial behaviour by individually filling in a table in a booklet (figure 55). Since dosing instructions for all common washing detergents are given only in millilitres, the participants were asked to weigh their consumption and were given a kitchen scale, thus preventing that the act of measuring gave too much of an indication of whether the dose was in line with the instructions on the package or not. The correlation between the volume and the weight is seldom as simple as e.g. multiplying by one, two, or ten, consequently calculating the volume from the weight is not easily done with mental calculation. Furthermore, the density varies with the brand of the detergent, and is often not printed on the package. The participants were instructed to weigh the whole package of washing detergent before and after dosing and to note the two values in the table. Consequently, in order to know the amount of detergent used, the second value must be subtracted from the first value, often with three digits per value, making also this calculation difficult to perform with mental calculation. To sum up, in order to get precise feedback on their dosing behaviour by filling in the table, the participants would have to put some effort into it.

The other data to fill in, in the table were:

» date

» washing detergent brand

» liquid or powder washing detergent

» washing detergent for white or colour

» washing temperature

» level of dirtiness; little, medium or very dirty

» amount of textiles; just a couple, semi-filled or full washing machine

» whether or not pre-wash was used.

If pre-wash was used, the participants were asked to dose for that programme before and separate from the weighing and dosing for the normal washing programme. The booklet had room for filling in up to twelve washes, but as this could be a too high demand for some of the participants washing pace, there was a request for a minimum of five washes in the booklet. Five washes were recommended by the project supervisor as an acceptable minimum.

To allow for the participants to document their dosing behaviour during the period in which they were requested to use the prototypes, a second booklet was created (figure 56). The table in this booklet was similar to the table in the initial documentation booklet, yet a few alterations was made in order to better match the table to the prototypes, e.g. the households given the washing detergent tablets had only to mark the number of tablets and did no longer have to weigh the package. Furthermore, the table was for only six washes. Based on estimations of the participants' washing tempo in the initial documentation booklet, the number of six washes was chosen because that would take approximately one month for the households to complete. One month was thought to be a suitable time period for the period of obligatory use of the prototypes.

To document the participants' dosing behaviour during the period of voluntary use of the prototype a third booklet was made. In this booklet, there were two tables with room for six washes in each, one table for use of the prototype and the other for non-use. The participants were asked to complete at least one of the two tables, but as they were allowed to use the prototype occasionally if they wanted to, it was also all right to fill in figures in both of the tables, as long as one of them was completed.
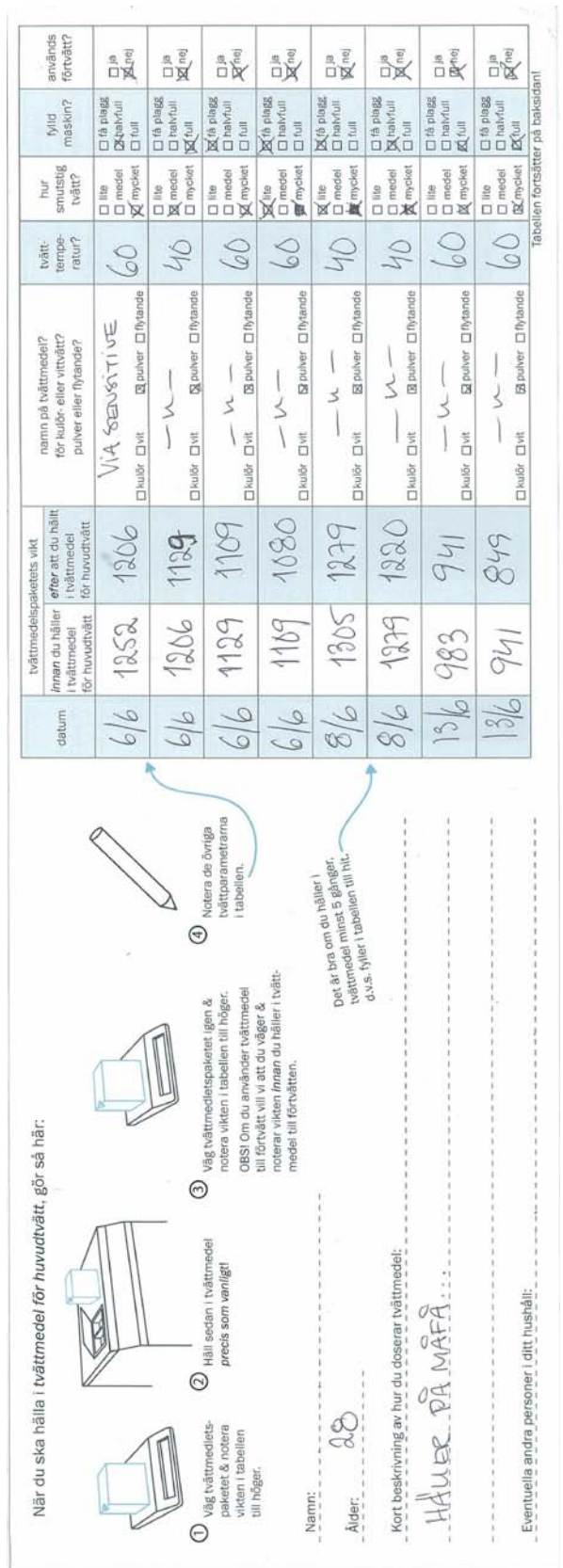

Figure 55. The documentation booklet used for reporting initial dosing habits. This scanned booklet is filled in by one of the participants, but the name has been erased to assure secrecy.

Figure 56. The documentation booklet for reporting dosing during the obligatory use period of the prototypes. This scanned booklet is filled in by one of the participants, but the name has been erased to assure secrecy.

Figure 57. The documentation booklet for reporting dosing during the voluntary use period. This scanned booklet is adapted to the use of washing detergent tablets and filled by one of the participants using the tablets.

All three booklets were created to look appealing and to be easy and fun to fill out, bright colours were used extensively and the instructions were illustrated for quick understanding. The aim was to make the participants feel that their contribution was important. On each of the three booklets there was a line for writing one's name on, thus making it more personal, and on the backside of the two first booklets pictures of the project duo were placed in order to further strengthen the commitment to the project duo.

Creation of the Initial and Closing Interview Form

In the beginning of the prototype evaluation it was necessary to gather some information on what requirements the participants had on their washing detergent, and to ask them whether they would accept a prototype containing washing detergent. Additionally the project duo wanted to elicit some clues on what kind of design strategy would be most effective on the different participants. Thus a short, semi-structured interview form (see 2.5.) was prepared where also the question about washing machine size was included. The interview form can be found in appendix 5.

To gather the qualitative knowledge on how the prototypes had influenced the participants a longer, again semi-structured, interview form was written in the end of the prototype testing phase. At this point, a smaller investigation on four products with traits from the four design strategies had been conducted (see chapter 9. Product Investigation), and questions for this closing interview was derived from the result of the product investigation. Moreover, the interview forms used by Löfstöm (2008) were reviewed, and questions relevant to the closing interview were included in the form. The interview form can be found in appendix 6.

2.5. The Method of Semi-Structured Interviews

For a semi-structured interview the questions to be posed are open-ended, consequently the respondent has the possibility to raise issues important to him or her. Still, the interviewer should have a rather clear idea on what topics should be covered by the respondent's answers, and thus steer the interview in that direction (Jordan, 1998).

8.1.2. Execution of Evaluation

A First Visit

The project duo visited all the participants in the end of May and beginning of June. At this initial visit, the participants were interviewed in accordance to the first interview form (appendix 5), given an electric kitchen scale and the first booklet, containing the table for documenting behaviour and instructions for how to fill it in. The participants were informed that this first part served to document their current behaviour and therefore encouraged to not change anything in their behaviour.

Matching Prototypes to the Households

With the participants' laundry situation, and their answers during the initial visit in mind, the project duo tried to match the prototypes with the households' requirements and desires. Limiting factors were for example the request for unscented washing detergent as the concept of *Habit Intervention* was only available in a scented version. One household would only agree to use a new washing detergent if it was a liquid one. As it was uncertain if the concept of *Eco-Affective Design* would withstand a liquid washing detergent, and also be unpractical to use with liquid detergent, and the concepts of *Scripting* and *Habit Intervention* were based on washing powder, the only possible concept for that household was *Competence and Autonomy*.

Delivery of Prototypes

In the end of June and beginning of July the participants were paid another visit. This time, the booklets for documentation of initial dosing behaviour were collected and the prototypes handed over. Neither did the project duo explain how the prototype worked nor the underlying design ideas, with the exception being the laundry scale in the prototype of *Competence and Autonomy* were the users was instructed on how the scale worked. Yet, several of the participants examined

the prototypes closely, perhaps more so than they would have done in a store. The participants were also given a note with a picture of the design concept, not the prototype, where it said that the product they received was only a prototype and therefore might malfunction. Furthermore, the participants were encouraged to notify the project duo if the prototype broke or when they ran out of washing detergent and wanted more (relevant for *Competence and Autonomy*, *Scripting*, and *Habit Intervention*). The participants were asked to start using the prototypes as soon as possible and finally the evaluation layout was explained to them.

Documentation of Initial Use of Prototype

The second documentation booklets were sent to the participants by mail approximately two weeks after the delivery of the prototype (mid July). The reason for sending the booklet afterwards was to allow the participants to use the product a few times before documenting the behaviour in order to avoid irregularities in the data due to first time usage deviations. Irregularities would have made the comparison with the dosing reported in the first booklet and third booklet more uncertain. After completing the tables, the participants were asked to return them by mail, in an attached stamped and addressed envelope. Once this was done, continuous use of the prototype was optional for the participants. This was stressed by the project duo both when delivering the prototypes, and with a text both on the front page of the second booklet and next to the table inside it.

Prototype Maintenance and Refill

Several participants contacted the project duo in order to get a refill of their washing detergent, and delivery of new detergent was carried out in a few days. No contact was made regarding problems with the prototypes.

Documentation of Optional Use of Prototype

By the end of September, participants who had not returned their second booklet yet were reminded to do so. When the project duo finally had received the second booklet from all participants, the third and last documentation booklet was sent out, and the participants were asked to return the booklets by mail, as with the prior booklet.

Closing Interview

The project duo decided to interview every household separately, in their homes. This decision was made even though eliciting comments and opinions could be easier in a group setting, as one can react to the comments of others. However, it could be difficult to get all participating family members to take part in a group session, and it was considered superior to get everyone's comments. Furthermore, the household itself often constituted a group, thus single households were the most problematic. Therefore, the project duo decided to interview single households only after interviewing couples or families that had tested the same prototype, and if the single household participant would have trouble coming up with comments, the project duo would inform about comments that other households with the same prototype had.

After receiving the last documentation booklets, all households were contacted and the interviews were scheduled from mid November until mid December. On average, the interviews took one and a half hour and were held according to the corresponding interview form, with topics such as the experience of using the prototype, the acceptability of the prototype, the efficiency of the prototype, and if the results were biased by the participants knowing that they took part in a study (the interview form can be found in appendix 6). If there had been any missing information, obscurities or greatly diverging doses in the booklets, the participants were asked about this to get the information right. The participants were also shown the other prototypes and asked about whether they would have preferred to use one of them instead. This practice implied that the prototypes for *Eco-Affective Design* and *Competence and Autonomy* had to be collected from two households, E4 and C1, prior to their closing interviews. For the two other strategies, the project duo used prototypes that there had been no need for during the evaluation.

To be able to analyse whether or not the participants' attitudes towards environmental issues had influenced their response to the prototypes, the interviews were ended with two questions on this topic. Firstly the participants were asked about what choices and acts in their everyday life they perform for the sake of the environment. Thereafter they were asked to read shorted versions of

Persson and Hemberg's (2010) Ecotypes (translated from the Swedish name Ekotyp by the project duo), descriptions of six different attitudes to the environment and environmental issues, and to choose which one that was the most descriptive of themselves. In the version of the ecotypes that the participants got to read, any discreditable personality traits had been reformulated by the project duo and the names of the ecotypes given by Persson and Hemberg (2010) had been taken away in order to make all of the descriptions equally attractive. The descriptions of ecotypes used can be found in appendix 7.

After each interview, the household was sincerely thanked and given an encouraging book on the environment theme, and fair-trade chocolate, as a sign of the project duo's gratitude.

8.1.3. Analysis

Analysis of Booklets

The data from all booklets were put into Excel

spreadsheets. The amount of detergent for each dose was in the booklets noted in grams, but the participants estimated suitable doses by volume. Furthermore, dosing recommendations on packages are given in volume, not in weight. Therefore, the weight of the doses reported by the participants was converted into volume. In order to do this, the density had to be known. Some washing detergent brands stated the density on the packages, while others did not. Furthermore, some participants had not noted the brand of the washing detergents they used in the booklets and did not remember it when asked about it. Some washing detergent brands that the participants used were not found in the groceries stores visited by the project duo, e.g. the brands Ajax and Green Care. Therefore, for some of the doses noted by the participants the density had to be estimated in order to convert each dose from weigh to volume. The estimations were done by using the mean density of all washing detergents of the same type (i.e. powder detergent and liquid washing detergent) for which density had been found. For liquid washing detergent, only one brand reported the density. The mean value of the density for powder

Brand, powder detergent	Density stated on package, (g/ml)	Density used in calculatioons, (g/ml)
Ariel	0.85 g/ml	1.2 ml/g
Ariel sensitive	0.85 g/ml	1.2 ml/g
Skona	0.85 g/ml	1.2 ml/g
Neutral	0.71 g/ml	1.4 ml/g
Euroshoper	1.06 g/ml	0.94 ml/g
Ica	0.68 g/ml	1.5 ml/g
Eldorado	0.71 g/ml	1.4 ml/g
Eldorado (big package)	0.7 g/ml	1.4 ml/g
Grumme	0.7 g/ml	1.4 ml/g
Coop color	0.75 g/ml	1.3 ml/g
Coop white	0.75 g/ml	1.3 ml/g
Änglamark	0.85 g/ml	1.2 ml/g
Mean value	**0.79 g/ml**	**1.3 ml/g**

Table 8. The density of powder washing detergent from different brands that reported the density.

Brand, liquid detergent	Density stated on package, (g/ml)	Density used in calculatioons, (g/ml)
Neutral	1.045 g/ml	0.96 ml/g
Mean value	1.045 g/ml	0.96 ml/g

Table 9. The density of the only brand of liquid washing detergent that reported the density.

detergent was 0.79 g/ml and 1.045 g/ml for liquid washing detergent. For the density of different brands, see table 8 and 9. With this estimation, a dose of 50 g of washing powder from an unknown washing detergent or from a brand with unknown density was converted to the volume 63 ml. But, the actual volume could have been as little as 47 ml (according to the highest density of all densities for washing powders in table 8) or as much as 73 ml (according to the lowest densities of all densities for washing powders in table 8) depending on the actual density. The actual volume could of course be even lower or higher as there might be brands not found by the project duo with even higher or lower density. The highest density of all densities for washing powder that the project duo found was 1.06 g/ml (Euroshoper) and this was much higher than any other density. If excluding Euroshoper, the smallest volume that 50 g of washing powder corresponds to would be 58 ml instead of 47 ml. Fortunately, changes in the participants' dosing behaviour are more interesting than the volume of the doses as the changes indicate behavioural changes. Therefore, if a household continued with the same brand of washing detergent throughout the evaluation phase, a correct estimation of the volume was of less importance. For the tablets, the size of one tablet was measured and the volume calculated. Thereafter one tablet was weighed and the density calculated. The volume and density of the tablets can be found in table 10.

Any dose that the participants themselves were sure was an error in writing was disregarded and then a mean value for the doses in each booklet was calculated and they are reported in section 8.2. If the volumes of all the doses in a booklet were calculated using the mean density this is reported as 'density unknown'. If the volumes for some of the doses in a booklet were calculated by using the mean density this is reported as 'density partly unknown'.

The data was assumed to be normally distributed and all the analysis was made using a t-test to determine significant difference in mean dose in the three booklets. The calculations were made using the function Ttest in Excel. The variances in the different booklets were assumed to be unequal, as the introduction of the prototypes could have influenced the variances. The null hypothesis in the tests was that the mean values in two booklets were equal. Two different alternative hypotheses were used. One of them was that one of the mean values was greater or less than another, resulting in a one-sided test in accordance with explanations by Montgomery and Runger (2007). This was often the case for tests on mean values from booklet one and two, where the prototype were thought to decrease – or in some cases increase – the mean value and this was the hypothesis to be tested. The other alternative hypothesis used was that the two mean values were different, resulting in a two-sided test, in accordance with explanations by Montgomery and Runger (2007). This was used especially in the case where there was no obvious reason for the mean values to be different, e.g. the difference in mean between the second and third booklet. Significance was set at $p \leq 0.05$. The results

Brand, tablets	Volume/tablet	Measured density (g/ml)
Omo	37 ml	1.1 g/ml

Table 10. The volume and density of the washing detergent tablets used for the prototype of *Habit Intervention*.

of the tests are reported separately for each household in sections 8.2.1-4., in the paragraphs Level of Potential Long-Term Effectiveness in Inducing Target Behaviour. The p-values are given together with information about whether the alternative hypothesis was one- or two-sided, and if unequal variances were assumed.

The mean doses for all booklets in every household were put into a bar chart in Excel, see section 8.2.1-4., paragraphs Level of Potential Long-Term Effectiveness in Inducing Target Behaviour. The maximum and minimum dose in each booklet was also presented in the bar charts as error bars.

For *Habit Intervention* and *Scripting* information about the number of tablets or number of doses used were also important to determine whether the prototypes were effective in inducing the target behaviour or not.

When judging whether a dose was appropriate or not the mean doses recommended for different washes for all powder washing detergent brands available in a couple of grocery stores in Gothenburg were calculated. The mean doses for filled washing machines with load capacity 3-5 kg and 5-8 kg are presented in table 11. No dosing recommendations have been found for less than full washing machines with the exception for the brand Neutral that gives dosing recommendations based on two different spans of laundry weight.

The bottom text of the frog cup prototype in *Eco-Affective Design* says that 45 ml often is enough for

Load Capacity	Laundry Soiling	Mean Dose, Full Machine
3-5 kg	Light	31 ml
	Normal	49 ml
	Heavy	72 ml
5-8 kg	Light	53 ml
	Normal	76 ml
	Heavy	102 ml

Table 11. The mean dose for filled washing machines with different load capacity based on dosing recommendations from different brands.

one wash, reinforced with the line of 45 ml being the last green line. In accordance with table 11, this is enough for a full washing machine of low load capacity with laundry soiling light to normal, while it is not enough for any full machine of high load capacity. The red lines of the frog cup starts at 75 ml and according to the mean doses in table 11 this amount is enough for all washes in a low capacity machine and almost up to normal laundry soiling for a full high capacity machine. The powder detergents Neutral and Hemköp used in *Competence and Autonomy* and *Scripting* give higher recommendations than the mean in table 11. See Appendix 8 for the dosing recommendations for common brands of washing powder found in Sweden.

2.6. The Method of T-Test of Mean Values

A t-test is a statistical hypothesis test where the function of the sample, i.e. the test statistics, follows a t-distribution. T-tests can be used to test hypotheses about the differences in mean of two samples with unknown variances, as long as the samples can be assumed to be normally distributed. To do a t-test a null hypothesis and alternative hypothesis have to be determined. Thereafter, a significance level is decided upon and the value of the test statistic can be calculated. Then, it can be determined whether or not the null hypothesis can be rejected. With the function Ttest in Excel the p-value is determined. The p-value is the lowest level of significance that leads to rejection of the null hypothesis (Montgomery and Runger, 2007).

Analysis of Interview

For each household the recorded material from the interviews was transcribed and sorted into four categories. Three of them were based on the research questions and the last one was findings relevant for discussion on the topic of the set-up of the evaluation. Findings that did not fit in any category were discarded. The categorisations are described below.

» Comments regarding the effectiveness of

the prototype in inducing the target behaviour during the prototype testing and comments indicating the potential of long-term effectiveness.

» Comments regarding the acceptance of the prototype and comments indicating the potential of long-term acceptance.

» Comments regarding the extent to which the applied strategy was accountable for the effectiveness and acceptability of the prototypes and whether other strategies unintentionally was accountable for the effectiveness and acceptability.

» Comments regarding the evaluation set-up.

The comments sorted into tha first three categories were summarised and can be found in section 8.2. together with the result of the analysed data from the booklets. Comments regarding the evaluation set-up can be found in section 8.2.5.

Analysis of Environmental Attitudes

The six different ecotypes were clustered according to their attitudes to the environment. This resulted in four levels of pro-environmental engagement, where the lowest level was assigned a score of zero points whilst the highest level was assigned three points. To construct a similar system for the participants' descriptions of their pro-environmental actions in everyday life, all the descriptions were compiled and sorted into groups depending on the magnitude and extent of the actions. Four topics were identified as important; means of transport, diet (e.g. vegetarian) and consumption of ecological food, electricity habits, and source separation of household waste. When the sorting was done it was possible to match the participants' levels of actions with the four levels of pro-environmental engagement identified for the ecotypes. Thus, each participant was allotted one score for their choice of ecotype and one score for their stated actions, and the total scale measuring their environmental attitudes hence ranged between zero and six points. The key findings regarding environmental attitudes are reported upon in section 8.2.

8.2. KEY FINDINGS

Below, the key findings from the evaluation are presented. The result is organised into four sections, from 8.2.1. to 8.2.4., one for each type of prototype. Each section starts with an outline of the findings from all the households that evaluated that type of prototype followed by an in-depth analysis of each household. The findings for each household are organised into three different headings that relate to the three last research questions. For the first two headings, Level of Potential Long-Term Effectiveness in Inducing Target Behaviour and Level of Potential Long-Term Acceptability, the last paragraph is a summary that can be read separately. These summarising paragraphs are marked with a dashed grey line. The last section, 8.2.5., contains the analysis of the participants' comments regarding the set up of the evaluation.

8.2.1. Eco-Affective Design

Outline: A Reminder in the Way

When in use, the effectiveness of the frog cup seemed high, as all participants either lowered their consumption of washing powder or stayed at an already low level of consumption. Additionally, Edgar, one of the two participants who stopped using the prototype after the second booklet stayed at his new lowered level of consumption also during the third booklet. The second participant of that kind, Erik, had a very modest consumption prior to this study, and a technique for how he measured his detergent doses by eye. Erik returned to his old habit and kept a low dose in all three booklets. The third booklet was never returned from two of the participants, Emelie and Edward in Household E2 and E1, which was a pity as those were the participants with an initial mean over 100 ml. Emelie was however present at the closing interview and she revealed that despite that she kept using the prototype occasionally after completing the second booklet, she thought it difficult to not use more detergent than the frog cup implied. Therefore, she believed that she had increased her consumption of washing detergent somewhat, compared to the second booklet.

The potential long-term effectiveness of the frog

cup seemed uncertain but not too low. Of the nine participants who were present at the closing interviews, five participants, Eva (in E1), Emelie (in E2), Ester (in E3), Erik, and Elisabeth (in E4) mentioned that they would like to keep the prototype if possible. Additionally, Eva, Emelie, Ester, and Edmund (in E3), stated that they wanted to find a new measuring cup when they had to return the frog cup. Eskil (in E4), one of the six participants who used the prototype in his last booklet, stated that the frog cup had accomplished its mission for him, as it had made him aware of his detergent consumption, and thus it appeared as if he would not continue his use even if he would have the possibility. Edgar (in E2) and Erik had, as mentioned, worked out techniques for keeping a low dose without a measuring cup, and Elisabeth mentioned trying to keep a low consumption even after this study. To conclude, all participants except Edwin expressed somehow that they wanted to continue with a low or lowered consumption of washing powder. Whether they will succeed with this without sustained access to the frog cup, or acquirement of another measuring cup, was however unsure.

The acceptability of the frog cup varied between households but was in general fair. Household E1 and E4 were fondest of the frog cup, and even if Erik thought the frog to be in the way he still appreciated it as a character. Ester liked the frog cup, whilst Edmund's initial liking of the prototype had decreased as he, just like Erik, found the frog to be in the way. Household E2 liked the prototype the least and for the same reason as Edmund. For the long-term acceptance of the prototype the opinion that the frog was in the way must be viewed as the largest obstacle. Besides that, the participants' acceptance seemed to remain unchanged or even grow stronger during the prototype testing period.

Eva, in E1, and Edwin, in E4, never expressed that they had associated the frog cup with environmental aspects. For the rest of the participants it seemed as if the prototype at least had acted in line with the design strategy *Value and Attitude Reminder* (see section 3.2.6., paragraph Value and Attitude Reminder), as they linked overconsumption of washing powder to environmental pollution. Only two, or possibly three, participants mentioned the interpretation that the frog

would drown or suffocate if one poured too much detergent into the cup. Three other participants mentioned feelings of guilt or positive feelings of doing good for the environment, but without relating it to the frog. The prototype's ability to give rise to feelings concerning the environment therefore appeared to be lower than intended. Yet, as everyone except Erik and Edwin had doses in their first booklets that would have drowned the frog, and no one stated to have been over the yellow lines when using the frog cup, its message still got through.

Household E1

Essential characteristics of Household E1 are presented in table 12.

Level of Potential Long-Term Effectiveness in Inducing Target Behaviour

Eva adopted the target behaviour as she used the frog cup almost every time she did her laundry during the prototype testing period and decreased her mean dose to be even lower than 45 ml, which was the measurement just below the frog's feet and also the highest level marked in green. The mean dosing reported in Eva's three booklets were 70 ml (density unknown), 38 ml, and 37 ml (density unknown), respectively, as can be seen in figure 58. The difference in mean between the first and the second booklet is significant ($p=0.0022$, one-sided and unequal variance). The difference in mean between the first and the third booklet was also found to be significant ($p=0.0020$, one-sided and unequal variance). The small difference in mean between the second and third booklet showed no significance, as was expected regarding that she dosed in the same way in both of them ($p=0.83$, two-sided and unequal variance).

The first time Eva used the frog cup she had no knowledge of how much washing powder she should use. Therefore she tried to fill the cup with her usual amount of detergent, but then she thought it became so much and therefore she used less detergent right from the start. In the beginning of the test period she tried out some different doses to see if the laundry still got clean, and after a while she settled on two different doses, adapted to the amount of laundry. Eva used the frog cup as a scoop, and looked at the lines for guidance

on how much detergent she took. Her eyesight hindered her somewhat from reading out the digits and she said she had not noticed the colours of the lines. For a full machine she aimed somewhere around the 45 ml line, and for less laundry she aimed at the 30 ml line, which she also pointed out was her usual dose. Eva also said she did not want to fill the cup completely as that would be too much, instead she felt that somewhere below the middle was a good measurement. The two measurements lines she used for guidance were both bold lines, placed on the middle of the cup and bellow middle, and these qualities thus seemed to be the reason why she aimed at them.

Eva believed that she had halved her detergent consumption, and that the decrease in dosing was due to the frog occupying a certain volume in the cup. If she would have used the same cup but without the frog she believed she might have used detergent up to the same level as with the frog, and then her consumption would have been greater. Nonetheless, she said that she did not use to use that much detergent previous to the study either. She wanted to use as little detergent as possible for the sake of the environment, but she had no knowledge on how little one could use and on detergent recommendations. With the frog cup she now knew approximately how little washing

powder she could use. However, she felt that taking part of this study probably had made her more attentive on the subject of detergent dosing, as she thought a decrease in detergent consumption to be the goal with the prototype. Additionally, Eva had noticed that oftentimes there were a lot of washing powder left in the detergent compartments after her neighbours had been using the laundry room, and thus she believed that a lot of people could use some help with decreasing their consumption of washing powder. Once, a friend of Eva told her that she used a tablespoon, 15 ml, of washing powder for one machine, a dose that Eva thought to be very low. Eva did not reveal when this happened, but still, this confirmation on that a conservative dosing behaviour is possible might have strengthen Eva's feeling that using less detergent is a good thing.

In the last documentation booklet Eva used a washing powder that she got from her boyfriend's work. As she had heard that it could be itchy if one washes regular clothes, such as underwear, instead of work clothes with washing powder meant for work clothes she believed she took even a little less in the last booklet.

Eva doubted whether or not she would have used the measuring cup if she, for example, had received

Members of household:	Eva
Age:	51 years
Occupation:	Intern at an arts and crafts association
Environmental attitudes:	Ecotype D(2) or F(3) + actions(2) = 4.5 points (out of 6)
Previous dosing behaviour:	Poured detergent powder directly from package into detergent compartment, aimed at 0.5 dl, and maximum 1 dl for a full machine. Thought it was difficult to estimate the amount of detergent then
Used to dose according to type of wash:	Used less detergent for less dirty garments, and a little more for beddings
Read dosing instructions:	No
Previous knowledge of Gothenburg's water hardness:	No

Table 12. Essential characteristics of Household E1.

it as a present. The period where it was compulsory to use the cup was vital for her sustained usage, as the usage of the cup during that time grew into a habit. Eva said that she probably will increase her consumption of detergent when she no longer will have access to the prototype. Yet, she stated she had to have a measuring cup, as she cannot just pour the detergent. Hence, she will try to find another measuring cup, one with the capacity of 30 ml. At the end of the interview Eva started to ponder whether she perhaps could use her coffee measuring spoon for the washing powder, as she does not drink coffee. But as she could not find any information on how much it contained, she seemed sceptical and expressed a concern for her next laundry occasion.

The effectiveness of the prototype was very high as Eva lowered her dose significantly. However, if it would not have been for the compulsory period, it is uncertain if Eva would have used the cup at all. The potential for long-term effectiveness seemed high if Eva would have sustained access to the frog cup, as she stated that the usage of it had become something of a habit. As Eva wanted to find a new measuring cup when the testing period was over, it is also possible that the behaviour change
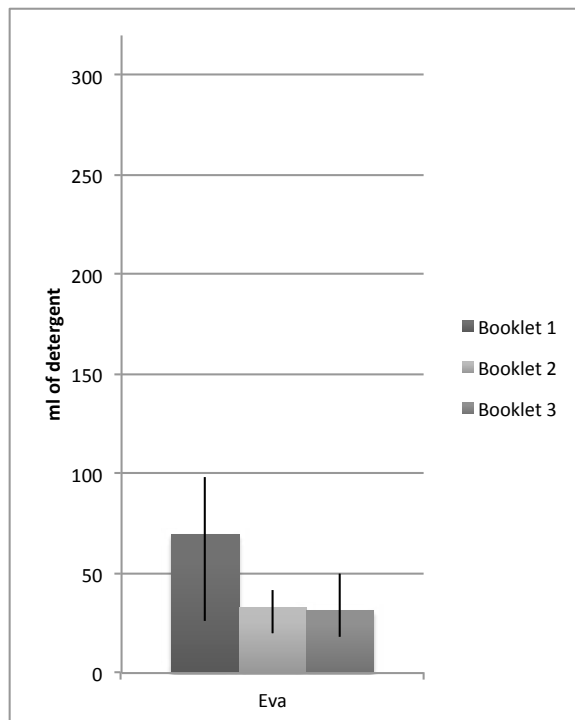
could be sustained also without the frog cup. Once again though, without the compulsory period, the potential for long-term effectiveness would be uncertain.

Level of Potential Long-Term Acceptability

When Eva received the prototype, she expected it to have some clear grading that she could follow, e.g. small amount of laundry, medium and large amount of laundry, or very dirty and less dirty laundry. When she started to use it she got accustomed to it quickly, perhaps after three times. However, she did remember that she in the beginning was wondering whether she was using it correctly or not.

Eva said that the frog was a little bit in the way when she used the measuring cup, but that that was how it was supposed to be. She liked the handle of the cup, but she thought the spout to be a bit unnecessary as she poured more with the side of the cup. Eva had not given any thought to why there was a frog in the measuring cup, but she liked that it was a fun animal and not just a ball. Eva was positive to the fact that she had been using less detergent compared to her previous consumption. She thought it had been all right to use the prototype, and she thought it was a good thing to have a measuring cup to scoop her detergent with. She also declared that it worked to use this little detergent, her laundry still got clean.

Eva expressed that she would be missing the frog cup and that if it was available in the stores now, she believed that she would have bought it. In addition, she asked the project duo to let her know if it would come in production. Regarding if she would have bought it before participating in this study, she said maybe, if it was not too expensive, as she did need a measuring cup. As Eva thought the frog cup to be pretty cute, with the resemblance to a larger jug, she thought she would choose that one instead of a measuring cup without a frog, as long as they had more or less the same price. Eva thought others would like to have the frog cup as well, and she imagined that she probably would have bought it to someone as a Christmas present if it was possible. The reason for this was that she thought it to be a little fun, at the same time as she believed it to be a common behaviour to overdose washing powder. Eva also

Figure 58. The mean doses of booklet 1, 2, and 3 from Household E1. The error bars represent the maximum and minimum dose in every booklet.

expressed that there should be a similar product for fabric softener which she sometimes uses for her beddings. As she was unaware of how to dose the fabric softener, she would have liked to have a measuring cup for that as well.

Regarding the other prototypes, Eva thought the tablets seemed easier to use than the frog cup. However, she would have liked them to be smaller, corresponding to her common dose of 30 ml, and to have a different package solution. The dosing kit seemed to require too many actions, making the laundry procedure too complicated. Finally, she found the packages with built in dosing systems to be quite easy to use and clever that no separate dosing aid was needed. However, she did not seem to appreciate that one still had to read the instructions.

As previously mentioned, Eva had a positive attitude towards sustainable behaviour and a limited use of detergents previous to the study, and the frog cup gave her a way to act upon her values. As she also liked the frog and thought the cup

to be cute, her acceptance of the prototype was high. The potential for long-term acceptability of the prototype seemed high as well as no change in attitude towards it during the test period was detected.

What Impact Did the Design Strategy Have?

Eva had not read the text under the cup, and neither had she by herself connected the frog to the environmental aspect of washing powder. As mentioned, she had not noticed the colours on the measuring lines either. Thus, she was unaware of all the elements in the prototype that is connected to the strategy of *Eco-Affective Design*. What caused the behaviour change seemed rather to be her attitude towards the environment, and the visual enlargement of the amount of washing powder in the frog cup.

Household E2

Essential characteristics of Household E2 are presented in table 13.

Members of household:	Edgar	Emelie
Age:	27 years	28 years
Occupation:	Architect	Engineer
Environmental attitudes:	Eco-type C(1) + actions(1) = 2 points (out of 6)	Eco-type C(1) + actions(1) = 2 points
Previous dosing behaviour:	Poured directly from the washing powder package into the detergent compartment of the washing machine, estimated the dose	Same as Edgar, but when she had just moved away from home she used a tablespoon for dosing her washing detergent and she tried to be rather accurate
Used to dose according to type of wash:	Maybe used a little more if a machine was fully loaded	Varied the dose depending on the amount of laundry
Read dosing instructions:	Maybe once, when he did laundry for the first time	Not now, but she used to when she had just moved away from home
Previous knowledge of Gothenburg's water hardness:	Seemed to have some idea of that one does not need that much detergent in Gothenburg due to the water quality	

Table 13. Essential characteristics of Household E2.

Level of Potential Long-Term Effectiveness in Inducing Target Behaviour

Emelie and Edgar had adopted the target behaviour to some extent. Emelie only filled in the two first documentation booklets, and her mean doses in them were 105 ml and 66 ml (density unknown for both figures). The difference in mean was significant (p=0.027, one-sided and unequal variance). Yet, she stated that after the second booklet she still used the frog cup sometimes. Edgar used the cup only during the second booklet and his mean values were 85 ml, 68 ml, and 67 ml (density unknown for all three figures). The mean doses can be seen in figure 59. The differences in mean value between the first and the second as well as the first and the third booklet were significant (p=0.0071, one-sided and unequal variance; p=0.0047, one-sided and unequal variance). The difference in mean between the second and third booklet was not found to be significantly different (p=0.74, two-sided and unequal variance). As Emelie and Edgar did their laundry in a shared laundry room, they used washing machines with a high load capacity. Hence, their figures from the prototype testing period are reasonable, even if they might have covered the frog's legs with detergent.
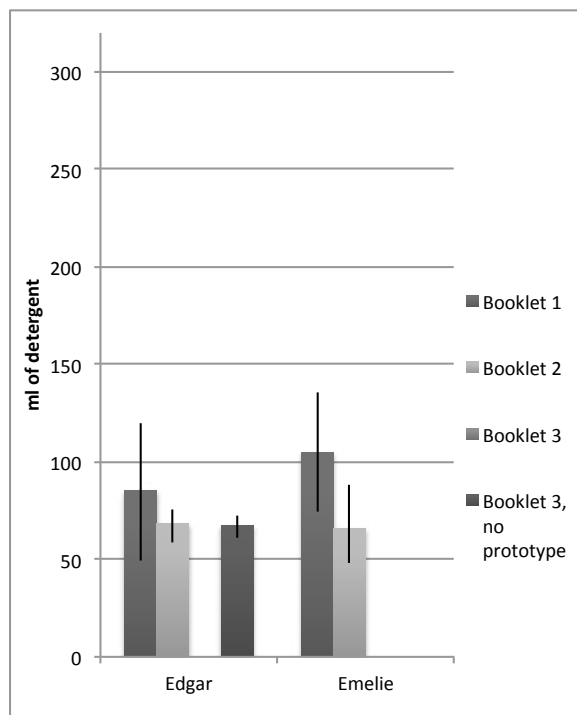

Figure 59. The mean doses of booklet 1, 2, and 3 from Household E2. The error bars represent the maximum and minimum dose in every booklet.

When Edgar first started using the frog cup he looked at the dosing recommendations at his detergent package and related them to the measuring lines on the cup. His verdict was that one does not need that much detergent and that approximately up to the highest green line was sufficient. He also thought that he searched Wikipedia, an online dictionary, for information on the water hardness in Gothenburg, even if he already had his suspicions.

Emelie believed she might have lowered her doses a little, both with and without the frog cup, and Edgar believed he had lowered his dose as he now had seen what amount was appropriate and sufficient. He felt he had improved his ability to estimate the amount of washing powder in the detergent compartment by eye, and he believed himself to pour nearly 50 or 60 ml each time.

Emelie tried to follow the colour code of the measuring lines, but often she felt as the green level was too low for a full machine, and thus she used a little more anyway. When this happened she usually did the judgement of the amount after she had poured the washing powder into the detergent compartment, and thereafter measured up some more powder in the frog cup and poured a second time. In her booklet it seems that she was on the green level when she had little laundry or a half filled machine, and on the red level when the machine was filled, with the mean values being 54 ml and 85 ml, respectively.

When using the frog cup and being careful with the dosing, Edgar could get the feeling of being good for the sake of the environment. But he also stated that it is a feeling that it is possible to get tired of, and instead just estimate the amount detergent. Edgar stated that even if doing good for the environment is a positive feeling, his opinion of a lot of actions told to be 'climate clever' was that their result is marginal and just a way to sooth one's conscience. Instead he believed much larger measures to be necessary. Emelie got a bad conscience when she poured detergent into the frog cup and reached higher than the green level, and she related this feeling to the environment. Emelie even called the coloured measuring lines for a scale of ethics.

Edgar said that it was mostly in the beginning that

he reflected upon the frog cup, even if he thought it difficult to judge if and how much his thoughts and feelings regarding the cup had changed during the test period. Emelie felt that the bad conscious was still present, but that is got easier to suppress as time went by. Additionally, when she still used the scale, she experienced that it was not just about the ethics, but also about money pouring out from the package. Edgar said that he also had made that reflection, when he was out shopping for washing detergent, but he settled with the thought that washing powder is rather inexpensive.

Edgar expressed that taking part of this study had made him think more about his washing procedure than ever before, and that the frog cup had put focus on that one should not overdose washing detergent. Emelie agreed and revealed that she probably got affected also by the booklets and tried to take a little less detergent in order not to appear too wasteful. When presented with the mean dose of her two booklets, Emelie said that in the second booklet she probably thought quite a lot about the frog, but that after that she believed she had increased her doses. Especially at the latest washing occasion when she was washing baby blankets and pillows.

As mentioned, Edgar had already started to estimate his doses, and when Emelie would no longer have access to the frog cup she said she would go back to estimating her doses as well. Emelie thought that she would probably increase her doses gradually when she no longer could use the frog cup, as she used to have a measuring cup earlier on but had increased her doses since then. Edgar on the other hand believed he would continue using a little less detergent, as his feeling at the time of the interview was that he was using even less detergent what he believes the recommendations to be.

The effectiveness of the prototype seemed moderate as Edgar had learned how to dose reasonably without the cup, whilst the behaviour change of Emelie was more uncertain, even if she did use less detergent when she used the frog cup and filled in the second booklet. The potential for a long-term effect on Edgar's behaviour was uncertain but existing. For Emelie it seemed less promising as she, even with sustained access to the prototype, had started to use a little more than she did in the second booklet.

Level of Potential Long-Term Acceptability

The first time Emelie saw the prototype she got surprised that it was a cup with a frog in. As she through a friend was acquainted with the educational background of the project duo she had expected an advanced and 'cool' product. Instead she was introduced to a prototype that she could not grasp.

Edgar had expected something to happen with the frog when he used the cup, like a change in colour when too much detergent was used, or a sound that would guide his behaviour. When nothing happened he thought that maybe he and Emelie was a part of a control group that had received non-functioning prototypes.

Emelie thought the good part of the frog cup to be the coloured scale, the frog itself she felt was in the way and without functionality. Additionally both she and Edgar thought that a lot of detergent got stuck on both the frog and the cup, and that it was difficult to get it off. What Edgar appreciated with the prototype was that he learnt how to estimate his doses from it. He also thought the frog looked pretty nice.

Edgar felt as if he got into a routine with the frog cup, the scale, and the booklets after just a couple of times. Emelie did the laundry more seldom compared to Edgar, and thus she felt it was less of a routine, especially regarding the scale. Edgar never used the prototype without filling in a booklet, however he did enjoy the weighing procedure somewhat, even if he found the slowness of the scale a bit frustrating in stressed situations, and he did find the booklets easy to fill in. Thus, this circumstance should not have lowered his acceptance of the prototype.

As mentioned, both Emelie and Edgar got some associations to the environment while using the frog cup. Edgar stated that it was a positive feeling to do something good for the environment, but that it also could turn over and make him ignore the message of the prototype. Emelie thought that somehow it felt good to become more aware of the environment also during washing, even if she was not always able to act upon it.

As previously stated, Edgar looked at the dosing

recommendations of his washing detergent, and searched the internet for information on water hardness. The information he found was in line with the colourings of the measuring lines on the cup, and thus he got confirmation of its accuracy.

Even if Emelie would have liked to get rid of the frog, she was not positive towards handing back the prototype as she liked having something to measure the detergent with. The frog, she thought, made it a bit more difficult to pour detergent from the cup. At the same time, she thought it could contribute to a feeling of satisfaction as it looks like one pours a lot of detergent into the cup, but in reality it is an illusion. Edgar thought the spout of the cup to be unnecessary, as it does not function when one does not pour liquids from it.

Emelie did not believe she would have bought the prototype if she had seen it in a store. However, if it was available without the frog, then she might have been interested. She added that if the project duo could spare the prototype, she would be interested in keeping it. Edgar, on the other hand, stated that he would not have bought any measuring cup for washing powder. Emelie was also unsure whether she would have used the frog cup if she would have received for example in a detergent package without taking part of this study. However, with the experience in her back, she would have liked to have the frog cup if it was enclosed to a package of washing powder, perhaps also as she in general likes to receive free merchandise that accompanies different goods.

Emelie did not believe that other people would like to buy the frog cup, with the reason being the frog. She would have preferred to only have the coloured measuring scale. Edgar associated the frog cup with the detergent brand Grumme (listed as Sweden's greenest brand in 2009 (Cederroth, 2010)), as the frog gives it an air of nature romanticism. He felt that the frog can work well as a symbol for sustainable dosing behaviour, but that it would be difficult to make people use the prototype in its current incarnation. He would have liked if the cup could have been compatible with the detergent package somehow, either that one put it into the package, or if it could be hung on the outside of the package.

Emelie had not seen the text underneath the frog

cup, and when she discovered it during the interview she said that it reminded her of the warning texts on cigarette packages. Edgar had read the text but forgotten it. However, he said that he already was aware of that one should not overdose washing detergents, still he thought that the information about surfactants could be good to have on such a product.

Regarding the other prototypes Edgar appeared enthusiastic about the laundry scale and the volvelle whilst Emelie initially thought it seemed too circumstantial. She was instead more interested in the tablets as she liked their tablets for the dishwasher.

The level of acceptability reach by the prototype within this household was rather modest. Edgar did not want to continue his use of it, but he appeared to appreciate that it had given him a chance to improve his ability to measure by eye. Emelie would have liked to keep the prototype, but she would have preferred if the frog was not there. Both of them seemed to accept the prototype's reference to the environment and view it as positive, but Edgar could also tire of it sometimes. The potential for long-term acceptability appeared rather low and in line with the acceptance reached during the test period.

What Impact Did the Design Strategy Have?

Both Edgar and Emelie connected the frog cup to environmental issues and they talked more about the environment during the interview than other households with equally low scores on their environmental attitude. However, they did not mention any specific associations to, or impact from, the frog. Emelie did mention once that she thought about the frog, but it was unclear whether she referred to the frog itself or the whole cup. They also mentioned feelings such as a bad conscience, or a positive feeling of doing something good for the environment, but no explicit feelings regarding the frog. Thus it is difficult to judge whether the strategy *Eco-Affective Design* was responsible for the change in behaviour or not. Other possible motivators could have been the study setting itself and the booklets, as both Emelie and Edgar mentioned these.

Household E3

Essential characteristics of Household E3 are presented in table 14.

Level of Potential Long-Term Effectiveness in Inducing Target Behaviour

Ester and Edmund did adopt the target behaviour as they used the prototype all through the testing period. For Edmund this did not imply much change in his washing powder consumption as his mean values in the three booklets were 60 ml (density unknown for half of the measurements), 63 ml (density unknown), and 47 ml (density unknown). Ester and Edmund uses a common laundry room in their block of flats, and as the capacity of the machines there are 6 kg, all his values were acceptable in comparison to the mean values presented in 8.1.3. Analysis. The difference in mean between the second and the third booklet were found to be significant ($p=6.0\cdot10^{-5}$, two-sided and unequal variance). The difference in mean between the first and the second booklet as well as between the first and third booklet were not found to be significant ($p=0.36$, one-sided and unequal variance; $p=0.06$, one-sided and unequal variance). In the last booklet the lower value might depend on a more

Members of household:	Ester	Edmund
Age:	31 years	32 years
Occupation:	Doctor	PhD student in energy technology
Environmental attitudes:	Eco-type D(2) or E(1) + actions(2) = 3.5 points	Eco-type F(3) + actions(2) = 5 points (out of 6)
Previous dosing behaviour:	Poured directly from the package into the detergent compartment of the washing machine, judged the amount by eye	Same as Ester
Used to dose according to type of wash:	More washing powder when the laundry was extra dirty	A little more detergent when there was a lot of laundry. If there were just a small amount of detergent left in the package he might have poured it all in, even if it turned out to be too much
Read dosing instructions:	Has done it occasionally, but have never had a measuring cup to use, and thus it was no point in reading the recommendations	Has probably read them, but not really registered the information, possibly as he never had any dosing aid either
Previous knowledge of Gothenburg's water hardness:	No, and still unsure	-
Additional members of household:	Their son, 1 year old	

Table 14. Essential characteristics of Household E3.

modest dosing behaviour, but also on that there were less full machines recorded compared to the other booklets, or that the density differed as he used different brands of washing powder in each booklet. However, his dosing did get more even when he used the prototype, see figure 60. For Ester a gradual change seemed to have occurred as her mean values were 75 ml (density unknown), 71 ml (density unknown), and 56 ml, see figure 60. The difference between the first and the third value was found to be significant (p=0.019, one-sided and unequal variance). The difference in mean between the first and the second booklet as well as between the second and third booklet were not found to be significant (p=0.29, one-sided and unequal variance; p=0.067, two-sided and unequal variance). In the two first booklets the mean dose would have been acceptable if she would have filled all her machines, but as approximately half of them were half filled, she could have used less detergent. In the third booklet her value were below the mean recommended dose as she had almost only full machines, and normal to extra dirty laundry. Just as Edmund, Ester varied her doses much less when using the prototype.
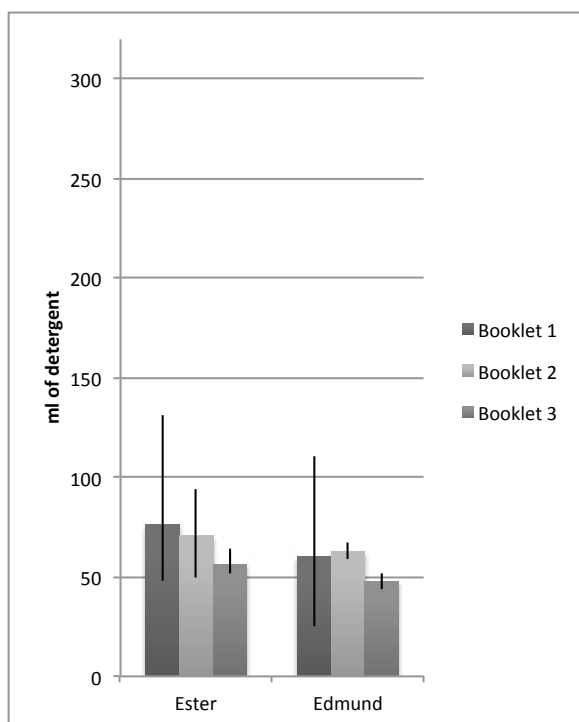
Edmund was doing the laundry at the time for

Figure 60. The mean doses of booklet 1, 2, and 3 from Household E3. The error bars represent the maximum and minimum dose in every booklet.

the interview, and he stated that he did not use the frog cup but instead was back at just pouring the washing powder by chance. The reason for it was that the new detergent package opened with a spout instead of a whole cap, and he was used to scoop with the frog cup, not pouring into it. Additionally he expressed that he was a little bit stressed, as the interview soon was to begin. Yet, he said it felt all right and habitual to dose detergent in that way.

Ester thought she had read instructions some-where, probably on the detergent package, and compared it to the scale on the frog cup. She was uncertain about the water hardness in Gothenburg and believed that it might have been the figures for middle hard water that corresponded to the green, orange and red measuring lines on the frog cup, as she would have found it reasonable to take the middle course. If this was the case, she had then found out that an appropriate dose corresponded to the highest green measuring line and approved of this. If this was not what happened, she believed that she must just have thought the project duo would know what an appropriate dose was, and thus she would have trusted the colour coding. Independent from how the knowledge regard-ing the green level came to Ester, she has aimed between the highest green line and the first yellow line ever since then. She said she knew exactly how much she used each time and thus she believed she used less detergent than without the prototype, and she felt certain that the amount was sufficient. Like Edmund, Ester used the frog cup as a scoop. Edmund used the frog as a reference when he scooped detergent with the cup. He aimed at the level where it looked as if the frog was floating on the surface of the washing powder, thereafter he checked to see if it was on the green level as well. Both Ester and Edmund had been adapting their dosing to the laundry type a little less when they used the frog cup. For Edmund it was the high-est of the green lines that caused this effect, whilst Ester perhaps took up to the yellow line if it was a lot of laundry, or if it was very dirty.

Edmund thought the frog cup to be over-explicit with the coloured lines, the frog, and the informa-tion text, all aiming at influencing people to use a dose of 45 ml detergent. However, he did not remember what the information text said. Ester had not observed that the frog's feet were more

or less in line with the top green line; neither had she noticed the information text. She had interpreted the green levels as being good for the environment, and the frog as a symbol for the environment somehow as it is a water living animal. In the beginning of the prototype testing period, Edmund and Ester had discussed the possible aim of this study, and even if they might have had somewhat different ideas they could unite in the belief that the goal was to make them standardise their dosing of washing powder. When talking about this, Edmund mentioned that he, as opposed to Ester, had not been thinking about the prototype as the frog being drowned and harmed by excessive use of detergent. Yet, Ester had not mentioned these thoughts during the interview and gave no clear response to Edmunds statement. Thus it is uncertain whether this was Edmund's interpretation of something Ester said, or if she had told him this previous to the interview.

Already before this study Edmund wanted a measuring cup, but he did not know where to buy one. He had been thinking about using one of their decilitre cups as he wanted something to scoop with. But it was the kind of thing he remembered only when he already was in the laundry room and thus he had not acted upon the thought. Ester stated that she would become annoyed by not having a measuring cup after this study, and thus she believed she would try to get hold of a new one, even if she was not prepared to put too much effort into this quest. Nonetheless, she felt that she now had some notion on how much detergent to use. Edmund believed that he henceforth would use different techniques for dosing washing powder depending on what type of detergent package they have and whether or not they would find themselves a new measuring cup. He also though that he from now on would get a bad conscience whenever he pours detergent directly from a package. Thus he believed that he somehow would try to keep an eye on how much detergent he uses. According to Edmund, this bad conscious was connected to the environmental issues of detergents, like surfactants.

Ester was unaware of that the usage of the prototype was optional after the second booklet. Yet, she believed she would have continued her use of it even if she knew she was allowed to stop. Edmund found it difficult to explain why he continued

to use the prototype in the third booklet, but he believed it could have been due to force of habit.

Edmund expressed that he probably would have been less frequent and thorough with his use of the prototype if it had not been for the study setting. He also said that he found some joy in using the kitchen scale and he said that it probably affected him into being more accurate in his dosing. Ester did not find it troublesome to use the prototype, but she was uncertain if and how soon she would have started using it if it was not for the study.

Ester had a feeling that she had decreased her consumption of washing powder, whilst Edmund believed to be on roughly the same level as before. He also commented that he varied more in his dosing previous to the prototype, and this was something he might have observed in his booklets. Ester based her belief on that she thought it looked like a small amount of detergent when she scooped it into the frog cup. She had ceased to look into the detergent compartment for judging the amount of washing powder, while Edmund on the other hand continued doing that by habit also when he used the frog cup.

The effectiveness of the frog cup seemed fair as it resulted in doses of an acceptable size, even if it did not produce doses smaller then the recommendations. However, with regards to the mean doses, both Edmund and Ester appeared to dose rather satisfactory already before the introduction of the frog cup. Yet, they varied in dosing a lot, with the highest dose being Ester's value of 131 ml. The potential for long-term effectiveness appeared to be highest for Ester as she lowered her dose somewhat in the last booklet, and possibly would continue this trend. For Edmund it seemed as the potential was low, as he at the time of the interview had stopped using the prototype, and stated that he probably would have been less persistent in his use if it was not for the study. On the other hand, both Edmund and Ester expressed a wish for a continuous use of a measuring cup. Whether they will make an effort to acquire one is however unsure as Edmund had thought about this also previous to this study.

Level of Potential Long-Term Acceptability

Both Esters and Edmunds first impression of the

frog cup was that it was a nice looking measuring cup, and that it was fun that it contained a frog. They both felt as if they got used to the prototype quickly and Edmund expressed that he was curious to see if any of their neighbour would comment the frog cup in the laundry room. Ester said she liked having a device for dosing of detergent, as she previously was uncertain of how she was supposed to dose. Edmund on the other hand felt the frog to be in the way, and that it was easier to just pour from the package. He suggested that perhaps the frog could be placed on the outside instead, and he reported that with time he grew tired of the frog. Ester was not at all troubled by the frog's position, instead she only viewed it as something positive and expressed disappointment regarding having to hand it back to the project duo. She liked having nice paraphernalia when engaging in different activities and the frog cup gave a gilt edge to the washing procedure. Edmund felt instead that he did not do that much thinking when doing the laundry, just rushing off to the laundry room.

Ester stated that she would have bought the frog cup if it now would be available in stores, provided that it had a low enough price. Edmund would have bought it if it did not contain the frog. Yet, previous to the study he might have bought it as he thought it looked fun. Ester believed she would have bought any measuring cup, previous to the study, if it would have been marketed as a detergent measuring cup and placed near the packages of washing powder. Both Edmund and Ester thought others would want to use the frog cup, but mainly due to the measuring cup and not the frog. However, Ester said that the frog would be a bonus and that perhaps it would make people choose the frog cup instead of a less fun measuring cup.

Regarding improvements on the frog cup, Edmund pointed out that the shape of the cup could be made better to scoop with. Ester did not feel that the whole shape should be improved, but perhaps the handle could be more adapted to scooping from a detergent package. She also mentioned that it was a bit heavy.

When shown the other prototypes Ester expressed that she would have liked to use the volvelle and the measuring cup. She said that she would look at the volvelle occasionally, and learn more or less

how much detergent to use. The laundry scale she felt was unnecessary as the washing machines in their laundry room had a built in scale. Ester thought the package with an integrated dosing system too tedious to use, and she expressed that she would not trust it and expected it to malfunction. Edmund appeared to be most interested in the tablets, but he would have liked them to be in a different package.

The acceptability of the frog cup differs for Ester and Edmund. Both of them had a positive attitude towards it initially, but whilst Ester's attitude remained unchanged Edmund grew tire of the frog as he thought it was in the way when he used the cup. Regarding the potential for long-term acceptance of the frog cup the verdict was the same; a high potential for Ester and low potential for Edmund.

What Impact Did the Design Strategy Have?

It seemed as both Edmund and Ester would have been susceptible to any measuring cup since at least Edmund expressed that he had felt the need for one previous to this study, and thus the frog cup can be seen as acting upon the strategy *Enabler*. Yet, they did both mention the environment in connection to the use of the frog cup, and they used either the frog's feet or the upper green line as a reference to how much detergent to use. It is also possible that Ester had interpreted the frog cup in the way that the project duo intended, i.e. as displaying a drowning frog when one uses too much washing powder. Additionally, Edmund mentioned a future bad conscience when dosing detergent by hand. Thus, it appears as if the strategy behind the frog cup might have had some influence on their behaviour during the test period.

Household E4

Essential characteristics of Household E4 are presented in table 15.

Level of Potential Long-Term Effectiveness in Inducing Target Behaviour

Household E4 adopted the target behaviour to a relatively high extent. Elisabeth, Eskil, and Edwin used the prototype all through the testing period.

However, Edwin was not aware that usage was optional during the third booklet. As Edward went travelling during the autumn, he stopped participating in the study after the second booklet and he was still away at the time for the interview. With regards to the load capacity of their washing machine, which was up to five kg, all family members had a reasonable low mean in the third booklet, see figure 61. The mean values for Erik were 34 ml (density partly unknown), 34 ml and 42 ml. None of the differences in mean were significant. (Test of first and second value gave p=0.48, one-sided and unequal variance. Test of first and third value gave p=0.17, one-sided and unequal variance. Test of second and third gave p=0.51, two-sided and unequal variance.) Elisabeth's mean values were 92 ml (density partly unknown), 52 ml and 36 ml. The differences in mean between the first and the second mean value as well as the first and third value were significant (p=0.031, one-sided and unequal variance; p=0.0053, one-sided and unequal variance). The difference between the second and third mean value was not significant (p=0.19, two-sided and unequal variance). Edwin's mean values were 22 ml (density partly unknown), 59 ml and 35 ml. Note that one value in the second booklet was very divergent, 205 ml, and mean value without this was 22 ml. Since all family members present at the interview stated that they had never used the frog cup twice for one laundry, it is possible that this value was faulty as the frog cup had a maximum capacity of approximately 100 ml. No differences in mean were found to be significant, neither when using the mean of 59 ml that included the dose of 205 ml nor with the mean of 22 ml that excluded that dose. (Test of first mean value and second mean value of 22 ml gave p=0.94, two-sided and unequal variance. Test of first and second value of 59 ml gave p=0.38, two-sided and unequal variance. Test of first and third value gave p=0.27, two-sided and unequal variance. Test of second mean value of 22 ml and

Members of household:	Erik	Elisabeth
Age:	45 years	45 years
Occupation:	Architect	Speech therapist
Environmental attitudes:	Ecotype F(3) + actions(2) = 5 points (out of 6)	Ecotype C(1) or D(2) + actions(2) = 3.5 points
Previous dosing behaviour:	Poured directly from the package onto the drum (E4 owned a top loading washing machine) and judged the amount by eye	Poured directly from the package into the detergent compartment
Used to dose according to type of wash:	-	-
Read dosing instructions:	No	No
Previous knowledge of Gothenburg's water hardness:	-	-

Table 15. Essential characteristics of Household E4. Edward was traveling abroad at the time of the closing interwiev, and

third mean value gave p=0.22, two-sided and unequal variance. Test of second mean value of 59 ml and third mean value gave p=0.27, two-sided and unequal variance.) The mean values for Eskil were 87 ml (density partly unknown), 38 ml, 34 ml with prototype, and 12 ml for a single occasion without the prototype. The differences in the first and second mean value as well as the first and third mean value with prototype were not found to be significant (p=0.075, one-sided and unequal variance; p=0.062, one-sided and unequal variance). The same goes for the difference between the second mean value and the third mean value with prototype (p=0.67, two-sided and unequal variance). For Edward the values were 130 ml (density partly unknown) and 74 ml. The difference in mean was significant (p=0.036, one-sided and unequal variance).

The first time Eskil documented his doses, he poured in a lot of detergent, 320 ml, and got surprised by this big amount when he weighed the detergent package on the scale. After that he tried to use smaller doses and keep them more even. This implies that Eskil's first mean value of 87 ml could have been much higher. Elisabeth said that she also got influenced by seeing how her numbers varied in the first booklet and that she might have tried to adjust her doses accordingly. However, she thought that this behaviour had ceased eventually, and at least prior to the last booklet. Edwin thought that he remembered that he during the first couple of times of documentation believed that the aim of the study was to use as little detergent as possible. Thus he had tried to get the weight prior and after the dosing to differ as little as possible. As with Eskil, it is thereby possible that Edwin's mean value in the first booklet should have been higher.

Erik stopped using the prototype as he thought it was inconvenient compared to his previous dosing

Edwin	Eskil	Edward
17 years	20 years	20 years
Student, upper secondary school	Works at a café, fire-eater	-
Ecotype C(1) or D(2) or E(1) + actions(1) = 2.3 points	Ecotype C(1) or D(2) + actions(2) = 3.5 points	-
Poured directly from the package into the detergent compartment	Poured directly from the package into the detergent compartment	-
-	No	-
No	No, believes that recommendations on detergent packages are adapted to the manufacturers desire to sell their products	-
-	Said "we have got soft water, right?" when he looked at the volvelle	-

thats why most information about him is missing.

method. Additionally, he believed that he was rather modest in his detergent consumption prior to this study. But if he would get proof showing that he actually used less detergent with the frog cup, then he would be motivated to keep on using it. He said that he had not changed his laundry habits, but that he was more aware of the situation now when he poured washing powder, compared to previous to the study. However, if this change in mind-set was due to the frog cup or to the booklets and the kitchen scale, he could not tell.

Eskil thought he would not continue his use of the frog cup, as it meant an extra step in the washing procedure. When he still had to weigh the detergent packages on the kitchen scale he thought it was all right to use the frog cup, as he already was performing an additional task. He said he used the frog cup at maybe half of his washing occasions during the optional period, yet he was unsure whether he did any laundry in between the second and third booklet. The prototype had however made him observant on his dosing behaviour and given him a sense of approximately how big a reasonable dose is, which he viewed as positive. Thus, in that aspect, he felt as if the frog cup already had accomplished its mission. Eskil also mentioned that he thought less about the frog cup now

compared to in the beginning of the test period, as he had gotten accustomed to it.

Edwin was unsure whether he had used the frog in between booklet 2 and 3 or not, but he thought that he might have documented all his washes in the booklets. As Edwin did not do the laundries very often previous to this study, this reasoning seems likely.

Elisabeth had used the frog cup almost every time she did the laundry, also when she had no booklet to fill in. She continued her use of the prototype as she thought the procedure was easier and worked better with the prototype than without. Elisabeth poured washing powder into the detergent compartment, which was placed horizontally on the lid of the washing machine, and when doing so with the frog cup, she spilled less detergent outside of the compartment. Additionally, the frog cup was stored close to their washing machine, and thus it was always at hand for her. Edwin agreed with Elisabeth on that it was easy to pour from the frog cup, as its angle was better adjusted for pouring into the detergent compartment, compared to some washing powder packages.

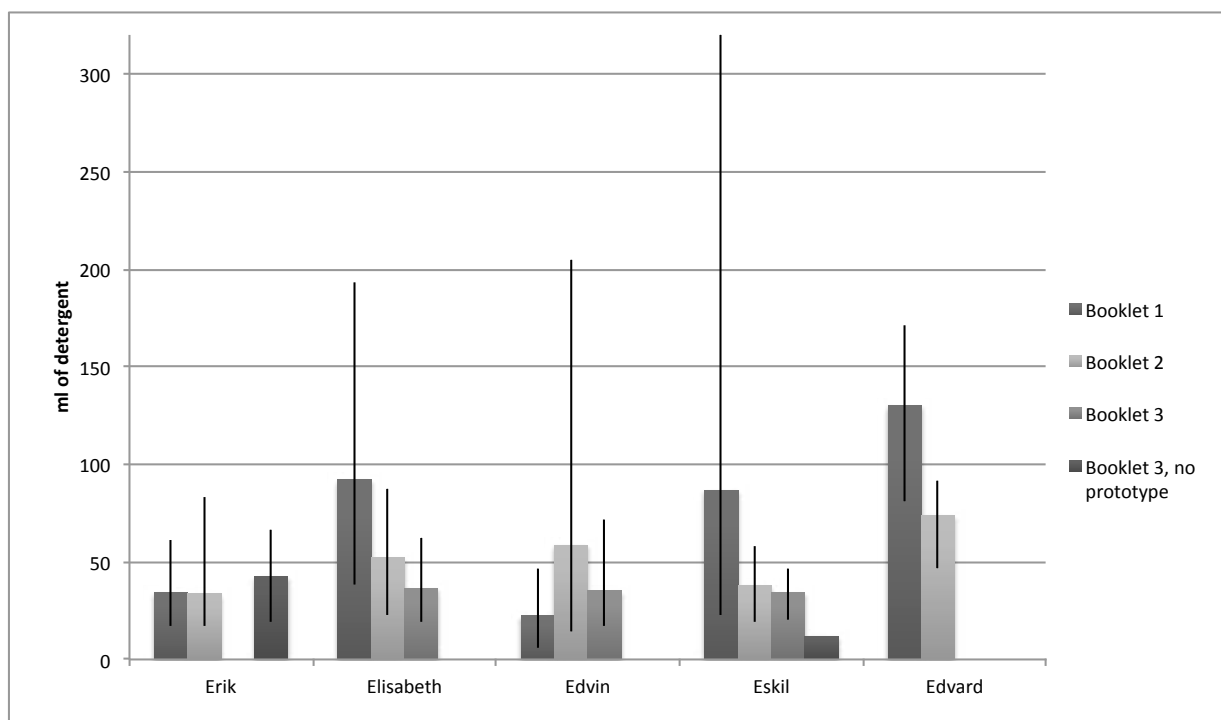Edwin did not reflect that much upon his dosing

Figure 61. The mean doses of booklet 1, 2, and 3 from Household E4. The error bars represent the maximum and minimum dose in every booklet.

of washing powder, but he stated that he had never had used more detergent then up to the top of the rock. Erik said he also had used the rock as an upper limit, and he appreciated that this meant that the frog, in a symbolic sense, never got choked. He did not want to use the scale on the cup, but rather trust his own intuition and thus he tried to get the same feeling of the amount as he used to get when pouring onto the drum and estimating the size of the powder pile. The rock had become a guide for him, and depending on how much of the rock was visible he knew if he had little, medium or a lot of detergent in the cup. Eskil on the other hand, seemed to have used both the scale and the frog as a guide for his doses.

Eskil had interpreted the frog cup as a prototype meant for lowering one's consumption of washing detergent. Erik had had the same thoughts and added that it was for the sake of the environment. Elisabeth had seen it as the volume of the frog and the rock was there in order to trick the eye into believing it to be more detergent in the cup than there actually was, and as a result one would use less detergent. She had also pondered upon why it was a frog and not just a lump, as the frog's shape made washing powder stick to it. However, she said she could understand that the frog makes it fun and at the same time makes it is easy to associate to the environment. Like Erik, she had thought about not covering the frog with washing powder, and not at all on the measurements. Erik stated that he in general thought it looked like a lot of detergent in the cup and that when it reaches the frog, then it really is a lot of detergent. Elisabeth suggested that in one sense, a measuring cup is made to be filled up, and thus if the cup would have been bigger or smaller, everyone's mean dose might have been larger or smaller as well. Edwin had only thought of the frog cup as an attempt to make a measuring cup fun in order to make it more tempting than a regular measuring cup.

Eskil expressed that he had started to become a bit of an environmentalist at home, due to amongst other things, the family's reintroduction of their compost which happened approximately at the same time as when the prototype testing period begun. Thus he said it felt good to use the frog cup. Eskil was unsure of whether the reintroduction of the compost was in any way connected to the introduction of the frog cup, but he expressed

that it at least was connected to an increased awareness of the environment that started around that time.

If Eskil would have received the prototype somehow, without taking part of the study, he believed he would have used it only a couple of times, and without reflecting much upon its message and the use of washing powder. Edwin agreed with Eskil on that he would have tried it as it is a somewhat strange artefact, but he could not tell if he would have kept on using it or not. Elisabeth did also believe that the study setting was important for at least her initial use of the frog cup.

Elisabeth thought she had noticed a decrease in the family's consumption of washing powder. Furthermore she thought she might would be using a little less detergent also now after departing with the prototype, even if she had gone back to her previous behaviour to pour directly from the package. If it would have been possible for her to keep the frog cup she stated that she would have continued her use of it. Edwin believed that he, like Elisabeth had already done, henceforth would continue to dose as he did previous to this study. Erik revealed that he might have used a little extra detergent once or twice in the last booklet, as he felt that he lacked the energy to be sparing and to compost etc. However, this reaction seemed to arise from circumstances beyond the laundry sphere. Eskil said he now used less detergent in general, but also that he adapted his doses more according to if there was a little or a lot of laundry. As he had his aha-experience with the 320 ml dose he concluded that the kitchen scale had been most influential on his behaviour. Yet, he added that the frog cup had been very good for learning what dose to aim for, and that this would not have happened with only the scale.

Eskil had read the information text on the frog cup and Erik had started to read it but stopped as he doubted that the project duo had put it there. Neither Elisabeth nor Edwin had seen the text.

The effectiveness of the prototype appeared to be quite high in Household E4 as the family members either lowered their doses or kept an already reasonable dose. The potential long-term effectiveness seemed less certain as only Elisabeth would have liked to continue using the prototype. It is

reasonable to believe that Erik would continue with his modest dosing, but that would not be a result of the prototype as it was an already existing behaviour. However, as mentioned, Erik stated that if he would have received proof that the frog cup made him consume less detergent, then he would have been very motivated to continue his use of it. For Eskil and Edwin it is possible that also they would try to continue keeping a low dose, as they now had got an understanding of how little washing detergent that is needed.

Level of Potential Long-Term Acceptability

Eskil had expected to receive a more advanced prototype and was surprised to find out that it was just a measuring cup and that it contained a frog. Elisabeth had no expectations on the prototype and when Elisabeth first saw the frog cup she thought it looked cute and she though the idea to trick the eye with a volume in the cup was clever. She also thought it was a fun idea to put a frog in the cup, instead of just a lump. Edwin remembered that he thought the prototype to be a bit weird when he first saw it. Erik was curious to see what prototypes the project duo had created and he had pictured something of a 'multistage rocket'. He remembers thinking that he would spill detergent when pouring into the frog cup, as he usually shook the package somewhat when he poured detergent on the drum. But he got used to the new procedure of pouring more slowly and he did not remember spilling any significant amounts of detergent. The rest of the interviewed family members reported it easy and quick to get used to the frog cup.

As mentioned, both Elisabeth and Edwin thought the frog cup to be easy to use when pouring detergent into the compartment. Eskil also stated that he thought the prototype to be easy to use and understand. Additionally, as he had gotten more conscious about the environment he thought it felt good to use the frog cup. Erik on the other hand thought the frog to be in the way, and that it was easier not to use the prototype. He also remembered that once or twice when he used the prototype and poured the detergent from the cup down onto the washing machine drum, he thought the resulting pile looked wrong somehow and perhaps too big. During the interview, Elisabeth gave Erik the tip to pour detergent into the frog cup while holding it above the washing machine drum, as it then would matter less if he spilled detergent. As a response Erik said that they would have to make their own frog cup now.

Erik had tried work out the purpose and the functionality of the frog and he wanted it to have some specific meaning. He thought the frog looked nice, and that it was fun and very personal, especially after it got covered by a thin layer of washing powder as he thought the colours then turned softer. He expressed that it then became almost like a frog in snow. He had also been pondering why the rock was narrower at its bottom, if it perhaps was a stump and not a rock, why it was a frog and not an elephant, a seahorse or a fish, if the frog had its origin in some story, etc. Erik thought the measuring cup to be comfortable and soft to hold in the hand. He used to feel a bit happy when he saw the frog cup in the bathroom, and he thought it was homely even when he did not use it. He expressed that if the frog had more functionality, preferable in a fun and engaging way with motion and sound, then he would have used it all the time. However, he reflected upon that then it might have broken down after just a week or two. Noteworthy is that Erik said that he liked frogs already before this study.

Elisabeth thought it was somewhat fascinating to use the frog as it made her reflect over the use of washing detergents. She also thought it was quite fun to fill out the documentation booklets as she liked lists in general. Elisabeth had grown accustomed to the frog cup and she thought it was a pity when the project duo had to reclaim it, as she then started to miss it. She liked the frog and thought it felt good that it brought some order to an otherwise somewhat messy home, as she no longer spilled washing powder. Erik agreed with Elisabeth regarding the loss of the frog cup, and added that he thought it was a pity that the project duo had washed it, which was done as it was displayed to the other households during the closing interviews. Erik had been thinking about taking a picture of the frog when it was still covered by detergent, and he expressed that it had become almost like a very easy-handled pet. He added, in a joking tone, that they had not had time to throw the frog a goodbye party. Eskil and Edwin had however not noticed that the frog no longer was in their home.

Edwin sometimes got tired of documenting his doses, but sometimes he thought the booklets, the frog cup and the kitchen scale to make the washing procedure more fun. Edwin also thought the frog itself to be rather fun, and with a personality. Additionally, he thought it was a bright idea to make a boring measuring cup fun and he saw no need for improving the prototype.

Erik expressed that if he would have received the frog cup without participating in any study he would have liked to try out what else he could have used the frog cup for, i.e. coffee, tea, dishwasher detergent etc. Eskil had also thought about using it for dishwasher detergent, but was unsure about whether or not the recommended amounts for washing powder and dishwasher detergent were the same. Erik did even regret a little that he never tested to use the frog cup for a fluid.

Eskil did not believe that he would buy the frog cup if it was available in stores after the testing period. To him it had already served its purpose as he had started to reflect upon detergent use, which he appreciated. Elisabeth said that it was dependent on the price, and that she would not have bought it prior to the study. Edwin on the other hand believed he could have bought it as it makes the washing procedure more fun and has a character. Erik thought he might have bought it if it was marketed with the information that it reduces one's consumption of washing detergent. But he would not have bought it just because of the frog. Eskil, Elisabeth, and Erik believed they could have bought the frog cup as a present to someone, and as it is an odd object the guessing of its use would be a fun part of the gift.

As Elisabeth liked the frog cup she could imagine having similar measuring cups for other things as well, perhaps with different animals or figures in them that could signal their purposes. Eskil expressed that he would have liked a solution that offered correct dosing without adding an extra step to the washing procedure, and he suggested something that gave away a small dose, suitable for a small amount of laundry, and that one could triple it when filling the whole washing machine.

Regarding the other prototypes Eskil expressed that he thought the package with an integrated dosing system was brilliant. He could imagine

using the tablets if they were smaller or somehow adjustable for different types of laundry. The laundry scale he thought seemed too time-consuming. Elisabeth had similar attitudes as Eskil since she liked the self-dosing package the most, and when finding out that it was based on a real product she said she would look for it in the store. Yet, what she liked with the frog cup in comparison to that package was that one is free to use whichever detergent brand one wants. She said that to weigh her laundry would have been all right but only for a limited period. The volvelle on the other hand she expressed a modest appreciation for. Edwin thought the laundry scale looked quite fun, but the self-dosing package seemed simple, and thus he preferred that one. Erik did not seem to have a specific favourite amongst the other prototypes but he expressed that he foremost believed in changing people's behaviour by making them more aware. Therefore he appreciated the concept of the frog cup.

In Household E4 the acceptance of the frog cup seemed very high, especially for Erik and Elisabeth. Edwin and Eskil had not noticed that the frog cup was gone, but it is possible that they had not done any laundry since the time of its departure and they both expressed positive opinion regarding its oddness and personality. Regarding the long-term acceptability of the prototype there seemed to be no indications that it should be less than the level reached during the evaluation period.

What Impact Did the Design Strategy Have?

For Edwin the important factor seemed to have been that the frog cup made it a little more fun to do the laundry. Even if he stated that he never took more detergent than up to the top of the rock, he never mentioned the environment during the interview. Instead it is possible that a misunderstanding of the study's purpose, which made him use low doses from the very beginning of the documentation period, together with the fact that he seemed to be a novice on the subject of laundry made him aim for low doses irrespective of the frog.

It is somewhat unclear how Eskil determined his doses but he seemed to have used both the frog and the coloured scale on the cup as a guide. He mentioned that he had started to reflect upon

the usage of washing detergent and that he had become something of an environmentalist. It is uncertain where these influences came from, but it is possible that the frog cup acted as a reminder of values and attitudes (see section 3.2.5., paragraph Value and Attitude Reminder).

Both Erik and Elisabeth expressed that they had thought about not suffocating the frog with detergent, and thus it is clear that the message of the frog cup got through to them. However, Erik used rather small doses from the start of the documentation period, with a mean of 34 ml, and had thus no reason for pouring more detergent into the frog cup than he did. Elisabeth herself mentioned the visual illusion, which makes the volume of washing powder in the cup look bigger than it is, as the feature that would make people decrease their doses. Thus, this illusion was probably an important reason to why she decreased her consumption. Nonetheless, since she had an initial mean dose of 92 ml which would have covered the frog, and as the measuring cup's original measurement at the level of the frog's feet is just about 70 ml, it still appeared as if the frog acted as an important guide to her.

8.2.2. Competence and Autonomy

Outline: the Troublesome Laundry Basket

The effectiveness of *Competence and Autonomy* was very high when the prototypes were in use. Nevertheless, only one participant, Christina in Household C1, out of seven continued to use the complete kit throughout the whole prototype testing period. Four of the participants used the prototypes now and then while two of the participants completely ceased to use them. All of the participants found the laundry basket to be very troublesome to use because it could not stand upright without support. For three participants this was the reason for not using the kit at all, with the exception of two washes for one of them. For two others, this resulted in a ceased use of the basket completely for one of them and only occasionally for the other. For one of the participants, Catrin in C4, the troublesome laundry basket was not the primary reason for the ceased use of the prototypes. Instead she stated that she stopped using them because she falsely thought that she

had learnt to estimate suitable doses by eye. Three of the participants maintained a low dose also after their ceased use of some or all of the prototypes. Caroline in C3 completely stopped using them but dosed even less in the third booklet. She explained that she now poured liquid washing detergent for a shorter time than before. Carl and Camilla in household C2 instead used the measuring cup and learnt to estimate the weight of the laundry. They also learnt the most common doses by heart and double-checked them now and then. The same goes for Christina that after withdrawal of the prototypes started using another measuring cup but tried to dose as when she had the prototypes. Three participants reported high doses in their third booklet. Curt, in C3, and Catrin, in C4, used even higher doses than in their first booklet while Clara in C4 had a very high mean dose already in her first booklet. The reasons for the increased doses were never completely understood, neither by the participants nor by the project duo. All of the households used the correct setting of water hardness on the volvelle even if they lacked previous knowledge. Some of the participants that reported that they used the prototype rather seldom and they got unsure of the procedure from one time to another which of course increased the risk of an incorrect procedure.

The acceptability of the laundry basket was, as mentioned, very low. The most prominent problems were that he laundry basket could not stand upright without support and the hassle of putting in and taking out the laundry before each wash. If the households would have gotten more than one basket and could have sorted and stored the dirty laundry in different baskets they would only have to check the weigh by lifting and then moving the content to the washing machine. This idea was also promoted by two households. On the contrary, the acceptability of the volvelle and the measuring cup was generally high.

If the strategy of *Competence and Autonomy* had an impact on the behaviour, then the behaviour should be performed also without prominent external motivation. Indications of this were that many of the participants reported that they found it enjoyable to get to know the weight of the laundry and to use the volvelle. Furthermore, the accuracy in measuring reported by all of the participants indicated that they started to

acknowledge the importance of correct dosing. One of the participants, Carl, saw the accuracy as a competitive element. Two of the participants, Christina and Camilla in C1 and C2 got very high scores on environmental attitudes (5.5 out of 6) and this might have been a strong motivational factor for them.

Household C1

Essential characteristics of Household C1 are presented in table 16.

Level of Potential Long-Term Effectiveness in Inducing Target Behaviour

The effectiveness of the dosing kit was very high. The mean dosing reported in Christina's three booklets were 58 ml (density unknown), 38 ml and 37 ml, respectively (see figure 62). The difference in mean between the first and the second booklet is significant (p=0.021, one-sided and unequal variance). The difference in mean between the first and the third booklet was also found to be significant (p=0.019, one-sided and unequal variance). The very little difference in mean between the second and third booklet showed no significance, as expected as she dosed in the same way (p=0.92, two-sided and unequal variance).

Christina used the complete kit during the whole testing period, also between the second and third booklet as she appreciated to make the procedure habitual. In total, Christina received four packages of washing detergent.

Soon after receiving the dosing kit, Christina had reserved the laundry room. As she still had the information about the kit fresh in memory the new procedure was easy to take in. She understood how to use the prototypes and did not find it difficult. She found it exciting to get to know the weight of the laundry and enjoyable to use the volvelle. Christina used to sort the laundry in the apartment and then carried it to the laundry room where she weighed every wash in the laundry basket. She was satisfied with the washing result.

Christina used three different doses, 20 ml, 45 ml and 70 ml, where the two lower doses were more frequently used and the only ones reported in the booklets. The mean doses reported in the booklet for these washes were 27 ml (6 washes) and 58 ml (4 washes), respectively. The difference in mean was significant (p=4.8·10-8, one-sided, unequal variance). Christina claimed to be very precise when measuring the detergent. Therefore, the reason for the difference between the mean doses derived from the weight of the dose and the

Members of household:	Christina
Age:	56 years
Occupation:	Mental training practitioner
Environmental attitudes:	Ecotype F(3) + actions(2.5) = 5.5 points (out of 6)
Previous dosing behaviour:	For powder detergent she used a one decilitre measuring cup and estimated the amount needed. For liquid washing detergent she used the cap to pour in and estimated the amount
Used to dose according to type of wash:	Both according to amount of laundry and dirtiness of laundry
Read dosing instructions:	Maybe a quick glance
Previous knowledge of Gothenburg's water hardness:	Yes

Table 16. Essential characteristics of Household C1.

recommended dose is thought to be incorrectness in millilitres indications on the measuring cup or changes in density due to compactness resulting from shaking.

Christina remembered that she during the prototype testing period used three different dosing recommendations. Yet, at the interview, she mentioned that she needed the volvelle again as she was going to wash covers, which was unusual for her.

During the testing period, Christina visited Gryaab, the regional sewage works of the Gothenburg region, at an open house day for the public. She learnt about this event at Gryaab from the local newspaper and the reason for going there was according to Christina her participation in the study. She found it exciting to learn more about water. At Gryaab, she got a measuring cup for washing detergent and asked for additional cups to place in the common laundry rooms and stickers for washing machines informing about the water hardness in Gothenburg and an exhortation to dose carefully. Christina seemed eager to spread the behaviour of correct dosing, but found it difficult, as she did not know where to buy suitable dosing equipment.
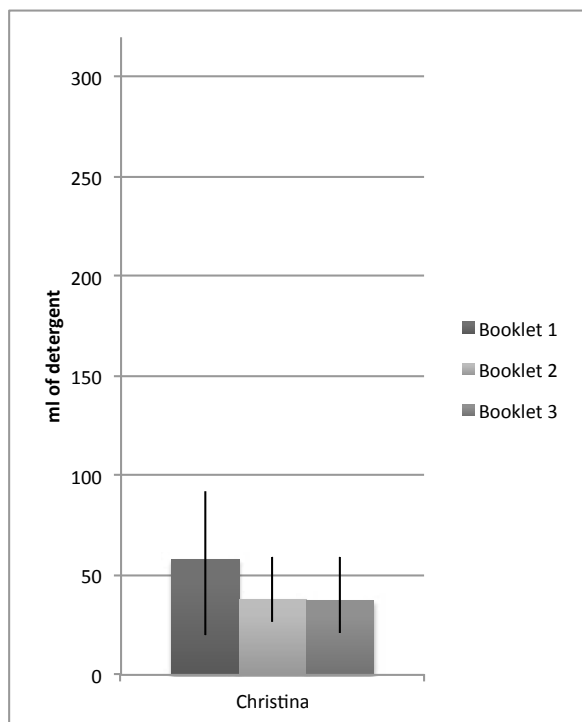

Figure 62. The mean doses of booklet 1, 2, and 3 from Household C1. The error bars represent the maximum and minimum dose in every booklet.

After the testing period, Christina started to use the measuring cup from Gyaab, which holds 55 ml. She also thought about getting a measuring cup similar to the one in the dosing kit. Yet, she decided to give up this ambitious endeavour and decided to content herself with the one from Gryaab. At the time of the interview, she had never filled this cup completely and 55 ml was considered as a large amount of detergent in comparison with the doses recommended by the volvelle. Furthermore, she mentioned that she now had some idea of the weight of her laundry, but she reckoned that she might use slightly more now than with the kit. In comparison with before the study, Christina thought that she after the prototype testing period used less, especially for small amounts of laundry. She mentioned that the laundry does not become cleaner just because more washing detergent is used. Instead, the washing detergent stays in the fabric.

Christina thought that she after the study would buy the kit if easily available at the stores. She also thought that she would have tried the dosing kit even if she had not participated in the study, as she is very curious. In that case, she thought that she would have used the kit more than once if it was durable and water resistant. But she was more doubtful to whether she prior to the study would have bought the kit.

Christina voluntarily continued the use of all the prototypes during the whole testing period. Christina was asked whether she would want to continue dosing as during the prototype testing and she replied that she would not want that. Yet, it was unclear if this statement included weighing the washing detergent and filling in the booklets or not. However, she seemed to want to learn to estimate the weight of laundry without the laundry basket and to use a measuring cup.

The effectiveness of the kit during the testing period was very high. During the study, Christina learnt to estimate the weight of the laundry and approximately what doses of detergent that are recommended and thanks to a measuring cup from Gryaab, she applied this knowledge. The procedure is rather time consuming and therefore it is uncertain for how long she would continue the use of all three prototypes. Yet, it is not necessary to always use all of them. As she already had learnt the doses

she used most frequently by heart and had learnt how to estimate the weight of the laundry, she could have started to use the laundry basket and the volvelle only occasionally to make ensure that her weight estimations were right and when forgetting dosing recommendation or when washing unusual washes. Under these circumstances, the potential long-time efficiency seemed high.

Level of Potential Long-Term Acceptability

In general, Christina found it exciting and interesting to use the prototypes. The reasons for participating in the study were Christina's curiosity and her wish to learn more about environmental issues. It felt good to use the kit and as she felt sure about the dosing.

Christina already made efforts for the sake of the environment. An example is that she some time ago decided to have as little electronic devices as possible in her bedroom and that she tried to unplug e.g. the computer and lamps when not using them. She also tried to use nothing but soft soap and washing-up detergent for cleaning the home. She used to live in a neighbourhood where environmental issues were in focus.

As mentioned, Christina found it exciting to get to know the weight of her laundry. Yet, the laundry basket was found to be difficult to use. Firstly, it did not stand upright without support and therefore it was difficult to put the laundry in it. Furthermore, it could not be stored and transported in a space-efficient way. The scale in the handle did not always work smoothly and she had to fiddle with it in order get it to weigh the laundry properly. The supporting spring steels in the corners of the basket from time to time came out of their tubes and hit Christina's wrist when lifting the basket. Christina even closed the top openings of the tubes with stitches in order to prevent this from happening. Finally, Christina would have preferred a water resistant basket as the floor in the laundry room sometimes is wet.

Christina liked the volvelle very much. She found it easy and enjoyable to use. She liked that she could get dosing recommendations for other locations as well. An improvement of the volvelle would be to make it water resistant.

The measuring cup worked well and Christina could easily read the numbers. She thought that the cup was made out of glass and that had made her anxious about dropping it. Christina was surprised when she learnt that it was made out of plastic.

Christina had not used the washing detergent Neutral before and she appreciated that it was non-perfumed. She continued to use her ordinary fabric softener. Usually, she changed brand from time to time and used both liquid washing detergent and powder detergent.

Christina had not discussed the study with anyone else. She thought that this type of products is easily spread via friends. Christina was pleased that she had tested the prototype of *Concept and Autonomy* even though she thought that tablets seemed handy and the frog cup to be amusing, especially for children.

The acceptability of the dosing kit was very high despite difficulties in handling of the laundry basket. Christina was particularly fond of the volvelle. The acceptability seemed related to the fact that she was eager to learn more about environmental issues and to her general curiosity, e.g. her excitement about knowing the weight of her laundry. The potential for long-term acceptability was hard to estimate. No change in acceptance during the prototype testing was reported, nevertheless, as it is a hassle to use the whole kit one might get tired of it. If the problems with the handling of the laundry basked would be solved and Christina would start to use laundry basket and the volvelle only occasionally, the potential for long-term acceptability seemed high as she still would feel good for doing positive things for the environment, yet without the hassle of using all the prototypes.

What Impact Did the Design Strategy Have?

When using the dosing kit, Christina thought about the environment and felt good about herself. She found it enjoyable to get to know what doses to use for different washes and exciting to find out the weight of her laundry. When using the measuring cup she was very accurate and she reported that she was equally accurate when not filling in the booklets. The accuracy in measuring reflected that she agreed on the importance of correct dosing. It

is difficult to tell whether she felt competent and autonomous. However, she enjoyed learning more about dosing and she seemed highly motivated to perform the behaviour with great accuracy without the presence of obvious external incentives.

Household C2

Essential characteristics of Household C1 are presented in table 17.

Level of Potential Long-Term Effectiveness in Inducing Target Behaviour

The target behaviour was adopted throughout completion of the second booklet and maintained to some extent during the rest of the testing period. The measuring cup was used during the whole testing period. The laundry basket was used occasionally in the third booklet but not used at all in between the booklets. The volvelle was used in the third booklet and occasionally between the booklets as Camilla and Carl had learnt the most frequently used doses by heart but still had to remind themselves of them from time to time. The mean dosing values reported in Camilla's three booklets were 65 ml (density unknown), 68 ml and 67 ml, respectively. No significant difference in the mean values was found. (Test of first and second value gave p=0.42, one-sided and unequal variance. Test of first and third value gave p=0.43, one-sided and unequal variance. Test of second and third gave p=0.96, two-sided and unequal variance.) The mean dosing values reported in Carl's three booklets were 100 ml (density unknown), 53 ml and 81 ml, respectively. No significant difference in the mean values was found despite considerable differences in mean, possibly because there were only four washes per booklet in the second and third booklet. (Test of first and second value gave p=0.056 one-sided and unequal variance. Test of first and third value gave p=0.21, one-sided and unequal variance. Test of second and third gave p=0.092, two-sided and unequal variance.) The mean doses can be seen in figure 63. In total, the household received four packages of detergent.

Members of household:	Camilla	Carl
Age:	28 years	32 years
Occupation:	Student	Informant at a university
Environmental attitudes:	Eco-type F(3) + actions(2.5) = 5.5 points (out of 6)	Eco-type A(2) or F(3) + actions(2) = 4.5 points
Previous dosing behaviour:	Poured directly from the washing powder package into the detergent compartment of the washing machine	Same as Camilla
Used to dose according to type of wash:	Used less washing detergent for small amounts of laundry, but rather on the large side	No
Read dosing instructions:	No	Not currently, but did so when he lived with his parents
Previous knowledge of Gothenburg's water hardness:	No	No

Table 17. Essential characteristics of Household C2.

The laundry basket was placed in Camilla and Carl's own laundry basket. As a consequence they had to take out all the laundry inside in order to weigh the laundry. They both thought that this procedure was very troublesome. Therefore, Carl discussed the advantage of having one basket for coloured laundry and one for white laundry but also commented that two baskets would take up a lot of room. At one time in the beginning of the prototype testing period the scale of the laundry basket was set on pounds. This caused very high recommended doses of washing detergent and they dosed accordingly. However, Camilla and Carl eventually understood what the problem was and it never happened again. Besides this, Camilla thought that it was easy to understand how to use prototypes and throughout completion of the second booklet Carl and Camilla used them as intended. Apart from the task of weighing the washing detergent package Camilla stated that she got used to the prototypes. Carl did not often do the laundry. Hence, he never developed a habit as he used the prototypes seldom and forgot how to use them properly in the mean time.

The volvelle was appreciated by both Carl and Camilla. The map with water hardness was helpful,
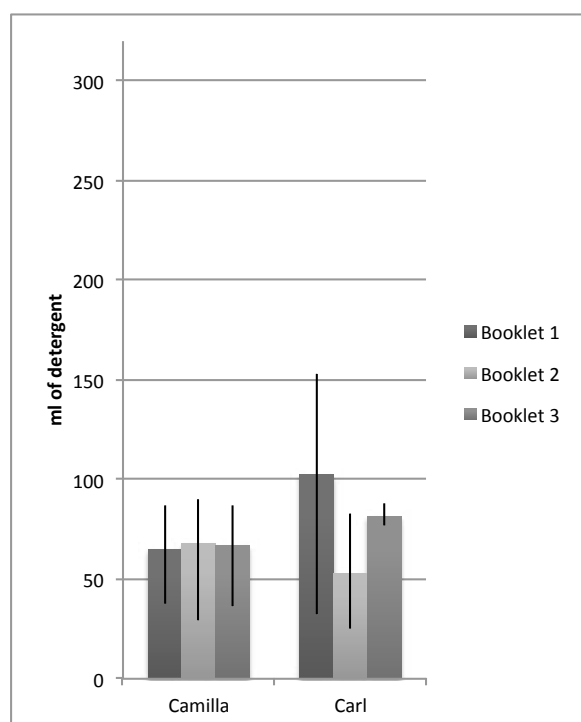
as none of them knew the hardness of the water in Gothenburg. They did not learn the water hardness; instead the volvelle was always set on soft water while they changed the other parameters. Camilla and Carl moved between the second and third booklet. In the first apartment they did their laundry in a common laundry room. In their new apartment they had access to a private washing machine and a more exceptionally used a common laundry room. When using the private machine the laundry always weighed the same as they always filled the machine. Therefore the different doses recommended by the volvelle were very easy to learn by heart. Both Camilla and Carl were accurate when using the measuring cup and retained the accuracy throughout the testing period, which is important as accuracy ensures efficiency. During the prototype testing period, Camilla and Carl used fabric softener because the washing detergent was non-perfumed.

Carl and Camilla mentioned that there was always a risk of forgetting to bring the prototypes when going to the common laundry room. Therefore, they would have preferred a dosing aid that was integrated with the detergent.

They knew that they were allowed to stop using the prototypes after completion of the second booklet. Both of them though that they would have used the measuring cup and the volvelle to the same extent also if they would not have participated in a study. Carl thought that he would have used the measuring cup with the same accuracy. The laundry basket would only have been used a few times in the beginning.

Carl mentioned that he after the study found correct dosing to be more important than before. Camilla thought that she was quite good at dosing correctly even before the study. Both of them had reflected over their dosing when filling in the booklets and they acknowledged that this might have had an impact on them. They did not know how they would dose after withdrawal of the prototypes. They thought about getting a measuring cup, but they were afraid that the measuring cups available in stores would have too few gradations. If they managed to get hold of a measuring cup, they would try to remember the doses recommended by the volvelle and dose accordingly. Otherwise, they had no idea of how their dosing

Figure 63. The mean doses of booklet 1, 2, and 3 from Household C2. The error bars represent the maximum and minimum dose in every booklet.

practices would be in the future.

The effectiveness in inducing the target behaviour was very high when all of the products were used. Interestingly, the efficiency seemed high also when using the measuring cup and occasionally the volvelle, as Carl and Camilla learnt the most commonly used doses by heart and the weight of laundry when their private washing machine was full. The potential for long-term effectiveness seemed high as long as they would have continued access to the measuring cup and the volvelle since they voluntarily continued the use of them and stated that they would have done it even if they had not participated in a study. They both reported accuracy in measuring and this is of course important for efficiency. If they would buy a measuring cup and try to dose according to dosing matrixes on the package their lack of knowledge of Gothenburg's water hardness would be a problem.

Level of Potential Long-Term Acceptability

Both Camilla and Carl appreciated the measuring cup and the volvelle very much, while they found the use of the laundry basket to be extremely troublesome, especially the task of taking out the laundry stored in the basket and putting in laundry to weigh it. As mentioned, Carl commented that two laundry baskets would facilitate this task, yet two baskets would take up a lot of room.

Camilla felt confident about her dosing when using the measuring cup. She felt a need for a measuring cup also prior to the study as she when living with her parents had used a dosing ball. She had been looking for a measuring cup but not very actively. Camilla found the washing with all of the prototypes to be more tedious that without them. But when she only used the measuring cup and the volvelle she thought that it felt better than with no dosing aid at all as she then knew that she did not waste washing detergent as she thought that she might have done prior to the study. Furthermore, she reported that prior to the study she was not comfortable with not keeping check on her dosing.

Initially, Carl saw a potential for savings with the prototypes. He thought that it felt good to use the measuring cup and the volvelle as he then knew that he dosed correctly. He stated that he experienced a positive feeling, yet a modest one.

Nevertheless, the fact that he towards the end of the prototype testing did not weigh the laundry seemed to make him slightly more doubtful regarding the correctness. For Carl, the use of the prototypes never became habitual and this made the use more tedious as he had to put effort into remembering how to use them. Carl mentioned that to him, the reduction in environmental impact resulting from correct dosing was more important than the economic savings.

Camilla mentioned that most of her friends have no dosing aid and that they wanted to have a measuring cup. When Camilla had told her friends about the laundry basket, they thought that it seemed troublesome to use.

As mentioned above, they would have preferred a dosing aid that was integrated with the washing detergent package. Carl wanted to be able to scratch with the measuring cup if the detergent forms a hard surface or lumps.

Carl and Camilla found it troublesome to no longer have access to the measuring cup and the volvelle and Camilla said that she would miss the measuring cup. They would have bought the measuring cup and the volvelle if they would have found it in a store if they were located close to the washing detergent and were sold at a reasonable price. Around 30 SEK for the measuring cup and the volvelle was thought to be an acceptable price. Camilla thought she would have bought the measuring cup and the volvelle prior to the study as she was looking for a measuring cup. Carl thought that he might have bought the measuring cup and volvelle. He wanted them to be connected to a specific brand and that they were bought as optional accessories to the washing detergent package.

Scripting seemed smart and handy in Carl and Camilla's opinions. But if the package would give uneven doses they would immediately dismiss it and they did not want to visit a different store only to get hold of it. Carl liked *Habit Intervention*, partly due to the perceived enjoyment in tearing off the paper, yet he thought that it could be a problem that it was for soft water only as he did not know the water hardness and he found the dosing to be too inflexible. *Eco-Affective* was thought to be unnecessary as they did not have to be reminded that it is important to dose

moderately. Yet, Carl mentioned that it would have been easier and more pleasant to use the frog as a gradation than the lines of the *Competence and Autonomy* measuring cup.

The acceptability of the measuring cup and the volvelle was very high. Camilla and Carl stated that they would continue to use the measuring cup and the volvelle if they would have had continued access to them or buy them if they were for sale. This indicated that the potential for long-term acceptability also was very high. Both Carl and Camilla thought that it felt satisfactory to dose correctly and the high acceptability seemed to be related to these feelings. The acceptability of the laundry basket was very low as Carl and Camilla found it troublesome to first empty the laundry basket and then refill it in order weigh the clothes. Carl commented that the weighing of the clothes would have been much less troublesome with two laundry baskets.

What Impact Did the Design Strategy Have?

As mentioned, both Carl and Camilla experienced that they dosed correctly and they thought that it felt satisfactory to do so. This indicated that they with the system were more competent as they prior to the study knew that they dosed by chance. Furthermore, the feelings of satisfaction indicated that they felt motivated to dose correctly, yet the reason for the motivation was not obvious. Carl mentioned that he saw it as a competitive element to get the amount of washing detergent very exact. If it was not perfect, he would pour back washing detergent into the package. After explaining the idea of *Competence and Autonomy* Carl mentioned that he found it enjoyable to use the volvelle, at least in the beginning. Carl also mentioned the reduction of environmental impact as an advantage. Thus, for Carl there seemed to be a motivational factor in the use itself but also by the reduction in environmental impact. Interestingly, the exactness in dosing was important for both Carl and Camilla when judging the other concepts in the study. Camilla was accurate in her measuring, but she did not report the same level of accuracy as Carl. After explaining the idea of *Competence and Autonomy* Camilla mentioned that she thought that for this to work one should have the traits of a chemist and she did not have it. Since long before the study, Camilla thought she needed a measuring

cup and had been looking for one. For her, this might have been the most prominent motivation. The use of the laundry basket did not add to the feelings of competence and autonomy as the use of it was found to be tedious.

Household C3

Essential characteristics of Household C3 are presented in table 18.

Level of Potential Long-Term Effectiveness in Inducing Target Behaviour

The target behaviour was adopted throughout completion of the second booklet, in which all of the prototypes in the dosing kit were used. After completion of the second booklet, when the use of the prototypes became non-compulsory, both Curt and Caroline stopped using all of the prototypes. In the third booklet, Curt did not maintain the moderate dosing behaviour while Caroline continued to dose even more moderately. The mean dosing values reported in Curt's three booklets were 69 ml (density unknown), 53 ml and 92 ml (density unknown), respectively, see figure 64. The difference in mean between the second and the third booklet were found to be significant ($p=0.036$, two-sided and unequal variance), while the difference in mean between the first and the second booklet as well as the first and third booklet were found to not be significant ($p=0.081$, one-sided and unequal variance; $p=0.19$, two-sided and unequal variance). The mean dosing values reported in Caroline's three booklets were 81 ml (density unknown), 68 ml and 44 ml (density unknown), respectively, see figure 64. The difference in mean between the first and the third booklet was found to be significant ($p=0.013$, one-sided and unequal variance), while the difference in mean between the first and the second booklet as well as the second and third booklet were found to not be significant ($p=0.21$, one-sided and unequal variance; $p=0.078$, two-sided and unequal variance). In total, the household got two bottles of washing detergent at the time of the interview they still had washing detergent for white laundry left.

Initially, Curt was very sceptical to the cleaning result of the doses recommended on the volvelle. With such moderate amounts of detergent he thought that the laundry would not be cleaned

properly and that he would have to wash them again. He thought that the doses on the volvelle were even smaller than recommendations on washing detergent packages. But, in the course of the testing he learnt that the laundry got clean also with moderate doses.

In the beginning Caroline and Curt mentioned that it was difficult to use the dosing kit and to remember what to do and in what order. Caroline mentioned that she had to read the instructions. It was not clear what instructions she referred to, but it might have been the course of actions illustrated in the second booklet. Curt mentioned that he missed steps and had to go back and redo it. Of course, the difficulty of the task increased the risk for mistakes. However, they both thought that they learnt the course of actions quickly, a couple washes were all that was needed. When they later in the interview were asked about the use in general, both of them replied that it was rather simple to use the prototypes.

Both Curt and Caroline used the measuring cup and not the dosing ball because the measuring cup had more gradations and it was easier to read on the measuring cup. They stated that they were very accurate when dosing. Caroline reported that she now and then poured detergent back into the bottle if she had taken too much and Curt that he held the measuring cup upside down for a little while to let the liquid washing detergent drain off into the washing detergent compartment. They reported that they tried to be accurate when filling in the booklets and the accuracy in measuring washing detergent was a part of this general accuracy.

Curt and Caroline stored their laundry in their private laundry basket. When washing, the laundry was moved from their private laundry basket to the laundry basket with scale and the laundry

Members of household:	Curt	Caroline
Age:	36 years	34 years
Occupation:	-	Interpreter for people with speech impairments
Environmental attitudes:	Eco-type A(1) + actions(0.5) = 1.5 points (out of 6)	Eco-type B(0) or E(1) or D(2) + actions(0.5) = 1.5 points
Previous dosing behaviour:	Used liquid washing detergent and poured directly from the package into the detergent compartment of the washing machine, and rather too much than too little	Same as Curt. She might have used more if the washing detergent package was full
Used to dose according to type of wash:	According to amount of laundry; if the washing machine was full or half full	No
Read dosing instructions:	No	No
Previous knowledge of Gothenburg's water hardness:	-	-
Additional members of household:	Their daughter, 1 year old	

Table 18. Essential characteristics of Household C3.

was weighed. This task was found to be very troublesome partly because the basket could not stand upright without support. Caroline complained about the laundry basket. If the laundry basket had been easier to use, Caroline believed that she might have continued to use the dosing kit, at least now and then. Curt said that the troublesome laundry basket made him unwilling to continue the use of the prototypes after completion of the second booklet.

Curt thought that the liquid washing detergent brand of the volvelle was not available in the store. Otherwise, he might have bought it because the doses on the volvelle would have matched and because he was satisfied with the washing result.

Caroline thought that if she had continued the use of the laundry basket and the volvelle, she would rather quickly have learnt to estimate the weight of the laundry and the most frequently used doses by heart. This would have simplified the process and she expressed regret over not doing so.

Curt reported that he fell back into his old routines when he stopped using the dosing kit. He commented it as a result of laziness and that
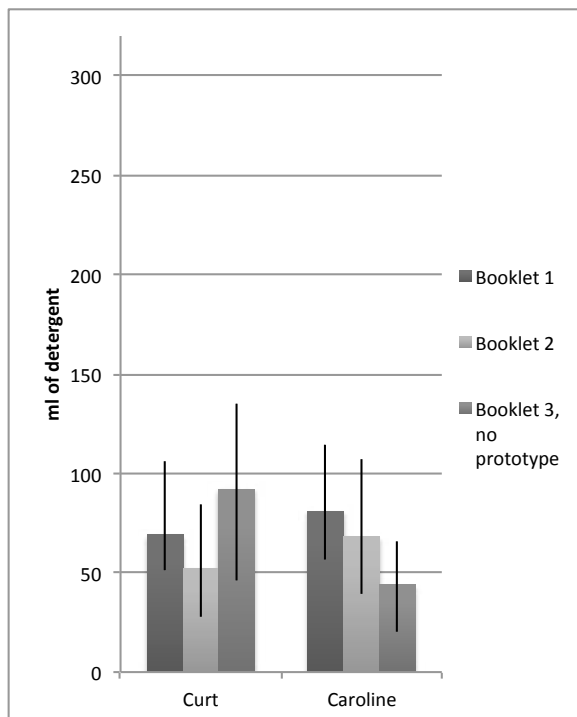

Figure 64. The mean doses of booklet 1, 2, and 3 from Household C3. The error bars represent the maximum and minimum dose in every booklet.

awareness of correct dosing was forgotten. Nevertheless, he did not know why he in the third booklet used even more than in the first booklet. He commented that when dosing without any dosing aid, there are often great differences in the doses. Furthermore, he thought that he in general used more detergent when dosing in a hurry, even though he did not know if that was what happened in the third booklet. After Caroline stopped using the dosing kit, she said that she had choosen to use less than before the study and that she believed that the laundry would get clean anyway. When pouring washing detergent out of the bottle she poured for a shorter time period towards the end of the study than prior to the study. Nevertheless, she did not seem confident that this behaviour would be maintained as she in a humours tone added that in two months, she might use as much as Curt did. The participation in the study did not affect Curt and Caroline in any other context.

The effectiveness in inducing the target behaviour was very high when the prototypes were used. Nevertheless both Curt and Caroline stopped using them as soon as they completed the second booklet. Even though Curt reported that he had learnt that moderate doses are enough for a clean result he increased his doses significantly when he stopped using the prototypes. The potential for long-term efficiency in inducing the target behaviour thus seemed very low. Caroline kept a low dose when she ceased to use the prototypes and she reported a shift in behaviour practices, i.e. to pour for a shorter time. Yet, there is no guarantee that this behaviour will be maintained, therefore, the potential for long-term efficiency in inducing the target behaviour seemed moderate. The reason for the ceased use of the prototypes was for both Curt and Caroline the troublesome laundry basket. If the basket would have been easier to handle, Caroline stated that she might have continued to use the prototypes now and then and eventually learnt to estimate the weight of laundry or the most commonly used doses by heart, as she mentioned that she regretted that she did not learn this in the course of the study.

Level of Potential Long-Term Acceptability

As mentioned, both Curt and Caroline found the laundry basket very troublesome to use as it could not stand upright without support. Apart from

that, Curt mentioned that the procedure went smoothly and that the measuring went fast.

Caroline thought that it was exiting to receive the product. As mentioned, Caroline and Curt found it difficult to use the prototypes for the first times. With initial difficulties there is of course a risk for low acceptability of the prototypes. Nevertheless, both Curt and Caroline reported that they learnt the course of action after a few washes.

They both felt as if they dosed correctly with the dosing kit and Curt mentioned that he thought it was fun to get to know what dose to use. After explaining the strategies behind the dosing kit, Curt added that in the beginning of the use of the volvelle it felt 'scientific' and as if he did a calculation, a cool feeling. Yet, after using the volvelle for a couple of times Curt knew on beforehand what the doses would be and the coolness ceased. Both Curt and Caroline found it enjoyable to find out the weight of the laundry. Curt pointed out that this information was useful as well as they then knew that they did not exceed the capacity of the washing machine.

When talking to people at work about the project, Caroline mentioned that they thought that it sounded interesting. Caroline thought that others would be interested in using the prototypes if the use would have been easier. The economical benefits of reduced use of washing detergent were acknowledged by both Caroline and Curt and the environmental benefits were mentioned by Caroline. If these prototypes would be sold, they believed that the economic benefits should be emphasised. Yet, for Curt himself, only this argument would probably not have convinced him to buy the laundry basket. As the laundry basket was used only as laundry scale, Curt saw it as a scale only. He then suggested that it should be sold as a laundry basket with the added function of weighing the clothes and this might convince him to buy it. Caroline mentioned that she want a laundry basket that is good looking as they have a small place to live. If they would have lived in a bigger apartment, Caroline would have wanted a system of laundry baskets that allowed sorting of the laundry right away. An even better solution would be if the washing machine weighed the laundry. Curt and Caroline would not have bought the volvelle, as they saw it as something one should get for free.

Yet, Caroline mentioned that if the volvelle would be made universal and given a more aesthetically pleasing appearance she thought that it could be sold at Designtorget (a store with unique products for customers that value style, function and innovation (Designtorget, 2011)) and that she and many others in that case would buy it, e.g. as a Christmas gift for a person you do not know what to give to. As Curt and Caroline no longer used the prototypes they were not bother about no longer having access to them.

Both Curt and Caroline thought that *Scripting* was smart, as it forces the user to dose deliberately. Curt found the tablets to be simple and handy. Apart from Caroline's general preference for liquid detergent, she questioned how to dose for a half full machine with the tablets. The frog in the *Eco-Affective Design* concept was thought to be in the way and to get messy.

In general, the acceptability of the prototypes was very low due to the difficulties in using the laundry basket. Hence, the potential for long-term acceptability seemed very low as well. The acceptability for the volvelle and the measuring cup seemed somewhat higher, yet it is hard to estimate this as the prototypes never were used separately.

What Impact Did the Design Strategy Have?

In general, Curt and Caroline were not motivated to use the prototypes as they only did so during completion of the second booklet. Hence, the strategy of *Competence and Autonomy* failed. The reason for its failure seemed to be the troublesome laundry basket. In addition, Caroline and Curt found it tricky to use the prototypes for the first times and Caroline reported that she had to read the instructions. This certainly did not add to the feelings of competence and autonomy. Nevertheless, they did find it interesting to get to know the weight of their laundry and Curt experienced competence when he used the volvelle for the first times, as elaborated on above. Furthermore, they did think that they dosed correctly when using the system. They were very accurate when measuring. Hence, they acknowledge the importance of correct dosing, at least in a study context.

In promotion of the use of the prototypes to others, Caroline and Curt stressed the importance

of highlighting the economic benefits of reduced consumption of washing detergent. If this holds for Caroline and Curt as well, it suggests that the strategy of Incentives was important to them even if the reward was not satisfactory worked out as they stopped using the prototypes.

Household C4

Essential characteristics of Household C4 are presented in table 19.

Level of Potential Long-Term Effectiveness in Inducing Target Behaviour

The target behaviour was adopted throughout completion of the second booklet, in which all of the prototypes in the dosing kit were used. After completion of the second booklet when the use of the prototypes became non-compulsory, both Clara and Catrin stopped using the prototypes, with the exception of Catrin that used the measuring cup now and then between the booklets and two washed reported in the third booklet where Clara used the dosing kit. In the third booklet both Clara and Catrin showed no preservation

of target behaviour, except for the two washed by Clara in which she used the dosing kit. The mean dosing values reported in Clara's first two booklets were 118 ml (density unknown) and 64 ml, respectively, see figure 65. In the third booklet she reported two washes where the prototypes had been used with the mean of 86 ml and six washes without the prototypes with the mean of 127 ml). The difference in mean between the second booklet (64 ml) and the six washes without prototypes in the third booklet was found to be significant (p=0.011, two-sided and unequal variance). No significant difference between the second mean value and the third mean value with the prototypes was found, maybe due to the fact that only two washes were reported (p=0.60, two-sided and unequal variance). No significant difference between the first mean value and any other mean value was found, maybe due to the fact that Clara reported only three washes in her first booklet. (Test of first mean value and second mean value gave p=0.19, one-sided and unequal variance. Test of first mean value and third mean value without the prototypes gave p=0.49, two-sided and unequal variance. Test of first mean value and third mean value with the prototypes gave p=0.39, one-sided and unequal

Members of household:	Clara	Catrin
Age:	19 years	58 years
Occupation:	Student	Teacher
Environmental attitudes:	Eco-type A(1) + actions(1) = 2 points (out of 6)	Eco-type D(2) or E(1) + actions(1) = 2.5 points
Previous dosing behaviour:	Pouring directly from the package	Same as Clara
Used to dose according to type of wash:	Yes, to some extent, but she did not specify in what way	No
Read dosing instructions:	No	No
Previous knowledge of Gothenburg's water hardness:	-	-
Additional members of household:	Father/husband	

Table 19. Essential characteristics of Household C4.

variance.) The mean dosing values reported in Catrin's three booklets were 64 ml (density unknown), 66 ml and 106 ml, respectively, see figure 65. The difference in mean between the first and the third booklet was found to be significant (p=0.026, one-sided and unequal variance). The difference in mean between the second and third was also found to be significant (p=0.029, one-sided and unequal variance). The difference in mean between the first and the second booklet was not found to be significant (p=0.42, one-sided and unequal variance). In total, the household were given four packages of washing detergent.

Both Clara and Catrin mentioned that they used somewhat less washing detergent in the first booklet than prior to the study as they got more aware of their dosing behaviour when writing down the weight of the washing detergent packages. Clara mentioned that she reacted negatively when the weight after dosing passed a hundred. Both of them did not want to seem wasteful as it is not environmentally friendly to be wasteful and they felt monitored.

This household had a private washing machine. They kept the laundry basket in the cellar next

Figure 65. The mean doses of booklet 1, 2, and 3 from Household C4. The error bars represent the maximum and minimum dose in every booklet.

to their washing machine. The dirty laundry was stored elsewhere in another basket and the laundry to be washed was brought down to the cellar. There, they put the laundry into the laundry basket and weighed it. Thereafter, they proceeded as intended.

As mentioned, after completion of the second booklet Catrin now and then used only the measuring cup. She did aim for a specific amount of washing detergent, but reported that she thought she used very little. She thought that the fact that the measuring cup was transparent made her use less washing detergent as she could see the detergent from the side and not only from above. When using the prototypes Catrin used to think about the final water basin at Gryaab, the regional sewage works of the Gothenburg region, which she had visited many times at field trips with her young students. In this final basin Catrin explained that the water is completely clean except for surfactants from washing detergent, as surfactants cannot be satisfactory removed from the water in the cleaning processes at Gryaab. The water from Gryaab is let out close to where Catrin and Clara lived. When dosing moderately, Catrin thought about that she facilitated the cleaning process at Gryaab.

If they had not participated in a study, Clara believed that she would not have used the prototypes at all as she found it very troublesome to use them. The weighing of the laundry was according to both of them the most tedious task as the laundry basket, partly due to the fact that the laundry basket did not stand upright without support. Both Clara and Catrin said that they trusted the system and Clara added that the laundry got as clean as before. They tried to be rather accurate when using the prototypes and they noticed that they used less washing detergent with the dosing kit.

Clara stopped using the prototypes because doing the laundry is something she just wanted to get over with as she did not find it enjoyable to do the laundry. Catrin stated that she stopped using the prototypes because she got better at estimating a suitable dose also without a measuring cup and got more aware of how much to use. Clara mentioned that they talked about only using the measuring cup and maybe the volvelle but they did not as they needed to know the weight of the laundry
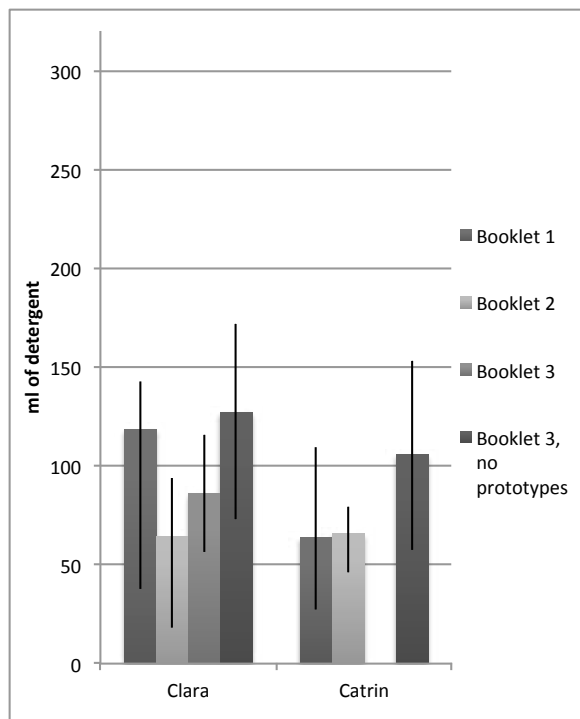
in order to know how much washing detergent to use. Catrin thought that the whole study, i.e. also including the initial phase of only weighing the washing detergent, increased her awareness. Furthermore, she thought that both she and Clara were already prior to the study moderate in their dosing and that she after the study probably was even more moderate.

When using the prototypes, Catrin and Clara both noticed that they used less and talked about this with each other. Clara noticed that the washing detergent compartment did not become as filled up as prior to the prototype testing. After the use of the prototypes Clara employed the same dosing practice as prior to the prototype testing, with the difference that she was more aware of her dosing and tried to dose moderately. Furthermore, she thought that she dosed more moderately than prior to the study as she in course of the prototype testing had learnt that the washing detergent compartment did not have to be filled as high up as she used to fill it. She had learnt that she used too much washing detergent before the study and that one does not need that much washing detergent. Catrin said that she might start using a measuring cup from her kitchen. She used to have it when she had bigger washing detergent packages that one could not pour directly from.

Both Clara and Catrin were surprised when they learnt that they had increased their mean value in the third booklet and stated that they henceforth would try to dose less. Catrin even stated that she now had to acquire a measuring cup.

The effectiveness in inducing the target behaviour was very high when the prototypes were used, except that Clara and Catrin did not report the same level of high accuracy in measuring as the other households of *Competence and Autonomy*. Nevertheless, Clara stopped using the prototypes as soon as she completed the second booklet and she then returned to using, high doses, even though she tried to maintain moderate dosing and thought she managed to do it. Catrin stopped using the laundry basket and the volvelle as soon as she completed the second booklet. She continued to use the measuring cup now and then, but she did not use it when she filled in the third booklet, thus, her mean dosing with the measuring cup only was not reported. Catrin thought that

she during the use of the prototypes had learnt how estimate a suitable dose by eye and she was surprised to find out that she instead had increased her mean dose. The potential for long-term effectiveness seemed very low as they did not want to continue the use of the prototypes and did not learn to estimate suitable doses by eye. Yet, they both seemed positive towards moderate doses.

Level of Potential Long-Term Acceptability

Clara and Catrin thought that they were too careless and lazy for this prototype kit. They thought that there were too many steps in the whole procedure, e.g. several different settings on the volvelle. Instead, they wanted the laundry to be over with quickly. Nevertheless, Clara later commented that it went fast to adjust the volvelle and they both found it enjoyable to get to know the right dose. Catrin mentioned that the use of the dosing kit indeed was a new procedure that she had to practice and try to adopt. Clara told that it went easier at one time when she washed several washes in one day. However, they both said that it was not difficult to understand how to use the prototypes. As mentioned, the weighing of the laundry was according to both of them the most troublesome task and they never got used to it. Catrin appreciated that the measuring cup could be used as a scoop and she felt satisfied when she saw that she dosed moderately. Both Clara and Catrin reported that they felt good and capable when dosing with the prototypes as they saw moderate dosing as doing something good for the environment. They thought that the fact that it was troublesome to use the prototypes contributed to this positive feeling.

Clara would not have bought the prototypes and while Catrin stated that she might have bought the volvelle and the measuring cup. Also prior to the study she might have bought the measuring cup, yet, she did not specify how she then would know how much to dose. Catrin and Clara thought that people in general were too stressed to use these prototypes. Yet, Clara believed that others would be interested in lowering their washing detergent consumption if made easy.

When asked about improvements on the prototypes, Catrin and Clara sought for improvements that would simplify the dosing. They discussed

possibilities for facilitating the weighing of laundry or to avoid it completely. Catrin wanted a bigger version of the kitchen scale for washing detergent that the laundry easily could be placed on and weighed. Another idea was markings in the washing machine drum that would indicate half full or full and then this information could be used to set the volvelle. Clara also suggested either markings on the measuring cup for half full or full machine or markings in the washing detergent compartment. She also suggested that tablets would be a good solution for her. When later shown the tablets in the *Habit Intervention* prototype both Clara and Catrin thought that the tablets were very smart. The prototype of *Scripting* was also appreciated as they thought it to be similar to the tablets. Catrin preferred *Scripting* as she did not have to tear off paper with that one. Clara discussed the possibility of having the tablets in a box instead, as with dishwasher detergent. Catrin mentioned that the map with water hardness was handy as she found it hard to remember the water hardness. The frog in the *Eco-Affective* prototype was found be cute, yet also to be in the way.

The acceptability of the prototypes were very low as the procedure was found to be too complicated and the prototypes troublesome to use. Thus, the potential for long-term acceptability seemed very low.

What Impact Did the Design Strategy Have?

In this household, the strategy of *Competence and Autonomy* failed as Clara and Catrin were not motivated to use the prototypes and only used the entire kit during completion of the second booklet. Nevertheless, Catrin and Clara reported some interesting experiences that can be linked to feelings of competence. They mentioned that they found it enjoyable to get to know the recommended dose form the volvelle. Furthermore, they did express that they felt good and capable when using the prototypes because the prototypes were difficult to use. Catrin also mentioned that she when dosing moderately had the water cleaning process at Gryaab in mind and felt that her moderate dose facilitated the cleaning process at Gryaab. Yet, these indications of feelings of competence were not enough to motivate continued use of the prototypes possibly due to the troublesome laundry basket.

8.2.3. Scripting

Outline: Good Idea, Bad Execution

In general, all four households dosed according to the recommendations fit for the load capacity of their washing machines, or even lower. Thus the effectiveness in inducing the target behaviour appeared to be good and would have resulted in maintained or lowered doses if the packages would have functioned as intended. Unfortunately, the packages gave too large doses and showed great irregularities. The mean value of weight per tilt in the different booklets varied from 10 g per tilt up to 33 g per tilt. Only one person, Sven in Household S4, stated that he tried to circumvent the prototype by shaking it in order to make the dosing process quicker. Whether or not the potential long-term effectiveness was sufficient also if the participants would not be provided with the prototype packages was however questionable. One of the participants, Samuel in Household S3, had started to use a measuring cup when his last prototype package was finished, and two participants, Sandra and Sally in S1 and S2, expressed a desire to continue to dose a little less even if they planned to start pouring directly from the packages again. The other three participants either did not reveal any thoughts on how they will dose in the future, or would go back to their previous dosing behaviour straight off. The latter was Household S4, which used a scoop to take washing powder with and was accustomed to use a quite small amount of detergent.

The acceptability of the prototypes seemed fair. Some faults, possibly connected to the fact that the prototypes were handmade, was negatively viewed. Still, all participants appeared to appreciate the functionality of the dosing system or the concept of the package, even if two participants found it a bit tiresome to tilt the package back and forth, and two others suggested solutions were you only had to tilt the package once. Furthermore, three out of four households expressed that they preferred *Scripting* to the three other concepts.

All participants were surprised to find out that the concept existed as a real washing detergent package, but no one said that they would buy it. However, the grocery store selling this product is not too common and only one of the participants said

he used to do his shopping there. This participant was also the one expressing himself in the most positive wording regarding this information.

The design strategy *Scripting* played a role in the effectiveness of the prototypes in three of the households as the constraint made the participants dose their detergent in a more conscious manner instead of just pouring an estimated amount of detergent from the package. Regarding the acceptability the households seemed to appreciate that no greater mental activity was needed for handling of the product and that it was an integrated solution, aspects of the concept that can be derived from the strategy *Scripting*.

Household S1

Essential characteristics of Household S1 are presented in table 20.

Level of Potential Long-Term Effectiveness in Inducing Target Behaviour

Sandra had adopted the target behaviour as she used the prototypes all through the prototype testing period, in total approximately three packages and the booklets showed that she used five or less doses each time, with the mean values of weight per tilt being 10 g in the second booklet and 18 g in the third. The mean dosing reported in Sandra's three booklets were 24 ml, 62 ml (density unknown), and 83 ml (density unknown), respectively (see figure 66), where the increase in dose was due to the high dosing recommendations of the prototype, imperfections in the construction of the packages, a higher rate of full machines in the third booklet, and the fact that Sandra was using very moderate amounts of detergent prior to receiving the prototypes. The differences in mean in the first and second booklet as well as between the first and the third booklet were found to be significant ($p=1.6 \cdot 10^{-5}$, one-sided and unequal variance; $p=0.0046$, one-sided and unequal variance). The difference in mean between the second and third booklet was not found to be significant ($p=0.68$, two-sided and unequal variance).

Sandra adapted her dose according to if the machine was full or half full, but at the time for

Members of household:	Sandra
Age:	24 years
Occupation:	Student at Chalmers University of Technology and director at a consultancy firm run by students
Environmental attitudes:	Ecotype B(0) or C(1)+ actions(0.5) = 1 points (out of 6)
Previous dosing behaviour:	Poured detergent powder directly from package into the detergent compartment and estimated the amount by eye. When it looked like quite a lot she thought it was good as that would make the clothes clean. At her parents' house, where she lived while filling in the first and second booklet, she used one or two heaped scoops (without any measurements)
Used to dose according to type of wash:	Not really, but perhaps according to the amount of laundry, i.e. a little less for a half full machine and a lot for a full one
Read dosing instructions:	Seldom
Previous knowledge of Gothenburg's water hardness:	No

Table 20. Essential characteristics of Household S1.

the closing interview she was a little uncertain about whether the maximum dose was five or six doses. When Sandra received the first packages she turned the packages around and discovered the instructions. As they had a brightly coloured background and included a map they looked fun to read and easy to grasp, and thus Sandra felt tempted to read them. In the beginning of the test period Sandra thought a lot about using the prototypes correctly, but at the end of the period it had become more of a habit. The fact that one must tilt the packages back and forth as many times as the number of doses one wants to achieve, which takes a couple of seconds, was a limiting factor for Sandra, as she might skip the last dose due to the required effort of using a little extra. This effort made her conscious of the act of dosing, which she thought was a good thing, but at the same time it was a bit annoying when she wanted the washing procedure to be quick. In the last documentation booklet, one of the packages had broken in the sense that it poured out too much for each dose, and when Sandra used that package she used less than five doses for a full machine and tried to judge the amount of washing detergent by eye. She did this also when she felt that the prototypes varied too much in their dosing. In addition, Sandra

started to use less fabric-softener during the test period. She now used the enclosed measuring cap, instead of pouring the softener into the machine as she did earlier, a behaviour change that she linked to the extra effort she put into dosing the washing detergent. Another change was that she avoided washing single garments in the programme for hand wash now as the packages did not give instructions for how much detergent to use in that situation, and Sandra felt that it was too big of a difference between a half full machine and just a single garment. Instead she now gathers sensitive garments in the 30°C programme.

Even if Sandra used more detergent when using the prototypes compared to her previous dosing behaviour, she thought she used less. One explanation could be the difference in size between the washing machines in Sandra's laundry room and her parents' washing machine, which also meant that the compartment for detergent in the washing machines at Sandra's apartment house were bigger than her parents' machine.

Sandra believed that she would go back to pouring directly from the detergent packages, but that she would use a little less detergent as the prototypes acted as an eye-opener. And when she used the washing machine at her parents' apartment she uses a little less detergent than before. However, if Sandra would have received a free package of washing detergent with the dosing system from the prototypes, without being a part of the study, she believed she would still have used it, but with less thought on the topic of dosing behaviour. Thus it seemed as the potential for a long-term effectiveness was rather high as long as the packages were available to Sandra, while the changes on other areas might be an effect of the study setting.

Level of Potential Long-Term Acceptability

Sandra had no expectations on the prototypes and she was pleasantly surprised that it was a dosing aid as she had no measuring cup herself. She got used to the packages after just a couple of washes, and as previously mentioned she thought the extra time it took to use the packages was a bit annoying, even if she thought the reason for it was good. Sandra thought the built-in dosing system was easy to use as it was a part of each package. In this way, she did not have to think of finding a measuring
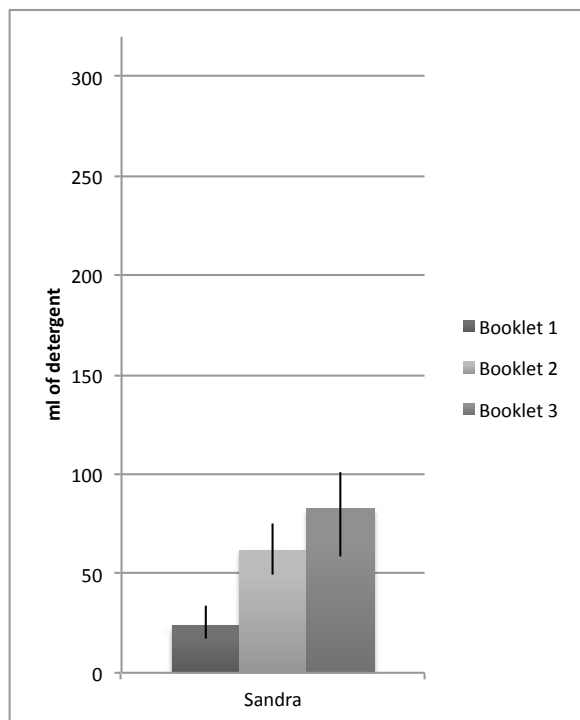

Figure 66. The mean doses of booklet 1, 2, and 3 from Household S1. The error bars represent the maximum and minimum dose in every booklet.

cup and then transferring it between the packages. She viewed the prototype package as more or less a standard package, but with a better shape for carrying the package and pouring detergent from it compared to the package of the detergent she used to buy previously. Concerning the functionality, Sandra had no thoughts on improvements, except for a more sturdy construction that would not break. She could however imagine a more selling look, for examples with rounded corners, or more vivid colours. Sandra knew of a similar dosing system for dishwasher powder which she though were good, other than that she has no suggestions for other products that would benefit from a similar system. Sandra liked the scent of the washing detergent and she said that now she would have to try and smell the different detergents in the store and see if she could find a nice smelling one again. When buying fabric softener, the scent was the most important factor for her, but regarding washing powder it was the price that matters most. Sandra was unaware of whether or not washing detergent packages with a built-in dosing system were available on the market, but if there were, and if they were in the right price range, then she would like to buy that kind of package. When the project duo revealed that the dosing system did exist, Sandra was positive but said that the store selling that solution was too far away from where she lives. Sandra believed that other people also would like to use this kind of detergent packages as she thought that the dosing system was rather good. Regarding if she thought she would have bought the detergent package prior to the study she answered that if the price was low enough, if the package was visible enough, if there was clear communication that it contained a dosing system, and if it looked a little environmentally friendly, then she could have noticed it and looked at it more carefully.

Sandra had mentioned to other people, mostly students, that she took part in a study and received free washing detergent with a built-in dosing system. The reactions were positive as a lot of other people also just pour the detergent from the package as no tool for dosing normally is enclosed with the package.

When shown the other prototypes Sandra reacted negative to them all; *Competence and Autonomy* seemed too complicated and she was not tempted

to buy three products, regarding *Habit Intervention* she thought one spends more when using tablets, and the prototype of *Eco-Affective Design* did just not appeal to her. *Scripting* was the solution she liked the best as it is recognizable, comfortable, and still adjustable when it comes to the dosing.

Sandra's acceptance of the prototypes was high, as she appreciated both the functionality and other aspects of the detergent. Additionally she got support for her acceptance in conversation with others. If the final product would have a more trust-worthy construction and a low price, then the potential for long-term acceptance appeared to be very high.

What Impact Did the Design Strategy Have?

The constraining quality of the prototype had an impact of the effectiveness in inducing target behaviour as it made Sandra dose her detergent actively instead of just pouring out an amount and trying to measure it by eye. The constraint also encouraged her to stop dosing at the recommended level, as the effect of a little extra washing powder was not worth the corresponding extra time and effort. The strategy of *Scripting* might also have had an impact on Sandra's acceptance of the prototypes as *Scripting* often implies an easy solution where information about usage is included in form and functionality of the product.

Household S2

Essential characteristics of Household S2 are presented in table 21.

Level of Potential Long-Term Effectiveness in Inducing Target Behaviour

According to the documentation booklets, both members in Household S2 adopted the target behaviour as they followed the dosing instructions or used less washing detergent then needed during the whole test period. In total Sally and Simon used approximately four packages. The increase in use of washing detergent, seen in figure 67, is a result of the high dosing recommendations of the prototype and imperfections in the construction of the packages. In addition, Sally were using rather moderate amounts of detergent prior to the study (too little data were collected from Simon on this

aspect as he only reported dosed for three washes in his first booklet). The mean dosing reported in Sally's three booklets were 64 ml, 99 ml, and 156 ml (density unknown for all three figures), respectively. Sally reported a single wash without the prototypes in the third booklet of 70 ml (density unknown). The differences in mean in the first and third booklet was found to be significant (p=0.0030, one-sided and unequal variance). The differences in mean between the first and the second as well as the second and third were not found to be significant (p=0.074, one-sided and unequal variance; p=0.064, two-sided and unequal variance). The mean dosing reported in Simon's three booklets were 74 ml, 88 ml, and 126 ml (density unknown for all three figures), respectively. The difference in mean in the first and third booklet was found to be significant (p=0.0031, one-sided

and unequal variance). The differences in mean between the first and the second as well as the second and third were not found to be significant (p=0.27, one-sided and unequal variance; p=0.067, two-sided and unequal variance). The mean values of weight per dose were in Sally's and Simon's second booklets 20 g and 21 g, respectively. The mean values of weight per dose were in Sally's and Simon's third booklets 33 g and 27 g, respectively.

Both Sally and Simon read the instructions on the package as they expected something different due to the study setting. The instructions were viewed as easy to understand and they were both previous unaware of the water hardness in Gothenburg. Sally dosed according to how many kilos of laundry she had instead of according to the capacity of the machine, perhaps as the largest of the washing

Members of household:	Sally	Simon
Age:	28 years	30 years
Occupation:	Project leader at an architect's office	Building services
Environmental attitudes:	Eco-type C(1) + actions(1) = 2 points (out of 6)	Eco-type E(1) or F(3) + actions(1) = 3 points
Previous dosing behaviour:	Used a small glass can to transport washing detergent powder from a big package (in the apartment) down to the laundry room in the basement. Then poured from the can into the compartment for washing powder measuring the amount by eye	
Used to dose according to type of wash:	Used a little less washing powder when there was little laundry in the machine	Used a little more detergent when washing clothes in 60°C instead of 40°C, and if the clothes were very dirty he used the prewash programme and a little extra detergent
Read dosing instructions:	Seldom	Seldom. Has tried but found it difficult
Previous knowledge of Gothenburg's water hardness:	No	No
Additional members of household:	Their son, 1 year old	

Table 21. Essential characteristics of Household S2.

machines in the laundry room displays the weight of the laundry. Simon stated that he used three doses for a wash in 40°C and five doses for a wash in 60°C, but this pattern is not visible in the documentation booklets.

Both Sally and Simon thought the prototypes to dose a bit too irregularly. Sally sometimes compensated for this in the beginning of the test, by pouring some more detergent from the package, and Simon did the same sometimes but in the end of the test period. In general, they both thought the recommended dose to produce quite some more detergent than what they were used to dose. When Sally no longer would have access to the prototypes, she would like to measure out the recommended dose for her standard wash, so that she thereafter can dose by rule of thumb, but with proper knowledge on what she should be aiming at.

As a conclusion, the potential for long-term effectiveness seemed high as both household members probably would continue dosing in accordance with the instructions, or even lower, if they would have sustained access to the prototype, especially if it would be improved and thereby dose more
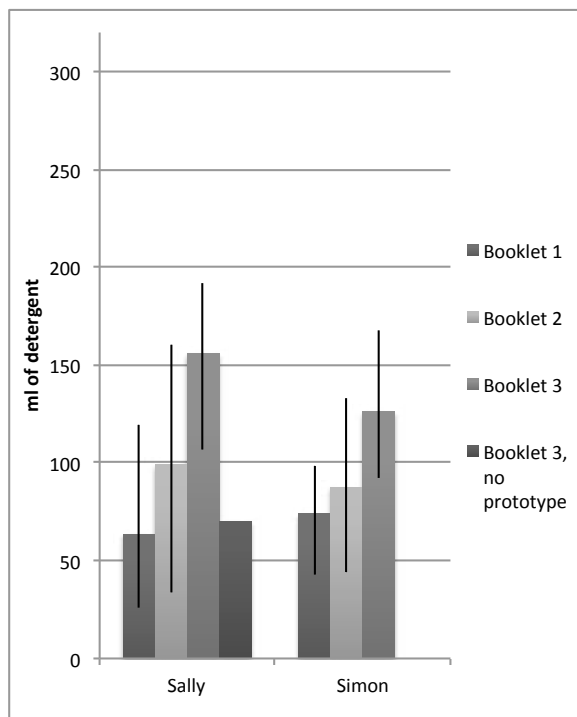
regularly. Furthermore there seemed to be a possibility that Sally would keep on dosing more or less in accordance with dosing instructions also without continued access to the prototypes as she wanted to learn to judge the correct dose by eye.

Level of Potential Long-Term Acceptability

Sally's first impression of the prototypes was that they were neat and looked like real packages, but she had anticipated a less ordinary packaging as she was aware of the educational background of the project duo. When she first read the tilting instructions she thought it was a little exiting to see how she would manage them, but when she tried it out it was not that complicated. In the beginning, Sally and Simon varied between using the prototypes and their own washing detergent as they were unsure about whether the washing powder in the prototypes would be suiting for their baby or not, and Sally had all along been wondering what brand of washing detergent it actually was in the packages whilst Simon settled with the opinion that it was of standard quality. As already mentioned, Sally felt as the recommended dose was larger than what she normally used, but she did not notice any difference on the clothes. She also thought the package to dose unevenly, which was a bit annoying. Both Sally and Simon compensated for this unevenness occasionally, but Sally said that in general she did trust the packages. Simon thought it was easy to stop measuring the washing detergent by eye, and he thought the instructions to be clear. He did not like to do the laundry and to put cognitive effort into the procedure, thus, despite an early scepticism, he liked the convenience and simplicity of the prototypes. Sally also thought the prototypes to be easy to use, and a clever solution as it only requires one hand for operating it. She said that using the packages was convenient as she did not have to carry any other stuff down to the laundry room and that they now had gotten used to not scooping the washing powder into their transportation jar. Additionally, she appreciated not getting detergent on her hands as it can be difficult to wash off, and Simon could list a couple of drawbacks with their previous system with the jar. However, they could both think of improvements that would make all the tilting unnecessary, and Simon could also imagine that the dosing recommendations on the packages could be adapted to the water hardness at the place

Figure 67. The mean doses of booklet 1, 2, and 3 from Household S2. The error bars represent the maximum and minimum dose in every booklet.

it would be marketed. Despite this, they could still picture the dosing system on other products such as cornflakes or gruel. Sally thought of the prototypes as a product one does not know that one needs, and thus she did not believe she would have bought it previous to the study, but when one once has started to use it then one will miss it when it is gone. Perhaps she would have tried the product out if she had heard from someone else that was pleased with it. Sally believed that other people could be interested in this type of product, as it is handy. Simon stated that the price would also be an important factor. Sally agreed and added that washing detergent is a product where she buys one type, and then continues to buy the same type, i.e. she does not make an active choice every time when buying it.

Sally's reactions to the other prototypes were that the one they got suited them best, but that the tablets also could have been convenient. She though the prototypes of *Competence and Autonomy* looked nice, and even if the volvelle seemed easy to use, it would just have been too many steps for them with the scale and all.

The acceptance of the prototypes seemed sufficient as both Sally and Simon had been using them during the whole test period. With improvements such as a more evenly dosing package construction, the potential for long-term acceptance seemed fairly high as they both appreciate the easy handling and usage of the prototypes.

What Impact Did the Design Strategy Have?

As in the case with Household S1 the constraint within the prototype influenced Sally and Simon to start dosing washing detergent in a more conscious way. However, the reason for them to stay within the recommended dose was that they had read the instructions and was used to use less detergent then the recommendations for the prototypes. The design strategy may also have influenced their acceptance of the prototypes as they appreciated the integrated solution and the low cognitive effort required for using the packages.

Household S3

Essential characteristics of Household S3 are presented in table 22.

Level of Potential Long-Term Effectiveness in Inducing Target Behaviour

The person handling the laundry in Household S3, Samuel, had adopted the target behaviour as he had utilised the prototypes, in total approximately four packages, all through the testing period, and according to the booklets he took five, four or three doses each time, with a mean number of doses being 4.1 in the second and in the third booklet. Samuel filled in Sofie's second and third booklet as well as his own and therefore many observations were obtained. Samuel's three different mean values were 56 ml, 119 ml (density unknown) and 97 ml (density unknown), as can be seen in figure 68. All differences in mean value were found to be significant. (Test of first and second value gave $p=7.0 \cdot 10^{-7}$, one-sided and unequal variance. Test of first and third value gave $p=6.8 \cdot 10^{-5}$, one-sided and unequal variance. Test of second and third gave $p=0.040$, two-sided and unequal variance.) Despite equal mean of number of doses, the difference between the volume of the mean dose in the second and third booklet was found to be significant. This is probably caused by imperfections and irregularities in construction of the packages as the mean weigh per tilt was 23 g in
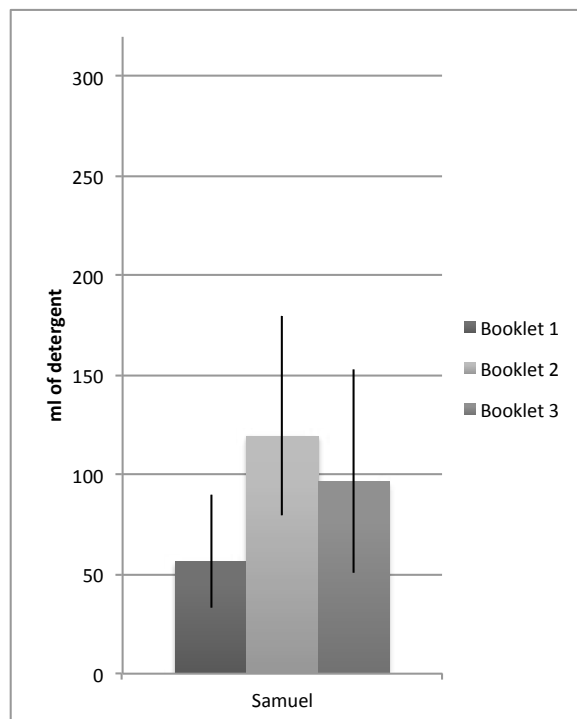

Figure 68. The mean doses of booklet 1, 2, and 3 from Household S3. The error bars represent the maximum and minimum dose in every booklet.

the second booklet and 18 g in the third and the difference was significant (p=0.018, two-sided and unequal variance).

Samuel read the instructions on the packages when he received them, and he commented that he might have done so due to the study setting. However, he did not remember the dosing recommendations, and thus he looked back at the table to reassure himself almost every time he did the laundry. He interpreted the table as recommending a dose depending on the amount of laundry, not depending on machine size, and thus he varied his dosing depending on the level to which he filled the machines. Unlike Household S1 and S2, Samuel never compensated for uneven doses, probably as the detergent compartments in his laundry room were rather big and steep and placed on top of the big washing machines which made the judgment of the size of the detergent pile even more inexact. Samuel had not read the instructions for hand wash, and he said that as they had been engaging in some hand washing they either had used a different detergent or dosed incorrectly. After filling in the first booklet Samuel took a quick glance at the dosing instructions for the detergent he then used and observed that he had

used too little detergent according to the manufacturer, therefore he believed that he by using the prototypes had increased his dose somewhat, even if he thought that the detergent pile in the detergent compartment was more or less of the same size. He had expected himself to overdose, so if he had not compared his initial dosing with the instructions, then he would have believed he had decreased his dose instead. When Samuels's last prototype package was empty he started to use a measuring cup from the kitchen, with the capacity of half a decilitre. He chose this cup as it was the one he could find, but as he had read the recommendations for his new detergent he knew he wanted to measure about 70 ml, and thus he was content with a cup of 50 ml, as it would give him sufficient control. Samuel could however see a risk with it being a kitchen utensil, since if it would be needed in the kitchen again he might not have the motivation to search for it at the next laundry occasion. Samuel believed that he definitely had been affected by taking part in this study as he now reflected more on his use of washing powder, and he pondered upon how long the effect will stay. Nevertheless, he thought it felt good and pretty accurate to use the newly acquired measuring cup.

Members of household:	Samuel
Age:	30 years
Occupation:	Industrial design engineer
Environmental attitudes:	Ecotype D(2) or E(1) + actions(2) = 3.5 points (out of 6)
Previous dosing behaviour:	Poured directly from the package and measured the amount by looking at the resulting pile of powder
Used to dose according to type of wash:	Not really, but if there were few garments in the machine, or a small machine, then he might have used a little less detergent than usual
Read dosing instructions:	Seldom
Previous knowledge of Gothenburg's water hardness:	Yes, in the sense that he knew the smallest recommended dose to be suitable in Gothenburg
Additional members of household:	Girlfriend Sofie, 31 years old. Their daugther, 2 years old, and their son, 3 months old

Table 22. Essential characteristics of Household S3.

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To sum up, the potential for long-term effectiveness was high as long as Samuel had access to the prototypes since he had been using them in the same way and without doubts during the whole prototype evaluation period. Samuel also stated that he would have used the packages to the same extent if he had received them somehow, independent from this study, as he viewed their functionality as an extra value. Additionally, as Samuel had found himself another way to follow the dosing instructions on his new detergent package, there seemed to be a potential for a long-term effect on his behaviour also without sustained access to the prototypes.

Level of Potential Long-Term Acceptability

As Samuel had the same educational background as the project duo he was curious on the prototypes he was to receive. He thought it looked like an ordinary washing powder package, that it was professionally made and close to a real package. Samuel thought it went quick to get used to the packages and it was easy to learn how to use the prototypes. He found the instructions clear and easy to grasp, but in the beginning he felt a bit unsure concerning the tilting procedure. As he did not know how the construction worked he was uncertain of whether or not he had tilted it backwards long enough, and thus he could not be certain that the doses he produced were correct. He questioned how much 70 degrees would be, but in the end he did not see this as a problem since he tilted the packages about 90 degrees instead. As he carried the packages in a plastic bag to and from the laundry room, he also felt insecure about whether or not this affected the dosing as washing powder could have been shaken into the dosing compartment of the package. As previously mentioned, it was hard for Samuel to judge the size of the pile of washing powder as the detergent compartments were deep and placed on top of pretty large washing machines. He could see that there was some variation in the doses, but it seemed sufficiently similar each time, except for one single time where no powder at all was poured out from the package. Samuel solved this easily though, by tilting the package backwards and shaking it thoroughly. A solution that Samuels proposed would be to make the dosing compartment transparent as it would be reassuring to know what happens in the package when tilting it back and forward.

Samuel found the usage of the prototypes to function well and he was quite content with them. The detergent itself had also worked well. He experienced it as satisfactory to use the prototypes, since this study made him focus on the dosing of washing powder and the prototypes then made it possible for him to gain more control over his dosing. Samuel described a typical laundry occasion as stressful since his children might be waiting for him in the apartment, thus he just wanted a quick procedure with a well functioning dosing solution, and he felt that the prototypes provided him with that. Moreover, they took no extra space and he did not need to bring additional utensils to the laundry room.

When Samuel used his new washing detergent and the kitchen measuring cup, he felt as if it was a somewhat sloppy procedure compared to when using the prototypes. The new practice implied more handling of the detergent, whilst the prototypes felt more sealed and hygienic. Even when carrying the prototypes around in the plastic bag he never experienced any leakage from them, in contrast to his experiences with ordinary packages, especially those with large openings.

Samuel expressed that it was a pity that he would not have access to the prototypes anymore after this study, as he thought it was a convenient solution that he definitely could have continued to use. He liked that the dosing system was embedded in the package. He was however not sure that he would have discovered it in the store just because of the dosing system as the package was very discrete and did not have loud information about the dosing aid on its front, but if he would, then he could perhaps even have paid a little extra for it due to the innovativeness. Furthermore he believed that other people would like to use this kind of product due to its integrated dosing aid, even if he did not know what peoples' laundry habits in general look like.

Samuel approved of the system with a fixed dosing system, but he saw the high number of doses required for hard water as a problem. Five tilts were already a bit on the upper edge, and therefore he suggested an adapted package with modified dosing compartment for people living in areas with hard water.

When comparing the four different concepts, Samuel expressed that he was content with his prototype and he would chose that one over the others. He perceived the tablets as a bit untidy and questioned if they would dissolve quick enough for the machines in his laundry room. The prototypes for *Competence and Autonomy* seemed unpractical for his situation. Regarding the frog cup Samuel expressed that he would feel sorry for the frog, even if he just poured detergent up to his feet, and in that aspect he thought it was a functioning prototype for decreasing the use of detergent. However, he felt that the message could be a bit too forced, especially if it came from a detergent manufacturer.

Samuel's was positive to the news that a grocery chain sold washing detergent with the dosing system from the *Scripting* prototypes. Samuel usually bought his washing powder at that store, but he had never seen that detergent there.

Samuels's acceptance of the prototypes seemed very high and it did not change during the test period. Hence the potential for long-term acceptance of the prototype appeared to be high as well.

What Impact Did the Design Strategy Have?

As with Household S1 and S2 the constraining quality of the prototype seemed to have contributed to Samuel's behaviour change. But the first booklet might also have had an important impact on his behaviour as he stated that one reason for his satisfaction with the prototypes was that they provided him with a method for dosing washing powder after the birth of his new focus on his inexact dosing technique. Regarding Samuel's acceptance of the prototype, the design strategy appeared to be vital as he appreciated its functionality and the ease of use.

Household S4

Essential characteristics of Household S4 are presented in table 23.

Level of Potential Long-Term Effectiveness in Inducing Target Behaviour

Selma and Sven used the prototypes all through the testing period, except for when Selma washed some single sweaters or jumpers, as she then used a liquid detergent commonly used for washing of delicate fabrics. According to their documentation booklets they used mainly 3 doses each time, and thus it seemed as if they did adopt the target behaviour. Selma filled in their son's first and second booklet as well as her own and therefore many observations were obtained. Selma's three different mean values were 35 ml, 49 ml and 56 ml (density unknown for all three figures). The difference between the mean value in the first and the second booklet as well between the mean value in the first and the third booklet were found to be significant (p=0.010, one-sided and unequal variance; p=7.9·10⁻⁴, one-sided and unequal variance). The difference in mean value in the second and third booklet was not found to be significant (p=0.27, two-sided and unequal variance). Sven's three different mean values were 29 ml, 53 ml and 51 ml (density unknown for all three figures). The difference between the mean value in the first and the second booklet as well between the mean value in the first and the third booklet were found to be significant (p=0.008, one-sided and unequal variance; p=0.0059, one-sided and unequal variance). The difference in mean value in the second and third booklet was not found to be significant
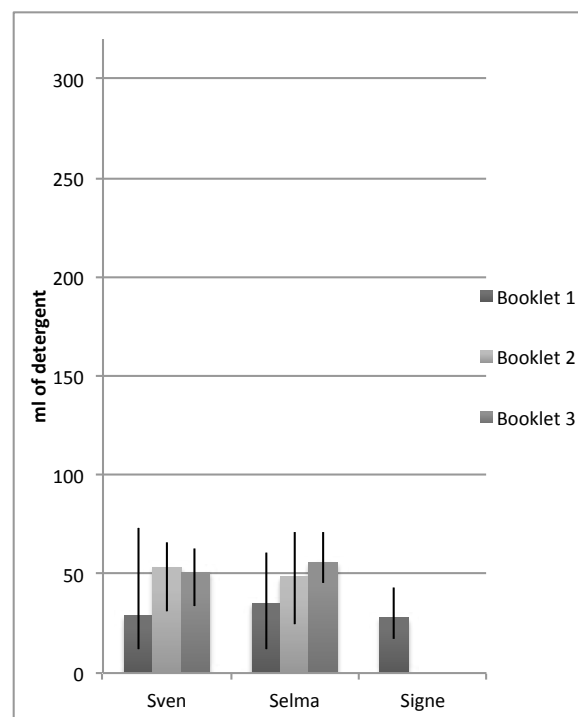

Figure 69. The mean doses of booklet 1, 2, and 3 from Household S4. The error bars represent the maximum and minimum dose in every booklet.

(p=0.80, two-sided and unequal variance). The mean values of weight per dose were in Selma's and Sven's second booklets 12 g and 15 g, respectively. The mean values of weight per dose were in Selma's and Sven's third booklets 13 g and 13 g, respectively. Their daughter Signe filled in the first booklet and obtained a mean of 28 ml, but as she thereafter went abroad she ceased to participate in the study. All mean values can be seen in figure 69.

Both Selma and Sven read the instructions on the prototype when they were about to start using it, as they knew the prototypes to be different from conventional packages. Nevertheless, Sven believed that if he had bought the package without knowledge of its dosing system, he would have discovered the limitation when first using it

and therefore would have examined the package and its information more closely. Sven followed the instructions and used mainly three doses, which was appropriate for the size of their washing machine. Nonetheless, Sven had previously said that he was unaware of the load capacity of their washing machine. Selma said she varied her dose between two or three doses depending on the amount of laundry. In the booklets she has been varying mainly between two and a half or three doses, and she believed that the half dose meant that she though that the third dose had become very small. Sven on the other hand thought it used to be the first dose that was a little smaller. On all together three occasions, Sven and Selma used four or five doses of detergent and one of those washes was probably white tablecloths of linen. As the

Members of household:	Sven	Selma
Age:	49 years	50 years
Occupation:	Employed by the government	Employed by the municipality
Environmental attitudes:	Eco-type D(2) or F(3) + actions(1) = 3.5 points	Ecotype D(2)+ actions(1) = 3 points (out of 6)
Previous dosing behaviour:	Used a measuring scoop or cup, holding approximately one decilitre, to scoop detergent with. They did not use the cup to measure with, but they still estimated and adjusted the dose somewhat, trying to make the detergent fill the cup a couple of centimetres	
Used to dose according to type of wash:	Did not reflect that much about it, tried to dose as usual, but if he was to wash e.g. sweaty football clothes, then he might have used a little more detergent	-
Read dosing instructions:	No	Seldom
Previous knowledge of Gothenburg's water hardness:	Yes	Seemed a little unsure, mumbled something about medium hard water in Gothenburg
Additional members of household:	Their daugther Signe, 20 years old, and their son, 18 years old	

Table 23. Essential characteristics of Household S4.

recommendations on the package was valid only for textiles of a normal degree of dirtiness, these three occasions can still be interpreted as the target behaviour.

Both Selma and Sven said they were unsecure of the dosing previous to the testing period as they both just roughly estimated the amount of detergent they used. With the prototypes, Sven felt as he had no choice but to dose correctly, possibly also as he had interpreted the instructions from the project duo to be that he had to follow the instructions. Therefore, Sven did not vary his doses depending on laundry, as he felt three doses to be enough already. Selma on the other hand suggested that one could use for example two doses if one would want to.

In the beginning, Sven thought the recommendation of three doses to produce a lot of detergent compared to what they used to dose, but he got used to the amount and in the end of the test period he rather felt as if they sometimes delivered slightly too little. Yet, when comparing the weight of each dose in his first and third documentation booklet no significant difference in mean was found (p=0.15, one-sided and unequal variance). The fact that he thought the doses to be high in the beginning, together with that he seemed to harbour the attitude that using less detergent is good, might be the reason why he used only three doses even though he did not know the capacity of their washing machine. Selma believed herself to use approximately the same amount of detergent with or without the prototypes, but Sven reminded her that she initially had told him she thought the prototypes to produce more detergent then what she was accustomed to use.

For Selma and Sven, the prototypes sometimes had faults. The dosing had been varying, and the powder sometimes formed lumps, making it difficult to get powder out of the package. When this happened, Selma used to pour once more from the package, which made it difficult to determine how many doses she should report in the documentation booklets. Sven also thought it was annoying to tilt the package three times, and sometimes when he was stressed while doing the laundry he shook the package, trying to get more out of it without having to tilt it three times. Depending on in what way and how violently he shook the

package, this worked.

Selma and Sven both believed that they would return to their previous dosing behaviour when they had used up their last prototype package. Selma thought that the difference was not that big, except for the dosing procedure, and the fact that she would have to estimate the dosing again feels okay for her.

In general, both Selma and Sven believed their consumption of washing detergent to have increased, even if Sven was surer of his statement than Selma.

The potential for long-term effectiveness seemed unsure. On the one hand Sven and Selma mostly followed the instructions suited for their washing machine size even if they were uncertain of the capacity of the machine, and Sven stated that as they thought the dosing with the prototypes to be high they did not want to use more than the smallest recommendation. But on the other hand, Sven sometimes violated the dosing system, and they both seemed to get accustomed to their increase in dose which perhaps in time would lead them to use more doses than three.

Level of Potential Long-Term Acceptability

Sven had no expectations when agreeing to participate in this study, he just thought it would be fun to try something different and to see how it would work. When Selma first saw the prototypes she got a bit happy as she thought the packages looked nice, whilst Sven on the other hand though the packages looked very dull. Sven expressed that it only took a week or a couple of days to get used to the new procedure. Selma also believed that the accustoming was a quick process, but she was a bit uncertain whether she perhaps embellished the story, as it was a long time ago since she first used the product. Still, in the beginning, Sven had a hard time accepting the increase in dose that the prototypes meant. But in the end of the test period he stopped caring about that. He started to wonder if perhaps the detergent in the prototypes was of a low concentration. Sven said that for some strange reason he believed that smaller packages contain a more concentrated content, which lead him to use less detergent. This fitted with his thoughts on a low concentration as the prototypes

were slightly bigger than the package they had previous to the testing period.

Both Selma and Sven thought the washing powder to be of ordinary quality, and in that sense the product was well-functioning. Sven also felt that the usage of the prototypes was not that different from using other washing powders, except from that he had to act a little bit different. However, as mentioned, he thought it was a bit tiresome to tilt the package and pour from the package three times every time he was doing the laundry. Another annoying thing was that the washing powder formed lumps due to the moist air in the bathroom, which made it difficult to pour the powder from the package. When this happened, Sven had to shake and hit the package against something in order to be able to use the package again. He even opened one package because he was curious to see its construction. Yet another thing that Sven found annoying with the packages was that it felt like the doses became smaller when there was just a little amount of detergent left in a package. But regarding the unevenness of the doses Sven's opinion was that it does not matter if one uses too little detergent as the laundry gets clean anyway. Sven often felt that one can use a little less detergent than the recommended dose, as he believed that the detergent companies of course wants to sell detergent. Selma thought of the problems with the package as a result of the prototype being in an early development phase, and thus she was more accepting towards them. She did however find it annoying when it was total stoppage, and once when it was difficult to open the package.

For Sven the study served as a confirmation on that one should not be wasteful. Sven said that they had not been wasting the washing powder previous to the study either, but that it now happened automatically due to the dosing system. Previously he might have had to think a little bit more on not using too much detergent.

Sven had not reflected upon the product that much. It had its place in their bathroom, and the usage became a matter of habit. But he did not know if he would have used the product or not if a conventional washing powder package also were present in the bathroom. However, he was sure that he would not have used the prototype packages to the same extent if he would have been required to buy them himself. He used them as it was convenient that he got them delivered, and as he wanted to help the project duo. Nonetheless, Sven stated that he is a bit of a habit ruled person, and thus he might have bought the packages if they now were available in a store, at least if the opening had been a bit bigger so that he only had to pour detergent once or maybe twice. However, he is unsure about if he would have bought it if the package had been more expensive, especially as he initially thought the dosing to be a bit wasteful. Selma was also unsure about a continued use of the packages if they would be more expensive than what she was used to. Yet, Sven was convinced that others would like to use the product, as it is a clever solution. He believed that it could appeal to all sorts of people, but perhaps a little more to those concerned about the environment. Selma also believed that other people would be interested in using the product, and that she would buy it again if it would work better (referring to the stoppage and the varying doses).

As they still had prototype packages left, Sven said he would keep on using them until they were finished. However, he would not miss the packages once they were gone and he believed that he would get used to the old washing detergent package again. Selma commented that then Sven would have to carry home washing detergent again, and that it had been convenient to have the prototype products at home. She would not exactly miss the products, but mentioned that they were nice, with pictures of small clothes. She thought that they were nicer than their previous detergent.

Regarding the other three prototypes Selma was positive to the tablets. Sven was vaguely positive to them as well but wanted them to be smaller in order to allow for a more nuanced dosing. Both of them thought the dosing kit to be too tedious and circumstantial. The frog cup was appreciated as they thought it looked nice, and Sven thought he might have used it only because of that. Selma and Sven did interpret it as was intended, and Sven referred to the poor frogs out in the river. Selma and Sven was surprised to know that the dosing system was available in a washing detergent on the market today, and Sven was curious to know whether or not it was expensive.

Selma's and Sven's acceptance of the prototypes

seemed moderate as they would not miss it, but still could imagine buying the product again if it had the same price as their regular washing powder. The high dosing recommendations and the problems depending on the prototype seemed to have been the main reason for their modest feelings.

What Impact Did the Design Strategy Have?

The strategy of *Scripting* did not seem to be that prominent for the reached level of effectiveness and acceptability. Regarding the effectiveness, it appeared as Selma's and Sven's previous moderate dosing behaviour was the reason for them to follow the instructions. If they would have been accustomed to use more detergent it is possible that they would have used up to five doses, which would have been too much for the low load capacity of their washing machine, as they were unaware of its size. However, Sven had successfully tried to circumvent the constraint when he was stressed and in a hurry, which apparently is a strategy related failure in effectiveness. This circumvention can also be related to the acceptability as he in that moment did not accept the constraint. However, in general their level of acceptance of the prototypes seemed connected to other aspects of the prototypes.

8.2.4. Habit Intervention

Outline: Love It or Leave It

The strategy of *Habit Intervention* consists of two phases. The first is the intervention of the previous habit and the second the formation of a new habit. The effectiveness and the acceptability of both phases are preferably high. Due to the study layout, the effectiveness of the tablets in the first phase is hard to judge, as the participants were obliged to use the tablets throughout completion of the second booklet. Yet, a few comments regarding the effectiveness of this initial phase can be made based on the participants' opinions. The two households that were positive to a continued use of the tablets, H2 and H3, thought that they would have been positive also prior to participation of the study, if the tablets were sold at a reasonable price. One of them found that the key issue was whether or not they would have discovered the tablets in

the store. The other household mentioned that trying a free sample of the tablets could have convinced them to start buying them.

When being used, the effectiveness in inducing the target behaviour both during the testing period and on long-term seemed very high. The reason for this appeared to be that they are pre-dosed and thus the control over the dosing lies in the hands of the designer, as predicted in the model for categorisation of design strategies in section 3.2.4. All of the participants dosed one tablet and only occasionally a second or half a tablet. For one participant, Henric in Household H3, the reminders of the dosing recommendation on the flaps ensured correct dosing rather than the tablets themselves. Here, the strategy of *Just-in-Time Prompt* seemed to be important. To only give dosing recommendations for soft water facilitates correct dosing since less information has to be given. Furthermore, not all participants knew the hardness of the water in Gothenburg and then dosing recommendations only for soft water ensured that dosing recommendations for another type of water was not followed instead. Interestingly, none of the participants commented that the detergent was for soft water only. When asked about it, one household told that they had not noticed it and they did not express any objections against it.

Yet, the effectiveness in inducing dosing of less than one tablet was low. The participants often washed machines that were half full or only with very little laundry, and in those cases, half a tablet would probably have been enough. No change in the extent to which the participants filled the machines was reported or observed. Furthermore, no attitude change or desire for dosing aid was noticed as a consequence of the prototype testing except for one participant mentioning that he would start looking for washing detergent tablets. One other participant, Hanna in Household H3, appeared positive towards reading dosing instructions and getting a measuring cup, but only after she in the closing interview got feedback on her initial dosing.

Three participants, Helen, Harry in Household H2 and Hanna in Household H3, accepted the product right away and a fourth participant, Henric also in H3, reached a high acceptance of the product first after coming up with a technique that

for him facilitated the handling of the tubes. These four participants that expressed a high accept-ability appreciated the product because they did not have to make the dosing decision themselves. In line with this, the tablets were by these partici-pants seen as handy and easy to use. One of the participants wanted to make dosing decisions by herself and therefore the acceptance of the tablets was low as they reduced her control over the dos-ing. Another participant was very sceptical to try new things in general and had strong preconcep-tions regarding washing detergent. Naturally, she did not want to try the tablets and the acceptance was very low. The most evident problems with the prototype were the crumbling of the tablets and the problem of tearing off the paper. Yet, this did not seem to have a great impact on the overall impressions as the participants that expressed high acceptance did so despite these problems and the participants that expressed low acceptance did so for other reasons.

As mentioned, in the strategy of *Habit Interven-tion*, there should be an element that makes the previous habit impossible or inapplicable. In the case of the tablets, this was that dosing by estimat-ing the size of the pile of detergent would not be possible. For Household H3, that initially over-dosed, this seemed important as they with the tab-lets were introduced to a new way of dosing, i.e. by number of tablets instead of by how full the wash-ing detergent compartment was. Furthermore,

Habit Intervention should result in the forma-tion of a new habit. For the three participants who accepted the product straight off the dosing quickly became habitual. For the participant who first had to invent a technique for handling of the tubes, the use became habitual after this invention. Thus, if acceptance occurred, the strategy seemed to succeed.

Household H1

Due to health related difficulties it was not pos-sible to perform a personal interview with Hilda. Instead, the interview was made via e-mail and it is therefore less comprehensive.

Essential characteristics of Household H1 are pre-sented in table 24.

Level of Potential Long-Term Effectiveness in Induc-ing Target Behaviour

With the tablets Hilda varied her dose between half a tablet and two tablets per wash and she used the tablets during the whole testing period, but at least at one occasion she used washing powder, reported in the third booklet. In the first booklet, Hilda's average dose was 64 ml (density unknown), in the second 1.25 tablets resulting in a mean value of 46 ml, in the third 1.3 tablets resulting in a mean value of 49 ml and 85 ml for the single occasion with washing powder. All the mean values

Members of household:	Hilda
Age:	40 years
Occupation:	Wrote "paperwork" in the e-mail
Environmental attitudes:	Ecotype E(1) + actions(0) = 1 points (out of 6)
Previous dosing behaviour:	Often with a measuring cup, but sometimes without
Used to dose according to type of wash:	Yes
Read dosing instructions:	Yes, as it varies with each brand she always reads it
Previous knowledge of Gothenburg's water hardness:	-

Table 24. Essential characteristics of Household H1.

can be seen in figure 70. In total she used 6 tubes. None of the differences in mean value were found to be significant. (Test of first and second value gave p=0.092, one-sided and unequal variance. Test of first and third value gave p=0.11, one-sided and unequal variance. Test of second and third gave p=0.80, two-sided and unequal variance.)

Hilda stated that with the tablets she roughly estimated a suitable dose according to whether the washing machine was full or not. She often wanted to divide the tablets into halves, something that was difficult due to the occurrence of crumbling. She appeared to actively make decisions regarding dosing as she mentioned that she did not find it easy to choose the dosing of the tablets by herself. Furthermore, the dosing with tablets was according to Hilda more difficult than with washing powder, as it was more difficult to vary the dosing with the tablets. She did not consider that she acquired a new habit as her practice with washing powder already was well established and she found that practise hard to relinquish. Nevertheless, she mentioned that she found the tablets easy to use and handy. She thought that she used less washing detergent when using the tablets than without. Hilda did not notice a difference in her washing
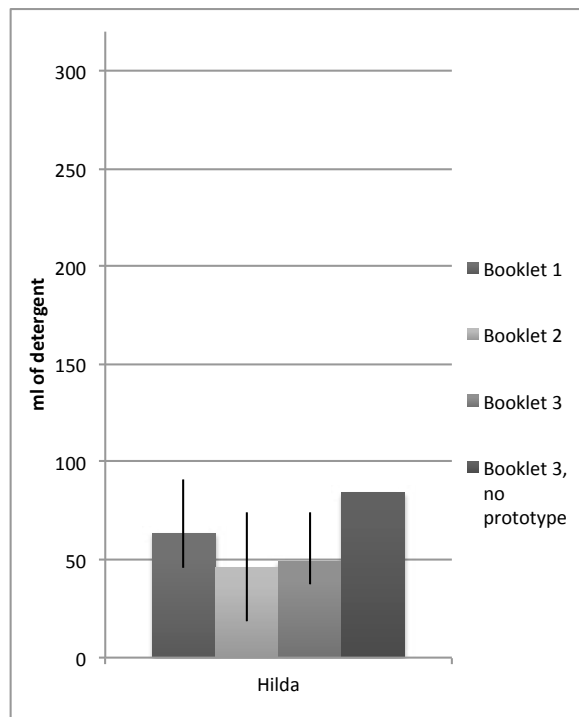

Figure 70. The mean doses of booklet 1, 2, and 3 from Household H1. The error bars represent the maximum and minimum dose in every booklet.

experience in the beginning versus the end of the prototype evaluation.

Even though Hilda used the lid, and consequently had access to the dosing instructions printed there she could not recall that she had read the instructions. Yet, as the interview was made by e-mail, she might have thought that the question referred to instructions in addition to the ones on the lid.

Hilda thought that her consumption of washing detergent would increase after the termination of the study due to her newborn child. Otherwise, it would have stayed on the same level as prior to the study.

The efficiency in inducing the target behaviour was high during the prototype testing phase, as she dosed according to recommendations, nevertheless, the dosing did never appear to be made by routine as she expressed that it was difficult to make decisions regarding dosing. The potential for long-term efficiency seemed very low as she did not want to continue the use of the tablets and the prototype evaluation period did not seem to have influenced her washing powder dosing habit.

Level of Potential Long-Term Acceptability

In general, Hilda was not fond of the tablets. The pre-dosing of the tablets was considered to be unwise, as it did not allow her to adjust the dose in the way that she wanted without crumbling the tablets to bits. Therefore, Hilda did not think that the tablets suited her. Furthermore, the easy crumbling of the tablets bothered her, especially when trying to divide them. To reduce the crumbling, the lid of the package was used. Despite this preventive measure, it came crumbles from the package as well and she thought that the package was not suitable for tablets. Furthermore, the package was hard to pile up and to store in a space-efficient way. The package was found to be somewhat difficult to open and the paper difficult to tear off in a neat way. Yet, she found the package to be fun. Hilda thought that the tablets would be expensive, and as a result of this conception she did not see them as a suitable choice for her as she is economical. The tablets were not seen as a cheap product suitable for families, rather it was considered a product for modern households. Hilda thought that single households in the aged 25 to 35 would

want to buy the tablets, especially male users with less experience and less interest in dosing. If Hilda would get a chance to improve the product she would want one package to last longer. She did not see any reason to implement this system in other product areas. Hilda talked about her participation in the study with her closest family, but they were also accustomed to powder detergent.

Hilda did find the tablets easy to use and she mentioned that the use of tablets probably saved a few seconds in comparison with measuring powder detergent. The smell of the tablets was thought to be nice.

Hilda would not have bought the tablets, neither before nor after participation in the study, as she preferred powder detergent. Nevertheless, she continued to use the tablets the whole testing period even though she knew that she was allowed to stop using the prototype. She continued the use because she found it enjoyable to test a new form and a new package.

Even though Hilda used the tablets during the whole prototype evaluation, her acceptance of them was low because they did not allow her to dose in the way she wanted. Hence, the tablets potential for long-term acceptability seemed low.

What Impact Did the Design Strategy Have?

Hilda's previous habit of washing powder dosing was not successfully intervened. This was possibly related to Hilda's comment that her previous dosing habit was well established and therefore hard to relinquish.

As the previous habit is intervened, the strategy of *Habit Intervention* should provide easy formation of a new habit. For Hilda, this never happen as she did not think the pre-set dosing choices of one or two tablets allowed for enough dosing adjustments. Therefore, the use never became simple and no new habit was formed.

Household H2

Essential characteristics of Household H2 are presented in table 25.

Members of household:	Helen	Harry
Age:	28 years	28 years
Occupation:	Works with administration	Computer engineer
Environmental attitudes:	Eco-type D(2) + actions(2) = 4 points (out of 6)	Eco-type C(1) + actions(2) = 3 points
Previous dosing behaviour:	Dosed by how it looked in the washing detergent compartment	Same as Helen
Used to dose according to type of wash:	Used more detergent for large amount of laundry and if the laundry was very dirty	Used more detergent for large amount of laundry. Might use less if the laundry was just slightly soiled
Read dosing instructions:	No	Seldom
Previous knowledge of Gothenburg's water hardness:	Yes	-

Table 25. Essential characteristics of Household H2.

Level of Potential Long-Term Effectiveness in Inducing Target Behaviour

Helen and Harry always used one tablet and used the tablets during the whole study, thus the target behaviour was adopted. The mean dosing reported in Helen's and Harry's first booklets was 33 ml (density unknown) and 63 ml (density unknown), respectively. In the second booklets they both used one tablet for all washes, regardless of dirtiness and amount of laundry. The third booklets unfortunately got lost either in the mail service or at Helen's and Harry's place as they were about to move and the apartment was slightly unorganised due to the packing. Helen and Harry remember preparing the envelope but the project duo never received it. When this was revealed, Helen reported to the project duo that they both had been using one tablet regardless of dirtiness and amount of laundry. As this is in accordance with the dosing behaviour reported in the second booklets the project duo found her statement to be very likely and these figures are used in figure 71. The difference in mean in Helen's first and second booklet was not found to be significant (p=0.26, one-sided and unequal variance). The difference in mean in Harry's first and second booklet was found to
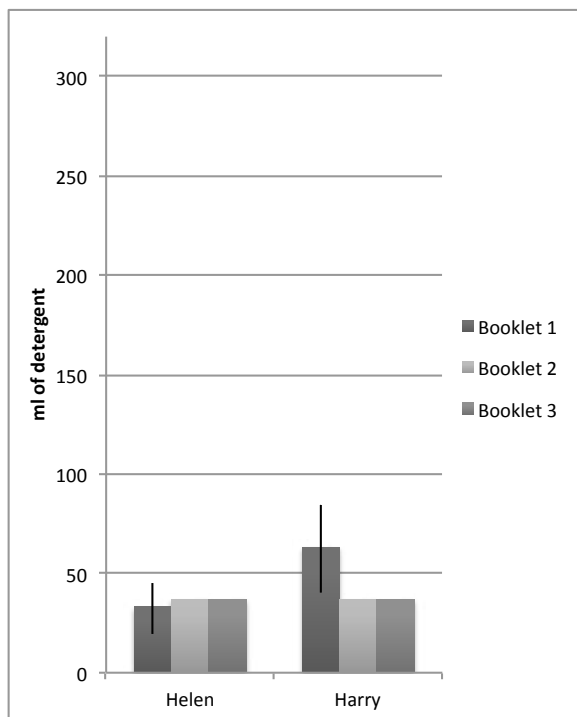
be significant (p=0.0019, one-sided and unequal variance). As the third booklets were not received no calculations on the significance in difference in mean values regarding it was made. Nevertheless, if the doses were as Helen reported, the difference in mean value for the first and the third should be the same as for the first and the second. Furthermore, there would be no difference in mean between the second and third booklets and the variance would in both cases be equal to zero. In total, they used 4 tubes.

The reason for not using more than one tablet was because they never washed such an amount of laundry that, in their opinion, would require two tablets, nor laundry with that level of dirtiness. When washing only one piece of clothing they thought about using less than one tablet, but in the end they took a whole tablet anyway. Apart from when washing very small amounts of laundry, one tablet was perceived as the correct dose and the tablets worked well. The use of tablets seemed almost automatic, firstly, they always used one tablet and secondly, they reported that with the tablets no active decisions regarding dosing was made, instead, they just took one tablet. They both read the instructions for how to use the tablets when they got them and they used the lid so the instructions were always available. Prior to the study, Harry sometimes read dosing instructions on the packages, but claimed that the size of the package may have influenced him as well, as small packages to him indicated high concentration. He thought that he might dose slightly too much. Helen knew that Gothenburg has soft water probably due to a sign in the common laundry room and this made her dose moderately. She follows this rather than dosing instruction.

Harry expressed that he already had to make so many decisions in his life that he found it comfortable to not have to make decisions regarding dosing. This may ensure a long-term efficiency as it indicates that Harry had no desire to start questioning the dosing of the tablets.

Harry and Helen described purchase of washing detergent as an investment as you are stuck with the washing detergent for half a year. Nevertheless, they were not negative to test different kinds if the one they usually had would be unavailable. If not participating in the study, getting a free sample

Figure 71. The mean doses of booklet 1, 2, and 3 from Household H2. The error bars represent the maximum and minimum dose in every booklet.

would increase the probability for purchase of the tablet.

Harry expressed that having an easy way of dosing, e.g. lid of fabric softener bottle, might increase the desire to dose correctly. If this was true, the easy dosing procedure of the tablet would have increased the desire to dose correctly.

They both may be somewhat more aware of their dosing with powder after the study, but they were not sure and Harry mentioned that it is hard to estimate the amount with powder detergent. They reported that they would go back to their previous habit, i.e. the washing detergent they used before receiving the prototype and to determining a suitable dose by how it looks in the washing detergent compartment. It was considered difficult to understand what amount of powder detergent would correspond to one tablet.

Thus, the effectiveness in inducing the behaviour of using one tablet was very high and the potential for long-term efficiency seemed high as they during the whole testing period dosed in the same way and found it comfortable that the dosing decisions had been made by someone else. The effectiveness in inducing the behaviour of using less than one tablet was very low.

Level of Potential Long-Term Acceptability

Both Helen and Harry used the tablets during the whole testing period, they stated that they want to continue to use them and that they thought it to be a shame to not have access to them anymore. They found the tablets to be handy and to work well. They felt comfortable with having the tablets and it felt good to use them. As they had run out of tablets for coloured laundry Harry used both powder and tablets at the latest wash, and using tablets felt better than using powder. Both Helen and Harry experienced the dosing with the tablets as correct, except when washing small amounts of laundry, e.g. only one pair of jeans. It was seen as very comfortable that decisions regarding dosing had been made by someone else. Harry pointed out that before, it felt as if he took too much and Helen that she before thought of taking small amounts of detergent but from time to time thought that the laundry was very dirty and then used more. Harry found the package itself to be

handy and out of good quality and Helen though that the package was pretty. They appreciated the lid as it ensured sealing of the package. Since they transported the detergent in the laundry basket back and forth to the common washing room ordinary packages may leak into the basket and this did not happen with the tube. The quality of the detergent was seen as important, but Harry found quality of the detergent in the tablets was difficult to judge as they did not have very dirty laundry. They both reported that they got used to the prototype very quickly and Helen stated that she hardly remembers what it was like before the tablets.

The most apparent problems with the tablets were that they crumbled and that the wrapping tissue not always came off completely when tearing. Both of them were annoyed with these problems and they were initially surprised of how much the tablets crumbled. At one time they spilled detergent on the floor. But in course of the testing, they learnt how to handle the package in a way that ensured control over the crumbles. Harry also pointed out that leakage may occur with ordinary packages as well as the spout often breaks. Other disadvantages of the package was that the part pulled off have to be disposed preferably close to the washing machine and this makes recycling difficult. If having a private washing machine, Helen would have preferred a box with tablets instead of the tube and that the tablets should be firmer. Harry appreciated the tubes and explained that he saw the difference between the tube and ordinary packages as the difference between a Macbook and an Iphone in comparison with ordinary computers and ordinary mobile phones.

They preferred the tablets over the other prototypes, with the detergent package as their second choice. The laundry kit was thought to be troublesome to use, even if Harry thought that it could be interesting to know the amount of laundry. The frog cup was found to be strange, yet for children it could be useful. Helen pointed out that an advantage of the tablets is that the dosing is included in the package. Even though Helen preferred a known brand of washing detergent, they would continue to use the tablets if they crumbled less, were available in their local store and not significantly more expensive than their ordinary washing detergent. If so, they would have preferred

to buy several tubes at a time for coloured laundry but one at a time for white laundry. If they had not been a part of the study, the best way to get them to start using the tablets would be a free sample.

The potential for long-term acceptability seemed very high if the problems with crumbles would be reduced and availability at a reasonably price could be ensured.

What Impact Did the Design Strategy Have?

Helen's and Harry's previous dosing habit was intervened by the study itself. But they stated that a free sample of the tablets could have been enough for breaking the habit if they had not participated in the study.

The use of the tablet seemed to have created a strong habit as they always use one tablet, even when they doubted that this was the correct dose and, as they wanted to continue to use the tablets. Furthermore, they reported that they did not make decisions regarding dosing with the tablets, they just used one tablet. Harry mentioned that he did not want to learn how to dose every time he bought a new kind of package, which indicated a desire for a habit.

Household H3

Essential characteristics of Household H3 are presented in table 26.

Level of Potential Long-Term Effectiveness in Inducing Target Behaviour

Both Hanna and Henric used one tablet most of the time. During the prototype testing period both of them always used the tablets when they had access to them. When Hanna considered the

Members of household:	Hanna	Henric
Age:	39 years	39 years
Occupation:	Salesperson	Unit manager at a purchasing department at a large company
Environmental attitudes:	Eco-type D(2) or B(0) + actions(1) = 2 points	Eco-type C(1) + actions(1) = 2 points (out of 6)
Previous dosing behaviour:	Dosed by how it looked in the washing detergent compartment	Same as Hanna
Used to dose according to type of wash:	No, but always full machines	-
Read dosing instructions:	No	No, reading the dosing matrix was seen as a hassle since both the water hardness and the amount of laundry have to be known
Previous knowledge of Gothenburg's water hardness:	No	No
Additional members of household:	Their three children, 6, 4 and 1 years old	

Table 26. Essential characteristics of Household H3.

laundry to be very dirty she used two tablets, with an exception in the beginning where two tablets were used also for normal dirtiness. Hanna filled in Henric's first and second booklet as well as her own and therefore many observations were obtained. The mean dosing reported in Hanna's first booklet was 136 ml (density unknown). In the second and third booklets the means were 1.3 and 1.2 tablets per wash resulting in a mean volume of 49 ml and 43 ml, respectively. The differences in mean dose in the first and the second booklet as well as in the first and the third booklet were found to be significant (p= 1.0 $\cdot 10^{-11}$, one-sided and unequal variance; p= 6.3 $\cdot 10^{-7}$, one-sided and unequal variance). The difference between the second and third mean value was not found to be significant (p=0.46, two-sided and unequal variance). Henric only filled in the third booklet, and in that one he consistently used one tablet, corresponding to a volume of 37 ml. All the mean doses can be seen in figure 72. Both Henric and Hanna saw the use of tablets as habitual and they used in total nine tubes of detergent.

Both Hanna and Henric initially experienced the tablet as very small and that made them doubt that one tablet would be enough for one wash. For

Figure 72. The mean doses of booklet 1, 2, and 3 from Household H3. The error bars represent the maximum and minimum dose in every booklet.

Henric, this was most prominent when seeing the tablet in the washing detergent compartment. Yet, they both trusted the recommendations and in most cases they used only one. As they never used the lid, they did not have access to the complete dosing recommendation. Hanna claimed not to reflect that much the first time she used the tablet and just followed the recommendation as she felt as if she was given an assignment. As it said on the package that one tablet was intended for one wash, using two tablets in one wash felt unnecessary, according to Henric and Hanna. Henric stated that he wanted to be environmentally friendly and as it said on the package that only one tablet was needed, then using only one meant taking care of the environment. With the tablets, Henric explained that it goes against the grains for him to use two. Henric thought that the information on the flaps (one tablet = one wash, place it in the washing detergent compartment) was valuable since it served as a reminder each time the tablets are used. Without these Henric thought that he might have used two tablets, whilst Hanna stated that she probably would have thought it to be one tablet per wash, even though nothing would have been written on the flaps. According to Hanna, the laundry was oftentimes not that dirty and the stains that she expected to vanish did also vanish with only one tablet. Hanna quickly got used to the tablets and she stated that when using the tablets, she did not think that much as she just put one tablet in the washing detergent compartment. The use of tablets felt natural to her and she was not aware of any changes in her experience of the tablets and washing in general during the study. Henric got used to the tablets when he came up with a trick for minimizing the mess created by the crumbling. This took approximately one month. Even though they mostly took one tablet, they still had some concerns whether this was enough and both of them said that when the washing machine was completely full and extra dirty they sometimes added another tablet. Henric expressed concerns about whether or not to put an extra tablet in when having different amount of laundry. He expressed a need for information and an explanation on the package that one tablet was enough for a normal wash since one normal wash was considered to be too undefined. He felt uncertain about the sufficiency of one tablet. Hanna explained that she thought of the amount of laundry and then it looked and felt so little with just one tablet. None
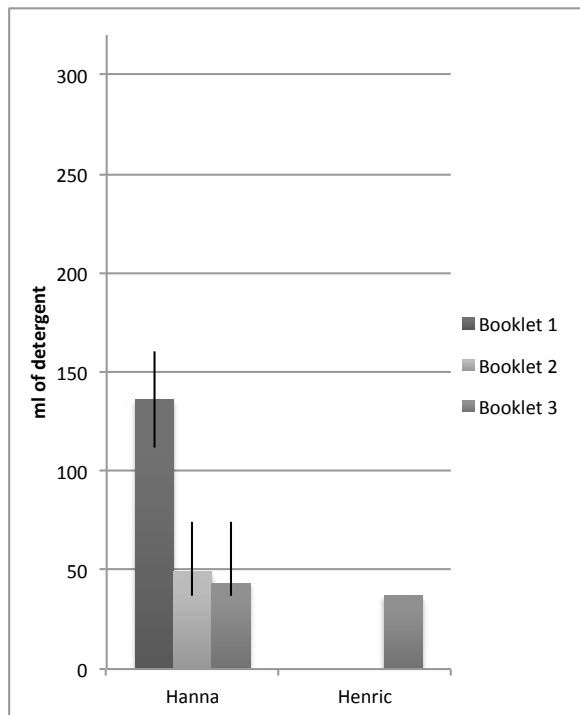
of them had noticed that the washing detergent, thus the dosing instructions, was for soft water. They both thought that they would have bought the tablets, even if they would not have been participating in the study. The critical element would be the price and whether they would have discovered them in the store.

Both Hanna and Henric said that they thought that they used less washing detergent now than before the study. Henric said that when using powder, he always had a feeling of using too much, and he continues to dose too much because he can. Hanna stated that she did it in order to have safety margins. Before participating in the study, she did not oftentimes reflect over her dosing behaviour, but she did it from time to time. Henric stated that before the interview he thought about looking for washing detergent tablets in stores. When receiving feedback on her initial dosing Hanna was surprised that she used to have enough detergent for up to three washes in just one wash. Henric said that the feedback on consumption was an eye-opener. They said that after the interview they would think more about it, but Henric pointed out that there is a risk of falling back into old behavioural patterns. After the interview, Hanna said that she would read the dosing instructions even though the water hardness was going to confuse her and she was positive towards getting a measuring cup. Without receiving feedback on initial dosing, Hanna thought that she would have continued to dose in the same way as before the study.

In summary, the tablets were effective in inducing the target behaviour. The potential for long-term efficiency seemed high as Hanna's initial uncertainty due to the size of the tablet shifted towards a more automated behaviour where one tablet was used without much thought put into it. For Henric, the long-term efficiency seemed high as the reminders on the flaps ensured correct dosing. Since none of them had knowledge about Gothenburg's water hardness only giving dosing instructions for soft water facilitated correct dosing.

Level of Potential Long-Term Acceptability

Hanna and Henric appreciated the tablets, thought that they fitted into their home and found the product idea as such to be smart. Both of them thought that the tablets were easy to use, except from the crumbling, especially during summertime due to damp air in the laundry room in the cellar. Henric thought that this might have been prevented if they would have used the lid. Hanna especially mentioned that the tablets were simple, handy and convenient. To her, the tablets were perfect and she would recommend them to others. She thought that other applications of the same principle could be fabric softeners and cleaning agents.

Henric foremost liked the pre-dosing element of the product, even though he felt a bit unsecure about the dose due to the size of the tablet and the definition for a normal wash. Furthermore, Henric appreciated that the way the packaging was done gave exact feedback on the number of washes left. Hanna thought that the tablets had a nice smell and felt fresh. Furthermore, she found the tubes to be easily stored. Yet, she said that she might have preferred a box instead of the tube, since boxes do not overturn. And if the tubes were left on top of the washing they fell down on the floor during spin-drying. Henric thought that it was difficult to get the tablets out of the tubes, because when tearing off the outer paper, the inner wrapping paper did not come off with the outer paper. But Henric found a technique that facilitated the opening; he hit the tube on the edge of the washing detergent compartment thus making the tablet fall into the washing detergent compartment. Henric believed that others would encounter the same problems with the inner paper as he did and that it might annoy them as well. Despite these reported problems, Henric said that having one package for each tablet, as with dishwashing detergent tablets, would be unnecessary. Hanna felt as if there was no stop when tearing of the paper slips. They continued along the tube. But to her, this issue and the problem with the wrapping paper were minor. Furthermore, Hanna and Henric both reported difficulties with powder washing detergent as well, Hanna said that powder also change structure in damp air, it forms lumps, and Henric commented that these lumps sometimes fall into the compartment for fabric softener.

Hanna got used to the tablets very quickly as the idea and the product itself was easy to accept. Henric stated that he got more of a relation with the product after experimenting with it. From a

completely unknown type of product, that at the first gaze seam simple, just to dose, then realizing that it was not as simple as he thought that it would be, experimenting and finding a way to handle the product, then, all of the sudden, he feel acclimatised with it. They both saw the use of tablets as habitual. Henric talked about the habitual use of the tablets as a result of that they had been around for a while.

Hanna preferred the tablets to the other concepts. Hanna found the frog cup to be fun. Regarding the concept of *Competence and Autonomy*, she thought that it would be to be somewhat interesting to get to know the weight of the laundry. The detergent package was in her opinion acceptable.

Hanna and Henric stated that they will miss the tablets, and Henric added that it felt difficult to start using powder detergent and to pour the powder again.

They both stated that they would buy washing detergent tablets if they found it in the stores and that they would look for it. They do not know if there already were tablets available in the stores. They both thought that they would have bought the tablets also if they had not participated in the study, as long as they would have discovered them and the tablets would have an acceptable price. They would be willing to pay slightly more for washing detergent tablets compared to powder because of the environmental and economical benefits of correct dosing.

The potential for long-term acceptability seemed high as they wanted to continue using the tablets, will look for new ones in the stores and would be willing to pay a little extra for it, despite problems with crumbling and the inner warping tissue.

What Impact Did the Design Strategy Have?

Even though Hanna and Henric thought that they at a reasonable price would buy the tablets if they notice them in the store also prior to the study, their previous dosing habit was rather intervened by the study itself.

Hanna had initial doubts about the dosing of the tablets due to the size of them. Yet, she seemed to overcome this as the use of the tablets quickly

became habitual and little thought was put into the dosing. Maybe the fact that she had no objections towards the cleaning result helped her in getting over the initial doubts. For Henric it took longer to create a habit and he also reported more uncertainties regarding dosing and in the sufficiency of one tablet, even though he most often used only one. For Henric, the reminders on the flaps seemed important for ensuring a correct dose and they can be seen as *Just-in-Time Prompts*.

Household H4

Regarding this household, lack in communication between the project duo and the mother in the family caused some difficulties. On the behalf of the whole household, the mother agreed to participation. Yet, she turned out to do very little of the family's laundry and was unexpectedly away for a longer time during summer. The two daughters in the family did the laundry and initially they did not want to participate in the study. But one of them, here called Hedwig, agreed to fulfil some of the commitments. Nevertheless, for this household the completion of booklets took longer time than for the others and therefore the time frame only allowed completion of the first and the second booklet. Under the circumstances, it was decided to conclude the prototype testing with a shorter interview with Hedwig.

Essential characteristics of Household H4 are presented in table 27.

Level of Potential Long-Term Effectiveness in Inducing Target Behaviour

The documentation of washing detergent use in Hedwig's first booklet was not carried out in the way that was intended. Instead of dosing solely by intuition, Hedwig used a dosing ball marked with millilitres that came with the liquid washing detergent and noted the volumes used in the booklet. Furthermore, Hedwig's mother also was present at this moment and interfered with Hedwig's washing practices. The mother told Hedwig to use less detergent and to fill up the washing machines. Thus, the amounts of detergent used at the laundry occasion noted in the first booklet were not authentic. Hedwig estimated that she normally uses fifty per cent more than reported in the first booklet, where the reported mean was

64 ml. In addition, Hedwig from time to time got into her head that the laundry was not completely clean after washing it and then washed it again, in total two or three times. This happens especially for clothes that Hedwig were careful with, as she wanted them to be completely clean, as well as with laundry that was thought to be very dirty, e.g. sheets, towels and pillows. The time limitation in access to the laundry rooms was the limiting factor of the number of re-washes. In the booklets, six washes with the tablets were noted and for all of these washes, one tablet per wash was used, resulting in a mean volume of 37 ml. The difference between the mean values in the first and second booklets was found to be significant (p=0.011, one-sided and unequal variance). The mean values can be seen in figure 73. The laundry occasion reported in the second booklet was the most recent laundry occasion at the time of the interview. Hedwig mentioned that she had used the tablets at one other laundry occasion. Hedwig mentioned that each laundry occasion could consist of up to 12 or 14 washes. The first usage time was not noted in the booklet as she forgot to do so. The household got four tubes and at the time of the interview, they had not finished them.

Hedwig did not want to try the tablets, as she was satisfied with the liquid washing detergent she used. She was sceptical to trying new thing in general and especially when it came to washing detergent. Hedwig worked as a salesperson in a clothing store and therefore, she had specific knowledge about how to take care of clothes and she carefully applied this when doing laundry. She only used the tablets because her mother nagged at her about using them. Otherwise, she would not have tried them at all and she did not want to continue the use of the tablets.

Hedwig did not read the instructions on the package and when deciding how to dose with them she followed her intuition. She thought that it should be half a tablet for one full machine, yet she took a whole tablet as she considered half a tablet to be insufficient. For small amounts of laundry in cold temperature Hedwig mentioned that she sometimes used half a tablet, even though this was not reported in the booklet. Hedwig thought that the reason for thinking that half a tablet should be used for a full machine might have been that she once read the dosing instructions on her washing detergent and she found the recommended

Members of household:	Hedwig
Age:	22 years
Occupation:	Salesperson in a clothing store
Environmental attitudes:	Ecotype D(2) + actions(2) = 4 points (out of 6)
Previous dosing behaviour:	Dosed by intuition/feeling, she poured liquid washing detergent into the washing detergent compartment. From time to time she washed the same laundry two or three times
Used to dose according to type of wash:	Yes, both amount of laundry and dirtiness
Read dosing instructions:	No
Previous knowledge of Gothenburg's water hardness:	-
Additional members of household:	Mother and sister

Table 27. Essential characteristics of Household H3.

amounts to be very moderate. Furthermore, she once accompanied a friend when washing and the friend also used very small amounts of washing detergent. The friend commented Hedwig's larger doses as being a result of still living at home and not paying for the washing detergent.

If Hedwig would have used the tablets at three or four more washing occasions and thoroughly would have examined the cleanliness and smell, she believed that she could have established a new habit. Hedwig compared this with when her mother switched from incandescent lamps to low-energy bulbs. Then, she just had to accept it and eventually accustomed herself to the new light bulbs.

Hedwig was certain that she used too much washing detergent and that her washing practices were somewhat irrational. The comments from the mother seemed to be somewhat of an eye-opener for Hedwig, even though no intention to change any practices was reported.

When being used, the tablets effectively induced the target behaviour, yet they were only used involuntarily and therefore the potential for long-term
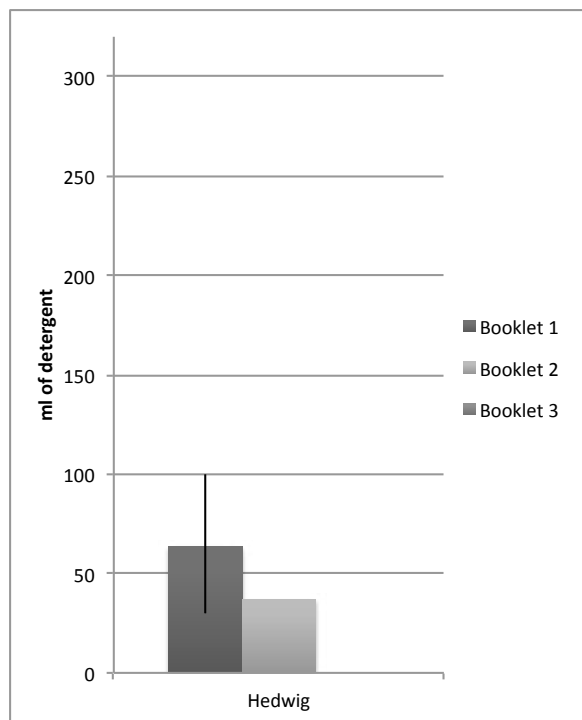
effectiveness must be regarded as very low.

Level of Potential Long-Term Acceptability

As mentioned above, Hedwig did not appreciate to try new things. Furthermore, Hedwig had preconceptions regarding washing and strong, peculiar washing habits that even Hedwig herself though were irrational. The only reason for testing the tablets in the first place was because her mother told her to do it for the sake of the study. And she only did it at two laundry occasions, both of them as a result of her mother's nagging. The involuntariness in the use of the tablets made Hedwig even more sceptical to them.

With liquid washing detergent, Hedwig knew how much to use, in order to get the feeling of freshness and the smell she wanted. Regarding the tablets, Hedwig mentioned that it was difficult to know if the laundry got properly clean. Yet, she said that she thought that the tablets did clean the laundry. She explained these contradictive thoughts with the fact that she once had forgotten to use any washing detergent at all and the cleaning result still was acceptable. Furthermore, the clothes were usually not that dirty. But for the sense of cleanliness washing detergent was needed. For Hedwig, the tablets felt as dishwasher tablets.

Hedwig had learnt that powder detergent was not good for washing jeans and quilted down jackets. This was the reason for changing from powder detergent to liquid, as she was using at the time of the interview.

Hedwig had back problems and therefore she mentioned that an advantage with the tablets was that they were not as heavy as her ordinary liquid washing detergent. She had not noticed anything particular in the smell of the tablets. Hedwig's mother was positive to the smell of the tablets, thought that the cleaning result was good and that they were handy to use as one just had to put one in.

Figure 73. The mean doses of booklet 1, 2, and 3 from Household H4. The error bars represent the maximum and minimum dose in every booklet.

Towards the end of the interview, Hedwig mentioned that she had been uncertain about whether or not the tablets consisted of genuine washing detergent. The project duo ensured her that it was washing detergent, showed her the original box and informed Hedwig about the brand name used

in Sweden for the manufacturer of the tablets. After that, Hedwig became less sceptical towards the tablets and even thought about using it some other time. She thought she could use tablets for half of the washes and the liquid washing detergent for the other half. She said that she wanted to keep the tablets that were left.

Hedwig would have preferred the frog cup prototype as the purpose of it is obvious. Furthermore, she did not want to use powder washing detergent. If the prototype of *Scripting* would have been available for liquid detergent it might have been an option. She thought that the laundry kit might have been enjoyable the first times, but eventually it would be too time-consuming as she wanted to do the laundry as quick as possible.

The acceptance of the tablets was very low, thus the potential for long-term acceptance seemed even lower. The lack of acceptance was a result of Hedwig's scepticism to new things, but it was also related to the fact that she did not experience her participation as voluntarily and she had not been convinced that the tablets contained real washing detergent. Furthermore, she preferred liquid washing detergent as she found it to be milder towards the textiles.

What Impact Had the Design Strategy?

Hedwig was in general very negative towards trying out new things, and the tablets were indeed seen as something divergent. In addition, she had a high satisfaction with the previous washing practice and strong preconceptions regarding washing and washing detergent. Consequently, the tablets were not found to be a promising alternative. The feeling of being forced into trying them added to the initial scepticism and she reported that the tablets were not given a proper evaluation. Nevertheless, when being forced to use them Hedwig mentioned no particular complaints regarding them.

8.2.5. Effects of the Evaluation Set-Up

In general, the participants found it difficult to distinguish what changes in attitudes and behaviours were related to the use of the prototypes or to the study set-up, i.e. an increased awareness of dosing and washing detergent, weighing washing detergent, filling in booklets, knowledge of that the booklets would be studied by the project duo etc. Often, the participants stated that both the prototype and the study as such influenced them. On the whole, the participants seemed to find dosing more important than before, and this was not only a result of the use of the prototypes. Some of the participants reported that they had more thoughts regarding the prototype than they would have had outside a study context.

In some of the households with two or more members, the study and the prototypes were discussed amongst the family members. Nevertheless, none of the households reported a lot of discussions. It was a few comments now and then. Some of the participants had talked about the study with family outside the household, friends or at work, and had received some comments.

None of the participants reported any difficulties in filling in the booklets and on the whole, they found the booklets to be easily understood. Some found it enjoyable to fill in the booklets while others thought it was annoying and troublesome. The greater part of the participants tried to dose as usual when filling in the first booklet. However, some of the participants took notice of their doses but stated that it did not influence them. A number of participants reported that their dosing behaviour was influenced by the act of filling in the booklets, e.g. participants in Household C4 and E4 tried to dose more even amounts and two participants in E4 tried to use slightly less or even as little laundry detergent as possible. For these households, this is reported on in section 8.2.1-4. within the paragraphs Level of Potential Long-Term Effectiveness in Inducing Target Behaviour.

The kitchen scale handed out for weighing of washing detergent was reported as rather easy to use, even though some participants reported minor problems, e.g. that the scale had to be placed completely horizontally in order to function properly. Some of the participants with shared laundry rooms commented that they sometimes forgot to bring the scale, the booklet or a pen with them when doing laundry. Furthermore, a few participants found it troublesome to carry

the equipment together with the laundry and the washing detergent.

Almost all of the participants knew that they were allowed to stop using the prototypes after completion of the second booklet. Two of the participants, one in E3 and one in E4, was unaware of this option. The participant in E3 stated that she would have continued anyway, but for the participant in E4 this was more unclear.

Few of the participants tried out the prototypes before filling in the second booklet despite the instructions of doing so. Therefore, some initial difficulties of use were reported in the booklets. This happened for example in Household C2. Furthermore, not all participants that voluntarily used the prototypes throughout the prototype testing period did any washes between the second and third booklet. Hence, several of the participants never used the prototypes without filling in the booklets.

Some of the participants were acquaintances of the project duo or friends of friends of the project duo. These households reported that their connection to the project duo had no influence of the results. Nevertheless, a few participants reported that they did have high expectations on the prototypes due to their familiarity of the project duo's education. Furthermore, some of them said that they would not have volunteered otherwise and that they otherwise might not have completed the study.

In many of the households, the project duo had contact with primarily one of the members in the household. As a result, not all household members were positive to the study, e.g. Simon in Household S2. In some households, one member that usually did do laundry did not participate in the study, e.g. Sofie in Household S3, the mother and sister in Household H4 and the father in Household C4. A shift in washing frequency throughout the study could also be seen, especially if it was a shift in who was on parental leave.

ECO-AFFECTIVE DESIGN

EFFECTIVENESS: reduction or increase? ACCEPTABILITY: continued or stopped use?

COMPETENCE & AUTONOMY

EFFECTIVENESS: reduction or increase? ACCEPTABILITY: continued or stopped use?

SCRIPTING

EFFECTIVENESS: correct or incorrect? ACCEPTABILITY: continued or stopped use?

HABIT INTERVENTION

EFFECTIVENESS: correct or incorrect? ACCEPTABILITY: continued or stopped use?

Figure 74. The figure illustrates the effectiveness and acceptability of the different prototypes. The figureines represent the number of participants that tested the prototypes. Their colour indicates the detergent consumption in the last documentation booklet, while the colour of the shadows represents consumption in the first booklet. Pink indicates overconsumption whilst green indicates an okey consumption. Grey indicates that the consumption is unknown.

8.2.6. Overview of Findings

The effectiveness and the acceptability of the four different prototypes is illustrated in figure 74, whilst table 28 presents an summarising overview of the findings from section 8.2. Key Findings.

PROMISING RESULTS **+**	SPLIT RESULTS **+/−**	LESS PROMISING RESULTS **—**	UNCERTAIN RESULTS **?**
Scripting Habit Intervention		Competence and Autonomy	Eco-Affective Design

Table 28. The table shows an overview of the strategies applied in prototypes and the potential to induce sustainable behaviour each strategy appeared to have in the evaluation of the prototypes.

9. ASSESSMENT OF PRODUCTS

In order to further investigate the inherent qualities of the four design strategies tested in the evaluation of the prototypes, existing products that make use of these design strategies were examined.

9.1. PROCEDURE

Firstly, suitable products were identified, thereafter users of these products were found and recruited to a group interview, one interview for each product.

9.1.1. Choice of Products to Assess

Eco-Affective Design: Global Warming Mug

It was difficult to find consumer products employing the strategy *Eco-Affective Design* even though there are quite a few product concepts and prototypes that show eco-affective qualities. The most suitable eco-affective consumer product found was the Global Warming Mug (see figure 75). The behaviour promoted by the mug is to reduce one's impact on global warming in general and particularly by not drinking heated beverages. When hot beverage is poured into the mug, the print of the world map changes and displays the consequences of a raised ocean level, i.e. the landmasses shrink. This effect might raise feelings of fear and concern for the effects of global warming, and these feelings could possible lead to a more sustainable lifestyle.

Competence and Autonomy: Lint Remover

For the strategy *Competence and Autonomy*, a lint remover was chosen (see figure 76). The behaviour promoted by this product is to prolong the use phase of an article of clothing by removing unwanted naps from it, and thus decrease the need for purchasing new clothes. The feeling of competence may arise as the user becomes capable to complete a task with good result, and as he or she can prolong a garment's life, the user can feel more autonomous from the clothing industry. By facilitating the removal of naps and making the user feel skilled and independent, he or she might get motivated to perform the target behaviour.

Scripting: Water Tap

For *Scripting*, the chosen product was a water tap that promotes the behaviour of reducing ones consumption of hot water and of water in general (see figure 77). The use of hot water and high water flow is physically constrained as the handle has a built in resistance upwards and leftwards. In order to maximise the flow and/or the heat, the handle has to be held up and/or held to the left with a

Figure 75. The Global Warming Mug makes use of the strategy *Eco-Affective Design*.

Figure 76. A lint remover. This product makes use of the strategy *Competence and Autonomy*.

constant force. Hence, the extra work needed for consumption of hot water and the extra work or time needed for consuming a lot of water steer the user into consuming less water.

Habit Intervention: Reusable Menstrual Cup

A reusable menstrual cup (see figure 78) was chosen for the strategy *Habit Intervention* as it provides a completely different sanitary protection compared to disposable sanitary pads and tampons, thus acting as a habit intervention. The behaviour promoted by the reusable menstrual cup is to use reusable sanitary protection instead of disposable sanitary protection, and thus decrease the amount of created waste. The reusable menstrual cup efficiently breaks the habit of using disposable sanitary protection, as they are no longer needed. If this product actually breaks the habit depends on if the usage of disposable sanitary protection could be considered a habit. This probably differs between users. After trying out the cup, the product should contribute to easy formation of new habit. In this case the cup contributes if it is considered to be comfortable, easy to use and safe, as the user then experiences a direct positive outcome of the use.

9.1.2. Preparation of Assessment

Recruitment of Participants

The project duo aimed at recruiting three users of every product, and users were recruited in several ways:

» putting up posters in a student flat house with the right kind of water tap generated the recruitment of two water tap users

» putting up posters at universities in Gothenburg and on public bulletin boards, which led to the recruitment of one menstrual cup user

» posting Facebook statuses asking for users of these products led to the recruitment of five participants, these were users of the global warming mug, the lint remover and the menstrual cup

» asking among the project duo's groups of

friends resulted in two recruited participants, one user of the lint remover and one user of the menstrual cup

» asking in stores offering the Global Warming Mug for sale led to the recruitment of one user of the mug, whom unfortunately did not show up for the group interview.

After recruitment, interviews were scheduled and the participants were asked to reflect over their

Figure 77. A tap with a built in resistance in the handle. This product make use of the strategy *Scripting*. Photo by Magnus Renström.

Figure 78. A reusable menstrual cup. It makes use of the strategy *Habit Intervention*. Photo by Diva International.

thoughts and feelings towards the product and product interaction.

Creation of Interview Form

The group interviews were set to be semi-structured (as explained in section 2.5.), and an interview form was written with questions aiming at creating an understanding of how the design strategy contributed to long-term acceptability of the product and to the effectiveness in promoting the targeted behaviours. The interview templates can be found in appendix 8. For three of the interviews a picture based answering sheet, where the respondents was to describe how they feel and what they think of when using the product, was created in order to be used as a warm-up exercise. This method is explained in 2.7. below. For the interview on the menstrual cup this structure was considered less fitting as the subject could be slightly too personal to start off the interview with. The method was instead used for a question halfway through the interview.

2.7. The Method of Picture Based Answering Sheets

This method is inspired by context mapping techniques (see 2.1.) and aims at making the user more open-minded and inspired to talk about feelings and experiences. When used in a group session it also contributes to that each participant gets a chance to think through his or her answer before getting biased by someone else's answer.

The idea is that each participant chooses amongst provided pictures on a sheet, as a way to answer a posed question. Pens are preferable also provided as participants might want to write down supplementing words. When the participants are ready they explain their answer with help from the sheet.

9.1.3. Execution of Group Interview

The interviews were held in accordance with the created interview forms and tape-recorded digitally. They were all held at Chalmers, and lasted for approximately 30 minutes.

9.1.4. Analysis

The recordings from the interviews were summarised under each question in the interview form. Thus, only relevant findings were registered. Based on this summation, an résumé of each interview was written and conclusions were drawn and written down.

9.2. KEY FINDINGS

9.2.1. Global Warming Mug

Two men aged between 20 and 40 years old, who both had owned their mugs for a couple of years, were interviewed. The younger man had his mug at his parents' home and used it rarely nowadays, whilst the older man kept his mug at the ship he worked on, and thus used it every day during month-long periods.

In this case, the strategy *Eco-Affective Design* seemed to be accepted over time as well as at first encounter, as no negative comments were made concerning the way the mug attempts to influence a user. However, during the interview, the men started to reflect upon what impact the mug itself, with its thermo-chromatic print, had on the environment. Regarding the effectiveness, one of the men said that it was a bit of a scare to see the landmasses disappear on the mug, but this emotional effect appeared to fade with time. The mug did not succeed in promoting a specific behaviour change, perhaps as it did not provide a solution or a plan of action for the user. Consequently, the effectiveness in inducing target behaviour seemed very low. Yet, if reflecting over and discussing global warming would be the target behaviour the product seemed fairly successful, and with persistent effectiveness as long as new people encountered the product and its user. On the other hand, for this target behaviour the potential effectiveness of reducing environmental impact would be very uncertain.

For the full summary of this interview see appendix 9.

9.2.2. Lint Remover

Three users aged between 25 and 30 were interviewed, two women and one man. Two users had received the product as a gift after trying out someone else's lint remover, while the third user had bought it on impulse. They had all owned their lint removers for a couple of years and used them infrequently but approximately once every other month, with an increase wintertime as the type of garment the lint remover is mostly needed for is used more frequently then.

For this product, the strategy of *Competence and Autonomy* seemed to be accepted on both short-term and long-term basis. Throughout the interview it was clear that the users most often felt competent while using the lint remover, and additionally, the usage seemed to make the users feel independent from both the clothing industry and from norms concerning household duties. This effect seemed constant over time and the lint remover did succeed in prolonging the lifetime of some garments. Despite this, the effectiveness of the product in reducing environmental impact appeared rather low as whether it made the users buy less new clothes or not was uncertain.

For the full summary of this interview see appendix 10.

9.2.3. Water Tap

Three men, aged between 20 and 30 years old were interviewed. One of them had the tap solely in the bathroom whilst the other two had it in both in their bathroom and their kitchen. But, at the time of the interview, one of the latter thought that he had only a flow limiter in his kitchen tap and no limiter at all in his bathroom tap.

The acceptability of the tap limiters seemed very high, as the interviewees expressed a general satisfaction with the tap. Furthermore, as the high flow above the limiter was appreciated by some of the users, they might have seen the high maximum flow as a result of the limiter, thus creating a positive image of the limiter itself. The users' attitudes towards consumption of water and hot water had not changed, nevertheless, there seemed to be an increased awareness of how they use water and

how they interact with different taps. The effectiveness in inducing target behaviour seemed rather high as none of the interviewees used the warmest water, and the high-flow mode were mostly used when a pre-determined amount of water was to be poured. Regarding the effectiveness in reducing environmental impact, all the users stated that they perceived a slight decrease in their consumption of hot water and water in general. This decrease in water consumption was, according to one of the users, partly due to the easiness of, and the precision in the movement of the handle. Accordingly, this affordance may also be as an important part of the script of this product.

For the full summary of this interview see appendix 11.

9.2.4. Reusable Menstrual Cup

Three women, aged between 20 and 30, were interviewed. They had all owned their cups for a couple of years, and two of the women used their cups regularly whilst one of them did not use her cup at all.

The long-term acceptance of the menstrual cup depended on whether or not the user had managed to learn how to use the cup without problems, which partly depended on if she had chosen a suiting model for her, i.e. it depended on how well the cup worked for the user. However, the cup did not support the formation of a new habit very well as all three interviewees had experienced difficulties during this phase. The users dealt with this in different ways. One of them consulted friends at an internet forum and got encouraged to keep on trying until she after a couple of month had learnt how to use it. The second user started by using the cup a little, and her previous protection a little, then she gradually shifted more toward exclusive use of the cup. She felt that it was probably normal with a trial and error period and therefore she did not give in. The third user had more severe difficulties as the cup caused her some pain when trying to insert it. Additionally she did not feel that she could sterilise the cup in the common kitchen in her student's corridor. These factors, in combination with lack of support from friends, made her angry and unmotivated and consequently she stopped using the cup very quickly. If the user

finally accepted the product it was very effective in both inducing target behaviour and in reducing environmental impact, as the new habit seemed to grow very strong and no more disposable sanitary pads or tampons were needed or even wanted. One reason to why the habit grew strong might be that the cup is always available and never needs to be refilled like a stock of disposable protection would. Additionally, the extra work the cup brings, like washing it after emptying it, and sterilising it when the period is over, is not an obstacle

in the moment you need to start using sanitary protection.

For the full summary of this interview see appendix 12.

9.2.5. Overview of Findings

An overview of the findings from chapter 9.2. Key Findings is presented in table 29.

PROMISING RESULTS **+**	SPLIT RESULTS **+/-**	LESS PROMISING RESULTS **—**	UNCERTAIN RESULTS **?**
Scripting Habit Intervention			Eco-Affective Design Competence and Autonomy

Table 29. The table shows the potential to induce sustainable behaviour each strategy appeared to have in the assessment of existing products.

10. DISCUSSION PART II

10.1. STUDY SET-UP IMPLICATIONS ON FINDINGS

10.1.1. Exploration of Context

The exploration of the context was done in accordance with the method of contextmapping, except for the different take on the generative phase of the session. Unfortunately, the validity of the findings might be lower than with traditional generative techniques, as the given statements may have biased the participants. Nevertheless, in the final part of the meeting, the participants expressed their own thoughts and attitudes, thus functioning as a validation of the prior result. If the literature review had been more thorough, this could have served as an additional validation. The data from the contextmapping study was analysed through a KJ-Analysis, yet only by the project duo and not by three to six persons as recommended.

Moderate dosing of washing detergent was chosen as the target behaviour. Yet, washing might not be frequent enough during a four month testing period in order to be able to draw conclusions on long-term implications. If a more frequent behaviour, e.g. washing up dishes, would have been chosen conclusions on the long-term effectiveness and acceptability could perhaps have been drawn with more certainty.

10.1.2. Concept Development

To develop concepts from a design strategy for sustainable behaviour was a new methodology for the project duo. Not to mix strategies unintentionally was found to be difficult and from time to time impossible. E.g. the strategy of *Information* is present in the concept of *Scripting* to inform about

water hardness. Furthermore, strategies embedded in the concepts that the project duo themselves had not been aware of played an important role in some prototypes' success or failure, as mentioned in section 8.2., paragraphs What Impact Had the Design Strategy?. Therefore, the effectiveness and acceptability of a single strategy got difficult to distinguish.

No list of requirement for the prototypes was established, despite the fact that this is the common procedure in the project duo's training. Nevertheless, the use problems reported by the participants were related to the prototype rather than to the concepts as such. However, regarding the concept of the laundry baskets, the project duo realised that it would not be handy to carry more than two laundry baskets at a time as one might want if using a common laundry room with several washing machines.

10.1.3. Prototyping

Due to the limited time and budget for prototyping, the options for manufacturing the prototypes were restricted and the prototypes were not properly tested before delivery to the sixteen households. This meant that some features of the prototypes diverged considerably from the concepts. One example of this was the laundry basket in the concept of *Competence and Autonomy*, where the inadequacies lead to ceased use of the prototypes. Thus, the effectiveness and acceptability of *Competence and Autonomy* as it appeared in the study might be less than the strategy's inherent possibilities.

In the case of *Scripting*, the prototype needed three doses for soft water and a small washing machine, while in the concept only one dose was needed. As the participants reported that they found it

tiresome to tilt the package back and forth, a single dose system might have increased the acceptability. Nevertheless, the prolonged dosing process may reduce washing detergent consumption as one gets tired of tilting the package back and forth; consequently one does not dose more than what one consider to be a minimum. Furthermore, if the prototype would have been adjusted to dose more evenly, it is possible that both the effectiveness and the acceptability would have been higher.

In the prototype of *Habit Intervention* one tablet was recommended for soft water and a small washing machine, while in the concept one tablet should be enough for half a wash in soft water and a small washing machine. As many of the participants used one tablet also for small amounts of laundry, the concept might have decreased the consumption of detergent. Furthermore, the participant that did want to adapt her doses might have showed higher acceptance. Nevertheless, the participants also expressed a desire for not having to make decisions regarding dosing, and with smaller tablets the behavioural possibilities increase. For Henric in Household H4 just knowing that taking a second tablet would mean that he used enough washing detergent for two washes deterred him from taking two, indicating that this increased the effectiveness of the prototype in comparison with the concept. The prototype was also cylindrical, the paper troublesome hard to tear off and the tablets crumbled. Nevertheless, it seems as if it did not influence the prototype's success or failure.

The prototype of *Eco-Affective Design* did not diverge from the concept considerably and the level of effectiveness or acceptability of the prototype did not stem from these small differences.

10.1.4. Evaluation of Prototypes

With such small amounts of participants, it is difficult to compare the result of the different prototypes with one another. If every household would have tested all the prototypes, a better understanding of the effects of each prototype could have been reached. Nevertheless, the testing period would have been significantly shorter and testing would have been more bothering for the participants as they would have to be visited

several times, to fill in more booklets and to adapt their behaviour to four different prototypes.

For many participants the dosing behaviour seemed to be habitual and therefore they might not have been susceptible to information about alternative dosing behaviours. In the prototype testing, the prototypes were forced on the participants and it was obligatory to use the prototypes. This radically differs from conventional acquisition of products and must be taken into account when considering design applications of the strategies.

The project duo wanted to promote behavioural changes in people's everyday life, a decision that certainly caused difficulties in collecting correct and exact data. Yet, there are quite a few factors that may have a great impact on people's tendency to change a behaviour that would not have been equally present in a controlled testing, e.g. stress, tiredness and laziness. Furthermore, the result of the behaviour would not be of the same importance for the participants if they would not have to live with it, e.g. if they would wash someone else's clothes in a lab they might be able to restrain their desire for flawless cleanliness.

Even though the participants' tendency to change behaviour was to be tested in their real life, the testing procedure could have been designed in such a way that the participants would not have been aware of the fact that they were in a test. Nevertheless, it would have been complicated and, foremost, highly unethical to observe behaviour during such a long time without informing the participants about the observation.

The recruitment of participants may have influenced the result. Firstly, the households recruited through the collection of persons willing to participate in user studies at the department of Design and Human Factors at Chalmers are positive to testing new things, otherwise they would not have volunteered. They might also have participated in tests prior to this study and this may have biased them. When asked, the participants recruited amongst the project duo's acquaintances and friends of friends, claimed that this social connection had not influenced them. Nevertheless, such a hypothetical question is difficult to answer. Interestingly, some of these participants stated that they would not have participated in the study if

they would have been acquainted with the project duo. Consequently, these participants might not be positive to testing of new products and might not have had prior experience of participation in testing.

When already having recruited several participants, the project duo were advised to try to get as similar groups of participants as possible in order to more easily distinguish the different effects of the prototypes. Unfortunately, as the recruitment of the participants was difficult and time consuming, the project duo did not want to replace the participants already recruited. This rendered the comparison of the different strategies more difficult.

When trying to recruit participants, the inquiry was formulated as: "Do you want to help us in our thesis work by testing a product?". And the aim of the thesis was formulated as follows: "Our thesis deals with how products can inspire and motivate people to change their habits.". The environmental benefit of correct dosing was not mentioned, although many participants probably guessed that this was the underlying reason for testing since the care for the environment currently is a popular theme in design. For the participants that evaluated the eco-affective prototype, the reasons for the evaluation of course became clear. Nevertheless, the project duo never confirmed the participants' suspicions; instead the project duo explained that they could not give an answer because that could bias them and that all their questions would be answered when the evaluation was completed.

It cannot be excluded that filling in the booklets did have a noticeable effect on the participants' dosing behaviour especially through an increased awareness of the importance of dosing. Therefore, the motivation to dose correctly might have been influenced and the effects of the prototypes alone will not be fully understood. For the greater part of the participants, the initial dosing behaviour reported appeared to be valid as they claimed to dose as usual. For the others, the reported initial dosing appeared to be less than usual.

The initial interview form was very short and mostly concerned the participants' preferences for washing detergent. Maybe a more comprehensive interview form could have given a more thorough understanding of the barriers for correct dosing

in each household that would have improved the matching of prototypes with the households. Furthermore, to get a complete picture of the mechanisms that influence any behavioural change, it would have been beneficial to get to know the participants' environmental attitudes prior to the study, as was done e.g. by Hopper and McCarl Nielsen (1991). Nevertheless, such a measure could have influenced the participants and given them further clues to the theme of the project. Since the aim of the study was to understand the long-term acceptance and efficiency, trying to not bias the participants was thought to be superior to getting a full understanding of the mechanisms with which the efficiency and acceptance was achieved.

A drawback of the first visit and the delivery of the prototypes was that not all family members were present. Therefore, not all participants were aware of the layout and the principles of the study. All information needed was also included in the booklets, but the participants did not assimilate all this information. As a result, some participants tried to use less washing detergent than usual in the first booklet and not all participants knew that they were allowed to stop using the prototypes after completion of the second booklet. However, the latter was of interest only for one participant, as he did not know if he would have continued the use otherwise. Furthermore, few participants started to use the prototypes as soon as they got them, thus using them for a couple of times before the second booklet arrived by mail. Instead, many of them started as they received the second booklet.

The matching of prototypes and households were constrained by requests of perfumed or non-perfumed washing detergent and powder detergent or liquid washing detergent giving few possible matches. This was problematic, as the prototypes could not be matched towards the different anticipated barriers for correct dosing in each household.

In the first booklet, there were twelve rows for filling in washes, but for most households the limiting factor of number of washes was the time frame. For some of the participants this resulted in very few observations due to low washing frequency. In the second and third booklet there were six rows for filling in washes in each booklet. For

some of the participants this was just about what they managed within the time frame, while other participants could have managed to report more observations. Higher number of observations gives higher statistical certainty of the findings. Nevertheless, there should have been room for using the prototyped without filling in the booklets as well to make sure that the participants could report on that experience.

The closing interview was semi-structured and therefore, all the questions were not asked in all interviews. Consequently, some issues were only discussed if the participants themselves brought them up and the results of the interviews are not completely comparable. An advantage is of course that it became obvious what topics the participants found most important and that the interviewers did not steer their attention towards an issue they had not thought of. An example of this was the cleaning result when using the prototypes. No question regarding satisfaction of cleaning result was prepared as the question itself might give the participants the idea that there should have been a difference. Yet, almost all participants mentioned that they were satisfied with the cleaning result.

There were many difficulties in the analysis of the data reported in the booklets. The decision to analyse the volume of washing detergent seemed as the only choice as this corresponded to how the participants dose, i.e. by visual estimations. Yet, it became problematic as the density for all washing detergents could not be obtained from the packages. Furthermore, not all participants had reported what washing detergent brand they had used. Nevertheless, to make the analysis in weight is just as incorrect as 50 g of powder detergent may correspond to 47 ml and 73 ml, a difference that can be seen with the naked eye. Furthermore, in the household that uses the same washing detergent, the exact density is of less importance as the incorrectness will be the same in all the measurements. An extension of the project would be to acquire all the washing detergents available in stores and measure their density. Another difficulty was the estimation of a suitable dose of washing detergent. All brands recommend different doses, yet, few of the participants read the dosing instructions and the greater part of the participants did not think that there was a great difference in dosing recommendations from different brands or had

never thought of it at all. Thus, most participants would have used the same amount of washing detergent regardless of the brand. Therefore a mean dose was calculated and used as a measurement of the effectiveness for the frog cup. Furthermore, many of the participants reported that they washed half full washing machines for which there are no dosing recommendations. In those cases, it was difficult to define what a suitable dose is. The statistical analysis of the data in the booklets was a great challenge to the project duo as they had no experience in empirical applications of the statistical theory taught in their education. To this date, the project duo is uncertain of the choice of Student's T-Test for statistical analysis. Furthermore the project duo is unsure of whether dosing of washing detergent is normally distributed or not, when to use a one-sided or a two-sided alternative hypothesis and if equal variance could be assumed in some cases. Nevertheless, the statistical analysis is not the only way to measure the effectiveness of the prototypes and the analysis could also be revised in an extension of the project.

The transcriptions of the closing interviews were sorted into four pre-determined categories. If a comment did not fit in any of these categorises it was discarded. This procedure was chosen as it was less time-consuming than a KJ-Analysis would have been. Furthermore, the aim was not to find all interesting comments regarding the prototypes but to be able to answer the research questions. However, if one would like to improve the design of the prototypes, the rest of the comments would be valuable insights.

To let the participants choose between shorted versions of Persson's and Hemberg's (2010) ecotypes was a fancy the project duo got just before the first of the closing interviews as they realised that the participants' environmental attitudes had to be documented in a way that made it possible to compare the households. There are for certain better methods for measuring people's attitudes that have been proven valid. Yet, the project duo found the use of ecotypes to be an acceptable solution. Firstly, the ecotypes deal with consumer behaviours, which suited the project. Secondly, it was a quick method, a necessity as the interviews themselves were long. Finally, the result of it was not extensively used, thus the result was not of great importance. A disadvantage of the use of

ecotypes was that the project duo reformulated any discrediting personality traits in order to make them equally attractive. This gave some of the ecotypes a slightly different shade of meaning than in the original text. Furthermore, the shortening and translation of them certainly had an effect. In addition, the participants were asked about what behaviours they engage in for the sake of the environment. This served as an indispensable validation of the choice of ecotype, yet, it was a delicate task to give fair points for the behaviours reported. It is surely awkward to give points for such a multifaceted thing as environmental attitudes, nevertheless, for a reader the points are a quick way to get a clue of the environmental attitudes of the household.

Unfortunately, there were five participants that did not complete the study. Two of them went abroad (in Household E4 and S4), one could not be interviewed other than by e-mail (Household H1) and the last two did not complete the third booklets (Household E2 and H4). Of course, this falling off decreased the validity of the study.

10.1.5. Assessment of Products

In the product investigation, there were very few participants in each group interview. The reason for not extending the study was the limited time available for this assessment. Nevertheless, it was not meant as a way to investigate the chosen products thoroughly, instead it should be seen as a quick attempt to validate the findings of the evaluation of prototypes. If the assessment of existing products had been enlarged, it could have given clues to the question of the extent to which the study set-up of the prototype testing influenced the result. Even though it was a minor investigation, some interesting findings were made that shed light on the prototype testing and on the project as a whole.

The set-up of the product investigation was a semi-structured interview, with the addition of the method of Picture Based Answering Sheet. The use of the latter did prove beneficial, as the participants got a chance to reflect over their own experiences before reacting to others. Furthermore, the participants brought up the experiences they themselves found most important. Finally, it was

a very quick method, a necessity as the interviews could not be too long. If a more extensive product assessment would have been made, it would be advisable to sensitise the participants prior to the group interview and to use established methods such as generative techniques.

Several of the participants in the product investigation were acquaintances of the project duo and were familiar with the aim of the project. This might have biased the participants and made them more open to recognising environmental connotations of their behaviours.

A great drawback of the product investigation was that behaviour changes due to the products were not known. The consumption of water with and without the tap was not measured, nor if there were any decrease in clothing consumption due to the lint remover. The effectiveness of the Global Warming Mug was also unknown and would be very difficult to measure. Nevertheless, the effectiveness of the reusable menstrual cup was known as the participants themselves were able to report this in a reliable way.

10.2. FINDINGS

10.2.1. Exploration of Context

In the context exploration it was established that there is a great variety of barriers to correct dosing, both in total and for each person. The findings are discussed together with the result from the prototype testing below.

10.2.2. Evaluation of Prototypes

Eco-Affective Design

The effectiveness of the frog cup did seem high, yet the effectiveness of the strategy *Eco-Affective Design* was not fully understood as other strategies also played an important role in the behaviour inducement. In addition, it was not certain that the use of the frog cup would have continued for a much longer time, as just three out of nine participants

clearly expressed that they would continue their use if they could. However, all participants in this group expressed that they wanted to continue to dose moderately, except for Edwin that made no statement at all regarding this. This reflects that the participants were enlightened about the importance of moderate dosing and motivated to act upon this attitude.

The acceptability of the frog cup was in general fair. The main reason for not liking the frog cup was the notion that the frog was in the way, something that four participants stated. Most participants expressed liking for the frog, even one participant that thought that the frog was in the way appreciated its character. Interestingly, the acceptance remained unchanged or grew stronger, thus suggesting that some kind of emotional bond was formed.

The metaphor of the frog being suffocated of extensive dosing did only get through to some of the participants. Nevertheless, the participants in this group did talk more about the environment than participants testing other prototypes. Thus, the connection to the environment seemed to get through anyway and as reported in section 8.3.2., paragraph In Total: A Reminder in the Way, the frog cup might have served as a *Value and Attitude Reminder*. The exploration of context did show that there are conflicting attitudes that could constitute a barrier to correct dosing, e.g. it was an almost general opinion that heavy dirt justifies overdosing, indicating that the positive attitude towards cleanliness sometimes was stronger than the negative attitude towards overdosing. Furthermore, deliberate deviations from personal principles were reported in the exploration of context, especially in the choice of detergents.

If the frog cup did serve as a *Value and Attitude Reminder*, this explains why the participants were motivated to dose moderately but not how they determined what a correct dose was as only one or possibly two participants, Edgar and Ester, checked the dosing recommendations on their washing detergent. When using the frog cup, the project duo experienced that it feels awkward to cover the frog with detergent. Thus, a possible answer is that *Scripting* with semantic constraints may have played a role in the sense that one does not want to make the main character, i.e. the frog,

disappear. In addition, the scale from green to red can be seen as *Scripting* with cultural constraints, as green denotes good and red denotes bad in many cultures. However, not many of the participants commented the scale. Furthermore, the cup may through its size have sent signals of the descriptive social norm for dosing, as it is likely that the participants assumed that there is room for a sufficient dose in the cup. This effect might be stronger for the ones that used to dose more than 90 ml, e.g. Emelie in Household E2 and Elisabeth and Edward in Household E4. Furthermore, the visual enlargement of the detergent dose due to the volume of the rock was by two participants thought to decrease the doses.

One suggestion is that the effectiveness and the acceptance get lower if the original dosing practice is far from the desired behaviour, as for Emelie and Edward. Emelie did lower her dose, but she reported that she from time to time added a little more detergent after first having measured up a reasonable dose, and she believed that she had increased her doses after sending in her last booklet. Edward, who was not present at the closing interview, also lowered his dose in his second booklet, but his mean was still 74 ml, which seemed to indicate that he had difficulties to act in line with the message of the frog cup.

The strategy of *Value and Attitude Reminder* appeared to be promising as a tool for conveying the importance of moderate dosing. Yet, *Social Norm Reminder* and *Scripting* with semantic and cultural constraints might have been important in order to communicate what a moderate dose is.

Competence and Autonomy

As mentioned, the result of *Competence and Autonomy* must be seen in the light of the troublesome laundry basket. However, it can be concluded that the effectiveness of the prototypes was high when it was used. In this group of households two participants, Catrin and Curt, increased their doses greatly when they stopped using the prototypes, as reported in the third booklets compared to initial dosing reported in the first booklets. Catrin stopped using the dosing kit because she thought she had learnt how to dose correctly and thus did not think that she needed it anymore. Yet, this was a false feeling of competence, as she had not learnt

to dose correctly by eye. Consequently, the dosing kit seemed to make her feel competent, yet it did not make her competent. The reasons for Curt's increased doses were obscure, even to himself. He did not like the laundry basket, and ceased the usage as soon as he completed the second booklet. Nevertheless, he did report that he had learnt that the laundry gets clean also with moderate doses of washing detergent during the course of the prototype testing. One might wonder if his disapproval of the laundry basket turned into disapproval of moderate dosing as such. In the context exploration it was established that the image of conservation behaviour can be negative and one of the participants in the context exploration described excessive use of detergent as macho. The dosing system was seen as an entity by three of the four households as few of them thought of using only the volvelle and measuring cup. This was a pity, as the acceptance of these two prototypes generally was high. To use only these two prototypes would probably be rather effective, as it was effective for Household C2.

Feelings of competence and autonomy did not appear in the extent as intended, but it is not established whether the prototype was an inferior attempt in general or if the troublesome laundry basket alone is to be blamed. The volvelle was, at least in the beginning, to some participants enjoyable and appeared to induce some feelings of competence. Furthermore, many of the participants enjoyed getting to know the weight of the laundry. Nevertheless, the feelings of competence from using the dosing system did not seem to be strong enough to create a motivation to use them, possibly as the positive feelings were overridden by the troublesome laundry basket. The latter seemed to cause feelings of incompetence rather than competence. Feelings of being autonomous were not reported by any of the participants. In summary, the strategy of *Support Competence* seemed to be present. Furthermore, the use of the volvelle may be related to the strategies of *Enlightenment through Interaction and Experience* and *Engaging Information* on the topic of *Instructions for Sustainable Behaviour*.

The use of the *Competence and Autonomy* dosing kit demanded a greater effort than any of the other prototypes. In comparison with the participants' earlier dosing habits, it was a considerable

difference. Furthermore, a majority of the participants chose *Habit Intervention* and *Scripting* as the prototypes they would have wanted to have. These two are the prototypes that demanded the least effort of the users. This finding goes in line with findings in the context exploration where convenience in dosing was desired. As discussed above, the use of the prototypes as such was not rewarding enough to create motivation for continuous use. Yet, it is possible that people could be motivated to use the prototypes for other reasons, e.g. reduction in environmental impact or economic savings. However, it seemed as if the effort needed was too great for the motivation reached. Interestingly, two of the participants in this group, Christina and Camilla had the highest points for environmental attitudes, 5.5 out of 6 and these two were the most persistent users of the prototypes. Camilla had prior to the study sought after a measuring cup, thus she was already motivated to dose in that manner. A tentative conclusion is that the effort asked from the user must be matched towards the perceived importance of the desired behaviour. This supports the finding of the importance of user studies presented in section 3.2.2., as this could have been discovered in a thorough study.

The potential for the strategy of *Competence and Autonomy* was difficult to establish. Yet, it seemed to be difficult to design for feelings of competence, at least on a long-term basis, and for feelings of autonomy, if the feelings should be strong enough to motivate a behaviour that demands a great effort. Thus, the strategy must be regarded as less promising than the other strategies in the evaluation of prototypes. Furthermore, most of the participants stopped using the prototypes during the evaluation period and afterwards, most of them returned to their initial doses or even increased them.

Scripting

The effectiveness of the prototype was high and the tilting back and forth appeared to be a suitable physical constraint. It was accepted enough by the participants to make them use the prototype throughout the testing period, and only one participant tried to circumvent the constraint occasionally. Furthermore, the tilting back and forth was found to be tiresome and as discussed in section 10.1.3., having a triple tilt as the smallest

dose might have contributed to the effectiveness, while it is likely to have influenced the acceptability negatively.

In total, the acceptability of the *Scripting* prototypes seemed fair but not exuberant, yet three of the households were happy with *Scripting* in comparison to the other prototypes. Additionally, together with *Habit Intervention* it was the most popular alternative for the participants who did not try it, suggesting that the initial acceptability could be high. As with *Competence and Autonomy*, imperfections in the prototypes had a negative influence on the acceptability.

The participants appreciated that *Scripting* was an integrated solution. This goes in line with findings in the exploration of context where separate dosing aids were found to impede correct dosing. As mentioned, convenient dosing was coveted in the exploration of context and the integrated dosing in *Scripting* can be seen as convenient. Furthermore, the participants appreciated that no greater mental activity was needed for handling the product, thus they liked to be directed, just as some of the users of the tablets, as discussed below.

All of the participants continued the use of the prototypes throughout the prototype testing period, yet none of them expressed delight when finding out that the package is available in the stores at a reasonable price. This might be a combination of the moderate acceptability of the prototypes and a lack of Hemköp stores close by most participant's homes. It is also possible that this revelation was too unexpected, as the participants all believed they were trying out an idea created by the project duo, and that this caused a slight disappointment.

The strategy of *Scripting* appeared to be promising as the effectiveness was high and the acceptability seemed to have the potential to be high, as this was indicated by the participants that tried other prototypes.

Habit Intervention

The strategy of *Habit Intervention* showed split results when it came to acceptability. But when the prototype was accepted, it showed high effectiveness. The acceptability was related to an appreciation of being steered as the participants who showed a high acceptance liked to not having to make decisions about dosing. None of the participants was bothered by the fact that the washing detergent was only for soft water, indicating that also this steering element was accepted. After the prototype testing the participants in this group reported that they most likely would return to their initial dosing routines. The participants mentioned neither any attitude change nor a strong desire for dosing aids. This goes in line with the nature of the strategies in this category as they serve the purpose to steer and not to motivate. Due to the set-up of the study few clues of how to break habit was identified, yet free samples was suggested and the key issue seemed to be whether or not the tablets would be noticed in the stores.

The prototype did effectively guide the usage as is illustrated by the fact that the households took one tablet also when less than one tablet could have been used. The habit formation through *Scripting* was very effective as soon as the tablets were accepted. Furthermore, the dosing of the tablets are the same as dosing of tablets for dishwashers, and many participants were familiar with dishwasher tablets. As many of the participants washed half full machines, less detergent might have been used if the prototypes had been scripted for half a machine, as in the concept. Yet, as discussed in section 10.1.3., the great difference between one and two tablets deterred Henric in H3 from taking two. However, it can be concluded that if scripting for a certain behaviour one must know the behaviour well in order to design the scripting element in a suitable way.

It can be seen as the tablets introduced a new way of measuring washing detergent, by number of tablets and not by estimating the size of the pile. In this way the prior habit was made impossible. For Household H3 this seemed important as they had very high doses initially, doubted that one tablet would be enough for one wash but still used only one tablet. If getting the prototype of *Scripting*, it is possible that they would have added another dose just to be sure as they would be able to compare with their prior doses. For Household H2, this did not seem as important as they expressed no initial doubt of the tablets. For two of the households, H1 and H4, the tablets did not manage to break the prior habit completely.

The reason for this for Hedwig in Household H4 seemed to be her general scepticism towards trying new things and a preference for liquid washing detergent. Thus, a tentative conclusion is that a certain extent of interest or curiosity has to be present for *Habit Intervention* to work. It is likely that the intervention would have been more successful with pre-dosed unities of liquid washing detergent due to her preference for liquid washing detergent, e.g. capsules from Persil (Persil, n.d.). Hence, some people might need to see a connection from their prior habit to the new habit in order to dare to make the transition. This idea is supported by findings in the context exploration were scepticism towards unconventional washing procedures was seen. Hilda in Household H1 continued to dose with the same ambition of adapting her doses to the amount of laundry even though this meant that she had to divide the tablets. She seemed to want to make dosing decisions by herself and therefore objected the *Scripting* by the act of dividing the tablets. This goes in line with findings in the context exploration where a need for control was identified amongst some of the participants.

Few of the participants read the instruction even though the greater part had access to them as they used the lid. The instructions were easy to understand, therefore, it is likely that the participants simply felt no need for them. The information on the flaps that one tablet is enough for one wash was very simple, so maybe the effect that information that is easy to process is more likely to be seen as valid, as described in section 3.2.5., paragraph *Simple Information*, played a role. Furthermore, the text on the flaps served as *Just-in-Time Prompt* for Henric.

The strategy of *Habit Intervention* showed split results, as prior habits were not always disrupted by the new habit. But when the prior habit was disrupted, *Habit Intervention* seemed promising. If the prototypes were promising during the prototype evaluation period, it seemed promising also on a long-term basis, as the participants had no desire for making dosing decision themselves and therefore they would probably not start questioning the dosage. Furthermore, long-term effectiveness have been seen for dishwasher tablets. Yet, this dosing situation is slightly different as dishwashers more often are filled. The formation of a new habit through *Scripting* appeared to be successful.

10.2.3. Assessment of Products

The effectiveness of the Global Warming Mug and the strategy *Eco-Affective Design* was difficult to determine but it was probably very low. It did seem to have some ability to evoke negative feelings about the climate change, but it did not present a way to act upon those feelings. However, the acceptability of the mug appeared sufficient. The main result of using the mug was instead the discussions on environmental issues that it rendered, and thus the design strategies *Design for Reflection* and *Attention Drawing Design* seemed to be more descriptive of its effect than *Eco-Affective Design*.

The acceptability of the lint remover and the strategy *Competence and Autonomy* was high, while the effectiveness was difficult to settle since the participants were unsure of whether or not their removal of naps made them buy fewer clothes. Therefore, *Competence and Autonomy* must be seen as slightly promising. Yet, two other design strategies were also visible in this product. As two of the users considered the usage to be fun and engaged in it out of free will, the strategy called *The Fun Theory* might be applicable. Secondly, the strategy *Enabler* can also be descriptive of the effect of the lint remover, as the participants seemed to have had a positive attitude towards a long use phase, but a negative one towards wearing clothes with naps.

The strategy of *Scripting* as applied in the water tap limiters seemed promising, primarily due to the high acceptability of the tap. The effectiveness in inducing the target behaviour was also high, even if the reduction in environmental impact was unknown and estimated to be modest. Interestingly, the acceptability of the limiters seemed to be related to a general satisfaction of the tap and thus relate to the strategy of *Value-Added Design*.

In the interview on the reusable menstrual cup and *Habit Intervention* an interesting finding was how users dealt with direct negative outcomes of a new behaviour. Verplanken and Wood (2006) pointed out that the new behaviour has to be reinforced at least in the beginning of the habit formation. For the menstrual cup social support seemed to have been be sufficient for one of the users. For another, the gradual shift towards increased use of the cup might have served as reinforcement as she gradually felt more and more capable. However,

she found it normal to have a trial and error period and therefore did not give in. For the third user the pain experienced when inserting the cup and the inconvenience of the sterilising process, in combination with lack of social support disrupted the habit formation. For the two users that did form a new habit, the long-term effectiveness and acceptability was very high, which implies that the strategy *Habit Intervention* was promising. Yet, the investigation gave few clues of how to break unsustainable habits in an effective way. The strategy of *Competence and Autonomy* seemed also to be vital for this product. The initial learning phase makes the user feel competent when she finally gets the hang of it, and the menstrual cup can make the user feel independent from the sanitary protection industry since the cup often is sold through small internet based companies, and furthermore diminishes the need to regularly buy disposable protection.

11. CONCLUSION

In this chapter the discussion is condensed to its essence, which constitutes the answers to this master's thesis' six research questions.

11.1. RESEARCH QUESTION 1

» Can sustainable behaviour be induced on a long-term basis through product design?

The literature review did imply that it is possible to induce sustainable behaviour on a long-term basis through product design, even if few explicit product related examples were given. This intimation is further supported by the findings from the evaluation of prototypes as some participants expressed that they would have liked to continue using the prototypes. Additionally, in the short assessment of products several users testified of a changed behaviour due to the influence of a product.

11.2. RESEARCH QUESTION 2

» If so, what mechanisms are employed within the design strategies for sustainable behaviour in order to accomplish this?

The basic influencing techniques employed within the design strategies are motivation and direction, which is indicated in the model for categorisation of design strategies (see figure 79). In the group *Enlighten*, motivation is reached through mechanisms changing or activating user's values, attitudes or norms or through informing on behaviour possibilities. *Spur*, *Steer* and *Force* act more directly upon one of the two basic influencing techniques and the names of these categories can be viewed as generic terms of the mechanisms employed to reach motivation or direction. Finally, the design strategies within the categories *Enlighten*, *Spur*, *Steer* and *Force* are also elements of mechanisms, such as reflection, feeling competent, being just-in-time-prompted, etc. (see figure 39, in section 4.2.). For *Match*, no mechanism is employed as neither motivation nor direction is needed.

11.3. RESEARCH QUESTION 3

» Which design strategies for sustainable behaviour seem promising?

In accordance with the literature review the strategies *Feedback*, *Exhort Behaviour*, *Modelling*, *Personal Norm Reminder*, *Guidance through Group Belonging*, *Public Commitment*, *Incentives*, *Goal Setting*, *Competition*, *Social Incentives*, *Just-in-Time Prompt*, *Habit Intervention*, *Functionality Matching* and *Ecodesign* seem to have some potential to induce sustainable behaviour. Based on the empirical study in this project the project duo concluded that additionally, *Value and Attitude Reminder*, *Social Norm Reminder* and *Scripting* seem promising. *Habit Intervention* also displayed some potential, even if the disruption of the initial habit was not studied. Regarding *Eco-Affective Design* and *Competence and Autonomy* it is still unclear whether they are promising strategies or not.

The mechanisms behind the promising strategies vary, and thus the project duo has found no common denominator to why these strategies are promising. For a longer and strategy-specific explanation to their potential for success, see section 3.2. Key Findings.

However, as also promising design strategies may fail, the recommendation to start with a user study in order to identify barriers towards the sustainable behaviour (see section 3.2.2.), and to combine different design strategies (see section 3.2.10.), are vital for success.

11.4. RESEARCH QUESTION 4

» In the evaluation of design strategies for sustainable behaviour, what level of potential

long-term effectiveness in inducing the target behaviour will the prototypes (developed from the design strategies) reach, and why?

The prototype of *Eco-Affective Design* had high effectiveness when it was used, and was used throughout the evaluation phase by the greater part of the households. The potential for long-term effectiveness seemed uncertain but moderate with sustained access of the prototype. Without sustained access the effectiveness is of course unsure, but eight out of nine participants expressed a desire for a continued moderate dosing behaviour.

The prototypes of *Competence and Autonomy* had high effectiveness when used. Yet, the potential for long-term effectiveness must be seen as very low as a majority of the participants stopped using their kit after the mandatory period, and some participants even increased their doses after ceased use compared to their initial dosing behaviour.

The prototypes of *Scripting* had high effectiveness in inducing the target behaviour even though the doses when using these prototypes occasionally were high as the high doses were a result of imperfections in the prototypes and not caused by deviations from the target

behaviour. The potential for long-term effectiveness seemed high if access to the prototypes would be sustained. However, if access is not sustained the effectiveness seemed low.

The prototype of *Habit Intervention* had high effectiveness when it was in use, yet it was accepted only by half of the households. The potential for long-term effectiveness seemed to be equal to the effectiveness during the evaluation if the tablets would be available at a reasonable price. Otherwise, the long-term effectiveness seemed very low.

11.5. RESEARCH QUESTION 5

»   In the evaluation of design strategies for sustainable behaviour, what level of potential long-term acceptability will the prototypes (developed from the design strategies) reach, and why?

The prototype of *Eco-Affective Design* had either a moderate or a high acceptability. The prototypes of *Competence and Autonomy* had a very low acceptability and the prototype of *Scripting* had a moderate acceptability. Finally, the prototype of *Habit Intervention* had either a high or low acceptability. Few participants reported any change in their acceptance of the prototypes, and thus it appears as the level of potential long-term acceptability was in line with the acceptability reached within the timeframe of the evaluation period.

In general, low acceptability did not stem from an aversion of the design strategies, rather it seemed to be connected to flaws within the concepts or prototypes.
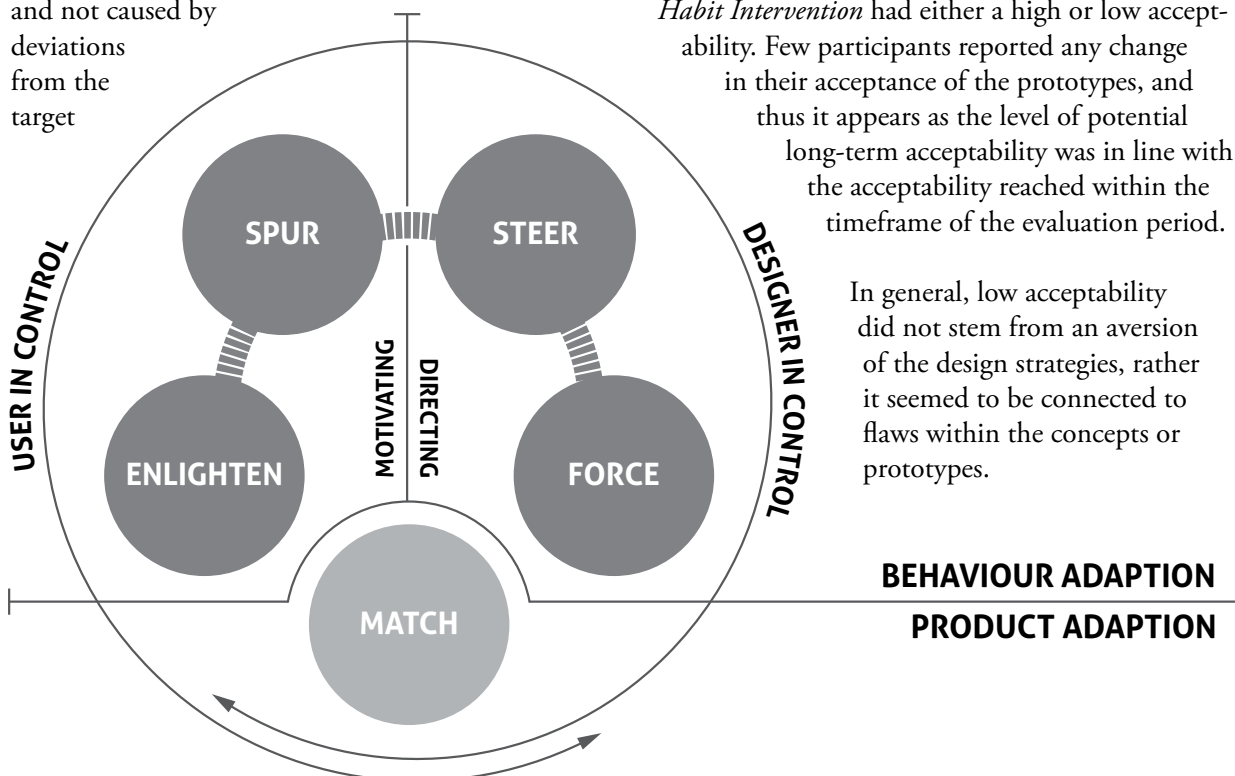

Figure 79. The model for categorisation of design strategies for sustainable behaviour.

11.6. RESEARCH QUESTION 6

» In the evaluation of design strategies for sustainable behaviour, to what extent will the design strategies be accountable for the level of acceptability and effectiveness reached by the prototypes?

For the prototype of *Eco-Affective Design* the most prominent design strategy seemed to be the strategy of *Value and Attitude Reminder* and this seemed to motivate the participants to dose moderately while *Social Norm Reminder* or *Scripting* with semantic and cultural constraints may have communicated what a moderate dose is. For the prototypes of *Competence and Autonomy* neither great feelings of competence nor any feelings of autonomy were present. Instead, the use of the volvelle may have been related to the strategies of *Enlightenment through Interaction and Experience* and *Engaging Information* on the topic of *Instructions for Sustainable Behaviour*. For the prototype of *Scripting* no other design strategy seemed to be present. Finally, for the prototype of *Habit Intervention* the strategy of *Scripting* was deliberately used to assist the habit formation. Apart from these two strategies, *Just-in-Time Prompt* was important for one participant.

It is reasonable to argue that the study setting itself also may have influenced the participants (see 8.2.5. Effects of the Evaluation Set-Up), and perhaps in line with the strategies *Feedback for Self-Monitoring*, *Value and Attitude Reminder*, *Social Norm Reminder*, *Personal Norm Reminder*, *Social Incentives* and a kind of *Habit Intervention*.

11.7. RECOMENDATIONS

Product design can be a feasible way to induce sustainable behaviour. Furthermore high effectiveness can be achieved together with high acceptance. This implies that designers can motivate and direct sustainable behaviour beyond the possibilities of laws and regulations. Therefore, it is advisable that the product and service producers start to employ design strategies for sustainable behaviour to decrease the environmental impact from the use phase of products and services.

The findings in this project showed that there are several promising design strategies for sustainable behaviour. But also promising design strategies may fail. Therefore, when designing for sustainable behaviour the design process should always start with a user study to identify barriers towards the sustainable behaviour in order to be able to choose the design strategies that have the potential to overcome the identified barriers. Furthermore, it is advisable to combine different design strategies to address different barriers and different types of users with the same artefact.

The results of the prototype evaluation showed that the concepts based on directing design strategies were most successful, but there were a couple of strong objections towards the forcing prototype of *Habit Intervention*. Furthermore, in other contexts, the motivating strategies have been proven promising. Thus, there is no evidence that one influencing technique is better than another.

The implementation of design strategies for sustainable behaviour in products and services has the potential to reduce the environmental impact of the use phase and therefore, the project duo argues that this emerging design and research field should be developed further. In addition to continue the investigation of the research question addressed in this project the project duo believes that the following questions could be of interest in future research.

» How can barriers towards sustainable behaviour be identified most accurately?

» How should design strategies be chosen to successfully overcome barriers towards a sustainable behaviour?

» How can several design strategies be combined in one artefact in order to address different barriers and different types of users?

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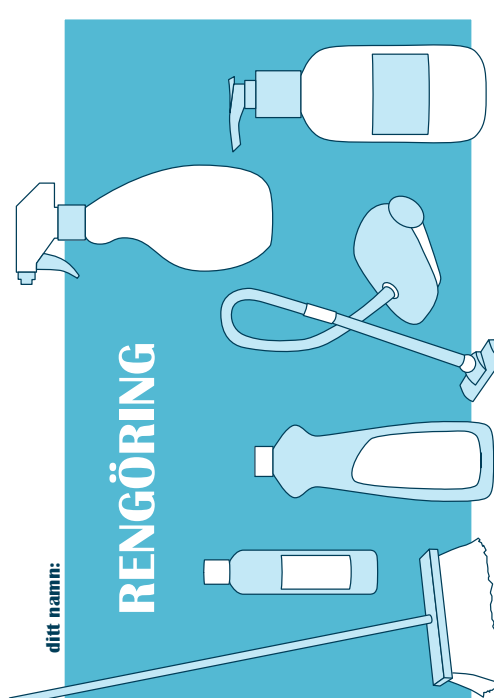
13. LIST OF APPENDICES

1. SENSITISING BOOKLET

ditt namn:

RENGÖRING

Ett stort tack för att du svarade på frågorna!

Ta med häftet till gruppdiskussionstillfället. Då kommer vi att samla in alla häften.

Informationen vi får från häftena & från gruppdiskussionerna kommer anonymiseras för att sedan användas i vårt exjobb om designstrategier för miljövänligt beteende.

Vi ses vid gruppdiskussionen!

Karin & Sara

---

pssst! att lägga en överbliven citronhalva i diskvattnet är ett typiskt husmodersknep, ska vara bra både för effekt & doft

DAG 7

Vilket är ditt favoritstädknep? ------------------------------

tvättmedel	tall herrparfym
möbelschampo	sparris rosor
allrengöringsmedel	garage hav
tvål	vanilj apelsin
diskmedel	grill
wc-rengöring	sten oparfymerat
fönsterputs	aceton nyklippt gräs

Para ihop medel & doft efter hur du skulle vilja ha det!

Vilka rengöringsprodukter saknar du? -----------------------
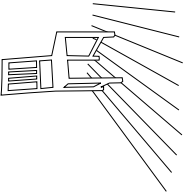
& vilken rengöringsprodukt kan du inte klara dig utan? ------

10

Om oss:

Hej!

Som du vet håller vi på med vårt exjobb och detta häfte är en del av vår förstudie. Här i häftet kommer du hitta några olika frågor och uppgifter som alla handlar om rengöring. Frågorna är uppdelade i sju avsnitt, avsedda att fyllas i under sju dagar och avsikten är att du genom detta ska bli förberedd inför gruppdiskussionen. Det är därför viktigt för oss att du startar med frågorna ungefär en vecka innan vi ses.

Dina svar kommer behandlas anonymt.

Tack så mycket för hjälpen! Vi ses snart.

Karin & Sara

Karin   Sara

1

DAG 1

Sätt ut klistermärkena för att visa vad du tycker om olika rengöringsmoment. Kommentera gärna om du vill!

p.s. om du vill kan du rita in andra moment också

3

DAG 5

Vilken superkraft skulle du vilja ha när du städar ditt badrum?

Varför då? ___

Om du bara fick välja en av uppsättningarna med städgrejer nedan, vilken skulle du då välja när du ska städa ditt badrum?
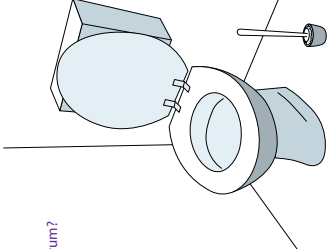
A
såpa
natursvamp
grapefrukt-halva

B
tandborste
klorin
scotch brite

C
allrengörings-medel i sprayflaska
disktrasa

Varför just den uppsättningen? ___

8

DAG 1

Om dig

Namn: ___ Ålder: ___

Boendeform: ___

Har städhjälp: Ja Nej

Miljöattityd:

Vad jag gör spelar väl ändå ingen roll, så jag beter mig som vanligt

När jag orkar, har råd och tid så gör jag gärna saker för en bättre miljö

Jag försöker bete mig så miljövänligt som jag kan, nästan jämt

2

DAG 6

I TVÄTTSTUGAN: PEST eller KOLERA?

välj ett av alternativen!

* en indisk nöt, traditionellt använd för rengöring

blekmedel eller tvättnötter*?

oparfymerat tvättmedel eller Guccis nya?

superkoncentrerat eller megautspätt?

ett kryddmått tvättmedel per tvätt eller en halvliter?

30 grader eller 90 grader?

handtvätt eller sjukhusets tvätteri?

vädring eller kemtvätt?

blanda rött & vitt eller en tvätt för varje nyans?

sköljmedel eller stela kläder?

mangling eller skrynklor?

ja, du måste välja!
(eller motivera varför du inte kan välja)

Vilken kändis skulle du vilja tvättade din tvätt? Varför då?

9

1. SENSITISING BOOKLET

DAG 2

I städskrubben

Vad har du för rengöringsgrejer hemma?

Vilka saker och medel använder du mest?
Ringa in dem & indikera ungefär hur ofta du använder dem

5

Har du en diskmaskin?　☐ Ja　☐ Nej

Vilka saker brukar du ändå handdiska?

Klipp & klistra! Använd de bifogade bilderna eller rita egna för att berätta hur du gör när du diskar för hand:

DAG 3

6

DAG 4

Vad är viktigast när du väljer schampo?
Prioritera följande aspekter, t.ex. genom att numrera (1=viktigast), eller kom på egna!

pris
lödder
doft
mot mjäll
milt
volymiöst hår
drygt

vill du kommentera ditt val?

Vilket sorts tvål föredrar du?

eller

hur mycket lägger du på? rita in i bilden.

hur klämmer du?

4

7

2. STATEMENTS ON COLLAGES FOR CONTEXTMAPPING

Six different sets of statements were used for the collages in the contextmapping session. Each set had four different statements.

Set 1

"Jag gör av med minst en flaska WC-anka i månaden."

"Jag städar oftast precis innan mina gäster ska komma och då är jag så stressed att jag bara öser på med medel så att det snabbt ska bli rent."

"Jag tänker på att inte ta för mycket tvättmedel, för om det blir tvättmedelsrester kvar i kläderna så är jag rädd att jag kommer utveckla allergi."

"Ju fler sorters produkter jag använder för att rengöra mig när jag duschar, desto renare känner jag mig."

Set 2

"Doseringsluckan i min diskmaskin är så liten, så om jag har full maskin så strör jag extra maskindiskmedel utanför doseringsluckan."

"Jag gillar inte hårda tvålar, de löddrar för dåligt."

"Dosering? Äh, jag bara tar mitt rengöringsmedel för badrum på sprayflaska och sprayar på. Snabbt och lätt."

"Jag vet inte vilken hårdhet jag har på vattnet, så jag doserar efter högsta hårdheten – för säkerhets skull."

Set 3

"En droppe diskmedel per disk är faktiskt tillräckligt. Det sa min hemkunskapslärare en gång i tiden."

"När det står en kapsyl på flaskan med rengöringsmedel brukar jag alltid ta två."

"Jag öser på med klorin i toan, det är ju massa äckliga bakterier där."

"Jag har miljömärkt tvättmedel så då tänker jag att det inte gör så mycket att jag tar lite extra av det."

Set 4

"Jag blandar ut diskmedlet med ganska mycket vatten i en sprayflaska. Då går det inte alls åt mycket diskmedel."

"Jag brukar tvätta håret två gånger i rad. Först då känns det ordentligt rent."

"Jag tar lite mer än vad som står på förpackningen, men annars måste man ju vänta på att det ska verka, och det hinner jag faktiskt inte med."

"Äh, jag bara öser i lite tvättmedel."

Set 5

"Diskmedlet måste löddra! Slutar det löddra så fyller jag på med mer efterhand."

"Jag föredrar pumptvål – för då kan man ta mycket."

"Jag tar en hink med vatten och en kapsyl grönsåpa i. Det använder jag till allt i badrummet – även till toalettskålen."

"Om det luktar tvättmedel om tvätten, då känns det rent."

Set 6

"Jag tänker på att inte ta för mycket

2. STATEMENTS ON COLLAGES FOR CONTEXTMAPPING

handdiskmedel. Jag tror inte diskmedel är så bra
för händerna."

"Man måste ta rejält med tandkräm, annars blir
det inte tillräckligt med fluor."

"När jag rengör toalettskålen så försöker jag få hela
ytan täckt med rengöringsmedel."

"När jag tvättar har jag ett decilitermått och så
läser jag på tvättmedelsförpackningen – det är ju
inte så svårt."

3. QUESTIONS ASKED AT THE END OF CONTEXTMAPPING SESSION

» Hur tänker du när du doserar? (Tar du så mycket som det står att man ska ta på förpackningen? Öser du på bara lite? Tänker du på smutsighetsgrad? Agerar du olika för olika medel?)

» Tror du att du tar lagom mycket? (För olika medel? Vad baserar du det på?)

» Om du tar lite extra ibland – varför gör du det? (Vilka medel gäller detta?)

4. DOSING RECOMMENDATIONS FOR COMMON BRANDS OF WASHING POWDER FOUND IN SWEDEN

Dosing recommendations (in ml) for soft water, for different brands of powder washing detergent	Amount of laundry (in kg) or size of washing machine (in kg of laundry)		
Ariel Color & White, Sensitive	<4 kg	4-5 kg	>5 kg
Slightly soiled		19	39
Normally soiled		39	59
Heavily soiled		59	79
Via Naturals	<3 kg	3-5 kg	5-8 kg
Slightly soiled		decrease dose 5-15 ml	
Normally soiled		40	60
Heavily soiled		increase dose 15-25 ml	
Skona	<3 kg	3-5 kg	5-8 kg
Slightly soiled			
Normally soiled		50	80
Heavily soiled			
Ecover	<4,5 kg	4,5 kg	>4,5 kg
Slightly soiled		30	
Normally soiled		83	
Heavily soiled		150	
Neutral	<3 kg	3-5 kg	5-6 kg
Slightly soiled		45	85
Normally soiled		70	110
Heavily soiled		95	135
Euroshoper	<3 kg	3-5 kg	5-8 kg
Slightly soiled			
Normally soiled		30	50
Heavily soiled			
ICA	<3 kg	3-5 kg	5-8 kg
Slightly soiled			
Normally soiled		70	105
Heavily soiled			
Via Classic, Sensitive	<3 kg	3-5 kg	5-8 kg
Slightly soiled		decrease dose 10-20 ml	
Normally soiled		50	75
Heavily soiled		increase dose 20-30 ml	
Via Color, Sensitive	<3 kg	3-5 kg	5-8 kg
Slightly soiled		decrease dose 5-15 ml	
Normally soiled		40	60
Heavily soiled		increase dose 15-25 ml	

Note: The leftmost label "Dirtiness" appears rotated alongside each of the three soiled rows in every brand block.

4. DOSING RECOMMENDATIONS FOR COMMON BRANDS OF WASHING POWDER FOUND IN SWEDEN

Via White, Sensitive	<3 kg	3-5 kg	5-8 kg
Slightly soiled		decrease dose 5-15 ml	
Normally soiled		42	63
Heavily soiled		increase dose 15-25 ml	

Rena tvätt	3-4 kg	4-5 kg	5-6 kg
Slightly soiled		decrease dose somewhat	
Normally soiled	40	60	80
Heavily soiled		increase dose somewhat	

Lina	<4 kg	4-5 kg	>5 kg
Slightly soiled		37,5	52,5
Normally soiled		50	70
Heavily soiled		66,7	93,3

Eldorado	<3 kg	3-5 kg	5-8 kg
Slightly soiled			
Normally soiled		44	75
Heavily soiled			

Eldorado (big package)	<3 kg	3-5 kg	5-8 kg
Slightly soiled			
Normally soiled		55	80
Heavily soiled			

Hemköp	<3 kg	3-5 kg	5-8 kg
Slightly soiled			
Normally soiled		55	85
Heavily soiled			

Grumme	<4 kg	4-5 kg	5-6 kg
Slightly soiled		40	60
Normally soiled		50	75
Heavily soiled		75	112,5

Color Coop		3-5 kg	6-8 kg
Slightly soiled		25	35
Normally soiled		55	85
Heavily soiled		85	135

Coop		3-5 kg	6-8 kg
Slightly soiled		25	50
Normally soiled		50	95
Heavily soiled		75	140

Änglamark, colour, white		3-5 kg	6-8 kg
Slightly soiled		25	50
Normally soiled		45	70
Heavily soiled		65	90

5. INTERVIEW FORM FOR FIRST VISTIT IN PARTICIPATING HOUSEHOLDS, EVALUATION OF PROTOTYPES

1. Vilket tvättmedel använder ni?

2. Vilken typ är det (flytande/pulver)?

3. Har ni parfymerat eller oparfymerat?

4. Hur mycket rymmer er/era tvättmaskin/er?

5. Kan ni tänka er att använda något annat tvätt-medel än det ni nu använder?

6. Hur samlar ni ihop er smutstvätt? Hur trans-porterar ni den till tvättmaskinen?

7. Använder ni förtvätt?

8. Vilket doseringshjälpmedel skulle ni föredra; ett roligt, ett snyggt, ett bekvämt eller ett proff-sigt hjälpmedel?

6. CLOSING INTERVIEW FORM, EVALUATION OF PROTOTYPES

Hur har det varit att använda den här produkten?

Hur brukade du göra när du använde produkten?

Habit intervention: Gör du alltid på samma sätt med tabletterna?

Känner du att du har kommit in i en ny vana nu när du tvättar med det här tvättmedlet?

Eller känns det enkelt att gå tillbaka till ditt vanliga tvättmedel?

Competence and autonomy: Funkar systemet bra? Varför/varför inte?

Competence and autonomy: Svårt eller enkelt att använda?

I vilken utsträckning har du använt produkten?

Om hon/han har valt att fortsätta använda produkten:

Om hon/han använde produkten vid ifyllandet av tredje häftet: Använde du produkten mellan andra och tredje häftet också? Varför/varför inte? & om nej: Varför började du med produkten igen när du skulle fylla i tredje häftet? Fortsatte du använda produkten efter att du skickat in sista häftet också? Varför då?

Om hon/han INTE använde produkten vid ifyllandet av tredje häftet:

När slutade du använda produkten? Varför valde du att sluta?

Hur gör du när du tvättar nu? Varför så? Om Habit intervention: Använder du samma tvättmedel som innan studien?

Kan du berätta om hur det var det när du fick produkten?

Var produkten som du förväntade dig? Varför/varför inte?

Kan du berätta om första gången du använde produkten?

Hur gick tvättandet? Vad tänkte och kände du? Vad tyckte du om produkten och tvättandet?

Hur lång tid tog det innan du vande dig?

Hur upplevde du produkten och tvättandet när du använt produkten någon månad?

Hur upplever du produkten och tvättandet nu jämfört med i somras?

Vad tycker du om produkten och tvättandet nu? Är det någon skillnad från i somras?

6. CLOSING INTERVIEW FORM, EVALUATION OF PROTOTYPES

Eco-affective design: Är det någon skillnad på hur det kändes när ni använde måttet i början av perioden och när ni använder det nu?

Någon skillnad på vad ni tänker på nu jämfört med när den var ny?

Eco-affective design: Hur har ni tolkat den här produkten? Hur tolkar ni användandet av den?

Kan du beskriva lite mer hur det är/känns att använda produkten?

Hur känner du dig vid användandet? Känns det annorlunda att tvätta med den här produkten jämfört med på ditt vanliga sätt?

Hur skiljer det sig att tvätta med produkten jämfört med hur du tvättade innan du fick den? Varför skiljer det sig så?

Competence and autonomy: Hur känner du dig när du använder systemet?

Är det roligt eller tråkigt att använda? Vad tänker du på när du använder systemet?

Competence and autonomy: Känns det som att du doserar rätt?

Competence and autonomy: Hur noga brukar du vara när du använder systemet?

Har du varit lika noga under hela perioden? Brukar du använda alla produkterna? Varför/varför inte?

Tänker du på något när du använder produkten?

Vad då? Varför/varför inte?

Har du lärt dig något/fått några insikter genom att vara med i studien? Vad då? Hur fick du de lärdomarna/insikterna?

Scripting: Vad tycker du om att det kommer en viss mängd när man häller? Varför?

Finns det någon gång när det är extra bra? Extra dåligt? Smidigt? Irriterande?

Scripting: Vad tycker du om produkten bortsett från doseringssystemet?

Eco-affective design: Tankarna/känslorna du ev. nämnde, är det något du tänker mycket på/är det starka känslor?

Eco-affective design: Känns det okej att den väcker känslor & tankar?

Eco-affective design: Om det uppstår tankar eller känslor, leder det till något då? Har du förändrat något/några beteenden i ditt liv sedan du fick hem produkten?

Vad tycker du om att inte ha tillgång till produkten längre?

Om produkten fanns i affären nu, hade du köpt det då?

Hur kommer du göra när du ska tvätta framöver?

Varför så?

Tror du att du hade valt att fortsätta använda produkten om du hade köpt den själv? Flerpersonshushåll: Om någon annan i familjen hade köpt den? För tvättmedel: Hade du fortsatt om det hade kostat lika mycket som vanligt tvättmedel? Om ja: Hade du fortsatt om det kostat mer än vanligt tvättmedel?

Om Habit intervention: Kommer du börja använda samma tvättmedel som innan studien?

Känns det som om produkten är din? (domesticering)

Tror du andra skulle vilja använda produkten?

Varför/ varför inte? Vilken typ av människor skulle vilja använda den?

Tror du att du hade köpt produkten om du sett den i en butik?

Varför/varför inte? I vilken butik tycker du att den skulle passa in?

Tror du att du hade använt den här produkten om du hade fått den av någon?

Vad är viktigast när du väljer tvättmedel? Vad tittar du efter när du köper tvättmedel? Är det samma saker som du tittade efter innan studien?

Habit intervention: Om inte, hade du vågat om förpackningen såg mer vanlig ut?

Hur hade du velat förbättra produkten så att den passat dig bättre?

Om den var så som du nu beskriver, hade det påverkat hur du använde produkten och i vilken utsträckning du använde produkten?

Skulle du vilja ha ett liknande system även för andra produkter? Vilka då?

Har ni reflekterat över eller pratat med andra om produkten/tvättmedelsanvändning?

6. CLOSING INTERVIEW FORM, EVALUATION OF PROTOTYPES

Om familj: Har ni pratat om den i familjen? & Vad har ni sagt?

Har du visat eller berättat om produkten för någon? Om ja: Vad har du berättat? & Hur har de reagerat?

Om gemensam tvättstuga: Har du fått någon kommentar från någon annan i tvättstugan?

Har du funderat någonting över din tvättmedelskonsumtion? Om flerpersonshushåll: Har ni pratat om tvättmedelsanvändning med varandra? & Vad har ni sagt?

Har du pratat med någon om tvättmedelsanvändning, tex. på jobb/skola eller med vänner och bekanta? Om ja: Vad har du pratat om? & Hur har de reagerat?

Nu när du tänker på tvätt och tvättmedel, är det på något sätt annorlunda än hur du tänkte innan studien?

Har produkten påverkat dig på något annat sätt? Tänker du annorlunda i något sammanhang? Beter du dig annorlunda i något sammanhang?

På vilket sätt tror du att du påverkats att vara med i en studie?

Tror du att du skulle använt produkten på samma sätt och i samma utsträckning om du inte varit med i en studie, det vill säga om du hade köpt produkten själv?

Kände du att det var okej att under studiens gång sluta använda produkten?

I vilken utsträckning har du anpassat ditt beteende för vår skull tror du? Exempelvis fortsatt med produkten längre? Om bekant till oss: Hade du agerat annorlunda ifall vi var personer som du inte kände/var bekant med/hade gemensamma vänner med?

Var det några problem med produkten? Vilka problem tror du var relaterade till att det var en prototyp?

Hur påverkades du av att det inte var en "perfekt" produkt utan en prototyp? Hade det känts annorlunda om det var en produkt som du hade köpt och som fungerade precis som den skulle?

Hur var det att fylla i häftena?

Var det några problem med att fylla i dem?

Hur stor påverkan på ditt beteende hade häftena jämfört med produkten?

Betedde du dig annorlunda när du fyllde i häftena än när du inte gjorde det? Exempelvis; började du fundera över ditt beteende när du fyllde i häftena? Var du mer noggrann med doseringen då?

> ### Habit intervention: Hur var det, brukade ni ha samma tvättmedel för det mesta, eller köpte ni lite olika sorter?

Habit intervention: Brukade ni dosera på samma sätt hela tiden, innan ni fick tabletterna?

Scripting: Har du läst instruktionerna på förpackningen? Varför/varför inte?

Om ja: När läste du dem? Brukar du vanligtvis läsa på tvättmedelsförpackingarna du köper hem? Hade du läst om du köpt det här tvättmedelspaketet på affären? Om diskrepans mellan hur personen vanligtvis gör och hur hon/han gjorde den här gången: Varför läste du den här gången? Om det behövs: Läste du för att du fått förpackningen av oss? Läste du på grund att du såg att det var något annorlunda med paketet? Läste du för att du provade att hälla & det då inte var som vanligt?

Scripting: Upplevde du det som att du doserar mer, mindre eller lika mycket med det här paketet jämfört med det du brukade använda?

Om hon/han nu har återgått till vanligt tvättmedelspaket: I vilken utsträckning har användandet av det här tvättmedlet påverkat ditt nuvarande användande?

Har produkten har förändrat ditt beteende? Hur? Varför?

Hur mycket tvättmedel tror du att du använde jämfört med andra innan studien? Under studien? Efter studien?

Hur tror du att din tvättmedelskonsumtion ser ut nu jämfört med andra häftet? Jämfört med första häftet? Om du jämför första och andra häftet?

Hur ser din nuvarande konsumtion av tvättmedel ut? Hur tror du att den kommer se ut om någon månad?

Scripting: Har produkten påverkat användandet av andra tvättmedelspaket?

Andra paket, tex. matvaror, schampo?

Återkoppling på tvättmedelsanvändning

Enligt det du har fyllt i i tabellerna så ser det ut som att du har minskat/bibehålligt/ökat din konsumtion mellan första och andra häftet. Vad tror du det beror på? Om det vi ser i tabellerna inte stämmer med hur du tycker att du har ändrat din tvättmedelsanvändning, vad tror du det kan bero på?

Enligt det du har fyllt i i tabellerna så ser det ut som att du har minskat/bibehålligt/ökat din konsumtion mellan andra och tredje häftet? Vad tror du det beror på? Om det vi ser i tabellerna inte stämmer med hur du tycker att du har ändrat din tvättmedelsanvändning, vad tror du det kan bero på?

Visa prototyper

Skulle du föredragit någon av de andra prototyperna? Varför/varför inte?

Ang. script: Den här typen av doseringslösning finns redan, det är Hemköp som har den på vissa av sina tvättmedelspaket. Vad tycker du om det?

Bakgrund

Ålder på alla i hushållet? Sysselsättning?

Är det någonting i din vardag som du gör för miljöns skull? Vad då?

Vilken av dessa beskrivningar (ekotyper) passar bäst in på dig?

7. DESCRIPTION OF ECOTYPES

A. Tror på ny teknik som lösningen på miljöproblemen, skulle tex. gärna köpa elhybridbilen Toyota Prius. Är gärna först med ny teknik, men tröttnar snabbt om tekniken inte var tillräckligt häftigt.

B. Tycker hittills att de flesta miljövänliga produkter har varit av för dålig kvalitet, om miljövänliga produkter ska vara intressanta måste de vara lika bra eller bättre än andra produkter. Tycker att miljöfrågorna berör andra mer än sig själv.

C. Har mycket kunskap om miljöfrågor och är väldigt intresserad, men är inte så bra på att faktiskt göra miljövänliga handlingar själv. Vill förstå hur allt hänger ihop.

D. Pratar inte så mycket om miljö med andra, men gör det som är ganska enkelt att göra, tex. sopsorterar, byter till lågenergilampor, semestrar i Danmark och har miljöbil. Tycker att vi alla måste ta ansvar!

E. Ser positivt på miljöproblemen, men orkar inte prata om dem. Det måste vara lättsamt, schysst och kul att leva miljövänligt, annars får det vara!

F. Har inget emot att göra uppoffringar för miljöns skull, känner stort ansvar och pratar gärna om miljöfrågor med andra. Tycker att alla måste visa solidaritet.

8. INTERVIEW TEMPLATES, ASSESSMENT OF PRODUCTS

Global Warming Mug

When using:

Picture sheet: How do you feel & what do you think of when using the mug?

Behaviour change:

» What you feel when you use it, what does those feelings lead to? If anything?

» What does the use make you think of?

» Are the thoughts/feelings stable over time or have they changed? I.e. what do you think/feel now compared to the first time you used the mug?

» In what way do these thoughts/feelings affect you and your everyday behaviour?

» Has it changed any behaviour in your life?

Interpretation:

» When and how did you discover the thermo chromatic effect of the mug?

» How do you interpret the concept/idea of the mug? (Fun? Serious? Creating awareness of global warming? Promoting drinking cold drinks?)

» Do you show it to others? If so, how do you explain the idea of the mug to them? What do they think of it?

Purchase:

» Why did you buy it? Where did you buy it? Or how did you get hold of it?

Lint Remover

When using:

Picture sheet: How do you feel & what do you think of when using the lint remover?

Usage:

» Does it work well? Why? Why not?

» Is it difficult to use it? When is it difficult? In what way?

» Is it enjoyable to use it? Why? Why not?

» How often do you use it?

Purchase:

» How long have you had the lint remover?

» Did you buy it yourself? Why did you buy it?

» How much did you pay for it? Is it price worthy?

» What would you do if you lost it?

Reasons for using:

» Why do you want to remove naps?

» If for clothes to last longer: Why do you want your clothes to last longer?

» What kind of garment do you use it on?

Behaviour change:

» Has it changed you consumption behaviour? Why? Why not?

Water Tap

When using:

Picture sheet: How do you feel & what do you think of when using the water tap?

Your tap:

» How does your tap work?

» In what rooms do you have it?

Usage:

» How do you use the tap?

» Do you ever use it in the maximum positions? When do you do that? How do you do it?

Behaviour change:

» Do you think that you use less water/less hot water because of the tap? A lot? Or just a little?

» Has it affected how you use other taps? E.g. in school/at work.

» Has it affected you attitude towards use of water and hot water?

Acceptance:

» If you would build a house of your own, would you install these kinds of taps? Why? Why not? In what rooms would you install it?

Reusable Menstrual Cup

Previous habit:

» Was there a habit before the acquiring of the cup?

» Did you always buy the same kind of disposable sanitary protection?

» Did you "experiment" with different kinds & brands? Why? Why not?

» Where you satisfied with the disposable sanitary protection you used before? In what way (Comfortable? Safe? Cheap? Eco-friendly? Accessibility?)?

» In what way were you not satisfied?

Habit intervention:

» How did you find out about the menstrual cup?

» If you hesitated before buying one, for how long? Why did you hesitate?

» In the end, what made you buy it?

» Did you start using it right away? Why? Why not?

Formation of new habit:

Picture sheet: How did you experience the initial usage? (Was there a direct positive or negative outcome?)

» If you still use the cup, why? Why not?

» Do you consider you current choice of sanitary

8. INTERVIEW TEMPLATES, ASSESSMENT OF PRODUCTS

protection to be habitual? Why?

» Do you look for information about new kinds of sanitary protection?

» If a friend of yours told you about a new kind of sanitary protection, would you be willing to try that new kind?

Eco-Affective Design: Global Warming Mug

Promoted behaviour: Reduce one's impact on global warming in general and particularly by not drinking heated beverages.

How: When hot beverage is poured into the mug, the print of the world map changes and displays the consequences of a raised ocean level, i.e. the landmasses shrink. This effect might raise feelings of fear and concern for the effects of global warning. The feelings evoked could possible lead to a more sustainable lifestyle.

Interviewees: Two men between 20 and 40 years old, who has owned their mugs for a couple of years. The younger man had his mug at his parents' home and uses it rarely nowadays, whilst the older man kept his mug at the ship he works on, and thus used his mug every day during month-long periods.

Summary of interview: The feelings raised when using the product were many. One of the users thought it something of a scare to see the landmasses shrink and mentioned the perceived unstopability of the global warming. To feel smart was also mentioned, as you by using the mug can draw attention to the subject. This possibility to influence others also created a feeling of being something of an activist and a bit radical, as you actually do something by pointing out the problems ahead. At the same time, the dubious nature of the act of buying a product in order to do something good for the environment created a feeling of guilt. The other user said that the product made him think of the carbon dioxide emissions, but also about coffee break, and that the important aspect of the mug was that it made other people feel curious about the displayed effect and the reflections and discussions that arise from this. The first time this user used the mug he caught himself

thinking something like "what fun it will be to see how the world map will change". The users perceived the product as both fun and serious at the same time, this is also apparent when others encounter the product, as some people want to discuss the global warming while others are more interested in the thermo chromatic effect. However, most time the effect acts as an eye-catcher and the discussion is then shifted towards global warming.

The two users of the product suggested that it promotes the behaviour of drinking something warm and that it can act as an eye-opener, for example by scaring you a bit. However, the product is somewhat undefined in its message as it does not provide a solution or a plan of action for the user. If you lack the energy to think for yourself, this can create negative feelings of powerlessness, but at the same time it can be positive that there is no lecturing going on.

Behaviour that actually did happen because of the mug was discussing with fellow coffee breakers about global warming as there was always someone noticing the mug. Initially the mug made one of the users curious about the actual facts and figures behind the scenario on the mug, which in turn made him search for information on the internet. On this topic the other user explained that he would have appreciated enclosed information about global warming and the raised sea level. Both users agreed that they had not become better persons per se because of to the mug, but that by owning it and talking about it, they might be influenced to do small changes in their lives, little by little.

Conclusion: In this case, the strategy *Eco-Affective Design* seemed to be accepted over time as well as at first encounter. However, the emotional effect appeared to fade with time, thus the efficiency will decrease. This specific product did not succeed in promoting a specific behaviour change and therefore the efficiency was low in the first place. Yet, if

9. FULL SUMMARY OF INTERVIEW WITH USERS OF THE GLOBAL WARMING MUG

reflecting over and discussing global warming would be the promoted behaviour the product seemed to succeed moderately, and with persistent efficiency, as long as new people encounter the product and its user.

For this product the design strategies *Design for Reflection* and *Attention Drawing Design* seemed to be more descriptive of its effect than *Eco-Affective Design* as the main result of using the mug was the discussions it rendered.

10. FULL SUMMARY OF INTERVIEW WITH USERS OF LINT REMOVERS

Competence and Autonomy: Lint Remover

Promoted behaviour: To prolong the use phase of an article of clothing, thus decreasing the need for purchasing new clothes.

How: After some use, many textiles get naps. This is often unwanted and the presence of naps may result in disposal of the article of clothing. By facilitating the removal of naps, the use phase can be prolonged. The lint remover makes use of the design strategy Competence and Autonomy firstly by encourage the users to feel autonomous from the clothing industry, as they can prolong a garment's life time all by themselves, and secondly by making the users feel competent as they become capable to complete a task with good result.

Interviewees: Three users aged between 25 and 30 were interviewed, two women and one man. Two users had received the product as a gift after trying out someone else's lint remover, while the third user had bought it on impulse. They had all owned their lint removers for a couple of years and used them infrequently but approximately once every other month, with an increase wintertime as the type of garment the lint remover is mostly needed for is used more frequently then.

Summary of interview: Concerning the autonomy, two of the users saw the use of a lint remover as a provocation towards clothing stores, because the removal of naps sends the message that no new sweater has to be bought. The users expressed slight frustration over the difficulty to predict what textiles that will get naps. Some of them wanted to buy clothes of better quality to avoid the formation of naps, but when trying to do so, the clothes had gotten naps anyway. One of the users mentioned that an advantage of buying second hand clothes is

that one can estimate the tendency to get naps of a certain article of clothing. To use a lint remover was not something the interviewees felt that they were expected to do, and according to one user it therefore becomes enjoyable to do it. Furthermore, the task was seen as independent from other regular domestic duties, such as doing laundry or ironing, and the users felt that they on their own were able to judge when it was appropriate to remove naps. After deciding that it was about time, the users stated that it was no hurry; the removal of naps could be done in a week or two.

Comments about feeling competent were common during the interview. The users definitely felt good about themselves when they had removed naps, and some of them compared it with the achievement of a capable housewife. To remove naps can be tedious, but it feels good when it is done and it gives a satisfying feeling of taking care of the clothes and making them last longer. With the lint remover, the removal of naps becomes much easier and more efficient than removing naps by hand. However, the surface of the lint remover with which the removal is done is very small, thus making the work unnecessarily inefficient. For garments with large surfaces of naps the use of the lint remover was considered tiresome, which resulted in that one user never had the energy to remove naps from such garments. The lifetime of the batteries was considered to be too short by one of the interviewees. Furthermore, the interviewees reported on a couple of incidents where the lint remover had damaged the textiles. Additionally, the interviewees mentioned that the result of using the lint remover on a garment often fail to meet their high expectations. Despite this, two out of three participants stated that they eventually would buy a new lint remover if they lost the one they have.

Two of the users found the use of the lint remover enjoyable and fun. The fact that they had a special machine dedicated to removal of naps contributed to

10. FULL SUMMARY OF INTERVIEW WITH USERS OF LINT REMOVERS

the fun. It is rewarding to see how the naps disappear, and one user compared the lint remover to a little friend or an animal eating the naps.

The perceived promoted behaviour was to prolong the use phase of clothes by removing naps. But, according to the users, this did not necessarily lead to decreased need for purchasing new clothes. One user though that the access to the lint remover rather increased the amount of clothes she had, because she did not throw away clothes to the same extent as before. She added that as the clothes got worn, they were degraded to informal use only, thus creating a need for purchase of clothes for formal use. If a favourite article of clothing got naps, the users stated that they would continue to use the garment irrespective of access to a lint remover. One of the users said that he wants to remove naps because it is tedious to buy new sweaters. Another interviewee mentioned that she would consider avoiding purchase of a new article of clothing if she already had a similar one. Some of the users did not mind using clothes for a long time, and could withstand a worn or washed out look of the clothes. Nevertheless, they still wanted to have a neat look and naps were not as accepted as the other signs of age.

Conclusion: For this product, the strategy of *Competence and Autonomy* seemed to be accepted on both short-term and long-term basis. Throughout the interview it was clear that the users most often felt competent while using the lint remover, and additionally, the usage seemed to make the users feel independent from both the clothing industry and from norms concerning household duties. This effect seemed constant over time and the lint remover did succeed in prolonging the lifetime of some garments. Despite this, the effectiveness of the product in reducing environmental impact appeared rather low as whether it made the users buy less new clothes or not was uncertain.

Two other design strategies are also visible in this product. As two of the users considered the usage to be fun and engaged in it out of free will, the strategy called *The Fun Theory* might be applicable. Secondly, the strategy *Enabler* can also be descriptive of the effect of the lint remover, with the conflict being solved would be having a positive attitude towards a long use phases but a negative one towards wearing clothes with naps.

11. FULL SUMMARY OF INTERVIEW WITH USERS OF WATER TAPS WITH LIMITERS

Scripting: Water Tap

Promoted behaviour: reduce consumption of hot water and water in general.

How: The use of hot water and high water flow is constrained as the handle has a built in resistance upwards and leftwards. In order to maximise the flow and/or the heat the handle has to be held up and/or held to the left with a constant force.

Interviewees: Three men, aged between 20 and 30 years old. One of them had the tap solely in the bathroom the other two had it in both in the bathroom and kitchen. But, at the time of the interview, one of the latter thought that he had only a flow limiter in his kitchen tap and no limiter at all in his bathroom tap.

Summary of Interview: All of the users expressed a great acceptance of the product; they would all use taps with limiters if they built their own house – except for the bathtub tap. They found the tap easy to use and two of them said that the limiters did not have much of an impact on their everyday tap usage, as illustrated by the fact that one of the users at the time of the interview had not even noticed the heat limiter in his kitchen tap and none of the limiters in his bathroom tap. Two of the users stated that they appreciate the ease with which the tap is set on the level just below the limiters. A level they thought had just enough flow and appropriate temperature for many duties. Since one of the users used to get splashed and burned when washing his hands because he, due to the easiness of the movement, turned the handle to the position of maximum flow and temperature, the benefits of the tap with limiters are obvious.

Furthermore, all the users expressed a great satisfaction with the tap in general: it is easy to turn on and off; there is a precision when moving the handle; the change of flow and temperature goes smoothly; the maximum flow is very high etc.

The two users that had the tap in their kitchens from time to time got annoyed at the flow limiter e.g. when they wanted to leave the sink while filling up a pot or the sink with maximum flow and when they wanted use both hands for doing dishes while having maximum flow. Nevertheless, the general satisfaction overruled this annoyance.

All the users though that they had lowered their consumption water and hot water, but they had difficulties in estimating how much the consumption had decreased. One of them commented that the decrease in his consumption also was related to the precision in the movement of the handle, thus never getting a higher flow than intended.

None of the users thought that they had changed their attitude towards use of water and hot water. One of them said that he nowadays, when using hot water or a high flow, reflects over what he does, why he does it, and the consequences of his usage. After starting using the tap with limiter, one of the users stated that he additionally had started to get annoyed at taps without limiters and another user mentioned that he now reflects over the design of other taps and the way he uses taps without limiters.

Conclusion: The acceptance of the tap limiters was very high, especially due to the general satisfaction with the tap. As the high flow above the limiter was appreciated by some of the users, they might see the high maximum flow as a result of the limiter, thus creating a positive image of the limiter itself. The users' attitudes towards consumption of water and hot water had not changed, nevertheless, there seemed to be an increased awareness of how they use water and how they interact with different taps. All the users perceived a slight decrease in their consumption of hot water and water in general.

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The decrease in water consumption was, according to one of the users, partly due to the easiness and the precision in the movement of the handle. The design strategy *Scripting* was also visible in this aspect of the tap, as the precision functions as an affordance for using the intended flow and temperature.

12. FULL SUMMARY OF INTERVIEW WITH USERS OF REUSABLE MENSTRUAL CUPS

Habit Intervention: Reusable Menstrual Cup

Promoted behaviour: To use reusable sanitary protection instead of disposable sanitary protection, and thus decrease the amount of waste one creates.

How: The reusable menstrual cup efficiently breaks the habit of using disposable sanitary protection, as they are no longer needed. If this product actually breaks the habit depends on if the usage of disposable sanitary protection could be considered a habit. This probably differs between users. After testing the cup, the product should contribute to easy formation of new habit. In this case the cup contributes if it is considered to be comfortable, easy to use and safe, as the user then experiences a direct positive outcome of the use.

Interviewees: Three women, aged between 20 and 30, who had owned their cups for a couple of years. Two of the women use their cup and one of them does not use her cup.

Summary of interview: All three women considered their use of menstrual protection before they bought the cups to be of habitual nature. They used to buy the same type of protection, and most often even from the same brand. None of them felt that they had been experimenting with different types of sanitary protection, except maybe when one of them started buying pads from the brand she now uses, as they back then was a bit different then other sanitary pads. Two of the users were pretty satisfied with the sanitary protection they used before the cup, apart from when there was no place for disposal of the used protection, or when they had forgotten to bring their protection with them. The third user was less satisfied as she felt the use of tampons to be somewhat tricky and a bit nasty due to the possible growth of bacteria.

One user first learnt about the reusable menstrual cup through a magazine while the other two heard about it from classmates or friends at an internet forum. Two users were vaguely positive towards the product but felt they needed to get confirmations from people around them that the product actually works, additionally, the thought of buying a new and unfamiliar product via the internet seemed to have hampered them further. The third user was initially direct negative towards the product but became more positive as more and more friends at the internet forum recommended the product. For all three women it took at least one year from hearing about the product until buying one for themselves. Several arguments for using the cup were stated throughout the interview, e.g. not having to buy new sanitary protection, not having dehydrated mucous membranes, caring for the environment by contributing less to the creation of waste, being able to start using the cup when suspecting ones period to be on its way without experience negative side effects from this, etc. However, knowing some of these benefits was not enough for making the women buy the cup. First when they had heard enough good opinions about the product from friends they finally bought the product. One user had the opportunity to buy the cup in a store and she only needed persuasion from one friend, and she got it at the buying moment. The other two users bought it on the internet and they both got information or encouragement from more than one friend, however, the amount of confirmation needed stood in relation to how negative or positive attitude they initially held towards the cup. These two users did not remember what actually made them buy the cup in the end, but one of them believed that she most likely had decided to buy one after considering the worst scenarios possible (spending 200 or 300 SEK on the product and eventually not liking it), and then bought the cup when she got reminded of it by her monthly period. The other user thought that she bought it when someone else at the internet forum recently had done so and then

12. FULL SUMMARY OF INTERVIEW WITH USERS OF REUSABLE MENSTRUAL CUPS

spurred the other forum members to do it as well. She also mentioned the relatively small cost as a factor that made her take the chance.

All three women used the cup at the first next period after the purchase, as they were curious about how it would work. One user had heard from friends that it may be tricky to use the cup in the beginning until you have learnt how it works best for you. She did experience these difficulties, but could consult her friends at the forum, and thus she got encouraged to keep on trying until she after a couple of month had learnt how to use it. The two other users had high expectations on the cup and new little or nothing about the possible difficulties for beginners. They also experienced this trickiness but handled the situation different from each other. One of them started by using the cup a little, and her previous protection a little, then she gradually shifted more toward single use of the cup. She felt that it was probably normal with a trial and error period and therefore she did not give in. The third user had more severe difficulties as the cup caused her some pain when trying to insert it. Additionally she did not feel that she could sterilise the cup in a pot in the common kitchen in her student's corridor, something that she would need to do after each of her monthly periods. These factors, in combination with lack of support from friends, made her angry and unmotivated and consequently she stopped using the cup very quickly, even though she really wanted it to work.

The two users who still used their cups did it because they now were truly satisfied with the product and the benefits the use results in, and they did consider their new behaviour a habit. They were not looking for information on other sanitary protection products, and if a friend told them about a new type of protection it would have to have greater benefits than the cup, something they believe not to be possible, for them to consider trying it out. The user who stopped using the cup did not consider her current

use of sanitary protection habitual, as she was unsatisfied with sanitary pads but do not have the energy to use tampons, which she considered tiresome to use. She thought that she would be susceptible to new information about the menstrual cup, as she still likes the concept. But she suggested that the menstrual cup should be fitted at the gynaecologist as it can be difficult to know which model that would suit you the best.

Conclusion: The long-term acceptance of the menstrual cup depends on whether or not the user manages to learn how to use the cup without problems, which partly depends on if she has chosen a model that is right for her, i.e. it depends on how well the cup works for the user. However, the cup does not support the formation of a new habit very well as all three interviewees had experiences difficulties during this phase. But if the user finally accepts the product it is very efficient since the new habit seems to grow very strong and no more disposable sanitary pads or tampons are needed or even wanted. One reason to why the habit grows strong might be that the cup is always available and never needs to be refilled like a stock of disposable protection would. Additionally, the extra work the cup brings, like washing it after emptying it, and sterilising it when the period is over, is not an obstacle in the moment you need to start using sanitary protection.

The strategy of *Competence and Autonomy* is also very vital for this product. The initial learning phase makes the user feel competent when she finally gets the hang of it, and it can make the user feel independent from the sanitary protection industry since the cup often is sold through small internet based companies, and furthermore diminish the need to constantly buy disposable protection.