REALLOCATION OF HOUSEHOLD RESOURCES FOR ENERGY SAVING BEHAVIOR

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REALLOCATION OF HOUSEHOLD RESOURCES FOR ENERGY SAVING BEHAVIOR

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ABSTRACT

REALLOCATION OF HOUSEHOLD RESOURCES FOR ENERGY SAVING BEHAVIOR

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This study focuses on persuasive design concerning the household users' energy saving behavior while using electrical household appliances for the housework. Household users form a balance at home determined by the household resources they have, and they do not want to change this fragile balance because it is established as a result of household users' habitual behavior. It is crucial to persuade household users to save energy at home without disturbing the balance among resources. Persuasion becomes an effective tool at this stage. The study provides an efficient reallocation of the resources for energy saving behavior, which is supported by household resource reallocation and persuasion literature, and an empirical study.

Keywords: Reallocation of Household Resources, Abilities, Persuasive Design, Design for Behavior Change

ÖZ

ENERJİ TASARRUFLU DAVRANIŞ İÇİN EV KAYNAKLARININ YENİDEN DAĞILIMI

Çelebi, Ayşe N.
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Bu tez, evdeki kullanıcıların ev işi sırasında elektrikli ev aletleri kullanımındaki enerji tasarrufu davranışlarını göz önünde bulundurarak özendirici tasarım konusu üzerine bir çalışmadır. Ev halkı sahip oldukları kaynaklarına göre ev içinde bir denge oluşturur ve bu kırılgan dengeyi bozmak istemez çünkü bu denge alışkanlıklar sonucu oluşmuştur. Bu dengeyi bozmadan kullanıcıları evde enerji tasarruflu davranışa ikna etmek önemlidir. İkna etme yöntemleri bu aşamada önem kazanır. Bu çalışma ev kaynaklarının verimli bir şekilde yeniden dağılımını, ev kaynaklarının dağılımı ve ikna etme literatürüne dayanarak ve amprik bir çalışmayla destekleyerek, sunar.

Anahtar Kelimeler: Ev Kaynaklarının Yeniden Dağılımı, Beceriler, Özendirici Tasarım, Davranış Değişikliği için Tasarım

To My Grandfather & Uncle

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Many thanks!

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INTRODUCTION

1.1 Problem Definition

Today, the increasing demand for energy resources and hence the increasing climate problems arouse new methods for energy saving. Many sustainability studies aimed at designing energy-efficient products and services to maintain the environmental equilibrium. However recently, it has been clarified that in order to create a long-term solution for a sustainable world, not only the products but also the users should change their behaviors accordingly. According to Houkes & Vermaas (2006), an environmentally-friendly design product should not only refer to artifacts as a feature of the product but also to user's behavior.

Electricity is the second largest in energy consumption by 17.2% (International Energy Agency, 2010), has been chosen as a focusing point for this study. According to International Energy Agency (2010) statistics, approximately 30% of the total electricity consumption in the world is demanded by household users. They demand electricity for lighting and for using electrical appliances and this demand is expected to increase (Elias et al., 2008). However, household users have potential to save electricity up to 15% only by changing their energy usage behavior at home (McCalley et al., 2005).

Although household users have potential to save observable amount of energy at home, it is difficult for them to change their habitual behavior. Therefore, this energy saving study on households takes its roots from persuasive design literature that has become popular in industrial design.

1.2 Problem Statement

Household members build their household system according to their resources, needs and external factors (Solomon, 2008). As it is difficult to behave different from what have had become habitual, household users maintain their household system without disturbing its balance. However this balance can be kept at the same level by changing the ingredients in other words by reallocating household resources. So the household system would remain in balance and the level of living is protected. That leads users easily to be convinced for behavioral change to save energy. What's missing in the literature is that there is no guidance to how to make a successful household resource reallocation for energy saving.

1.3 Aim of the Study

For a successful household resource reallocation, there are already existed and proven reallocation ways (trade-offs) between household resources, such as money-time reallocation. Therefore, the aim of this thesis is to enhance the knowledge in reallocation of household resources and to analyze the most strategic way to organize this reallocation for persuasive products.

1.4 Scope of the Study

The goal of this study is to understand the way to reallocate household resources effectively to persuade users to save energy while using electrical household appliances.

The scope of this study is shaped by the household resource reallocation and persuasion theories. In accordance with the literature review, an empirical study is conducted in order to collect data on household users' energy saving behavior at home, current abilities, preferences in ability changes and way of reallocation of resources.

1.5 Structure of the Thesis

The study is of five chapters including the conclusion. Each of the chapters addresses the sub-questions of the study. In the conclusion chapter, the main question of the study will be answered. The main and sub- questions of the study are presented on Figure 1.1 in a structured way.

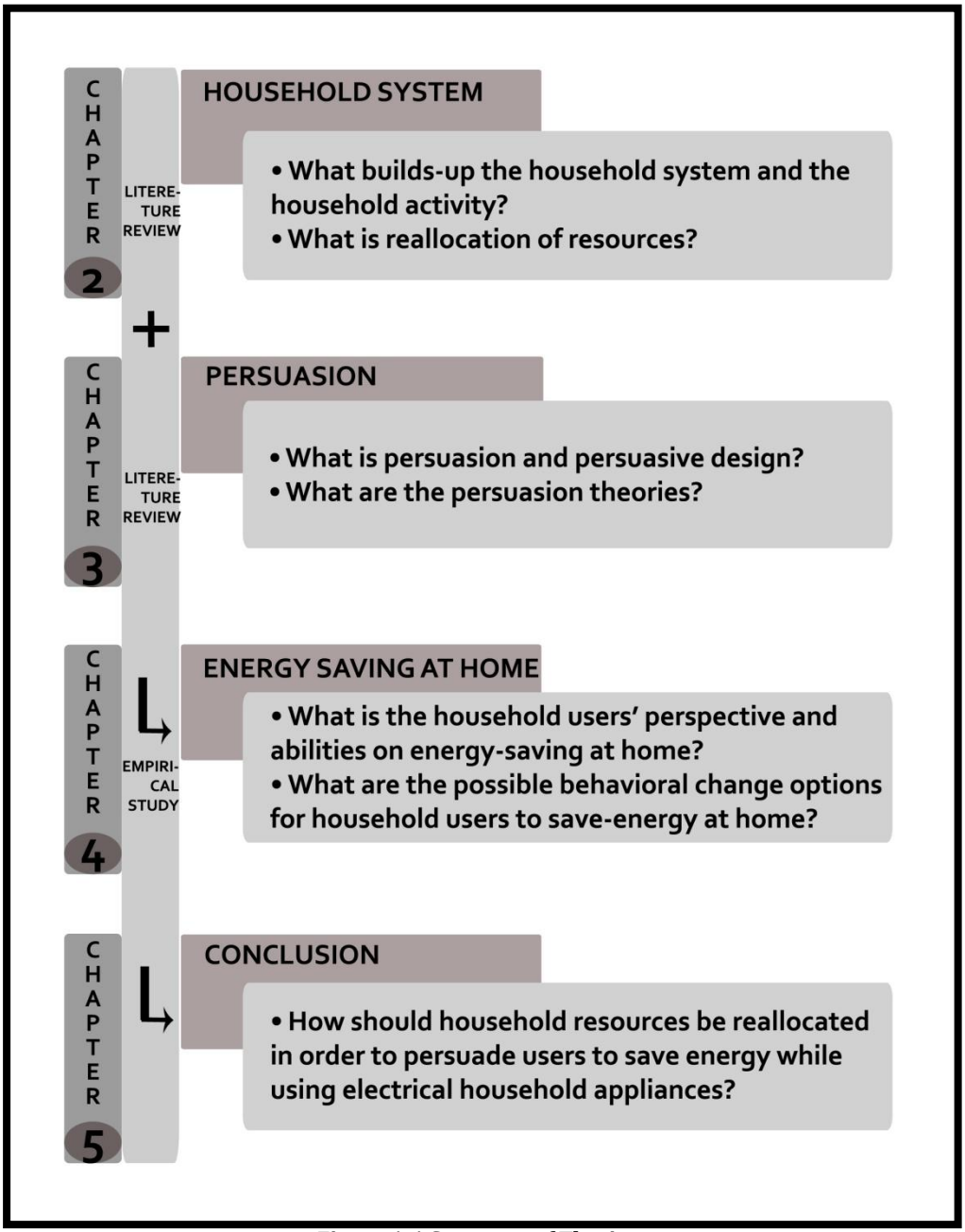


Figure 1-1 Structure of Thesis

Chapter 2 introduces the structure of the household system. It starts with the presentation of the factors influencing the household activity and keeps on the literature survey with the explanation of the 'reallocation of resources' as it is the basis for this study.

Chapter 3 concentrates on persuasion from both psychological and design point of view. In the beginning of this chapter, persuasion and persuasive design are studied. They are followed by an overview of persuasion theories in a chronological order. The persuasion theory, chosen for this study, is elaborated by the end of Chapter 3.

In Chapter 4, the results, analysis and discussions of the empirical study are presented. The empirical study, as a whole, addresses the question how to persuade household users to save energy at home. The study investigates household users' perspective on energy saving at home, their abilities, and their preferences when a change in one of the resources takes place. It is followed by the presentation of the premature results of reallocation of resources with respect to personas.

The study ends up with a final discussion of an effective household resource reallocation to change household users' behavior into an energy-saving one. The conclusion chapter does so by improving the results of household users' preferences in reallocation of resources. The final chapter closes with the limitations of the study and the suggestions for further research.

CHAPTER 2

THE HOUSEHOLD SYSTEM

2.1 The Household Concept

A household group is the smallest entity in the society. “A useful conceptualization of a household is that it is a place where some activity or other goes on continuously when members of the household are present” (Venkatesh, 1985, p. 190). According to Cockburn (1997), there are four components required to constitute a household; a building, people, household activities and equipment. People are the members of the household, household activities are the daily tasks and care work, equipment is all the household items and the building is the place where these other three components of the household interact with each other. The function “of households have been to create a familiar space for everyday life and to fulfill people’s daily needs. Children will always need a safe place to develop their character and skills and to socialize. Grown-ups need a place to recover, physically and mentally” (Moll & Groot-Marcus, 2002, p. 84). Thus, the aim of householders is to provide well-being for each member living in this smallest entity.

2.2 Household Well-Being and the Standard of Living

It is important for household members to make home a place where they feel comfortable and secure, and grow up. As Brodeur (2010) says;

> *“Social scientists, medical professionals, educators, and policymakers generally point to a strong relationship between the quality of the home environment and the wellbeing and development of individuals in the home. Thus, whether performed by a family member or a paid professional, these tasks are essential to the establishment and maintenance of a home environment that can allow for fullest development of the individuals living in it”* (pp. 1,2).

With its philosophical use, well-being is “the notion of how well a person's life is going for that person. A person's well-being is what is ‘good for’ them” (Stanford Encyclopedia of Philosophy, 2008). Well-being is formed by six different domains; “positive self-regard, mastery of the surrounding environment, quality relations with others, continued growth and development, purposeful living, and the capacity for self-determination” (Ryff & Keyes, 1995, p. 724). According to Neergard and Venkatesh (1989), well-being is a ‘tripartite’ concept and constituted by physical health, mental health and material health. In order to increase well-being of the household, householders should balance and consider this ‘tripartite’ concept (Neergaard & Venkatesh, 1989) and should also maximize the six domains forming the well-being. The level of well-being is not only related to the household members, but to the household activities as well, as shown in Figure 2.1. According to Groot-Marcus et al. (2006), well-being is how well household members live with respect to the society’s definition of standard of living as a result of the household activities.

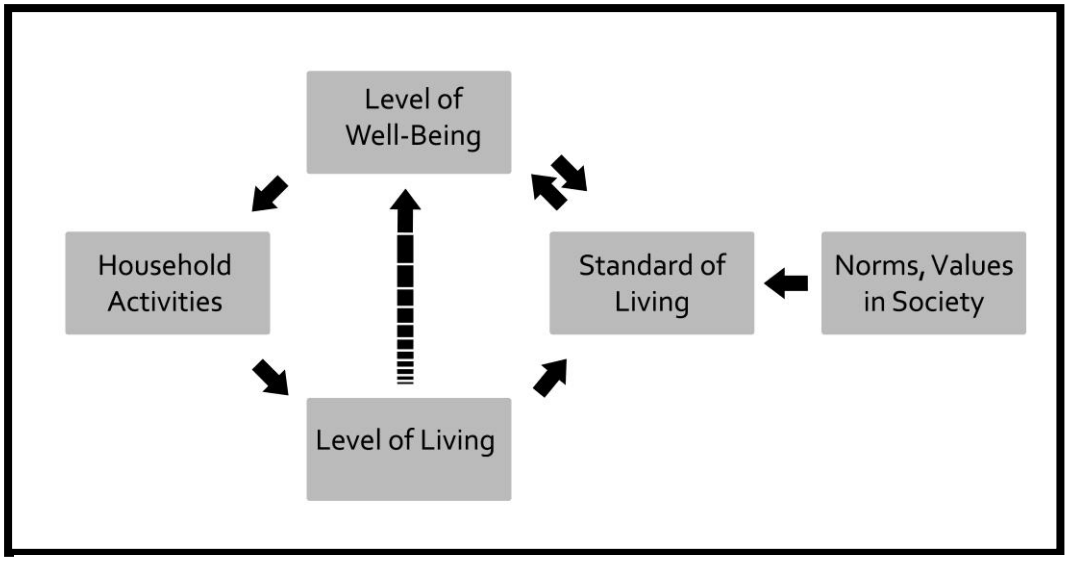


Figure 2-1 Consumer-Technology Interaction Model

adapted from Groot-Marcus, et.al (2006)

Householders’ goal is to achieve the standard of living through increasing the level of well-being. The standard of living is a “set of norms and values about daily life, partly formed by values and norms in the outside world and partly by those of the household group, by which members formulate their goals, views and ideas about the way they live” (Moll & Groot-Marcus, 2002, p. 84).

It can be concluded that, the way household activities done and the results of it are in interaction and affecting each other. This interaction continuously takes place as a result of the efforts to maximize the level of well-being.

2.3 Household Activities and the Technology

According to Brodeur (2010), household activities include “all the tasks that are required in the daily maintenance of a household” (p. 2) and “all the care work that can be involved, such as caring for children, the infirm and, increasingly, the elderly” (p. 2). Household equipment eases the way of doing the household activities. Technology, which is embodied in the household equipment, manipulates household activities at this very point. From physical tasks of the daily maintenance to the non-physical tasks, technology is involved in household activities, e.g. from “food preparation, and cooking” to “repose and sleep” (Cockburn, 1997). Therefore, according to Groot-Marcus et al. (2006), technology either improves or reduces the skills of the household members. New technology or the new household equipment improves household members’ skills by making them to perform more effort, or reduces household members’ skills by making them lead all or part of the household activity done by the new technology. In both cases, the technology provides household members better results, otherwise the new technology will fail to be accepted.

In Figure 2.2, Consumer-Technology Interaction Model shows the interaction of household activities with society and environment through a technological perspective (Groot-Marcus et al., 2006). It presents the relationship between household activities and their inputs and outputs. The household equipment, which is shaped according to household resources, influences the household activities (Verbeek, 2006). Household activities affect the level of well-being and the standard of living, and produce waste. Household activities are maintained to fulfill the goal of the household members.

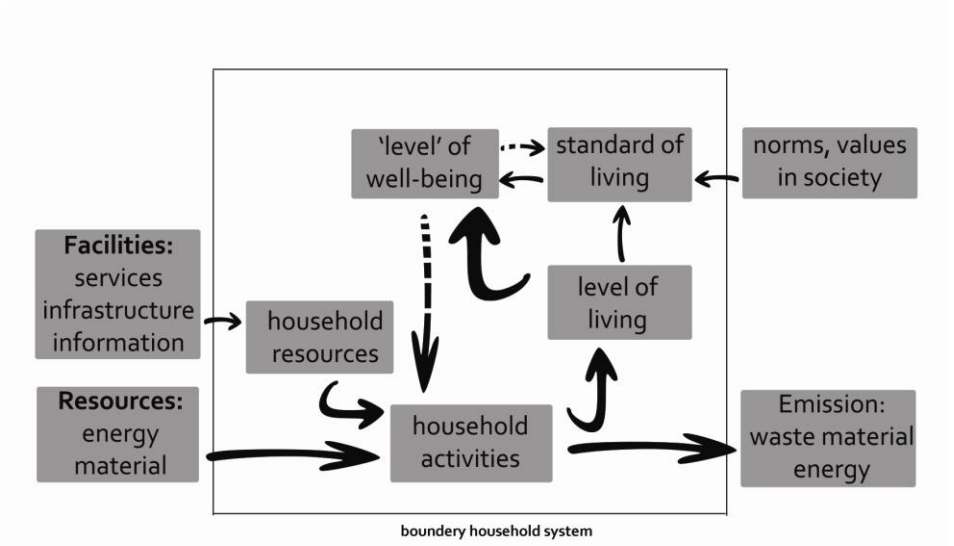


Figure 2-2 Consumer-Technology Interaction Model (Groot-Marcus et al., 2006)

As mentioned before, the householders try to move to upper levels in their level of living and well-being in order to reach the standard of living. According to Moll and Groot-Marcus, "The discrepancy between the standard of living and the level of living works as a controlling mechanism" (2002, p. 84). Since household members' goal is to equalize the standard of living and their level of living, they try to eliminate the discrepancy. Therefore, householders arrange their household resources in such a way that this discrepancy is at the minimum level. This interaction between the elements of the household builds the household system. In the following section, this interaction is studied in details.

1.1 The Structure of the Household System

To achieve the standard of living, which is the household goal, household occupants have three means; external facilitating conditions, needs, and resources (Solomon, 2008). In Figure 2.3, adapted from Solomon (2008) and Groot-Marcus et al.'s Consumer-Technology Interaction Model (2006), a simple model to explain these three means for the household system is presented.

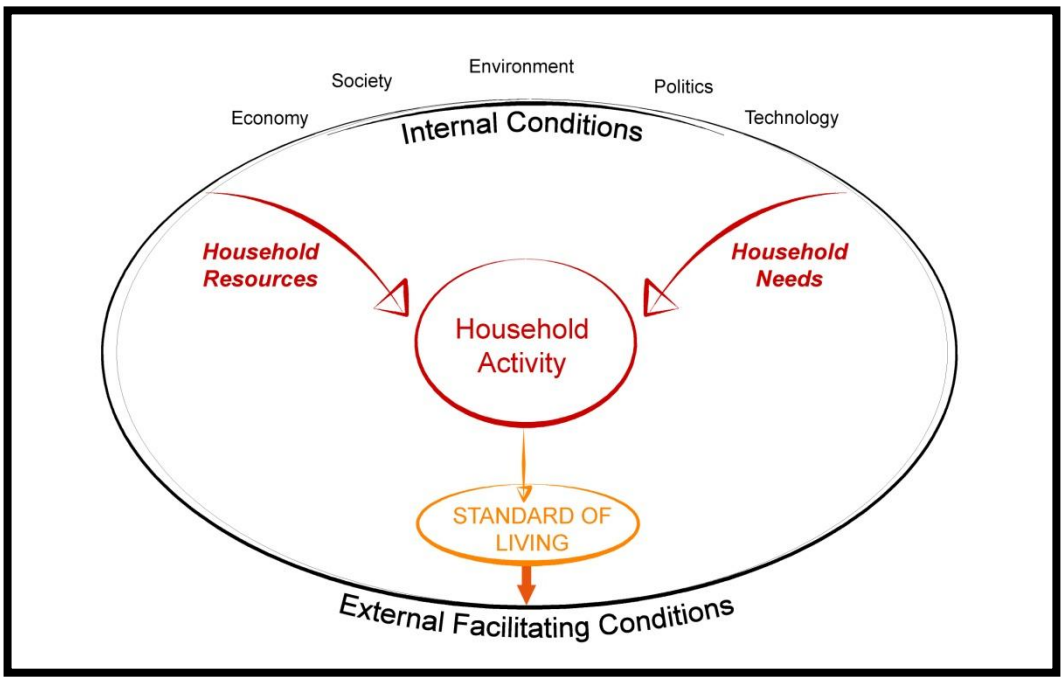


Figure 2-3 A Simple Model for the Household System

(adapted from Solomon (2008) and Groot-Marcus et al. (2006)

External facilitating conditions are formed by economy, society, environment, politics and technology. In Figure 2.2, the previous illustration, external facilitating conditions are represented by facilities and global and local resources. All these external conditions facilitate the realization of the household activity as we know today.

Internal conditions consist of needs and resources. First, household needs are formed by norms and values in society, and by the level of well-being, as it is described in Figure 2.1. As Groot-Marcus et al. (2006) says, the householder's needs are affected by both outside and inside conditions, and their needs partially shape the household activities. Second, household resources consist of time, money, effort, knowledge and other characteristics of the occupants (Uitdenbogerd, 2007). Household resources are required to do the household activity and the occupants try to manage their own limited household resources as efficient as possible depending on their needs and external conditions. This resource management results in the determination of householders' level of well-being.

A change in one of these three means to achieve the standard of living results in a change in the level of well-being. "If things change for the better, there is greater goal-fulfillment and well-being increases; if, for the worse, there is a greater shortfall from one's goals, and

well-being declines" (Easterlin, 2003, p. 16). Usually the result of a change in these means is rare to happen, since household occupants get used to their current conditions and are difficult to re-adapt a change, due to their habitual behavior.

2.4 Habitual Behavior and the Level of Well-Being

There are two kinds of actions; the ones are done as a result of less conscious decisions (such as habitual behavior) and the ones are done as a result of high conscious decisions (such as planning) (Heijs, 2006a; Fischer, 2008). In the household, the residents perform mostly the habitual behavior since they have a pre-created balance at home and do not want to change it. As Fischer (2008) says;

> *"Many of our everyday activities are habitual and this is also true for most electricity-consuming activities:*
> *We switch on the light, stove, or electric heating without thinking; we use the washing machine the way we have learned to use it, we have a routine of throwing clothing into the dryer after washing, or of switching on the radio or TV when we come home"* (p. 81).

The household occupants do these household activities unconsciously, they do not perform too much cognitive effort and once they start doing household activities, the process continues automatically (Heijs, , 2006a). This so called the habitual behavior.

According to Fischer (2008), habitual behavior has both advantages and disadvantages; it is advantageous because it spares people more time since it does not take time for the decision-making process as it starts and continues unconsciously, and it is disadvantageous because the occupants get used to their automatic behavior and they stop finding an optimum way to perform a behavior. Therefore, habitual behavior influences the level of well-being as it creates an illusion for the occupants that performing habitual behavior derives the maximum utility (Easterlin, 2003). As a result, householders are not willing enough to change their habitual behavior since their utility or well-being maximization is affected by their habitual behavior. Even if a change in the habitual behavior could increase well-being, householders stick to their habitual behavior as if that habitual behavior were providing them with the maximum level of well-being level.

2.5 Household Resource Reallocation and the Technology

The occupants pre-allocate their household resources and continue with this allocation in the household because of their habitual behavior. Since householders balance and consider the three dimensions for well-being (mental, physical and health), they are applying "strategies, issues, tradeoffs, and themes pertaining to each of the three dimensions" (Neergaard & Venkatesh, 1989). As a result of these strategies, tradeoffs and other means; householders allocate their resources, and make a balance in the household with respect to that household resource allocation.

The household studies became popular after the feminist movement around 1970s (Brodeur, 2010). In the mid-1980s, research on intra-household resource allocation started in order to have thorough information about households, i.e. the "black box" (Haddad et al., 1998). First, intra-household resource allocation was only a research subject for studies in economics. Later the term was changed into household resource allocation and it started to be a research subject for various fields and interdisciplinary studies.

Intra-household resource allocation is "the processes by which time, money, and other resources are allocated among individuals" (Haddad et al., 1998, p. 71). According to Haddad et al. (1998), the intra-household resource allocation is required to increase the wellness of an individual in the household where the 'complex interactions' occur.

In economics, the 'black box' was seen only as a consumption system until 1992 Nobel-prized Gary S. Becker published his work "A Theory of the Allocation of Time" in 1965. With Becker (1965), household members happened to be regarded as part of both production and consumption systems due to their consumption of time and reproduction of it in a new way that they combine it with resources. "For economists, the study of housework and caregiving is naturally framed in terms of time and resource allocation as it relates production, consumption, and distribution" (Brodeur, 2010, p. 7). In economics, while microeconomic studies focus on time and resource allocation in the household, in macroeconomics time and resource allocation is studied for the development of economic and social accounting systems (Brodeur, 2010, p. 9).

As mentioned before, household members are trying to allocate their resources in the fullest so that they can increase their level of well-being. Household resource allocation is

made through household decision-making process. There are two theories about decision-making; one is the unitary (traditional) decision-making process, the other is the collective (common) decision-making process (Thomas & Chen, 1994; Haddad et al., 1998).

The traditional decision-making process has a unitary approach in which either the dominant member (a dictator) in the household determines all the decisions on resource allocation or all the household members are assumed to have common preferences for resource allocation (Thomas & Chen, 1994; Haddad et al., 1998). That ends up with a unitary decision on household resource allocation.

On the other hand, the modern theory offers a "collective" decision-making process. This theory assumes that different preferences of the household members combine and results in collective decisions (Haddad et al., 1998). "This theory holds that the identity of the person targeted by policy will affect how benefits for the household are used, and that decisions often reflect the bargaining power of different household members" (Haddad et al. , 1998, p. 71).

According to "Multiple Pool Model", by Commuri & Gentry (2005), there should be a common pool where all household members' resources should be gathered in, and there should also be a pool for each household member where the allocation of the resources is separated with respect to the preferences of the household members (as shown in Figure 2.4).

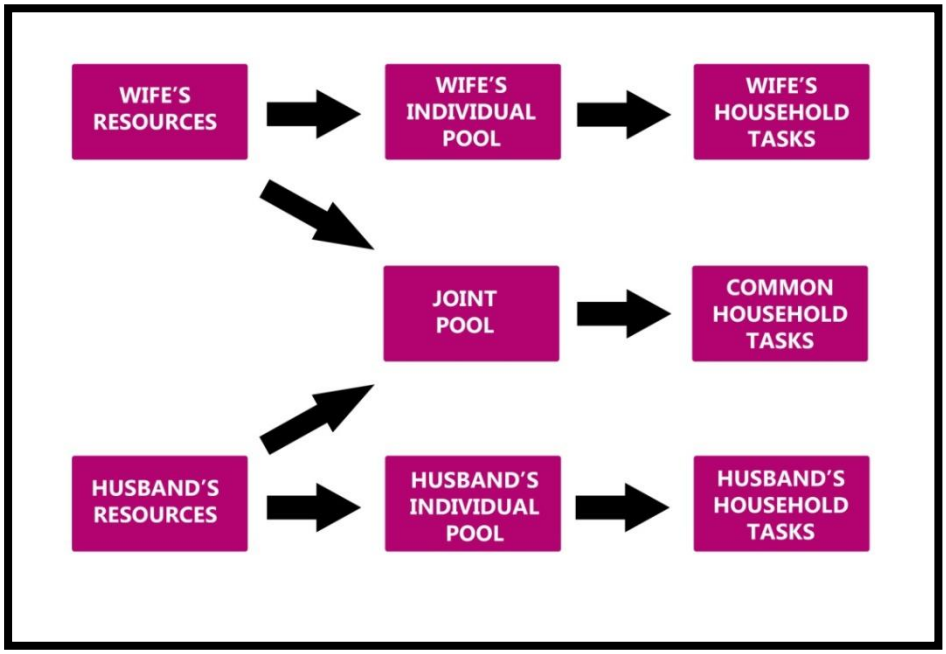


Figure 2-4 Multiple Pool Model (adapted from Commuri & Gentry, 2005)

As mentioned before, after a decision process, household resources are allocated. However, this decision-making is not a continuous process. Once the decisions are given, they are maintained in the same fashion. As Groot-Marcus et al. (2006) states;

> *"… households do not always plan or make decisions. The diversity and daily return of household activities, as well as the incorporation of these activities into a previously constructed material background, are the reason that people do not continuously decide anew how to act and gear household resources to one another. Actions that have been learned in the past often become habitual"* (p. 37).

Therefore, once the resources are allocated, household members behave accordingly. To recall, household resources are income, space, time, abilities, skills and other characteristics of household members. Household members allocate these resources in order to achieve the standard of living by increasing their level of living and to make a balance in the household system. They, in the end, come up with the most efficient composition of resources to bring their living level up to the standard level (Moll & Groot-Marcus, 2002) and this composition varies from household to household (Uitdenbogerd, 2007). Different household resource allocation preferences of households are clarified in Figure 2.5.

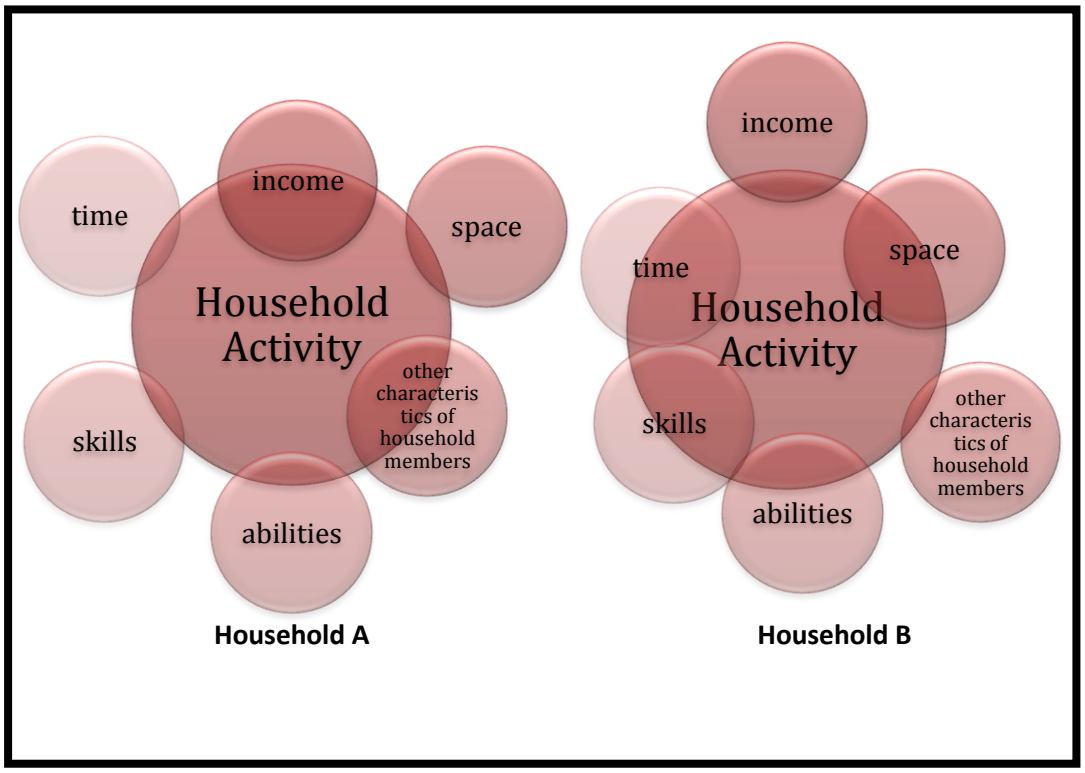


Figure 2-5 Different Household Resource Allocation Preferences

With the habitual behavior formation, it gets difficult for household members to change their once set mix of resources. However, “when a new technology is introduced in a household system, the fragile balance between resources, level of living, and living standard may be disturbed, introducing a reaction” (Groot-Marcus et al., p. 37). In other words, the new technology changes the standard of living by disturbing the fragile system of the household balance. This disturbance requires a rearrangement of household resources to maintain the existing balance of the household system. That is called “household resource reallocation”. When the new technology is incompatible with the existing system of the household, household resource reallocation is required.

To sum up, as Uitdenbogerd (2007) says as well; the household system involves in the interaction within the household members, standard of living, implementation of household activities and household resources. With the introduction of a new technology, the householders’ standard of living changes. The change in the standard of living results in an unbalanced household system and changes the way the household activities implemented. The household members might not be in favor of this situation. Thus, household members seek for new ways of rebalancing the household system and come up with the reallocation of household resources which is an efficient way to provide this balance. By reallocating household resources, householders can adapt easily to the new technology.

CHAPTER 3

PERSUASION

3.1 What is Persuasion?

Persuasion is “a process in which a source (persuader) uses a message to achieve a goal by creating, changing, or reinforcing the attitudes of others (the audience)” (Benoit & Benoit, 2008, p. 7). To create a new attitude, to change an attitude or to reinforce an existing attitude into a new attitude is the main goal in persuasion. Attitudes are cognitions or thoughts that shape our behavior and they are formed by beliefs and values (Benoit & Benoit, 2008).

Beliefs are facts about people’s surroundings which are true or false statements (CIOS, 2011; Perloff, 2010). Here are some examples to clarify beliefs:

- Elif knows that Department of Industrial Design at METU requires the score of at least 504.676 to attend. (a true belief).
- As Zeynep knows, a full-loaded washing machine consumes more water than hand-washing (a false belief).

On the other hand, “Values are judgments of worth. Because they are judgments, they are subjective and are neither true nor false. Of course, some people hold a given value so strongly that they believe it is true” (Benoit & Benoit, 2008, p. 11). Here are some examples to clarify values:

- According to Elif, METU is the best university in Turkey (a subjective judgment).
- According to Zeynep, washing machines are expensive for students. (a subjective judgment)

As a result, with the combination of beliefs and values, one can say that:

- Elif's attitude is to attend Industrial Design at METU since she has got a score of 510.143 and she thinks that METU is worth to attend.
- Zeynep's attitude is to prefer washing dishes herself since she finds washing machines expensive and water-consuming.

To be persuaded, our attitudes (or thoughts) must agree with the persuasive message (Benoit & Benoit, 2008). In other words, if someone is going to be persuaded for something, the target goal must not be in conflict with the audience's beliefs and values. Beliefs and values are formed as a result of experience and that makes them alterable (CIOS, 2011). Hence, as in the Elaboration Likelihood Model (ELM), audience's thoughts (or attitudes) are of great importance. As also the name of the model indicates, the audience elaborates the message and its similarity to his or her attitudes, thoughts, or cognitions. In ELM, there are two routes to persuasion; central route to persuasion and peripheral route to persuasion (Petty et al., 1983; Petty & Cacioppo, 1986; Benoit & Benoit, 2008). According to Petty and Cacioppo (1986), central route of persuasion takes place when the audience gives full concentration on the information supplied by the persuader. The central route to persuasion, as Benoit & Benoit (2008) says, "occurs when a listener has both the motivation and the ability to think about the message and its topic" (p.23). On the other hand, the peripheral route to persuasion "takes place when the receiver does not expend the effort to think carefully about the ideas in a message" (Benoit & Benoit, 2008, p. 23). In other words, the audience does not have high motivation and ability to give full concentration on the message. It is difficult to persuade such audiences so the central route to persuasion is preferred (Petty & Cacioppo, 1986). In order to induce central route of thinking to the audience, in other words to raise the concentration and the motivation of the audience on the topic, persuasion techniques are examined in the next section.

3.2 What is Persuasive Design?

As persuasion is often a work of verbal communication, it is mostly studied in psychology and advertising. In persuasive design, "things influence the way we think and act simply through their physical form" or in a "material form"" (Redström, 2006, p. 116). Persuasive design is addressing the importance of describing object, the user and the use. Comparing

persuasive design with persuasion in psychology, the object is the persuasive message itself, user is the audience, persuader is the designer, and the use is the designer's intent of persuasion.

Persuasive design is a recent research area in design literature. However, according to Redström (2006), persuasiveness is not a recent feature of design since "design is inherently persuasive" (p. 112) because it "shapes the way we think and live also in other and sometimes fundamental ways" (p. 113). As Buchanan (1985) says;

> *"By presenting an audience of potential users with a new product – whether simple as a plow or a new form of hybrid corn, or as complex as an electric light bulb or a computer – designers have directly influenced the actions of individuals and communities, changed attitudes and values, and shaped society in surprisingly fundamental ways" (p. 6).*

Persuasive design from a technological perspective holds the view that we are surrounded by man-made environment and objects. Having similarities with environmental psychology, man-made environments are influencing people's psychological processes, and so their attitudes and behavior (Heijs, 2006b). "In all these environments and objects, there are prescribed ways of using them that will influence and govern the way we work, live and think" (Redström, 2006, p. 113).

Persuasive design from a sociological point of view underlines the importance of sociological discriminations among people, such as their aspirations, tastes, views, social status and other discriminative factors (Buchanan, 1985). According to Marcuse (1991), design has power to "indoctrinate and manipulate" (p. 14) because a product is designed with an intended way of use, context, and with an intended user behavior (Marcuse, 1991; Redström, 2006). If the designed object achieves an attachment with its user, then this indoctrination and manipulation wide spreads among the society.

Persuasive design from a philosophical perspective examines the "use" term. An object adopts the designer's intended message to the users. In other words, a product works as a defender and in favor of the argument of its designer's perspective (Redström, 2006). A product adopts the argument and influences its users. Therefore, the argument transfers

from the product to the user. Redström (2006) defines this situation as; “just as the user uses an object, so does the object use its user” (p. 114).

In three different perspectives for persuasive design, it is claimed that products have the capability to influence user’s behavior. This is because products are intermediaries between human actions and environment (Latour, 1992; Verbeek, 2006). According to Latour (1992), human actions are ‘co-shaped’ by products because most of the time a human being requires a product to achieve certain actions. In other words, “a user action is facilitated by an artifact when proper cognitive, perceptive and motor processes are initiated and accommodated during the interaction with the artifact” (Arnold & Mettau, 2006, p. 15). As a result, products are ‘co-shaping’ human actions. However, to make a successful ‘co-shaping’, products need scripts (Latour, 1992; Verbeek, 2006; Jelsma, 2006b).

3.2.1 Script

New technology is adopted without changing the existing behavior (Slob & Verbeek, 2006). As a result, users may adopt the new technology in a way that the designers have not intended to and thus, a conflict between the designer’s intent and the user occurs in an unpredictable way. Therefore, while designing a product with a new technology, designers must pay attention to users’ existing behavior and the possible future influence of the newly designed product on the user’s behavior. It is crucial to determine the target behavior of the new design clearly so that the users can use the new product in the same way the designers have intended them to. To make the target behavior clarified and estimate the influence of the product on the user behavior, it is suggested to clarify a script of the product (Latour, 1992). “A script is not the intended but the proven force that an artifact exerts on a user by translating his goals and actions” (Jelsma, 2006b, p. 68). Just like the use of the metaphor of a script in movie scenarios or in theater plays, a script in a product ‘prescribes’ its users behavior (Latour, 1992; Slob & Verbeek, 2006; Verbeek, 2006). As in Verbeek’s (2006) words, “an artifact can ‘prescribe’ its users how to act when they use it” (p.58). For instance, a curtain is responsible for providing the users with privacy and protecting them from the direct sunlight.

A designer delivers a ‘materialized message’ to the user through the product (Jelsma, 2006b). In this way, a script is a guideline that includes the designer’s intention and the persuasive ways to reach out the designer’s purpose. As Jelsma (2006b) says;

> *"It carries a materialized message ('text') from the designer to the user. Through the scripted artifact, the designer can act a distance. He does not have to be present and hold your hand in operating a cup or a spoon. The deliberate shape, colors and signs of artifacts tell you what to do with it"* (p.58).

In other words, a design object is carrying "certain ideas about its use and context" (Redström, 2006, p. 114) with in itself that guide the users. Therefore, a script must be clarified carefully and must take the interaction of a product and a user as a basis. In Figure 3.1, the interaction between products and users are shown. A script must contain these interaction tools to influence the user behavior.

In sensation and perception processes, the interaction between a product and a user is provided through interaction guidelines; the product visibility, affordances and mapping.

The visibility of the product is important for users to perceive and sense the product (Heijs, 2006b, p. 49). The user-side perception and sensation of the product should be the same as the product-side supplies and that is provided by the visibility of the product. Visibility is crucial for further stages of user-product interaction.

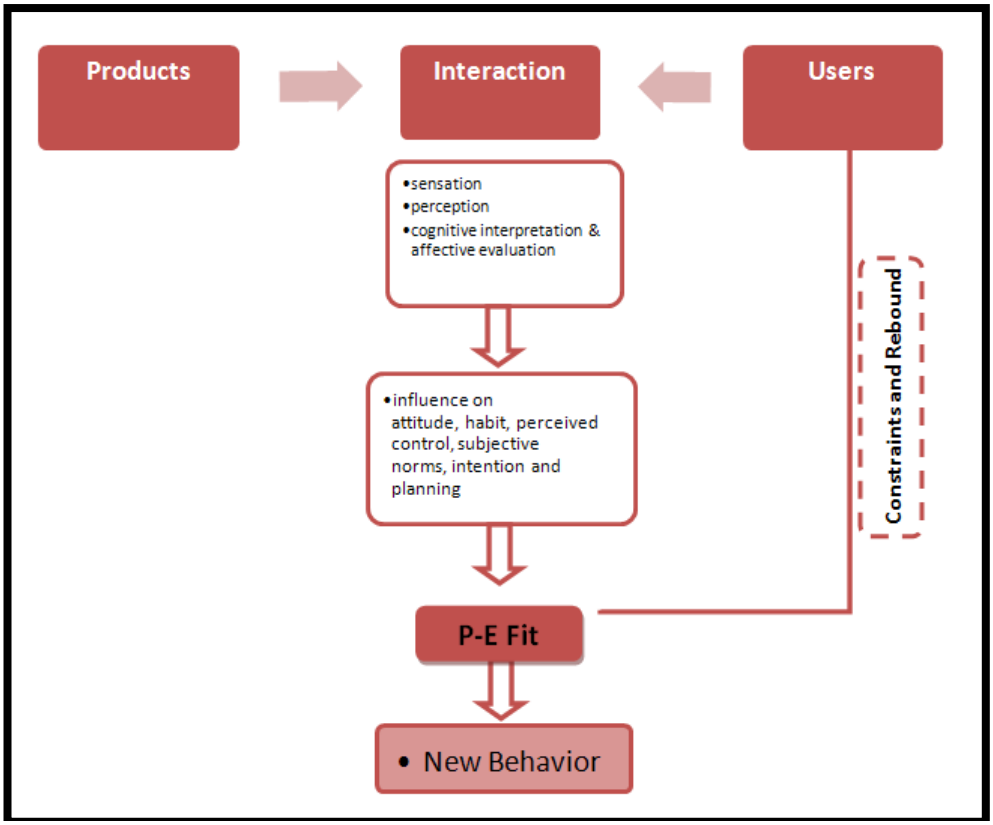


Figure 3-1 The influence of product-user interaction on behavior (adopted from Heijs, Technology and Behavior: Contributions from Environmental Psychology, 2006)

The term “affordance” is first introduced by Gibson in 1979. Affordance is the case when an environment (or a product) gives clues to the people on how to act (or how to use it) through its physical features (Gibson, 1979; Norman, 1990). So, the affordances are the physical features of objects that are guiding users about what to do and how to do it. Recently affordances studies are widely observed in technological products, since they require more successful guidelines (Redström, 2006).

A mapping is a guideline which enables users to associate the product controls with their related functions. A successful mapping offers users a conjunction with the product and is a step further to cognitive interpretation and effective evaluation (Heijs, 2006b).

After a cognitive interpretation and an affective evaluation process, if an effective interaction has occurred (with the aid of the interaction guidelines), user attitudes, habits, perceived control, subjective norms, intention and planning are influenced. That leads to a person-environment fit (P-E fit). When the P-E fit takes place, the product changes user behavior and persuades user to re-use the product (Arnold & Mettau, 2006). This case occurs as long as the user does not rebound, reject and have constraints towards the target behavior. Therefore, behavior change does not only depend on products also on users. To realize persuasion, user behavior should be studied. According to Spaargaren et al. (2006), to make this influence of products on users more sustainable and permanent; in other words, to make a long-lasting behavior change, “the value- or belief-systems that are ‘guiding’ individual behavior” (p. 107) must be altered.

3.3 Theories of Persuasion / Behavior Change Models

The main logic behind persuasion is a successful transfer of the ‘persuasion stuff’ from the persuasive message to the audience (Benoit & Benoit, 2008). To comprehend how to make this transfer successful, different theories of persuasion are studied in this part. At the beginning of behavior change studies, attitudes were taken as a focusing point. However, since attitudes are influencing behavior and behavior is a more permanent phase for a change, behavior-based theories have been taken more seriously for persuasion studies recently.

3.3.1 Attitude-Based Theories

3.3.1.1 Consistency Theories of Attitude Change

As people are consistent with their beliefs and values, they are consistent in their attitudes as well. People tend to disregard and deny inconsistent beliefs and values, and thus, to continue with the same, old attitude they have unless a strong and powerful inconsistency is created. There are three main consistency theories and they are all based on the same idea; that is, an inconsistency in thoughts or cognitions results in an attitude change (see Figure 3.2).

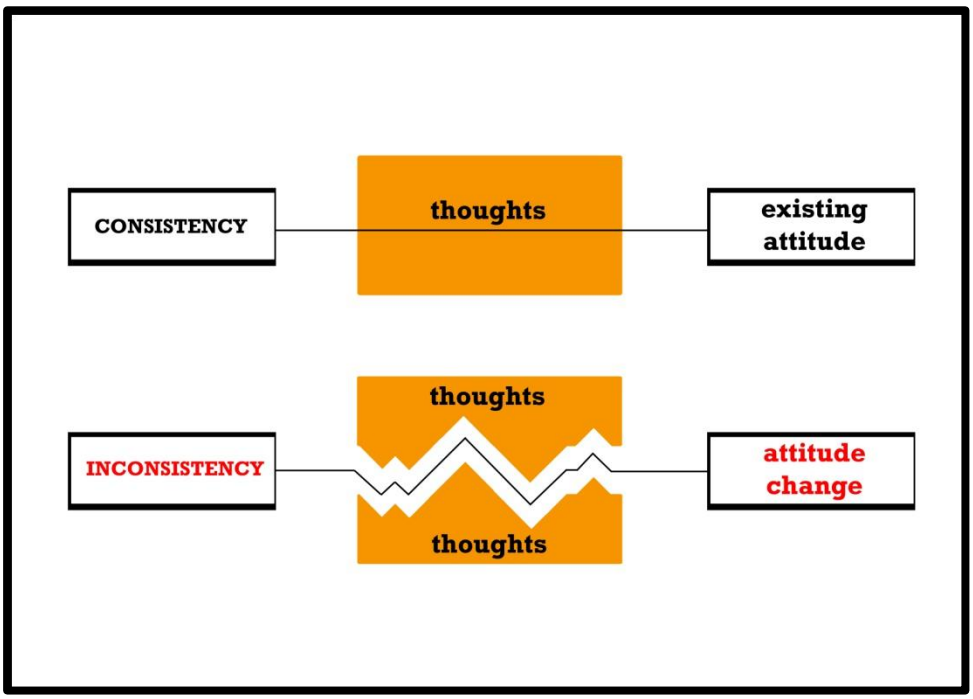


Figure 3-2 Basic Concept in Consistency Theories

Balance Theory

In 1946, Heider's Balance Theory claimed that when there is an unbalanced thought in a triad of a person, another person and an object, this person is willing to restore the balance (Perloff, 2010; Benoit & Benoit, 2008; Heider, 1946). Figure 3.3a is the ultimate result people want among their thoughts. Hence, Figure 3.3b is showing the triangle with an unbalanced thought. In the end a person will turn his/her situation into the balanced one just as in Figure 3.3a even if that costs him/her to change in the attitude (Benoit & Benoit, 2008).

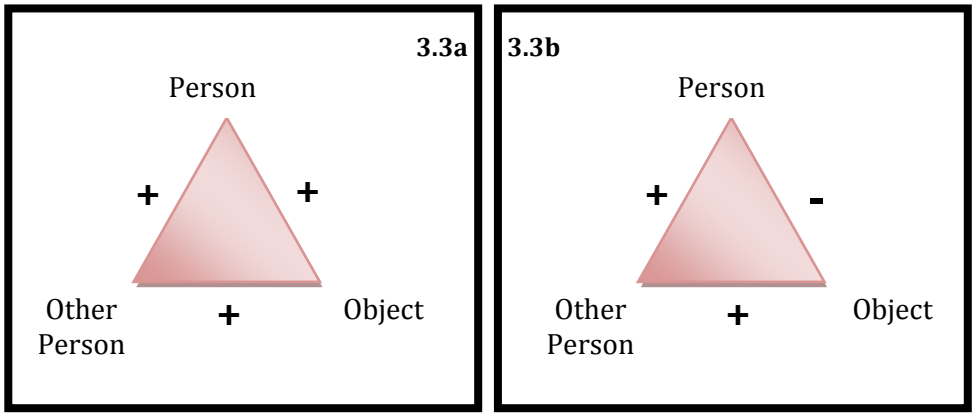


Figure 3-3 A Balanced and an Unbalanced Triad

There are three ways to regain the balance among thoughts; the first way is to change the attitude toward the object, the second is to change the attitude toward the other person, and the third way is to assume a change between other person and the object (Benoit & Benoit, 2008) (see Figure 3.4).

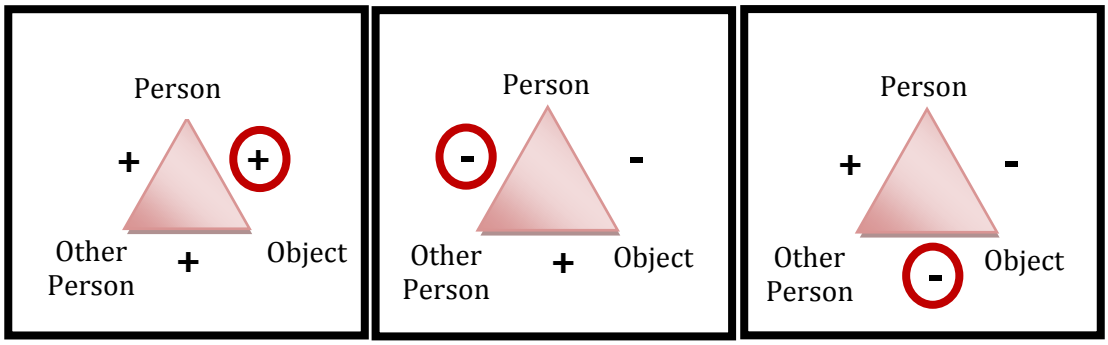


Figure 3-4 Three Ways to Restore the Balance

Congruity Theory

In 1955, Osgood and Tannenbaum proposed the Congruity Theory. Congruity Theory is very similar to Balance Theory, except that Congruity Theory makes predictions on attitudes by quantifying the level of cognitions (Benoit & Benoit, 2008). In Congruity Theory, "incongruity (like imbalance) is unpleasant and motivates audiences to change their attitudes" (Benoit & Benoit, 2008, p. 167).

Cognitive Dissonance Theory

Cognitive Dissonance Theory was developed by Leon Festinger in 1957. According to Cognitive Dissonance Theory, like other consistency theories, "a negative, unpleasant state that occurs whenever a person holds two cognitions that are psychologically inconsistent" (Aronson, 1968, p. 6). According to Benoit & Benoit (2008), this unpleasant inconsistency motivates attitude change for a consistent state. "The more inconsistent a person's thoughts are, the more dissonance he or she should experience" (Benoit & Benoit, 2008, p. 171). In Cognitive Dissonance Theory, dissonant and consonant thoughts are weighed according to each thought's importance (Benoit & Benoit, 2008). Thereby, the amount of dissonance is estimated. There are three ways to restore the consonance in Cognitive Dissonance Theory; the first way is to change a thought to decrease the dissonance level, the second way is to add a new consonant thought, and the third way is to change the importance weights of thoughts (Benoit & Benoit, 2008).

In all three consistency theories, either named dissonance or imbalance, or incongruity, an inconsistent cognition creates a willing to restore the stability. Persuasiveness can be implemented by creating a dissonance and as a result, the desired attitude can be achieved through an attitude change (Benoit & Benoit, 2008).

3.3.1.2 Social Judgment/Involvement Theory

Social Judgment/Involvement Theory was developed by Muzafer Sherif and Carl Hovland in 1961. As named social judgment/involvement theory, judgment of the message by the audience and the involvement of the audience in the topic are very important, and that seperates this theory from consistency theories.

"The audience interprets or judges a message" that "how much the message agrees or disagrees with his or her own attitude" (Benoit & Benoit, 2008, p. 178). When there is too much discrepancy between one's attitude and the message, in other words when the message disagrees with one's attitude, the one rejects being persuaded. If the discrepancy between one's attitude and the message is small, the message works effectively as persuasive.

So far, these claims have been similar to consistency theories; if the message is consistent with the audience, he or she accepts persuasion and vice versa. However, a discriminative claim of Social Judgment/Involvement Theory puts is that when the discrepancy is too small

(or even negligible) between the message and receiver's attitude, the receiver is neutral for persuasion because he/she finds out no meaning in changing his/her attitude (Benoit & Benoit, 2008; Perloff, 2010).

According to Social Judgment/Involvement Theory, audience's involvement to the message topic is another factor to determine the acceptance or the rejection of the message (Benoit & Benoit, 2008). The second discriminative claim of Social Judgment/Involvement Theory is about the relationship between the level of involvement and the latitude of acceptance which is illustrated in Figure 3.5. If the audience is closely related to the topic of the message (high involvement), latitude of acceptance gets narrower and latitude of rejection gets wider. If the audience is not interested (low involvement) in the topic, his or her latitude of acceptance increases and his or her latitude of rejection decrease.

The third discriminative claim of Social Judgment/Involvement Theory is the subjective judgment of messages. Since perception differs among people (Perloff, 2010), it is important to make a perceptible message by everyone. Misperception reduces the persuasiveness of the message (Benoit & Benoit, 2008).

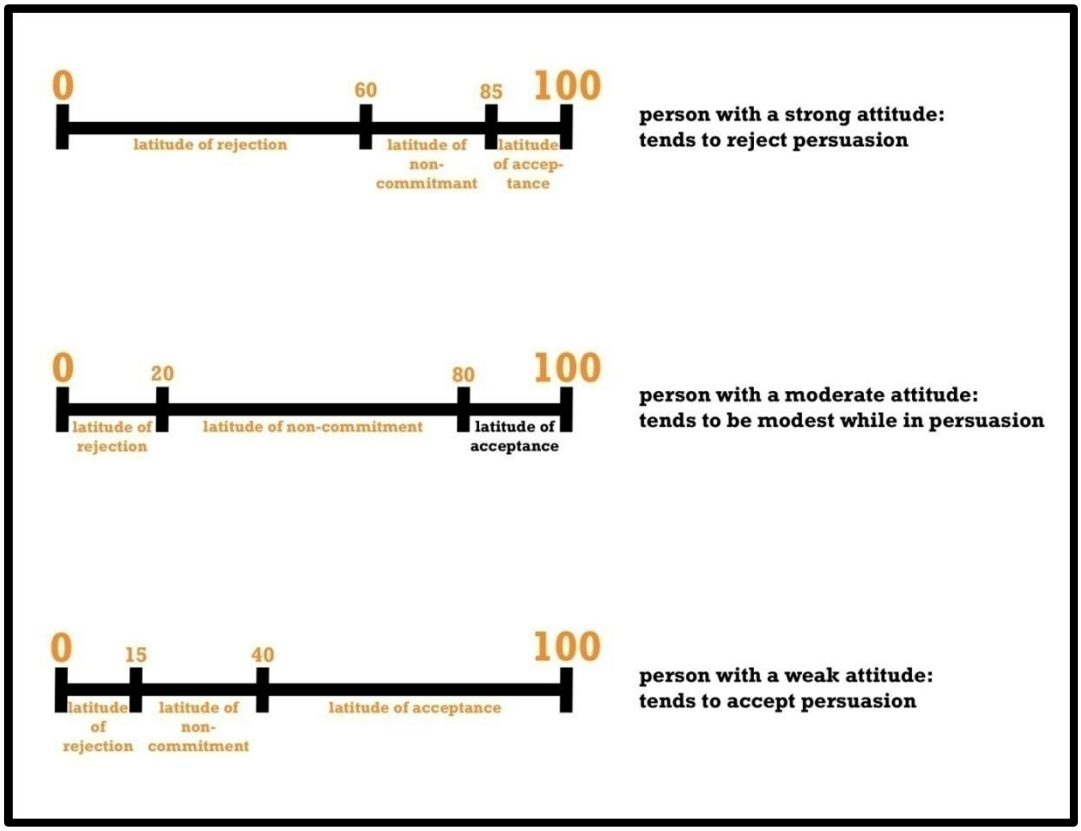


Figure 3-5 Latitude Graph of People (Adapted from Perloff, 2010)

3.3.2 Behavioral-Intention Based Theories

3.3.2.1 Theory of Reasoned Action

Theory of Reasoned Action was developed by Icek Ajzen and Martin Fishbein in 1975. The theory is interested in the relationship of persuasive messages, behavior and attitude. "The model assumes that people rationally calculate the costs and benefits of engaging in a particular action and think carefully about how important others will view the behavior under consideration" (Perloff, 2010, p. 95). Theory of Reasoned Action introduces new terms; behavioral intention, attitude toward behavior and subjective norms, which make this theory discriminative from the previous attitude change theories. As Benoit & Benoit (2008) say, behavioral intention works as a bridge between attitude and behavior. It is the intent or plan to realize the behavior (Perloff, 2010). There are two factors influencing behavioral intention; attitude toward behavior and subjective norms as defined in Figure 3.6.

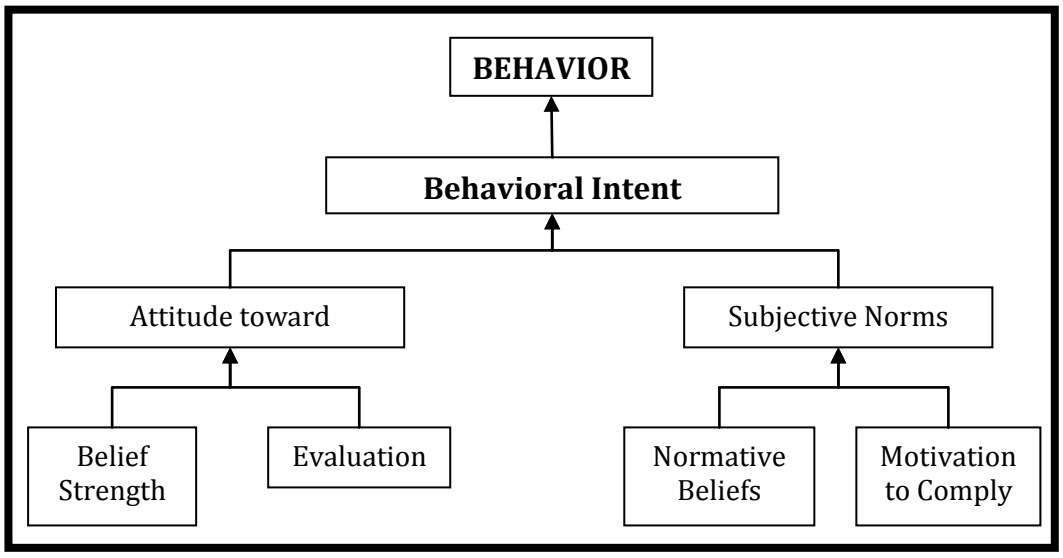


Figure 3-6 The Theory of Reasoned Action

(Adapted from Benoit & Benoit, 2008 and Perloff, 2010)

Attitude toward behavior is the interpretation to perform a behavior depending on its goodness or badness (Ajzen & Fishbein, 1980) and it is sub-divided into two as belief strength and evaluation. As Perloff (2010) says, belief strength is the power of personal beliefs that result from the performance of a behavior. Evaluation is the personal interpretation of the outcomes of that very performed behavior (Perloff, 2010).

Subjective norms are “the person's perceptions of the social pressures put upon him or her to perform or not perform the behavior in question” (Ajzen & Fishbein, 1980, p. 6). They are sub-divided into two; normative beliefs and motivation to comply. Normative beliefs are believes that people think what others expect them to behave (Benoit & Benoit, 2008; Perloff, 2010). Motivation to comply is the importance level of how others behave matters to a person to comply (Benoit & Benoit, 2008; Perloff, 2010).

This theory can be used in persuasion more effective than the previous theories because reasoned action measures each of these sub-components and therefore, estimates the behavioral intention (Benoit & Benoit, 2008). As there are many sub-components that are influencing the behavioral intention, “this theory reveals that we have many options when trying to persuade someone” (Benoit & Benoit, 2008, p. 195). Moreover, by analyzing the audience, the persuader may categorize the audience as attitude-based or norm-based audiences. As a result, the persuader can create a successful persuasive message addressing correctly the audience type (Benoit & Benoit, 2008).

3.3.2.2 Theory of Planned Behavior

Theory of Planned Behavior is a further developed version of Theory of Reasoned Action by Icek Ajzen in 1991. Ajzen adds a new term Theory of Planned Behavior; perceived behavioral control as the third component affecting behavioral intention as shown in Figure 3.7. “Perceived behavioral control is the individual’s perception of how much control he or she has over the behavior. The more I perceive that I can perform the action, the more successful I should be in translating intention into behavior” (Perloff, 2010, p. 100). Perceived behavioral control has two sub-components; control beliefs and the power of the potential control factor. Control beliefs are abilities the audience has, whereas the potential control factor is the importance of the abilities while making a decision (Benoit & Benoit, 2008). Perceived behavioral control can be measured as well, like the other sub-components of behavior intention. According to Perloff (2010), the measurement question aims at learning a person’s self-sureness of performing the target behavior.

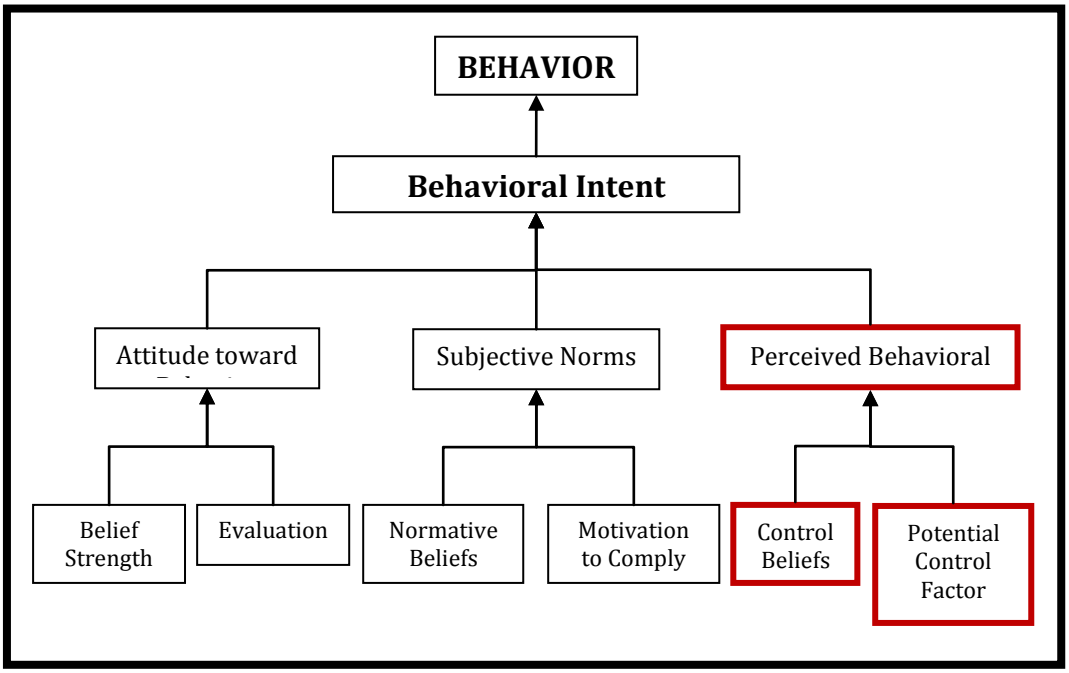


Figure 3-7 The Theory of Planned Behavior

3.3.3 Behavior-Based Theories

So far, the theories presented have not analyzed the determinants of behavior change, but behavioral intention change and attitude change specifically. From now on, behavior change factors are analyzed in theories.

3.3.3.1 Social Cognitive Theory

Social Cognitive Theory (SCT) is introduced by Albert Bandura in 1986. It claims that for a behavioral development, a triad of behavior, environment and cognitions (personal factors) are interacting with each other (Bandura, 1986) and behavioral changes are the consequences of attitude changes (McCalley, 2003). Behavior change, according to SCT, is based on four factors including vicarious capability, forethought capability, self-regulatory capability and self-reflective capability. Vicarious capability addresses behavioral development to observational learning and it suggests that in order to learn an individual should not have to observe and experience directly but also can learn by other's experiences. Forethought capability suggests a behavior change through an anticipation of the future and thinking what might be the consequences of certain actions which cause

people to act in a predefined way. Self-regulatory capability, in other words self-reactiveness, is a self-correction system of an individual. The motivator of self-regulation is directing oneself in a way that he/she wants to get corrected. Self-reflective capability is the capability of people to reflect his/her experiences, analyze these experiences and afterwards to "derive generic knowledge about themselves and the world around" (Bandura, 1989)

3.3.3.2 Transtheoretical Model

"The Transtheoretical Model (TTM) uses stages of change to integrate processes and principles of change across major theories of intervention, hence the name *Transtheoretical*" (Prochaska et al., p. 97). TTM has emerged from leading psychotherapy theories and behavior change theories. Therefore, the main application of TTM is in health behavior change. TTM is constructed on four core elements; stages of change, processes of change, decision balance and self-efficacy. There is a relationship between these four constructs, those changes a behavior, as shown on Figure 3.8.

The stage of construction has six stages for progress; *precontemplation, contemplation, preparation, action, maintenance and termination stages*. In the procontemplation stage, people do not see any need for change since they are stabilized with their current behavior. They do not realize that the consequences of changing behavior might result in better conditions. That might occur because they are not informed at all or well about the negative outcomes of quitting the old behavior or they lack the ability (Prochaska et al., 2008). In the contemplation stage, people become more aware of the consequences for a behavior change, and thus, they start to have intents to take action for a change. In the preparation stage, people get prepared and have a plan to take action in the very next future. This stage is also a transition stage between behavioral intention to behavior change (Velicer et al., 2011). Action is the stage in which people make alterations in their behavior, and thus, in their lifestyles. In the maintenance stage, people maintain those alterations and try to prevent relapse. In the termination stage, the final stage, people "have zero temptation and 100 percent self-efficacy" (Prochaska et al., 2008, p. 100) to perform the new behavior automatically. To understand the practical implementation of stages of change, see Appendix A.

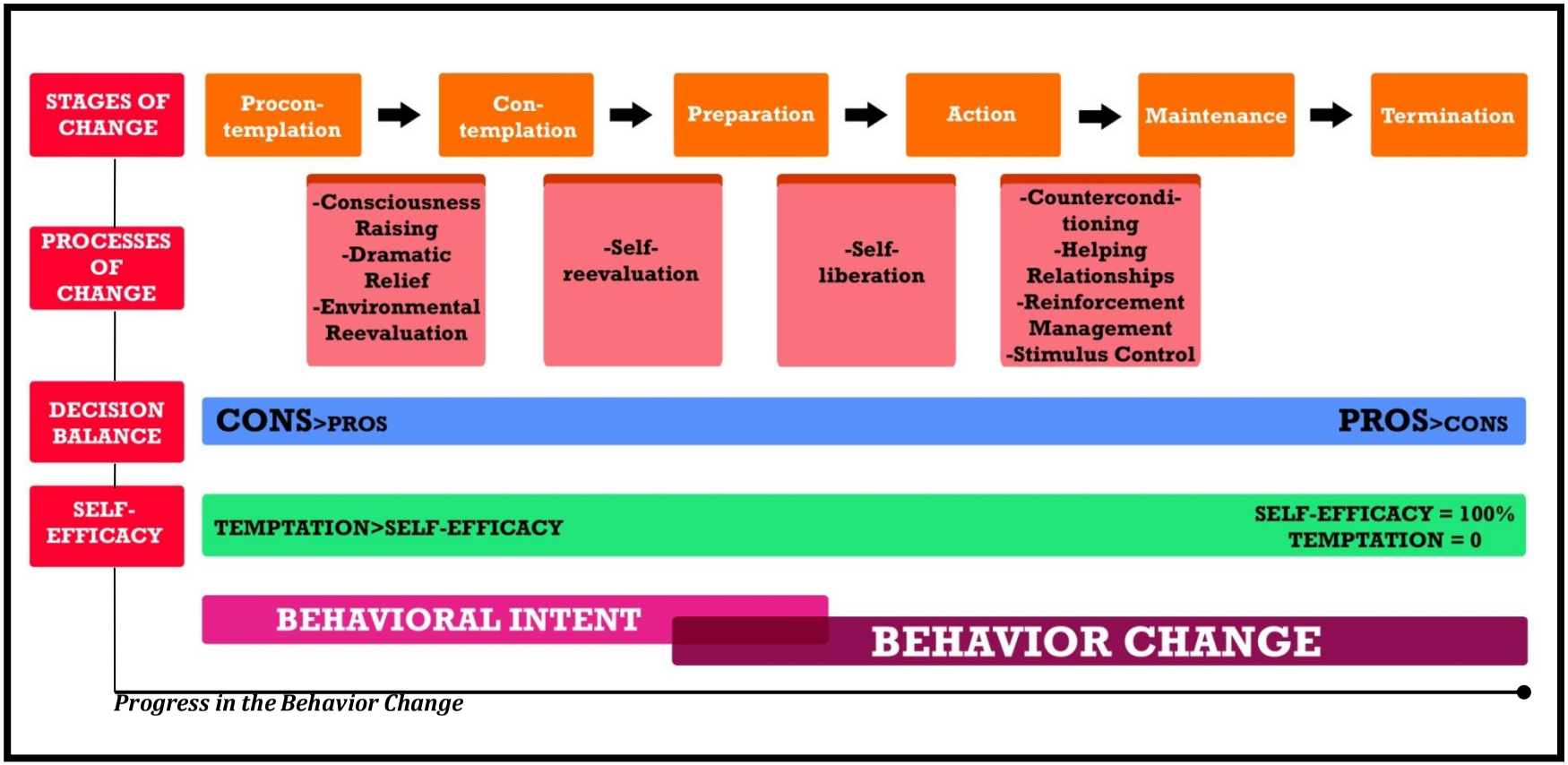


Figure 3-8 The Transtheoretical Model (TTM)

The second construct, processes of change, is the "activities use to progress through stages" (Prochaska et al., 2008, p. 101) and consist of independent variables (Velicer et al., 2011). There are ten processes as shown in Figure 3.8; *consciousness raising, dramatic relief, self-reevaluation, environmental reevaluation, self liberation, social liberation, counter conditioning, stimulus control, reinforcement management and helping relationships* (Prochaska et al., 2008). Consciousness raising is the process in which people become more aware of the reasons, outcomes and solutions for their old behavior. Dramatic relief involves emotional arousal that people react. Self-reevaluation is the cognitive and affective interpretation of one's self-image with both old and new behavior, which helps one to imagine oneself (Prochaska et al., 2008). Environmental reevaluation "combines both affective and cognitive assessments of how the presence or absence of a personal behavior affects one's social environment" (Prochaska et al., 2008, p. 101). Self-liberation is the belief that a change is possible and it is the commitment to that belief. Social liberation is like a social guideline that motivates people to commit a change. Counterconditioning requires being aware of that there is a better substitution for the old behavior. Stimulus control makes cues for the old behavior unseen where making the prompts for the new behavior observable, and thus pushes people to perform the new behavior. Reinforcement management involves reinforcements that ensure people to follow the direction of the new behavior, such as punishments or rewards. Helping relationships, the last process "combine caring, trust, openness, and acceptance, as well as support for healthy behavior change" (Prochaska et al., 2008, p. 101). To understand the practical implementation of processes of change, see Appendix A.

Decisional balance, the third core construct of TTM, involves in weighing the positive and negative outcomes of changing in mind (Velicer et al., 2011). It is, therefore, also named as pros and cons of changing. As people go through and proceed in the stages of change, they start to have more pros and fewer cons about the new behavior.

The fourth core construct of TTM is Self-Efficacy (or the Temptation scale). Self-efficacy theory was originally introduced by Bandura in 1977, in his article; Self-Efficacy Toward a Unifying Theory of Behavioral Change. Self-efficacy is "the belief that one can perform a behaviour" (Nye & Burgess, 2008) and it determines "whether coping behavior will be initiated, how much effort will be expended, and how long it will be sustained in the face of obstacles or aversive experiences" (Bandura, 1977, p. 191). Self-Efficacy is like the concept

of Perceived Behavioral Control in Theory of Planned Behavior. The increase in self-efficacy brings situation-specific self confidence to an individual to perform the target behavior. The opposite term for self-efficacy is temptation which is "the intensity of urges to engage in a specific behavior when in difficult situations" (Prochaska et al., 2008, p. 102). As there is a progress in the stages of change, people tend to have reduction in their temptations and an increase in self-efficacy, which is 100% and temptation is 0 in the termination level (Prochaska et. al, 2008).

TTM is a very helpful approach to persuasive design since it gives the designers the opportunity to determine on which stage the users are and afterwards tells which measures should be taken, which stage should come next and which processes should be followed (changingminds, 2011).

3.3.3.3 Environmentally Responsible Behavior Model

Environmentally Responsible Behavior (ERB) is a mediating model between Altruism-Centered Approach and Reasonable Person Model. In the altruism-centered approach, people are sacrificing their wellness for others' wellbeing or for environment, whereas in the Reasonable Person Model, people are the 'economic men' whose self-gain is the only thing with an importance (Kaplan, 2000). As Oskamp (2002) says, sustainable living is the ultimate goal in ERB. Therefore, ERB mediates both Altruism-Centered Approach and Reasonable Person Model, and comes up with an environment caring and at the same time self-advantageous behavior model. As Young says it, there are two motivations in ERB; "providing material incentives and disincentives sufficient to make the behavior worth attending to and focusing on the altruistic reasons for engaging in the behavior" (2000, p. 509).

Since ERB is a wide ranging of topic considering environmental behavior change, it has been studied by a number of researchers and thus, different factors influencing ERB exist. Although the basis for this environmental behavior approach is a lot like in Young (2000), Oskamp (2002) and Tribbia (2007), there are few additional and discriminative points in their analysis of ERB.

According to Young (2000), three intrinsic satisfaction must be derived from the environmental behavior in order to be performed; behavioral competence, frugality (thoughtful consumption), and participation. Behavioral competence is about overcoming the problems and accomplishing the given tasks. Frugality, the core satisfaction element in ERB, is being aware of the limited resources on the planet earth and thus, consuming thoughtfully. Participation involves the activities done as a group and trying to create a difference as an individual amongst it. These three intrinsic satisfactions require individual skills and abilities (Young, 2000).

Oskamp's (2002) view of ERB finds the support from Fisher & Fisher's (1992) three-determinants to behavior change for AIDS prevention. This three-factor conceptualization of behavior change is named as IMB , the abbreviation of Information-Motivation-Behavioral skills (Fisher & Fisher, 1992). Oskamp (2002) adapts the IMB theory of behavior change for AIDS prevention to behavior change for environmental responsibility. When the IMB is adopted by ERB, one should get information about what is to be done, have the sufficient motivation to perform ERB and have the required behavioral skills (Oskamp, 2002). Behavioral skills are also "necessary to put the information and motivation into effect" (Oskamp, 2002, p. 176).

In Tribbia's approach to ERB, there are five components affecting the behavior change; inclination, motivation, information processing & behavioral intent, ability & skills, and external support. Inclinations are users' belief system or attitudes. It is determined by their socio-economic status, disposable income, demographic variables and value orientation (Tribbia, 2007). Motivation is formed by an individual's knowledge & and the information supplied to him/her about the ERB, individual's feeling & emotions toward ERB, individual's identity fulfillment, desires & aspirations, and personal needs (Tribbia, 2007). Information processing and behavioral intent are affected by the mental model of an individual, his/her process of information and behavioral intents (as studied in Theory of Reasoned Action). To achieve ERB, the users must meet the required abilities; including appropriate skills, self-efficacy, and access to financial, technical and informational resources. External support is the fifth component assisting to perform ERB and it could be the user's peer groups and friends, social norms and institutions, and infrastructure. All these components enable the performance of ERB.

In all approaches to ERB, no matter how different the number and the names of the factors are, the main idea is the same; as long as people have the motivation, behavioral skills and abilities, sufficient individualistic characteristics and mental models, and external facilitators, they can perform ERB. Amongst all the determinants of ERB, according to Young (2000), Tribbia (2007) and Oskamp (2007), skills and abilities are the most important factor determining the performance of ERB. In case of lack of skills and abilities, the user cannot perform ERB and this lack also affects the condition of other determinants; motivation and mental model of the individual. However it is not enough to meet all the required determinants to perform ERB. In addition to that, people need to be ensured that performing ERB will come up with benefits to them, not with disadvantage affects (Kaplan, 2000).

3.3.3.4 Fogg Behavior Model

B.J. Fogg introduced his behavior model for persuasion in 2009 at Persuasive Congress'09 and named his model as Fogg Behavior Model (FBM). FBM is actually conceptualized for persuasive design studies. The model provides an easy application of persuasion in design and has a wide-range of application areas, from health to ecology. FBM groups the factors that affect human behavior for persuasion in three groups; motivation, ability and triggers. "For a target behavior to happen, a person must have sufficient motivation, sufficient ability, and an effective trigger" (Fogg, 2009a, p. 1) as shown in Figure 3.8. A sufficient motivation means the motivation a person has is high to perform a new behavior. However, being highly motivated is not enough for a behavior change. The abilities, a person has, have to meet all the requirements of the new behavior as well. The equation between the motivation and the abilities forms the individual activation threshold; the orange curved line (see Figure 3.8). However, high motivation and meeting all the required abilities to perform the new behavior is not enough to change a behavior. Another factor for behavior change is the thing that turns an individual to be willing to perform the target behavior; a well-timed trigger. Triggers below the activation threshold do not work for persuasion and they fail to do so (Fogg, 2009a). The triggers are successful when the activation threshold is crossed over. These three factors for persuasion will be explained in details.

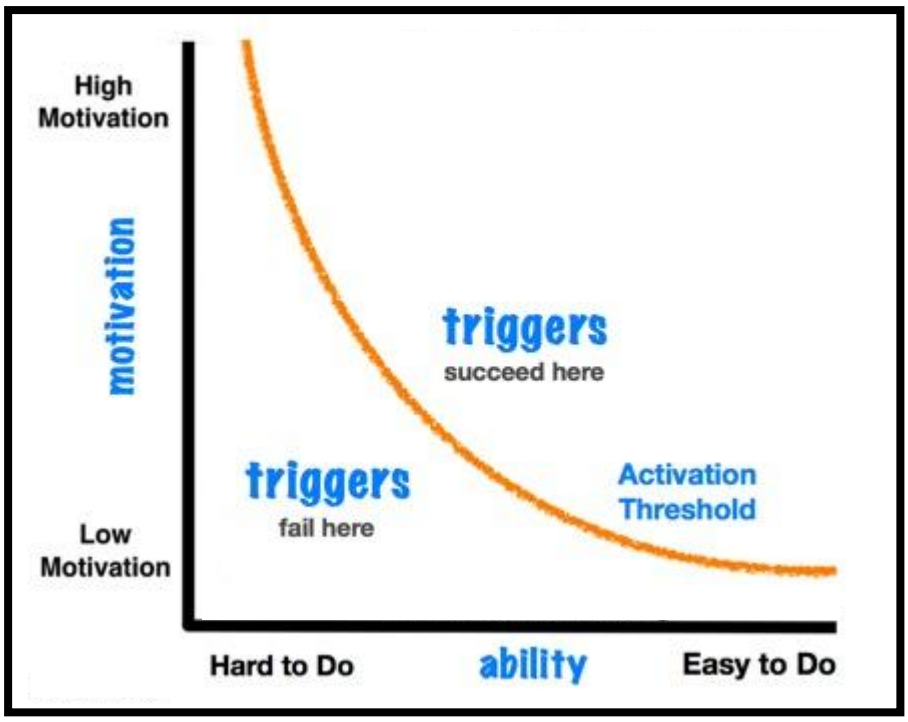


Figure 3-8 The Fogg Behavior Model (Fogg, 2011)

Motivation, as said before, should be high for a behavior change. There are three types of motivation to achieve a behavior change; pleasure/pain, hope/fear and social acceptance/rejection. All these three coupled motivations are like the opposite sides of a coin. Pleasure or pain motivates users to change a behavior immediately because this kind of motivation requires low level of thinking and anticipation (Fogg, 2009a), in other words low involvement occurs when the user feels pleasure or pain. Hope or fear motivates users through anticipation of good things (hope) or bad things (fear) (Fogg, 2009a). Fogg (2009a) prefers to motivate people by offering them hope which is, according to him, the most ethical way for persuasion in FBM. Social acceptance or rejection motivates people through the creation of the willing of being socially accepted. As people avoid being socially rejected, generally accepted rules in society works as a motivator, which is just like the "subjective norms" in the Theory of Reasoned Action. Recalling subjective norms, it is the instinct of a person to perceive how others expect him/her to behave and it works as a motivator on people while persuading them to perform a target behavior.

Abilities, a person has, should be optimized to pass over the activation threshold. "To increase a user's ability, designers of persuasive experiences must make the behavior easier to do" (Fogg, 2009a, p. 5). Therefore, Fogg (2009a) calls this factor as "simplicity". A behavior as simple as possible is most likely to be performed by users. There are six

elements determining the simplicity of a behavior; time, money, physical effort, brain cycles, social deviance and non-routine. Each of these elements is explained in detail in the last part of this chapter (see Chapter 3.3). As a result, the simpler the target behavior, the more able user is to perform it.

Triggers have to match the person when he/she has high motivation and high abilty to perform a behavior, otherwise they will not succeed in the behavior change. For instance, a person who is highly motivated (high motivation) to wake-up at 6 am in the early morning and is also capable to do so (high ability) might not wake up at 6 am because he/she lacks a trigger, a trigger that makes him/her open his/her eyes in the early morning, such as a pre-set alarm clock. Therefore, well-timed triggers must be designed for persuasion. These triggers should be noticeable, should be associated with the target behavior (should not be irrelevant with the target behavior) and should be activated when high motivation meets the high level of ability (Fogg, 2009a). There are three different types of triggers; spark, facilitator and signal. Sparks are working as a motivator while triggering and sparks are capable of waking up any of the elements of motivation (Fogg, 2009a). Facilitators trigger users by convincing them that the target behavior is easy to perform. Signals are neither motivators nor facilitators but indicators (Fogg, 2009a). They trigger the user by indicating that it is time to perform the target behavior.

While examining these three factors affecting the behavior change, it was realized that the FBM has similarities with Solomon's Consumer Behavior Model. In Solomon's (2008) approach to consumer behavior, there are also three determinants to achieve the target behavior; external facilitating conditions, needs and resources. External facilitating conditions are the triggers that influence the user as an outside facilitator, motivator or reminder. According to Solomon (2008), external facilitators are the politics, the economy, the society, the environment and the technology. Needs in Solomon (2008) are the determinants of a motivation in FBM and the available resources are the main factors forming abilities in FBM for behavior change.

FBM does not only describe the determinants of persuasion but also suggests that designers should "do primary research with target users" (Fogg, 2009a, p. 4) and presents designers a way to design persuasive technology as shown in Figure 3.9. The process starts with choosing either an easy target behavior or a receptive audience, and the order does not matter. The target behavior with an appropriately defined audience is the crucial

beginning for the process. After defining the target behavior and the target audience, the researcher has to determine what prevents users from performing the target behavior. It could be the lack of motivation, the difficulty of the behavior or the inappropriate triggers (Fogg, 2009a). Determining this preventer helps researchers to know which element to focus on. On the fourth step, the researcher finds the appropriate way to persuade target users by defining the barriers for the target behavior via a familiar technology channel. Selected channel must address "the answer to the question from Step 3: Why isn't the audience performing the target behavior? Is the problem a lack of motivation, ability, triggering, or some combination? The answer will help to guide channel selection" (Fogg, 2009b, p. 4). In the later steps, as shown in Figure 3.9, the researcher finds examples of persuasive design that are relevant and successfully designed and imitates them, tests the draft immediately and puts the design in an iterative process for improvement. After achieving a successful persuasive design, the researcher should follow step 8 and expand the success.

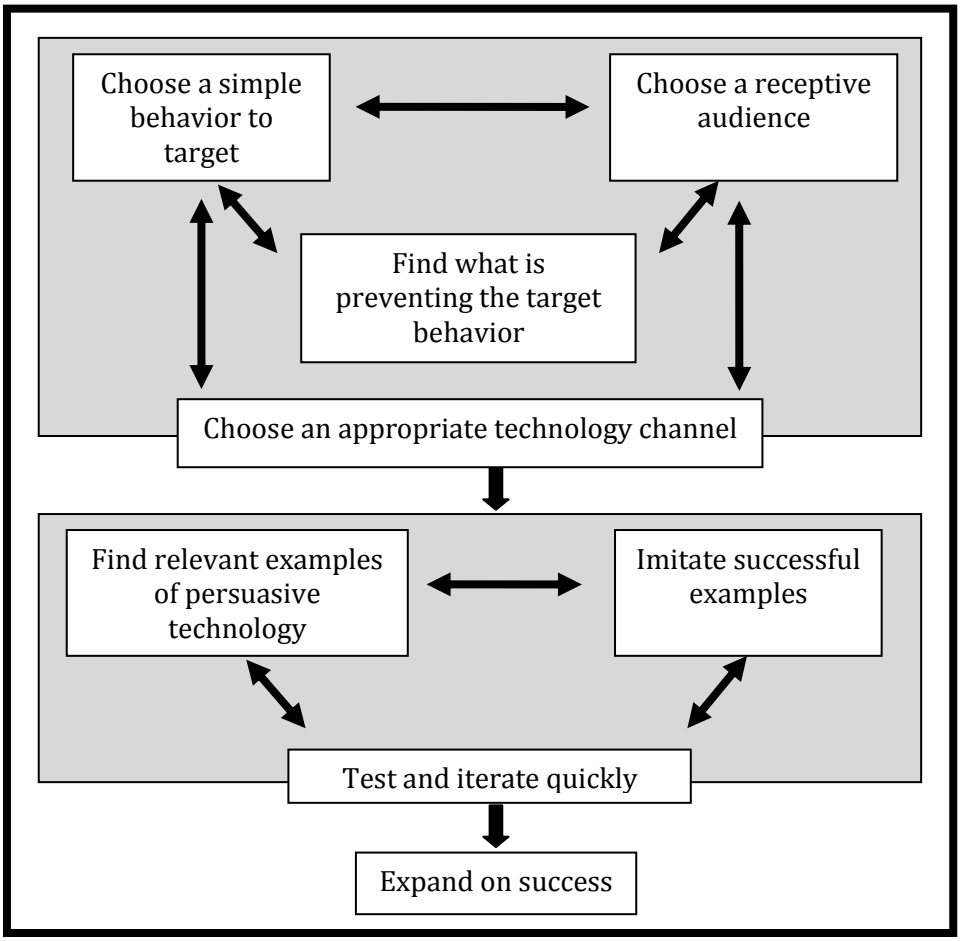


Figure 3-9 The Iterative Process of Persuasive Design (Fogg, 2009b, p. 4)

This eight-step way to persuasion also has similarities with the Human Action Theory. Moreover, FBM is the expanded version of it. To act on a new behavior according to Human Action Theory, there are steps to be prepared; goal-setting, orientation and design of action program (Arnold & Mettau, 2006). When it is adapted to FBM, the main logic in the steps is the same. First phase is the goal-setting, which is the set of the target behavior. Second, phase is the orientation, which is the finding of a familiar and appropriate technology channel for being adapted to the new behavior easily. Final phase is the design of action programs which is the design of the persuasive products to influence users' behavior.

FBM is a useful behavior change model since it provides the information for how to apply persuasion in design products. FBM is not only a behavior change model explaining how to activate a new behavior, but is also helping to figure out what prevents any behavior from performing and to identify problems in current persuasive design in systematic way (Fogg, 2009a).

3.3.4 An Overview and the Scope of this Study in Persuasion Theories

The persuasion studies first started with an emphasis on the importance of the "disturbing factor" with the Consistency Theories. After it came the Social Judgment/Involvement Theory that adds the involvement and the interest of the user to the persuasion topic. Next theories, the Theory of Reasoned Action and Theory of Planned Behavior organized the determinants of the behavior and examined the relationships between behavior, behavioral intent and attitude. Until the Social Cognitive Theory, all the studies focused on personal aspects of behavior change. However, with the Social Cognitive Theory, the influence of the social context started to be taken into account. Transtheoretical Model achieved a great combination of all behavior change studies through stages and processes of change. However, the TTM is a behavior change model for health and medical-care studies. For the purpose of the wellness of environment, Environmentally Responsible Behavior Model was introduced and it focused on the determinants of and approaches to behavior change. Fogg Behavior Model, the recent behavior change model, has summarized all the determinants of behavioral components studied so far and has presented researchers a simple and an effective way to change a behavior.

FBM is constructing the theoretical base for this thesis. However, since the interest of this thesis is behavior change for the wellness of environment, factors influencing ERB are crucial as well. Therefore, they all find a place in FBM which has gathered all the determinants of persuasion in the shortest way. A quick view to the similarities and the sub-groupings of the theories mentioned so far are represented below.

The term “motivation” has developed with the progress in studies. Motivation in Theory of Reasoned Action only referred to a motivation implied by other people. However, now, motivation is addressing to all kind of motivations, including personal aspects and others’ influences.

The term “abilities” has developed with the improvement in studies as well. It used to be called as control beliefs in Ajzen (1991), behavioral competence in Young (2000), behavioral skills in Oskamp (2002), ability & skills in Tribbia (2007) and abilities in Fogg (2009). As this study adopts the FBM approach to behavior change, throughout this study, abilities are preferred.

“External factors” was introduced by Social Cognitive Theory first. Before that, the theories had disregarded the fact that external factors influenced the behavior change. External factors can be institutionalized rules, government incentives, pushers in economy, society itself, environmental conditions, and technological facilitators (Solomon, 2008).

Here now, the adaptation of persuasion theories to persuasive products is the main focal of this study. It is known by the Consistency Theories that when a user faces an inconsistency with a product, he/she is willing to change the product. However, it is not easy to change a product since it influences the behavior and the way people use it. They all have to be changed with the introduction of the new product; that is difficult. Moreover, doing this behavior change for the goodness of environment is the hardest part. Therefore, from the design-side perspective, as mentioned in chapter 1.2, products should give the feeling of success, provide benefits and create advantageous results by co-benefiting while influencing the user’s behavior for the goodness of environment which is the target behavior of the product (Moll & Groot-Marcus, 2002; Arnold & Mettau, 2006). Users do not use an environmental product that causes disadvantages, difficulties in using and a decrease in their well-being level (Kaplan, 2000). As this thesis is adapting the persuasion theories for persuasive products; FBM is the most adaptable behavior change model. It

underlines the user's motivations, abilities, and external factors. To design a persuasive product, it is essential to follow the steps in FBM and prepare a design script for the product accordingly. Finding a literature support in previously examined behavior change theories, environmentally responsible behavior model and consumer behavior theory, FBM forms the scope of this thesis on a theoretical base. Moreover, since the simplicity of the new behavior is determined by the elements of ability in FBM, abilities are chosen to focus on for this thesis.

3.4 The Use of Abilities in Persuasion

3.4.1 Why Abilities

A person's both ability and motivation should be high for the persuasion topic to be persuaded directly like central route to persuasion in the Elaboration Likelihood Model (ELM), which is the most efficient way to persuasion (Benoit & Benoit, 2008). Motivation, abilities and external factors affect behavior. Since external factors are a wide range of topics (including economy, environment, society, politics, technology), they can only be studied in a multi-disciplinary team. Moreover, motivation is also a wide range of concept including personal aspects and the influence of social context, and it is versatile; thus, it is difficult to study motivation. Hence, both motivation and external factors are out of the scope of this study.

As explained in ERB part, according to Young (2000), Oskamp (2007) and Tribbia (2007), required abilities, for an environmental behavior change, play a more important role during persuasion rather than motivation and external factors. Lacking the required abilities to perform a behavior results in not being able to perform it and this lack also affects the condition of other behavioral determinants, such as the motivation. Therefore, ability has been chosen to study for this work of thesis, since it is observable, stable, reliable, and the elements it has are clear. Hence, this thesis focuses on abilities in the FBM approach for behavior change. The elements of ability are described in the following sections.

3.4.2 Time

Changing a behavior brings up the time problems. If the user does not have the time to spend to perform the target behavior, he/she is not able to do it in terms of time; in other words, the target behavior is not simple (Fogg, 2009a). For simplicity, a target behavior should demand less time or even should be timeless.

3.4.3 Money

Financial means is a very important capability of the user to perform a behavior. “A target behavior that costs money is not simple” (Fogg, 2009a, p. 5). The target behavior should not require money for simplicity and for being applicable by everyone. Moreover money has the power to start the environmental behavior change but only for a short term (Young, 2000). On the other hand, for long-lasting, behavior all other elements of ability should be simple and in coherence. However, as firstly introduced by Gary Becker in 1965, money is a substitute for time. There is a proven trade-off between time and money (Becker, 1965; Fogg, 2009a). For instance, instead of hand washing the clothes, which requires personally devoted time, one prefers to buy a washing machine to save time.

3.4.4 Physical Effort

Physical effort requiring behaviors are physically not simple. Users usually tend to perform physically easy behaviors and prefer to perform a physically effortless behavior. Therefore, the target behavior should be as easy as possible to perform and ensure that the target users are physically able to do it.

3.4.5 Mental Effort

According to Fogg (2009), mental effort required to perform a new target behavior should be small, otherwise, the user might find the target behavior difficult to perform and rejects being persuaded. Fogg (2009) calls this state of ability as “brain cycles”. So, to keep persuasive design simple, the user should cycle his/her brain at low level because “thinking deeply or thinking in new ways can be difficult” (Fogg, 2009a, p. 6). In fact, that is what the Elaboration Likelihood Model (ELM) suggests. Both ELM and FBM suggest that the persuader should prepare the persuasive message influencing the target audience directly

and mentally effortlessly. It is important for audience to be able to receive and process the message to be persuaded (Benoit & Benoit, 2008). For instance, distracted audiences cannot focus on the subject (Benoit & Benoit, 2008). As a result, in persuasive design, the required mental effort should be kept as low as possible rather than making the design complex, in order to prevent mental distraction and have the user with the full attention to the topic.

3.4.6 Social Deviance

Fogg describes social deviance as "going against the norm, breaking the rules of society" (2009, p.6). Requiring a socially deviant behavior is not a simple request for most of the people, it needs "having the guts". "Because persons value social relationships and therefore orient their behavior, among other things, along lines of what they think is socially desired" (Fischer, 2008, p. 82). Therefore, it should be kept simple.

However, "some people are tending to create more difference as others notice it" (Tribbia, 2007, p. 245). In behavior change, people with discriminative behaviors, in other words socially deviant people, play an important role in the society. If these people are role models to other people, this might also motivate those others to comply and vice versa. As Tribbia (2007) says;

> *"If an individual aspires to be seen as an environmentally responsible person by his or her peers, superiors, or family, ERB will play an essential part in one's behavioral repertoire. Such an individual would be compelled to buy less and use fewer resources, seek acceptance from like-minded people, and build his or her sense of competence from acting in environmentally responsible ways" (p. 243)*

Within this sense, "motivation to comply", the element of subjective norms, in Theory of Reasoned Action is referring to the exact same concept.

3.4.7 Non-Routine

Products mean so much in everyday routine life and so in persuasive design. "Routines are patterns of unconscious actions guided by material infrastructures acting like beacons and signs. Specific material features of the artifacts involved (e.g. those of cup, saucer and

spoon in coffee drinking) support and guide the actions of the user" (Jelsma, 2006a, p. 222). Therefore, a behavior changing new product might influence the routine life and thus, might result in refusing its use. Fogg defines routine in terms of simplicity as "people tend to find behavior simple if they are routine, activities they do over and over again" (2009, p.6). If the behavior is in contrast with the audiences' routine or is disturbing that routine, they would find the target behavior difficult to perform.

3.4.8 Conclusion

For behavior change, all these elements of ability demanded by the user should be as simple as possible. Moreover, they do not always have to be on the lowest level because trade-offs between abilities occur. For instance, a behavior may require a lot of money to be performed but needs just a little time to spend. A user can make a trade off here by choosing spending a lot of money over spending less time. However, so far there have been only certain proven trade-offs between abilities. By using the simplicity components and trade-offs between abilities, a script for household appliances to persuade users to change their behavior environmentally can be prepared. Therefore, the aim of this thesis is to analyze the most strategic way to organize this simplicity for persuasive products.

CHAPTER 4

ENERGY USAGE AT HOME

4.1 Introduction

Environmentally behavior change is the main domain of this thesis and it is narrowed down to explore the behavior change for energy saving in households. In accordance with this domain, an empirical study was conducted to investigate household users' behavior on energy saving and their preferences of reallocation of resources.

In this chapter, firstly the current energy usage behavior of household users will be introduced, and secondly the abilities of household users as a part of behavior change for energy saving will be introduced, both supported by the literature and interviews (for the interview questions, see Appendix B). In the third and fourth part of the study, the focus will be on ability changes. The results of change in abilities and their affects on electrical household appliances and on other abilities will be introduced. In the third part, which products are preferred when a change in one ability takes place will be explained, and in the fourth part, how a change in ability can be accepted by reallocation of abilities in order to persuade users for energy saving will be examined.

4.2 Energy Usage at Home

Household users are one of the major groups consuming energy and this consumption is even expected to increase more in near future (Elias et al., 2008). Household users consume energy at home through either direct or indirect ways. Direct energy consumption

involves “the energy used by households in the form of energy carriers like natural gas, electricity and petrol” (Moll & Groot-Marcus, 2002, p. 86). On the other hand, the indirect energy consumption occurs during the “production and distribution of goods and services that can be attributed to households” (Moll & Groot-Marcus, 2002, p. 86). For this study, direct energy requirement at home is the focusing point instead of indirect energy requirement.

In the households’ energy use literature, there exists two ways to diminish the direct energy consumption; efficiency behavior (technological line) and curtailment behavior (behavioral line) (Pierce et al., 2010; Moll & Groot-Marcus, 2002). Efficiency behavior, the technological line, addresses energy saving through buying energy-saving products and services or upgrading of products and services (Pierce et al., 2010). Curtailment behavior, the behavioral line, on the other hand, involves personal methods to reduce energy consumption, which is changing a behavior to decrease energy use (Pierce et al., 2010). Although households have potential to save energy up to 10% only by changing their energy usage behavior at home (Chetty et al., 2008, p. 243), they do not.

The pro-environmental literature counts six ways to motivate household users for energy saving at home; receiving information (observable, reliable and attractive), setting a goal (directing a specific target behavior), emphasizing comparisons (comparing between one and the society or one’s now and past behavior), making commitment (pursuit of commitment for the target behavior), enabling incentives/disincentives (facilitate/complicate the target behavior) and rewards/penalties (make target behavior attractive/unattractive), and providing feedback (users’ contributions to and their profits from energy saving) (Froehlich et al., 2010). The literature shows methods and motivations for energy saving at home. However, this study will investigate household users’ methods, motivations and much more to save energy in the first part of the study.

For this thesis, the behavioral line is used to guide improvements in household appliances. Therefore, in the beginning of the study, the general manner of household users’ direct energy usage at home will be investigated in order to figure out a framework for the energy usage and saving potentials of the household user group at home.

4.2.1 Study - Part 1: Household Users' Current Energy Saving Behavior

The aim of the first part of the study is to understand the household users' perspective, actions and behavior in energy-saving at home. In this part, two main questions addressed to find out the facts and the reasons about household users' current energy saving behavior at home were:

- What is the main approach of household users to energy-saving at home?
- What affects household users for energy-saving at home?

4.2.1.1 Methodology

Interviews were conducted with the participants and the questions were asked to interviewees right after the explanation of the study and getting a short demographic information. The questions asked in the first part of the study were aimed at understanding household users' energy saving behavior at home through open-ended questions, and thus, a keyword pool was formed with the collected information. The questions asked in the first part of the interview were:

- What are you doing at home for energy saving?
- What is your aim in energy saving at home?
- What motivates you to save energy at home?
- What prevents you from saving energy at home?

With the first part of this study, participants got a general idea about the topic of the interview, and get familiarized both with it and the interviewer by telling her about their energy saving methods at home. The interview was audio taped. Tapes transcribed carefully, later categorized to derive the headlines of the current energy saving behavior at home. MS Excel was used for calculations and graphics.

4.2.1.2 Sampling

The study was conducted with 30 participants; 27 females and 3 males. The crucial determinant of each participant was to be the one who is in charge of the household work done at home. The age of the sampling ranged from 22 years old to 77 years old in order to

ensure a homogenous age distribution among participants. The mean age of the participants was 42.53. 22 participants were full-time workers, 4 participants were students, 3 participants were retired and 1 participant among 30 was a full-time housewife.

4.2.1.3 Results and Analysis

Regarding the answers of the participants for the first part of the study, categories were formed to determine their ways of energy saving, aim in energy saving, motivations and demotivations to save energy at home.

Methods to Save Energy

Participants were first asked to tell their ways to save energy at home. Three strategies derived over this question were using energy efficient products, changing behavior to decrease energy waste and healing environmental conditions. Each keyword was derived according to the participants' answers and these answers were grouped under these three main ways to save energy (see Figure 4.1).

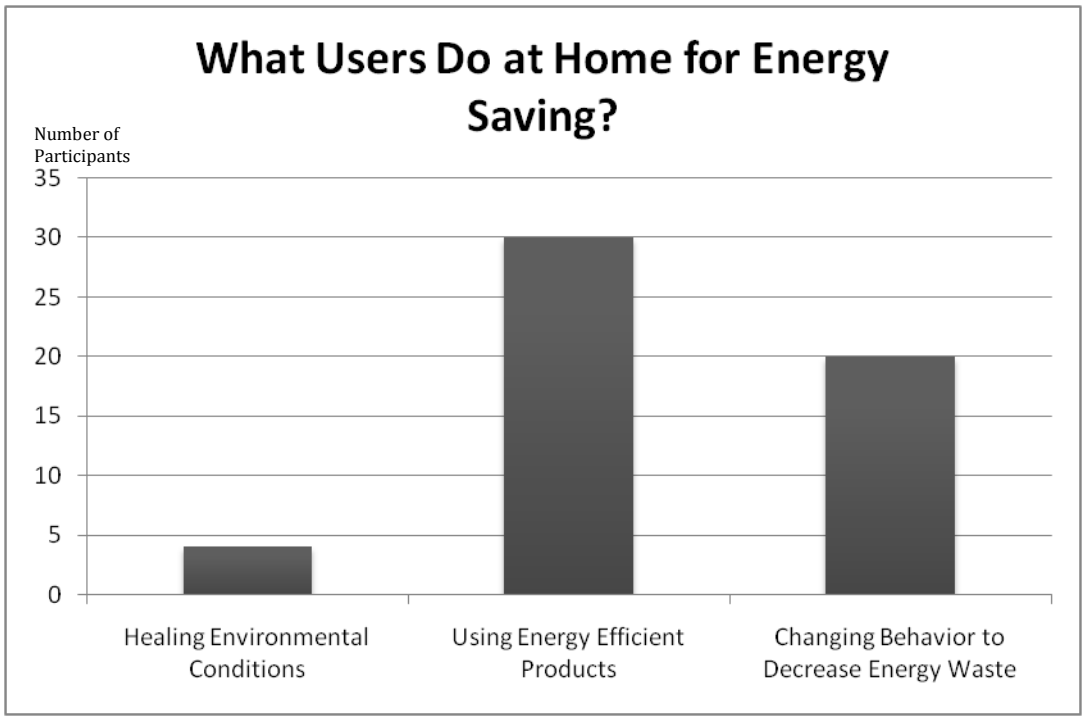


Figure 4-1 Methods for Energy Saving

Four participants' way to save energy is healing environmental conditions. This includes changing the infrastructure of the house such as isolating the house to save energy from heating, to fix the broken appliances immediately to prevent energy waste and changing the complementary products of the energy consuming machines to reduce the damage of it to the environment (i.e. ecological detergents).

All of the thirty participants try to use energy efficient products as much as they can. This includes using an A class product for less energy consuming and economical light bulbs.

Twenty participants try to change their behavior to decrease the energy waste at home. Their methods while doing so are to shut down the electrical appliances and turn off the lights if they are not used at that moment, to shorten the running period of a product, to change the programs of the appliances into energy saving programs, to prevent the wasted water, not to use an appliance before it is fully loaded, separating recyclable wastes from the others, to decrease the natural gas usage, to cook several foods together or respectively when the oven is heated to prevent energy waste.

Aims at Energy Saving

The second question in the first part of the study was asked to learn the aim of household users at saving energy. The participants' aims at saving energy were grouped under three

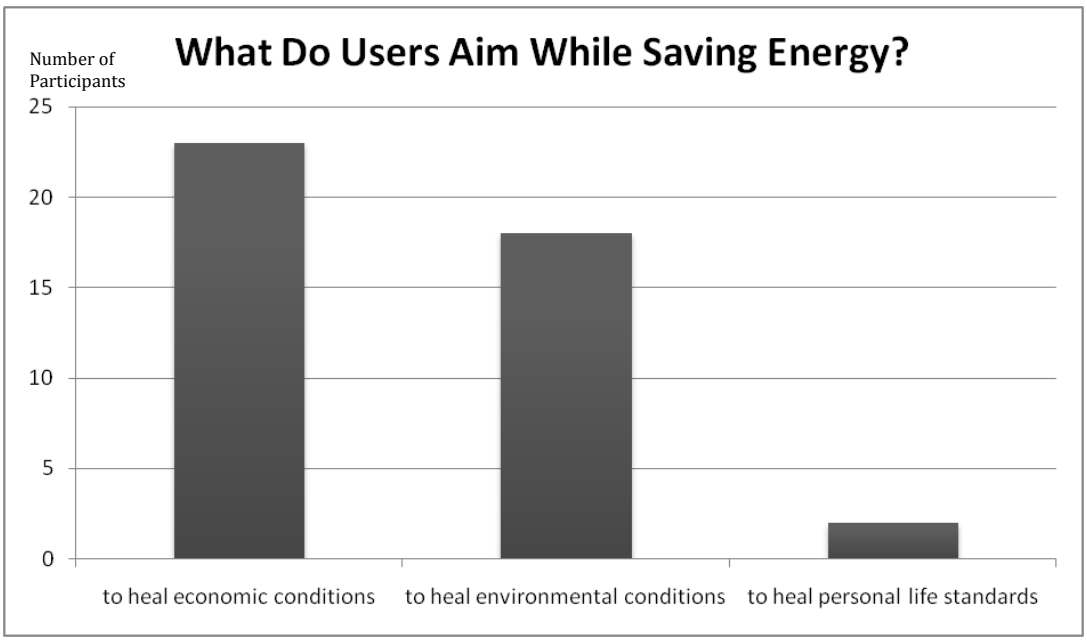


Figure 4-2 Aim at Energy Saving

headlines as healing economic conditions, healing environmental conditions and healing life standards as shown in Figure 4.2.

Twenty-three participants' aim at saving energy at home is for economical reasons including to save money for household budget, to save money to increase the national wealth, to protect energy resources for the national wealth, to decrease consumption and hence, the wasted money and to enable products with a long duration.

Eighteen participants' aim at energy saving is to heal environmental conditions. Their aims are to save energy resources with future concerns; i.e. next generation, and with the current environmental problems; i.e. global warming, and to simply give less harm to environment and protect it.

Two participants have an aim at healing the personal life standards by saving energy. They were aiming to save energy for a healthier living by decreasing the harmful energy radiations.

Motivations for Energy Saving

In the third question participants were asked to tell what could possibly motivate them to save energy. As shown in Figure 4.3, participants' motivations to save energy were grouped under four categories. The four categories that motivated participants to save energy are being informed, having economic advantages, being ensured with product effectiveness and having an added value in the product.

Fifteen participants have said that they are motivated by being informed. They are motivated by receiving information about the results of their contribution while saving energy, by increased awareness among people around them, by being informed on what to do to save energy through media channels, by being aware of the current environmental problems, and by a reminder to tell them to repeat an energy saving action.

Thirteen participants are motivated by having economic advantages while saving energy. Participants' answers included saving money with energy saving and increase in energy prices.

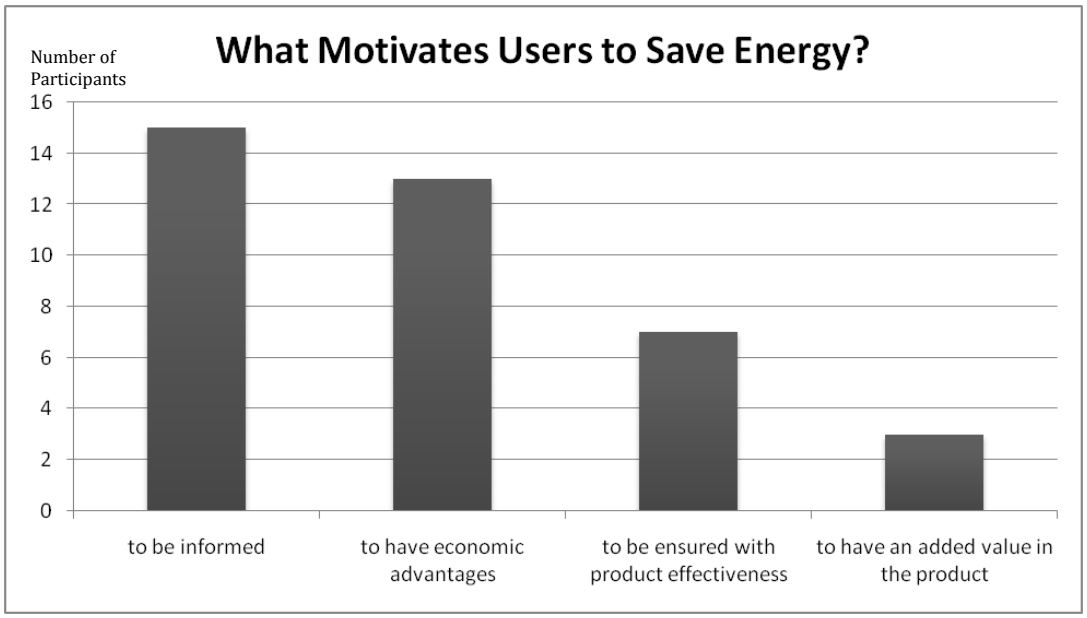


Figure 4-3 Motivations for Energy Saving

Seven participants are motivated to save energy when the product effectiveness is ensured. They expect an energy-saving product to provide the same or even higher level of efficiency and they want to be convinced that the product still can provide the same results.

Three participants have said that they are motivated when the product not only has an energy saving feature but also another added value such as, being simple to use, aesthetically appealing and less time demanding.

Demotivating Reasons for Energy Saving

The fourth question asked to participants was to tell what prevents them from saving energy. The answers to that question are grouped under four categories. These four categories are change in well-being standard and comfort, deviation from a group, economic concerns and change in product effectiveness, as shown in Figure 4.4.

Eleven participants have said that change in their well-being standards and comfort prevents them from saving energy at home because they think that saving energy would disturb their comfort and style of living, decrease hygiene, affect health negatively, hinder the other housework, negatively affect the house context when having special conditions

such as welcoming guests at home, prevent being align with other household members, and psychologically require to be in the mood for it.

Nine participants have said that economical reasons prevent them from saving energy. According to these participants' replies, high prices of the energy saving products, not having an alternative energy resource, long run of products, low energy prices, insufficient governmental incentives and high electricity prices which pushes one participant to consume more natural gas instead prevent them from saving energy.

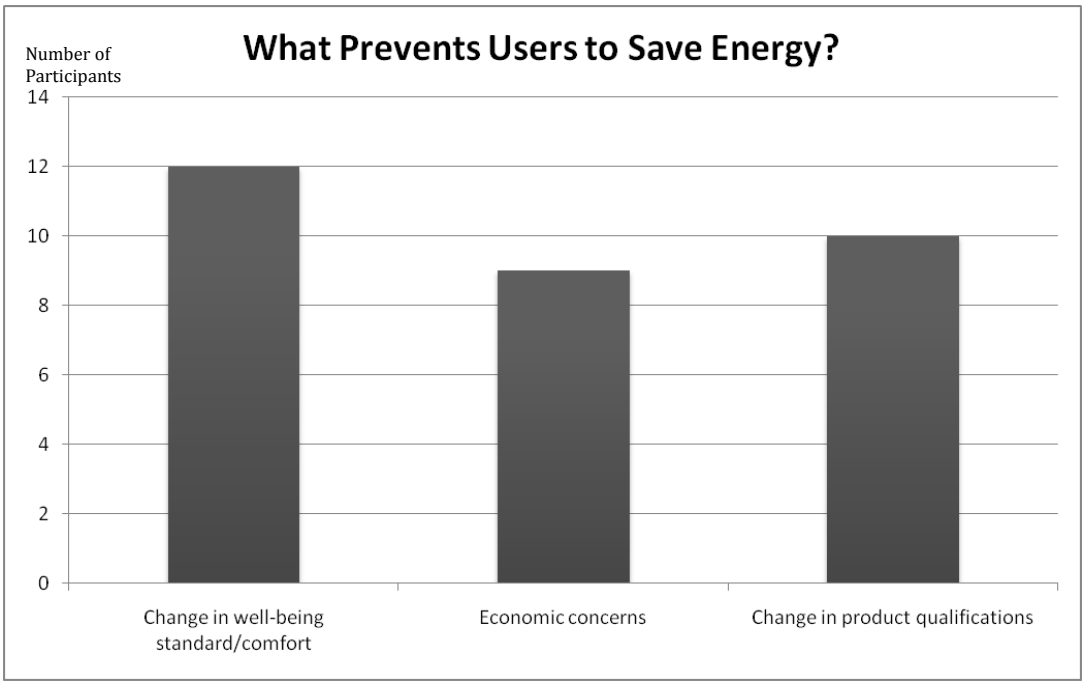


Figure 4-4 Demotivations for Energy Saving

Ten participants have said that change in product quality is a reason for giving up energy saving. Aesthetically not appealing energy saving products, decrease in the product efficiency, not being informed by and having an idea about the product's energy saving features, and difficulty in use and adjustments of the settings for energy saving are the factors that prevent users from energy saving.

4.2.1.4 Discussion

The profile of the user group from an energy saving perspective was introduced with the first part of the study for this thesis. Their ways to save energy, aim at saving energy, motivations and demotivations while saving energy at home were introduced. We can summarize the general profile of the household users as in the following.

The most common methods of household participants to save energy, derived from the first question, are using energy efficient products and trying to change their behavior to decrease energy waste. As explained before, these two most preferred methods are categorized as efficiency and curtailment behaviors by Abrahamse et al. (2005). Efficiency behavior includes using energy light bulbs and A class of product (products with highest energy efficiency). In curtailment behavior, participants have different methods to reduce energy use through behavior change. These methods are named as cutting, trimming and shifting by Pierce et al. (2010). When household users shut down the electrical appliances, turn off the lights and shorten the use period of a product, they literally cut the energy usage at home. Trimming method to save energy involves changing the programs of the appliances to save energy and decreasing the natural gas usage. Shifting method includes the use of an appliance when it is fully-loaded and trying to cook several foods together once the oven is heated.

According to second question, household users mostly aim at bettering-off the economic conditions and environmental conditions while energy saving. These two aims are the opposite sides of a person according to environmentally responsible behavior. According to Kaplan (2000), environmentally responsible behavior is mediating the Altruistic-Centered person and the Reasonable person, as mentioned in Chapter 2.3.3. A person who wants to heal the economic conditions regarding self's budget, national wealth and the long duration of products can be counted as a reasonable person (economic man). Energy saving, aiming at an increase in the life standards can be seen as a reasonable person's behavior as well. On the other hand, a person who wants to heal the environmental conditions regarding next generations and world's environmental protection can be counted as an altruistic person. Therefore, it can be concluded that household participants perform both altruistic and reasonable person model while aiming at energy saving at home.

In the third question, it is observed that household users are mostly motivated by being informed and having economic advantages. The common part of these two motivations is that both of them are involved an information receiving system. Information receiving system can be divided into two as providing information and consequence interventions according to Abrahamse et al. (2005). Providing information is addressing to motivate users through increasing awareness and receiving information on what to do to save energy (Abrahamse et al., 2005). According to Abrahamse et al. (2005), consequence interventions, on the other hand, involve feedbacks and rewards. Feedbacks are said to be the information receiving about the results of the users' contribution while saving energy and rewards are said to be the information receiving about the economic profits users made through energy saving.

As explained in the fourth question, what affects household users most in order not to perform an energy saving behavior are change in well-being standard and comfort, change in product quality and economical concerns. Change in well-being standard and comfort is a crucial factor determining the household users' behavior as it was issued previously in Chapter 2. Therefore any actions taken to save energy should not disturb household users' balance of standard of living. Change in product quality should never be downward which will prevent household users from saving energy. Economical concerns, on the other hand, are out of control of the participants, so the economical and governmental factors must be regulated and implemented accordingly.

Although household users individually try to save energy, they do not fully perform what they are capable of, because it depends not only to the household users' willing to save energy but also to the product itself and outside factors (including economical concerns, governmental incentives and society). Therefore, household appliances have an important role in household users' performance of energy saving behavior. As long as the product informs users about the methods, programs and outcomes of energy saving, and provides the same or even more efficiency with better performance quality, the user prefers to use this energy efficient household appliance. These criteria while designing energy saving household appliances should be taken into consideration.

4.3 Households Users as a Part of Behavior Change for Energy Saving

The profile of the household users while saving energy was introduced in the previous part. However, there are difficulties determined about the household user group for energy saving behavior in the literature. There are three reasons why household users are a difficult group for environmental behavior change.

First of all, household users are difficult to change their behavior for environmental protection because they "are not inclined to accept individual sacrifices for the common good of a climate-neutral society" (Moll & Groot-Marcus, 2002, p. 83). Oskamp (2002) and Young (2000) define this characteristic of people as 'self-interested'. They are difficult to quit their self-interested behavior and become environment-interested. Their cognitions about environmental behavior depend on the society's behavior because they perceive "environment" as a common good and thus, they do not take individual actions. This affects one another, and as a result, the society does not take any action to protect the environment.

Secondly, household users are a difficult group to be persuaded to change their behavior for the environmental sustainability because the group consists of different types of people; including different cultures, religion, nations, educational backgrounds and socio-economic indicators. Moll and Groot-Marcus (2002) calls this factor as 'pluriformity'.

Lastly, it is difficult to change household users' behavior for environmental reasons because their consumption habits have not been designed to do so. According to Moll and Groot-Marcus (2002), both the economy and the society force household users to demand for more energy.

For the above mentioned reasons, household users are not warm enough to change their behavior for the protection of environment. It seems difficult for them to change their habits and their behaviors because as it is explained in Chapter 2 and 3, household users form their habits and behaviors according to the abilities (as in FBM from Chapter 3) they have or in other words according to the household resources (as in Consumer-Technology Interaction Model from Chapter 2) they have. Since they do not want to change their current standard of living and cannot change the abilities they have, they are difficult to

perform energy saving behavior. Therefore, it is crucial to determine and know the level of household users' abilities.

4.3.1 Study - Part 2: Household Users' Current Abilities

The second part of the case study is influenced by two facts; one is that the electricity is one of the major energy means consumed in the world by 17.2%, and the other is that 30% of this total electricity consumption is demanded by household users (International Energy Agency, 2010). Although, household users can reduce this percentage of use, they do not because of the reasons explained in the previous part. However, as explained in Chapter 3, to change a behavior, simply, a problem is to be created. As the problem for this study is reducing energy usage at home, household users should be persuaded in this way. The crucial part of persuasion is to know the current abilities of the target user group, and afterwards, to take action accordingly. Since this thesis is related to direct energy requirement through household appliances, in this part of the case study, the current abilities of household users while using electrical household appliances for doing the housework will be investigated. The abilities are determined according to Fogg Behavior Model's elements of abilities; time, money, physical effort, brain cycles, social deviance and non-routine. The main question in the study was:

- What is the level of abilities used while using household appliances?

4.3.1.1 Methodology

In the second part of the study, the interviews continued. Likert Scale was used in order to determine the level of household users' abilities. Participants marked their levels on interview sheet and, at the same time, audio-taping was still on record to understand the reasons behind the determinations. The transcription was done after the interviews. Transcribed and analyzed data were used to create graphs to see the general pattern of household users while spending the abilities they have during the housework. Interviewees gave answers according to their own perception of high or low, which means that one's own perception of low level might mean someone else's high level, so the relative answers derived. In this part, participants understood the progress of the whole case study because the questions included only the elements of abilities they have during the housework. The

focus of the abilities they spend was on the electrical household appliances for doing the housework addressing the washing machine, the dishwasher, the refrigerator, the iron, the vacuum cleaner, the electrical oven, the dryer and the small kitchen appliances. The questions asked in the second part of the case study are:

- In your opinion, how much **time** do you spend for the daily housework considering the electrical household appliances you are using?
- In your opinion, during the housework, do you take **money** and thus, the amount you spent for the energy-consumption into consideration and behave responsibly while using the electrical household appliances?
- In your opinion, during housework, how much **physical effort** do you perform considering the electrical household appliances you are using?
- In your opinion, how much **mental effort** do you perform to understand the use of and find out the right program to use the appliance while doing the housework?
- In your opinion, how much do you **deviate** from the society while using electrical appliances during housework?
- In your opinion, how much do you break off your daily **routine** of housework and try out different things while using electrical household appliances?

4.3.1.2 Results and Analysis

Time

As it can be seen on the Figure 4.5, household users spend moderate time while using electrical household appliances for doing the housework. Participants spending medium level of time to do the housework told so, because they do not use the electrical household appliances to do the housework everyday but several days changing from three to four days in a week.

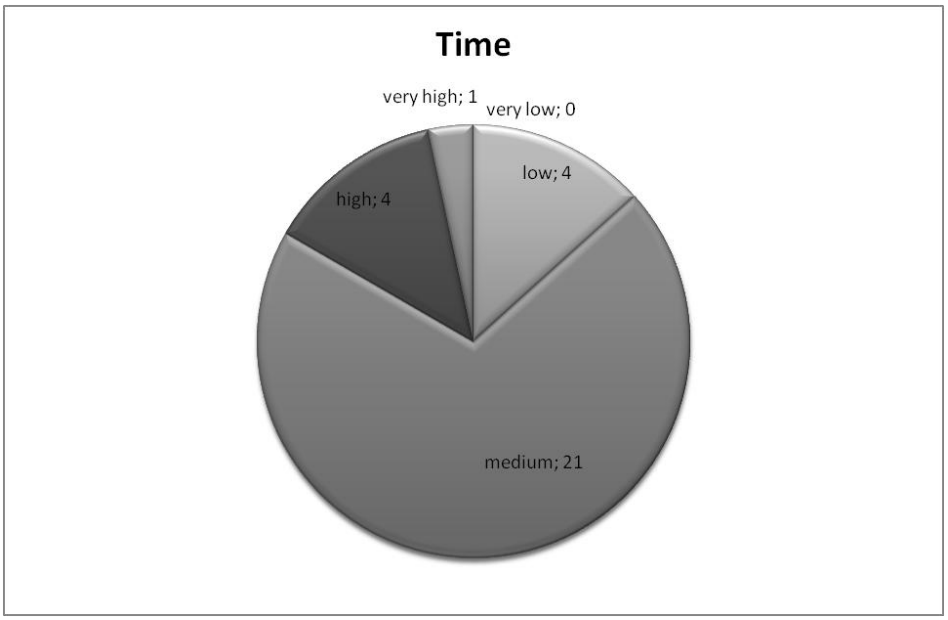


Figure 4-5 Time

Money Concerns

Participants are behaving economical while using household electrical appliances for the housework. Most of the participants concern their expenses on electrical household appliance.

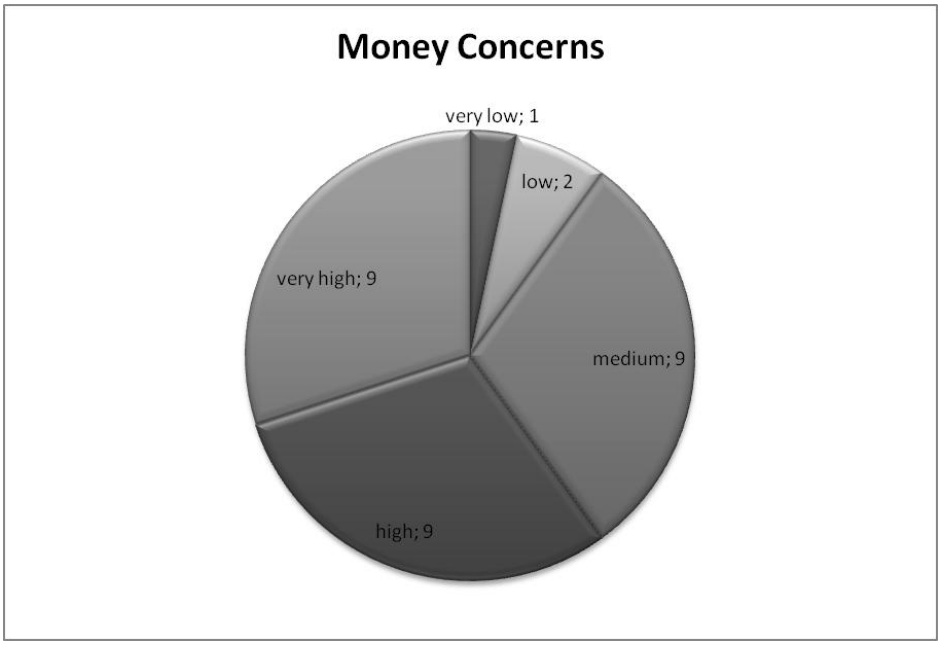


Figure 4-6 Money Concerns

There are several important points that participants said concerning money while using electrical household appliances for the housework. For instance; one of them tries to pick up the stuffs he needs in the refrigerator at one time to prevent energy loss because he is aware of that opening and closing refrigerator consumes lots of electricity, and thus, money in order to save the heat at the same level. Another participant tries to cook two or three meals in the oven at one time when it is on because she is aware of that turning on and turning off the oven consumes lots of electricity to bring up the heat, and thus, money. Two of the participants do not run either the dishwasher or the washing machine when it is not fully loaded. Another two of them run the household electrical appliances after 10pm since it is half the price. All these examples are considered to be as the participants' efficient management of time in housework. The three and only old-age participants told that they were economical people. So this behavior is also related with their characteristics.

Physical Effort

Physical effort spent while using electrical household appliances for doing the housework is shown on Figure 4.7. Participants think that they spend medium level of physical effort using the electrical household appliances. There is a few worth to mention points that the participants said on their physical effort usage during the housework.

Six participants who mark this question as either 'low' or 'medium' do not do the hard work of the housework by themselves. They have a cleaning lady helping them with the housework since they are employed and do not have time to do the hard housework such as ironing and vacuum cleaning.

Three participants said that they physically spend lots of effort on housework because one of them considers herself as a physically weak person, another one said that she is old-age person and the third one has health problems (backache).

Three participants complain while using the iron and vacuum cleaner since they think that these appliances require the most physical effort.

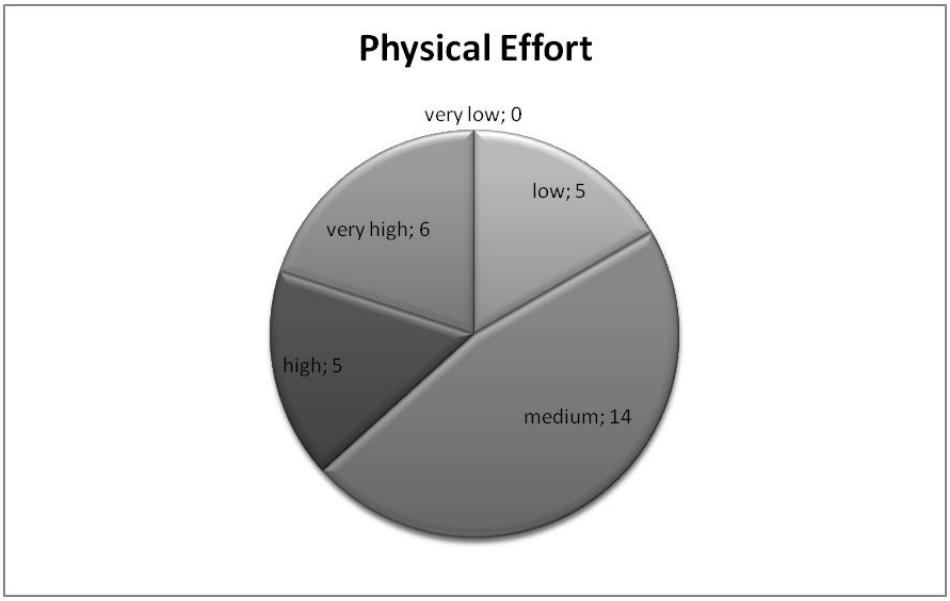


Figure 4-7 Physical Effort

One of the participants said that she does not spend lots of physical effort now compared it to the old days of household technology.

Mental Effort

Participants are showing a heterogeneous distribution while spending mental effort using the electrical household appliances, as shown in Figure 4.8.

Sixteen participants said that they spend mental effort to understand the usage and the adjustments of a new product. After they get used to the product, the product becomes mentally effortless for them.

Six participants said they cycle their brain when reading the prescription about the product usage.

Five participants said that they spend mental effort most while programming the washing machine because they have to readjust the settings depending on the texture and color of the clothes.

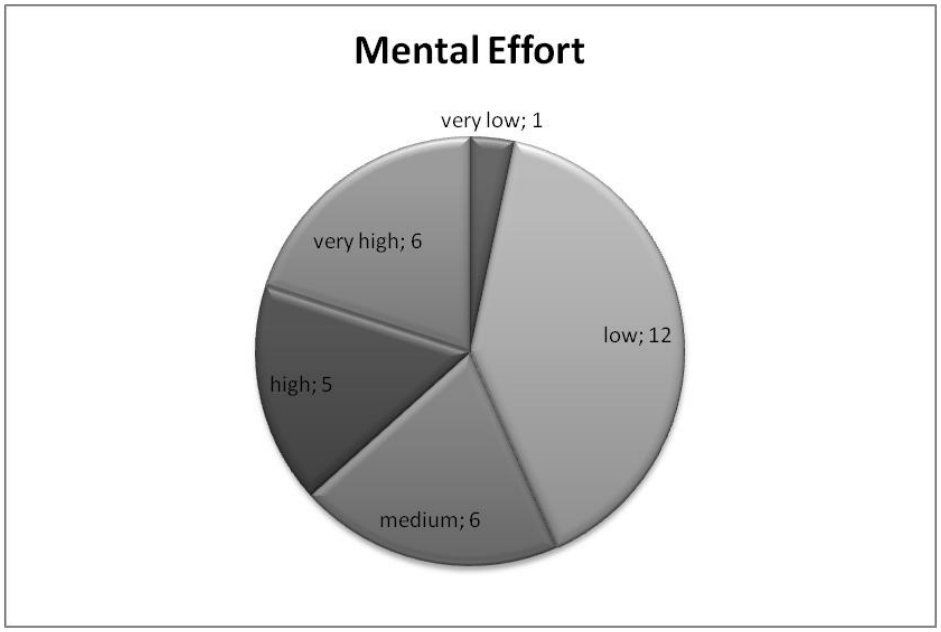


Figure 4-8 Mental Effort

Social Deviation

Participants are tending to deviate socially medium or less while using electrical household appliances for the housework. There are several worth to mention points about participants' explanations on that:

Five participants said that they care so much on the product and are very accurate while using it. They think they are socially different about this aspect of using electrical household appliances from other people.

Five participants said that they show differences on program adjustments from other people; for instance, they wash clothes at a low temperature to reduce the harmful effects of the washing machine.

Four participants think that they are different from other people since they are aware of environmental problems, and thus, use electrical household appliances regarding this fact.

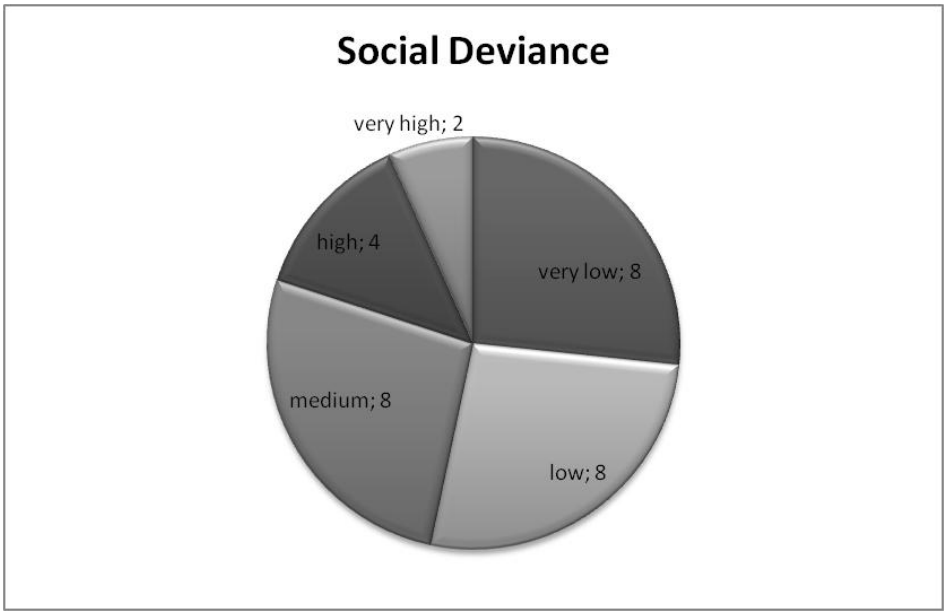


Figure 4-9 Social Deviance

Three participants follow their own plan of using household appliances rather than follow the way the others do it. One of the participant explains this situation as not following her mother's way of doing the housework but instead creating her own personal way of doing it because she thinks that her way of doing the housework is the most efficient way, not her mother's.

Non-Routine

The participants are cumulated on low levels while breaking of the routines of housework, as shown as in Figure 4.10.

Four participants think that being different in routines is a characteristic aspect, and they have got it. They change their routines while using electrical household appliances because they love to try new things.

Three participants said that they do not habitualize the housework with respect to time only, which means that they do not have a specific day or time to use the electrical household appliances but they have a habitualized way of using them.

Three participants said that they break their routines only when they have to readjust the programs of the appliances, otherwise they do not.

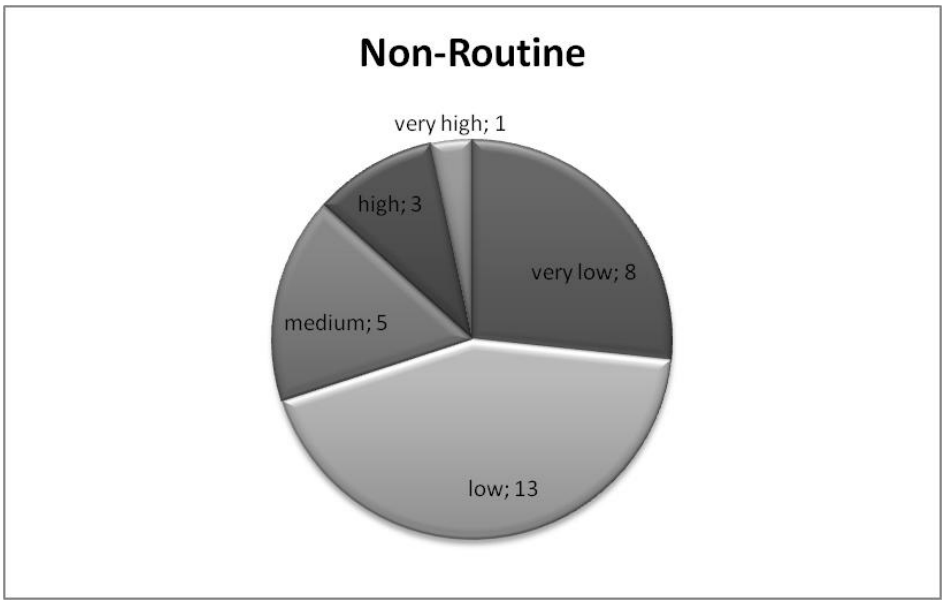


Figure 4-10 Non-Routine

However, most of the participants do not change their routines in housework and usage of the electrical household appliances because they think that they have a habitual way of doing it.

4.3.1.3 Discussion

Here the abilities of the household users will be summarized and discussed respectively according to the previous results of the interviews.

Although time is a definite concept and everyone has the same hours in a day; the use of time differs among people. Household users think that they spend a moderate level of time in their daily life of doing the housework. As mentioned in FBM, new designs to change behaviors should be adaptable with users' time limitations, in other words; the new product's time demand should be compatible with the user.

Money is concluded to be one of the most concerned ability that the household users have. They pay attention to their electricity bill, and thus, try to consume less electricity while

using the household electrical appliances. None of the users would apply for a new electrical appliance that would consume more money during its use. For example, this kind of a design might reduce the use of electricity for energy saving, but hence, consumes more money on use such as requiring a specific and expensive detergent. Considering household users behavior on money consumption during the use of electrical household appliances, one can say that household participants do the time management efficiently for saving money, for instance; cooking several foods once the oven is heated up.

Household users spend a moderate level of physical effort on housework. Nevertheless, they complain about their performance of physical effort demanded by the housework and thus, about the electrical household appliances' physical effort requirements. Therefore, a new design of an electrical household appliance should not demand more physical effort than the current ones.

Mental effort or the brain cycling (in FBM) demanded by the electrical household appliances is of medium level. It can be concluded that household users do not have difficulties in understanding the use of electrical household appliances once they have learned how to use it. However, the period of learning to use appliances requires mental effort. Some of the users still have difficulties to find the right program settings of the washing machine. A newly introduced electrical household appliance for energy saving behavior should require less brain cycling, especially in the period of learning the use.

Being socially deviant is the second less scored ability the household users have. This may show that household users follow what the society imposes but nothing different. As explained by Young's (2000) 'participation' factor in environmentally responsible behavior, a group movement motivates people to behave environmentally responsibly. Therefore, it is important for all individuals in the society to perform energy saving behavior in order to influence other people.

Breaking the routines is the least shown ability among the household user group. They tend to continue housework without changing their routines and habits. Therefore, a new design of an electrical household appliance for energy saving should not offer an unconventional way to do the housework. According to Jelsma (2006a), habits and routines are reflecting the household users' behavior most. Therefore, to change a behavior household users' routines must be known and must guide the new design in this way.

4.4 Study – Part 3: Change in Abilities

In this part, the aim is to understand which abilities required by the products are willing to be changed by household users and for what reasons. While designing an energy-saving electrical household appliance, knowing which abilities household users complain about a specific type of product is a useful datum which should be taken into consideration during design. According to Muellbauer (1987), eliminating difficulties to persuade users requires an investigation on how they would feel better when changing current conditions, which is the basic domain of this part of the case study. It is assumed that changing current abilities addresses changing current conditions and feeling better by these changes refers to be wiling a change in a specific electrical household appliance. The main question of this part is:

- Which type of products are preferred when one of the abilities changes?

4.4.1 Methodology

This part of the interview was continued to be recorded on tape and at the same time, the researcher wrote down participants' answers on the interview sheet. Open-ended questions were asked to participants aiming at obtaining qualitative data. However, quantitative data were also derived at the end of the interview. The questions asked in this part are:

- Assume we can change the time requirement of an electrical household appliance to do the housework, which product would you prefer to change the most? What kind of a change would you look for? Why?

- Assume we can change the electricity spendings while using an electrical household appliance to do the housework, which product would you prefer to change the most? Why?

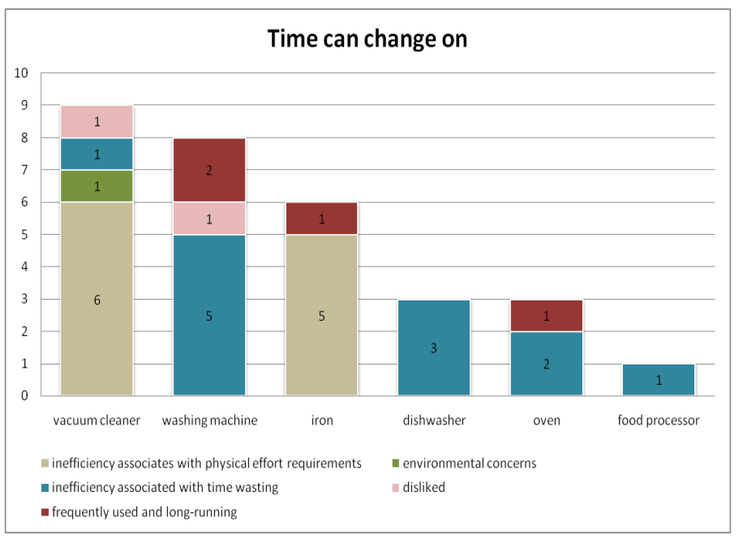
- Assume we can change the physical effort requirement of an electrical household appliance to do the housework, which product would you prefer to change the most? Why?

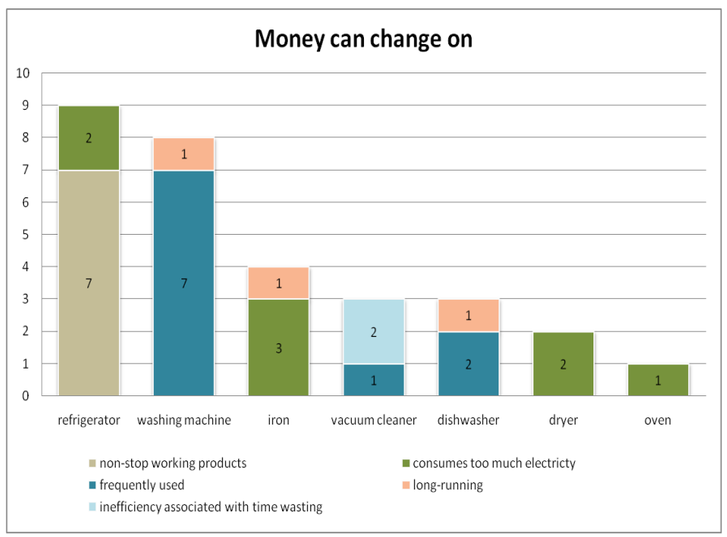
- Assume we can change the mental effort requirement of an electrical household appliance to do the housework, which product would you prefer to change the most? Why?
- Assume you are asked to use an electrical household appliance different from the people around you, which product would you accept to change the most? Why?
- Assume all the routine and habits of using electrical household appliances to do the housework change, which product would you accept to change? Why?

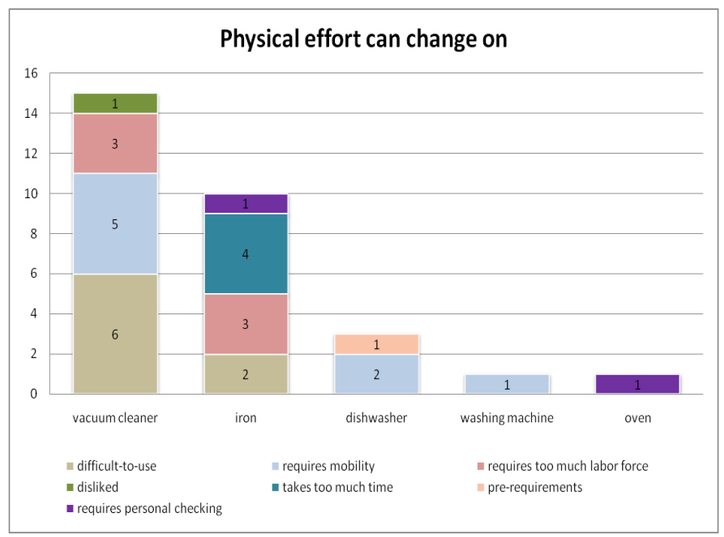
During analysis, qualitative data was used to group electrical household appliances with respect to their common features. Qualitative data was entered to Microsoft Excel in order to draw bar charts for each ability change and the product preferences. As a deep note, since the third part of the study was a continuation of the second part, the sampling of the participants was the same as the previous part.

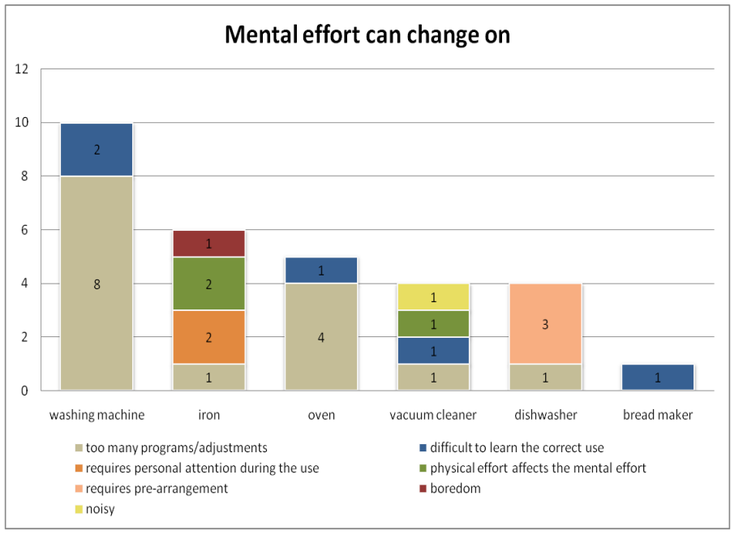
4.4.2 Results, Analysis and Discussion

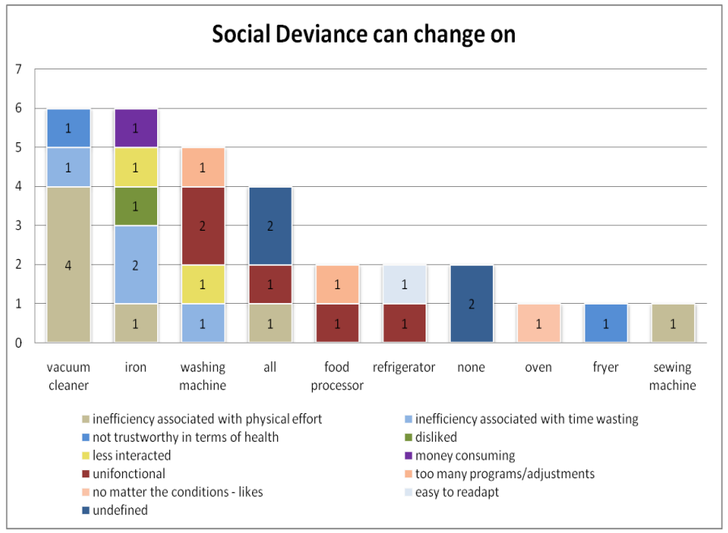
The results and analysis of the findings, here, are introduced according to the elements of abilities in FBM. Which products household users would prefer a change in is explained with their problematic features and the relative reasons for that in the graphs below.











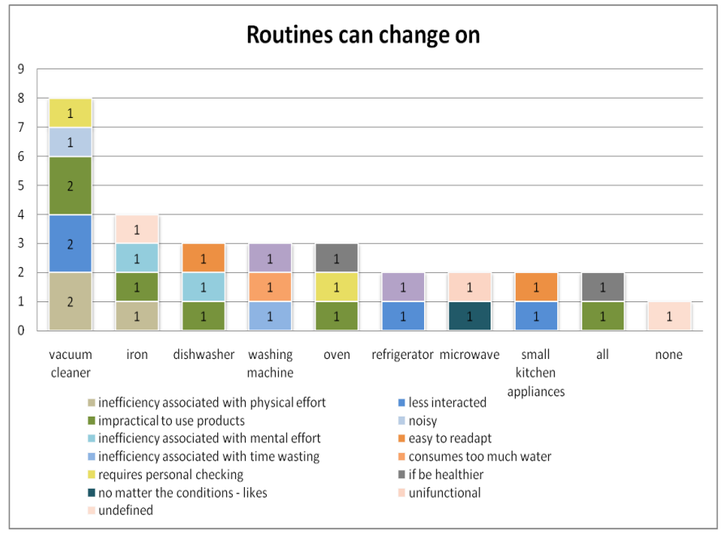


Figure 4-11 Users' Product Preferences

It is observed from the results that most of the users complain about vacuum cleaner. They prefer spending less time and physical effort, being more social deviance, and changing the routine in vacuum cleaner. Change in the abilities of time, social deviance and routines are mostly associated with the physical effort requirements. Preference of a change in physical effort is associated with difficulties in use and mobility requirements of the vacuum cleaner. Therefore, vacuum cleaner is the product which is complained the most about the physical requirements.

Regarding money concerns, participants prefer a change in refrigerator because of its 7/24 non-stop running. Also, no option is provided to the users to turn the refrigerator on and off. Household users feel that they cannot control the energy consumption, and thus, they prefer electricity expenses on it to decrease.

As for the mental effort change, participants choose washing machine mostly because of the mental tiredness caused by its different kinds of programs and adjustments. Washing machine was chosen, in the second rank, concerning time and money decrease due to its frequent use. Therefore, the washing machine can be associated with time since it is regarded as wasting it.

Iron is preferred to change in all abilities. Complaints on iron are addressed to its physical effort requirements and electricity consumption.

Product based results on ability change preferences are shown above. However, it is important to point out that the product features, not the products themselves, are primarily responsible for the product change preferences. Therefore, the discussion will be sustained over these features of products in which the ability changes are demanded. A useful illustration for designers who are going to design persuasive electrical household appliances for energy saving is introduced in Table 5.1 and the criteria defined for each ability should be taken into account for electrical household designs to persuade users for energy saving.

If you are changing	you can manipulate the ability on	examples
TIME	-physical effort requiring products -frequently used and long-running products -waste of time regarded products	iron washing machine dishwasher
ELECTRICTY EXPENSES	-non-stop working products -too much electricity consuming products -frequently-used products	refrigerator dryer washing machine
PHYSICAL EFFORT	-mobility requiring products -labor force requiring products -difficult-to-use products	dishwasher iron vacuum cleaner
MENTAL EFFORT	-multi-programming products -pre-arrangement requiring products -physical effort requiring products	oven placing dishes in the dish washer iron
SOCIAL COMPATIBILITY	-time taking products -physical effort requiring products -unifunctional products	iron vacuum cleaner washing machine
ROUTINES	-impractical to use products -physical effort requiring products -less interacted products	vacuum cleaner iron small household appliances

Figure 4-12 Ability Changes for Persuasion

For the time ability, household users generally associate the products on which they want to spend less time with their physical effort performance and waste of time. Frequent use and long-run products are regarded as time consuming. Taking time criteria into consideration for the persuasive design, electrical household appliances should eliminate the perception of waste of time, become efficient by requiring less physical effort and decrease the usage frequency and the running period in order to persuade users to save energy.

Electricity expenses made through electrical household appliances for the housework are mostly associated with time factor and with the household user's partially reliable knowledge about the most electricity consuming products. According to household users, the more the product runs, the more money it consumes. In order to persuade household users for energy saving, the product should be less time taking and persuade its user by providing him/her the information that the energy consuming product is no longer consuming too much electricity.

Change in physical effort is preferred in mobility requiring products, heavy to handle products, difficult to use products and user presence requiring products. Need to move, heaviness to handle and the difficulty in use arouse the usability problems about electrical household appliances. In order to persuade users to save energy, these usability problems should be eliminated. Products requiring users' presence should be less attention demanding and this might be provided through automation of the product.

Mental effort is spent most on multi-programming, pre-arrangement requiring and physical effort requiring electrical household appliances. When a product has too many adjustments and programs, it gets difficult to learn the correct use. As Venkatesh (1985) says; "Multifunctional technologies increase the complexity of task management for the household. They require greater manipulative abilities and lead to a higher degree of technological dependence" (p. 192). Therefore, multi-programs should be designed as simple as possible, which require detailed studies on interfaces of the electrical household appliances in order to persuade users for energy saving. Pre-arrangement requiring products are mentally tiring for the users because they need to think on how to manage and arrange the items related with the product before using it. Mental effort is also associated with the physical effort. According to participants, physical effort requiring

products affect the users' mental state and cause exhaustion. Moreover, as it is observed during the measurement of users' abilities, recently bought electrical household appliance require mental effort to learn the use by analyzing, trying and investigating the product, and by reading the user manual. In order to persuade users to save energy while using the electrical household appliances, mental effort requiring products should be designed to demand less brain cycle.

Household users have said that they can perform socially different behavior while using physical effort requiring products, unifunctional products and time taking products. They mostly associate being socially deviant with time and physical effort abilities. They choose to be socially deviant while using these types of products as long as these products provide them with better qualities of living and increase the level of well-being. For persuasion, if an energy saving product demands its users to be socially different from the people around them, that product should be designed to require less physical effort and time, and provide multi-functions (washing-ironing) .

Although changing routines and habits in the housework is difficult, household users have said that they can change their routines for physical effortless products, less interacted products and more practical to use products. To change habits, impractical and physical effort requiring products are chosen because of a belief that new technological products would provide a comfortable way to use, and thus, increase the users' level of well-being. Less interacted products, on the other hand, are chosen because users can accept such a routine change only in rarely used electrical household appliances, so they will not be influenced too much by such a change. Therefore, if electrical household appliances aim at persuading users for energy saving through changing the routines, the designer should focus on less interacted, physical effort requiring and impractical to use products.

To sum up, most of the ability change preferences are associated with the physical effort. Household users want to have a difference mostly about physical effort requiring electrical household appliances. Therefore, the physical effort demands should be decreased in order to persuade users for energy saving. Time taking products including frequent use, long-running and non-stop working products, and the perception of waste of time products should be designed in such a way that these perceptions and facts are eliminated to save energy.

4.5 Study – Part 4: Reallocation of the Abilities

As mentioned in Chapter 3, indicated by Young (2000), frugality, the thoughtful consumption, is the core factor affecting Environmentally Responsible Behavior (ERB). It motivates ERB by increasing the awareness of the limited resources on earth, and it requires abilities and skills to be able to use the resource carefully and by planning. This planning of using resources was studied in different literatures as well and it is the main focus of this study.

In Chapter 2, it was issued that household system is in balance with the household resources in the way that household users arrange them. This system does not let designers design a new way of the household system but a new reallocation among the resources, which will not disturb the balance.

According to Fogg Behavior Model, although the abilities people have are stable, they can be their trade-offs. Since the household resources are the same as FBM's elements of abilities, this study offers a reallocation of abilities in such a way that this reallocation will not disturb the balance of the household system. Moreover, the reallocation will persuade users for energy-saving since it is done taking household user's preferences into consideration.

When household users are provided with better conditions, behavior change for energy saving happens. In other words, the 'economic men' (see ERB) always try to maximize their benefits and minimize disadvantages, and therefore, they can be persuaded to behave environmentally responsible as long as the new behavior will provide rational advantages (Froehlich et al., 2010). In most of the energy saving studies, these rational advantages refer to financial advantages (Mert, 2008). However, any kind of benefits provided by the elements of abilities can encourage persuasion.

According to Neergaard & Venkatesh (1989), household users are doing strategies and tradeoffs in order to protect their level of living. In this part of the study, strategies and tradeoffs between elements of abilties are prepared according to household users' preferences. Moreover, in order a new household electrical appliance to persuade users for energy saving, it should be compatible with the household system. If not, as Groot-Marcus

et al. (2006) suggests, a new rescheduling, redistribution of abilities and another combination of resources be designed.

The aim of Study's Part 4 is to supply designers the knowledge of ability reallocations for strategic electrical household appliance design in order to persuade users to save energy at home. The main question of this part is:

- What is the most efficient way to reallocate abilities to persuade users for energy saving while using the electrical household appliances?

4.5.1 Methodology

Participants were asked what kind of a reallocation they would prefer in order to be persuaded by the electrical household appliance's energy saving target, and they marked the amount of change on the interview sheet as shown on Figure 4.13. At the same time, the audio tape was still recording. So, the data collected both as hard and soft copy. Each participant picked up one electrical household appliance to materialize the subject as it makes the interview easier, and they were expected to give answers considering this appliance, though not a matter of importance. The participants were first introduced the reallocation questions with the instruction:

- Now, I will request you to make some sacrifices. These sacrifices will be made in order to protect the environment. Despite these sacrifices, you will have a chance to change certain facts. Now we will discuss which facts and how much of units of change will satisfy you to accept the difficulty. One condition is that, the tradeoffs will take place at 4 units in total.

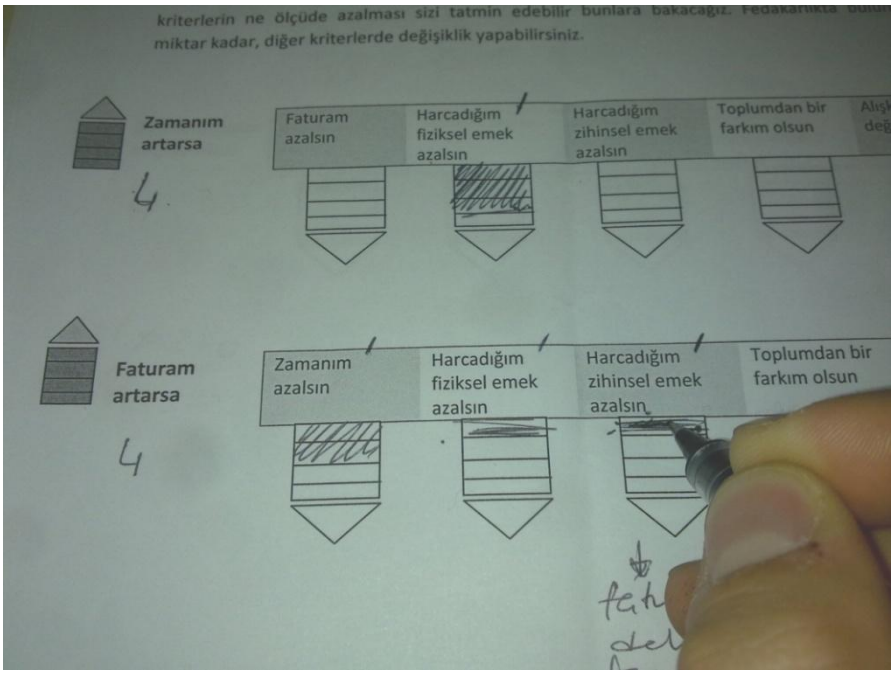
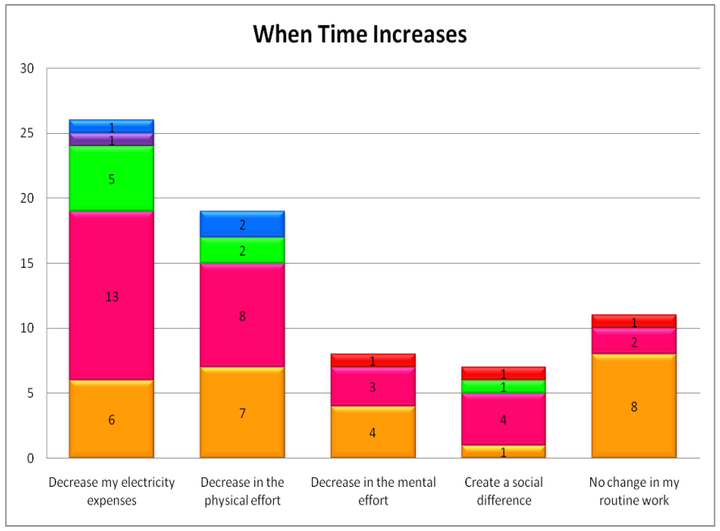


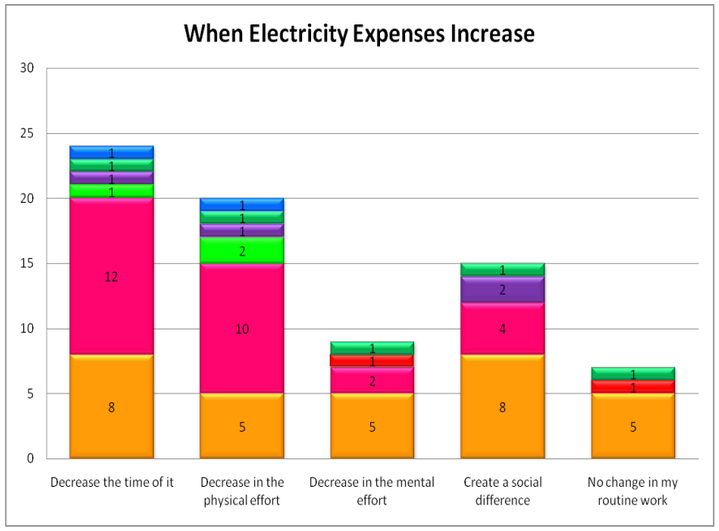
Figure 4-13 A Participant While Marking the Reallocation Questions

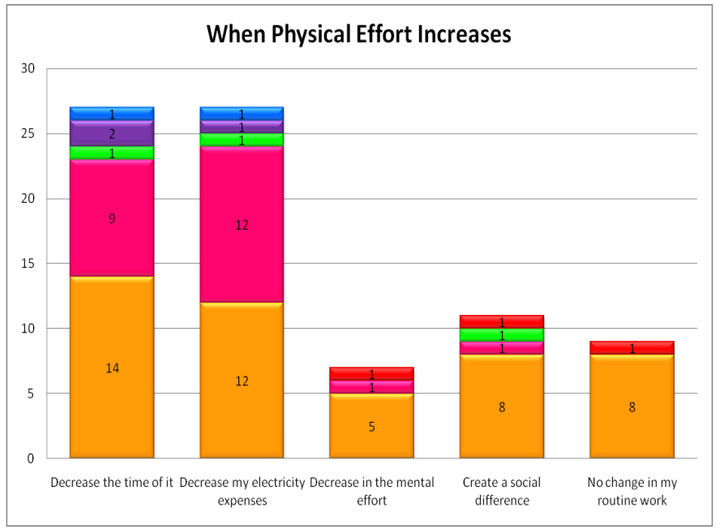
The amount of four units for reallocation and trade-offs was determined according to the number of abilities and the number's divisibility. As a result, the participants were enabled to choose one, two, three, four or all of the abilities as a trade-off for the sacrificed ability. After the instruction, participants gave their answers and choices of reallocation. Both qualitative and quantitative data were derived. Quantitative data was analyzed in SPSS Statistics Program. Data is interpreted and later discussed qualitatively over statistically drawn tables. Participants were the same as the whole case study sampling.

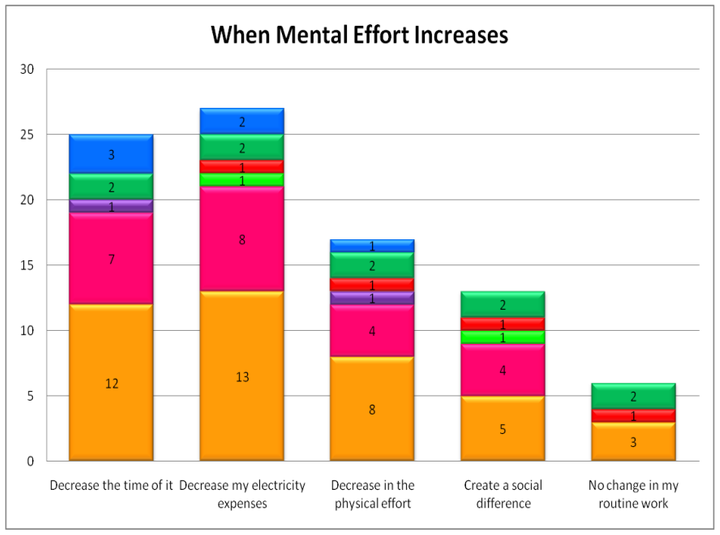
4.5.2 Results and Analysis

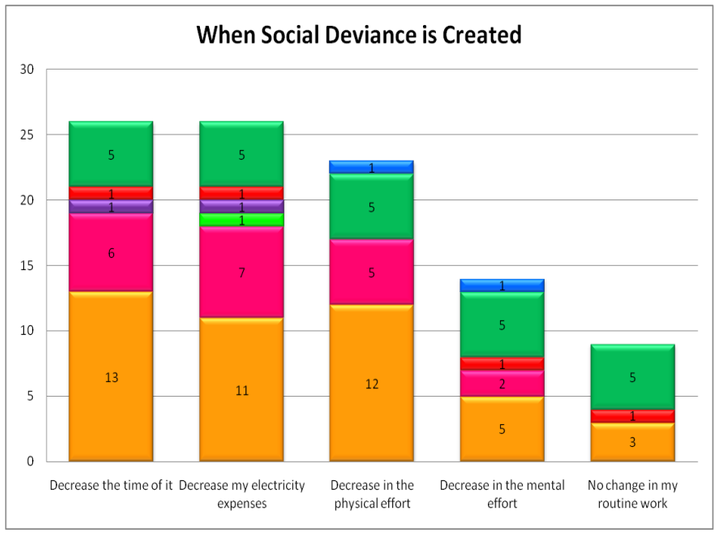
The general preferences of the household users' reallocation of their abilities are graphed below in Figure 5.2.

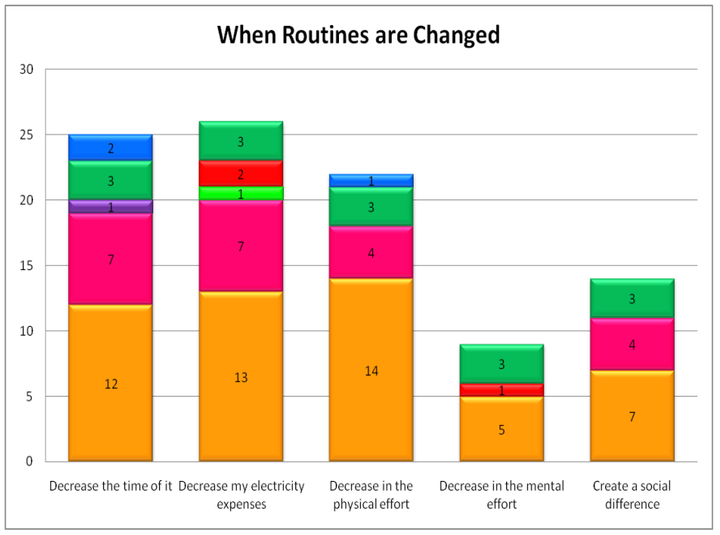












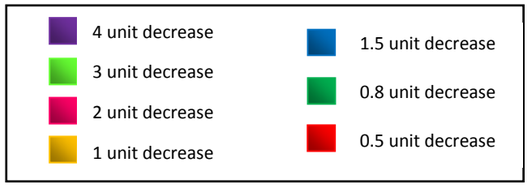


Figure 4-14 Users' Reallocation Preferences

It is obvious that when a sacrifice is requested, the participants mostly prefer a strategy to decrease the time, money and physical effort spent. With this way they can be persuaded to save energy while using electrical household appliances. The other leading analysis are:

The mental effort has a stable ranking among the ability changes. However, a decrease of it is mostly wanted when the social deviance is created. It is mainly because participants want to show off they perform less mental effort, which will make them allegedly exclusive.

The courage of being social deviant is shown the most when the money expenses, physical effort and mental effort increase, and when the routines change. Since household users are expected to pay more on their electricity expenses, spend more physical and mental effort, and change their routine housework, they prefer to be different in an advantageous way from other people. What they mean by advantage is having a practical, aesthetically appealing product. They also want to be noticed by other people because of their concerns about the environment.

When the household users are expected to be social deviant, some of them get afraid of a social exclusion, and therefore, equally choose all the abilities as a trade-off, as shown in Figure 5.2 (0.8 units are given, shaded with the dark green color). They have said that if they are going to make such a sacrifice and take this risk, all the ability-wise benefits should be provided.

Routine change is preferred the most when the time spent is supposed to increase. They have said that if they are going to spend more time, they will not mind keeping their habits and will prefer to change them then.

4.5.3 Discussion

In order to discuss on household users' reallocation preferences, personas are derived for each ability. The relationship between personas and their related reallocation preferences (as shown in Figure 4.15) will be interpreted in this section.

Personas are derived according to data in Study Part 2. Participants' level of abilities is divided into three groups by statistical means (frequency percentiles).

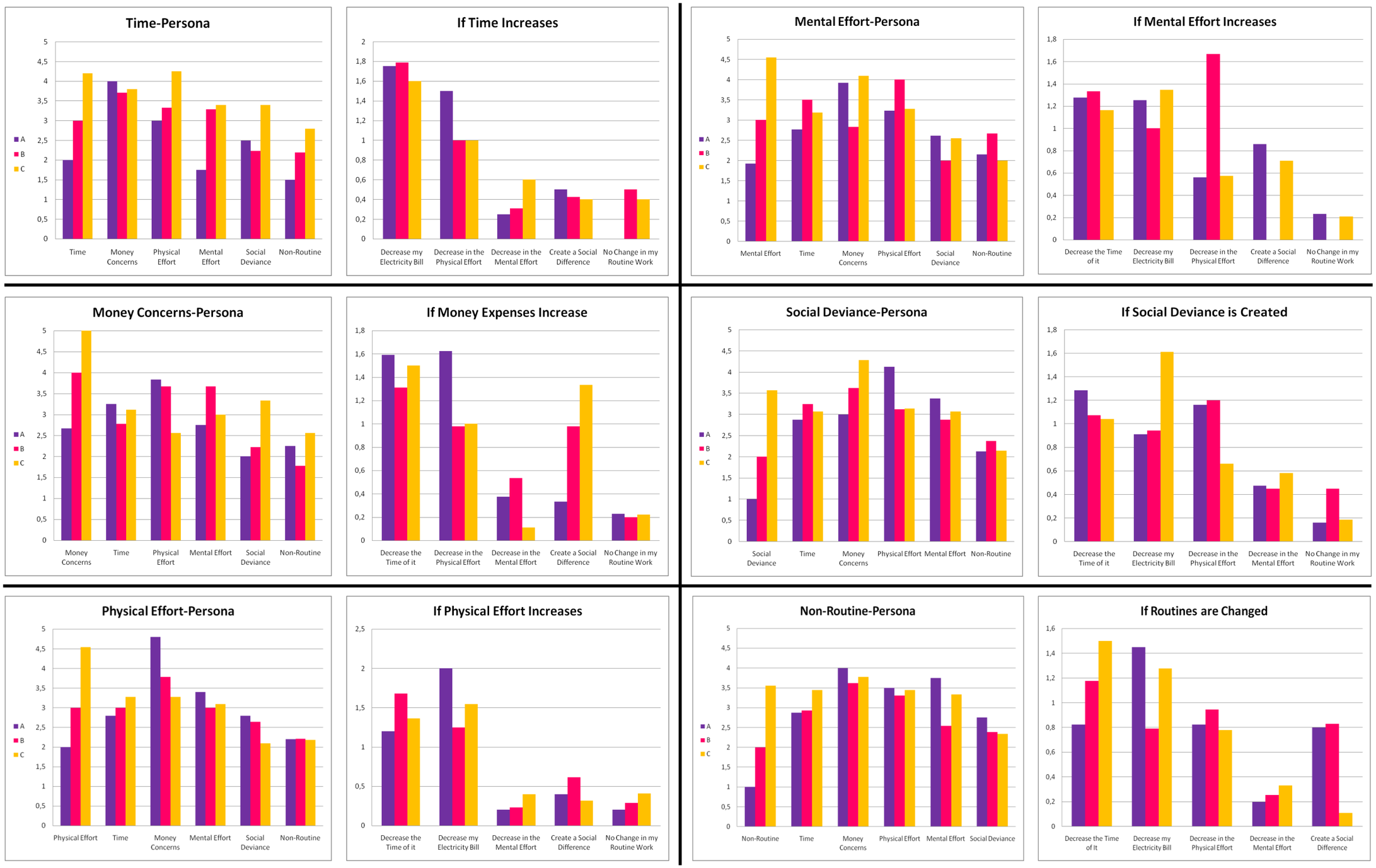


Figure 4-15 Reallocation Preferences according to Personas

As for the time factor, personas are grouped as low (Group A; 4 participants), medium (Group B; 21 participants) and high (Group C; 5 participants) time spenders. Significant facts about these personas are that; Group A, the lowest time spending persona, concerns about their electricity expenses the most and they prefer their electricity expenses to decrease the most as a trade-off for an increase in time spent. Although Group A is the lowest persona group of time spending, they want a decrease in the physical effort more than other personas. Moreover, Group A does not have any restrictions in routines, they apparently seem to be the most routine changers when the time spent increases. Group C, the high time spenders, perform the most physical and mental effort, and they can reallocate an increase in time with a decrease in mental effort more than the others.

Regarding the money, personas are categorized into non-economicals (Group A; 12 participants), moderate money spenders (Group B; 9 participants) and economicals (Group C; 9 participants). Group A, the non-economical persona, spends physical effort more than the others and they are the least socially deviant group. Their significant reallocation preference is on their high willingness to decrease the physical effort. On the other hand, Group C, the economical group, is the most socially deviant group. They do not take their mental effort performance into account when electricity expenses increase, but they want to be noticed in the society when they have to pay more electricity bill than the others. Group B, the moderate money spenders spend more mental effort than other personas, and thus,want a decrease in it as a trafe-off for an increase in money.

Physical effort personas are divided as; physically not tired persona (Group A; 6 participants), moderate physical effort spenders (Group B; 14 participants) and physically tired persona (Group C; 11 participants). Group A, the least physical effort spenders, concerns about their electricity expenses the most and they want to trade-off physical effort with a decrease in their bill the most. The other physical effort personas do not show any significant difference.

Mental effort groups are categorized as non-brain cyclers (Group A; 13 participants), moderate level of brain-cyclers (Group B; 6 participants) and brain-cyclers (Group C; 11 participants). Group A, the non-brain cyclers, concerns about their electricity expenses. Group B, the moderate level of brain-cyclers, is the most consistent persona group. They spend time and physical effort, behave economically, be socially compatible and change

routines more than other personas. In accordance with their abilities, Group B's reallocation preferences are decrease in time spent, electricity expenses and physical effort, they do not want to be socially deviant, but to change their routines as trade-offs for an increase in mental effort.

Personas in terms of being socially deviant are grouped as very socially compatibles (Group A; 8 participants), socially compatibles (Group B; 8 participants) and socially differents (Group C; 14 participants).Group C, the social deviant persona, behaves more economical while using electrical household appliances than the others, and they want to reallocate their resources with paying less electricity bill. They are able to change their routines as a trade-off for social deviancy. Group A, the very socially compatibles, perform more physical effort than others. They say that they can also change their routines when they have to be socially deviant. Group B, the socially compatibles, change their habits more than the others. However, when the social deviancy is created, they do not want to change their routines.

Personas according to the commitment of habits are categorized as; routine maintainers persona (Group A; 8 participants), moderate routine changers (Group B; 13 participants) and routine breakers (Group C; 9 participants). Group A, routine obeying persona, pays attention to their electricity expenses more than the others and they perform mental effort more than the others, as well. They want to reallocate any routine change with a decrease in electricity expenses. Group C, the routine breakers, shows the least tendency to be socially deviant and they do not want to show social deviancy but a decrease in their electricity expenses as a trade-off for a routine change. It can be said that the routine breakers are socially compatible people.

An additional illustration to observe clearly the common and uncommon reallocation preferences between different personas and different ablities are provided in Figure 4.17.

Figure 4-16 User Preferences According to Personas

CHAPTER 5

CONCLUSION

As a hot topic persuasive design arouses a new research area. For those who want to study persuasive design for sustainability, the literature lacks of many academic studies. This lack has been the source of this study. The study investigates the behavioral line of household users in energy saving, and commentaries are made in accordance with it, and results in both behavioral and technological strategies.

Figure 5.1 illustrates the findings of the study referring to the research questions. The study has been conducted with a literature survey and an empirical study. Literature survey reviews the household system and persuasion theories.

The household system chapter of the literature review concludes with the importance of the household resources, which are time, wage, abilities and skills, and household member characteristics, and the fragile balance of the way of the allocation of these resources.

In the second literature survey part, the persuasion theories are overviewed. Fogg Behavior Model (FBM) has been chosen to study in a detailed fashion in order to persuade household users to save energy at home. The study concentrates on the elements of abilities as described inFBM.

Both of the literature review topics support and form the basis for the empirical study. The empirical study chapter includes a literature review on household users' energy saving behavior at home, as well. In the first place, household users' perspective on energy saving has been investigated addressing to their methods to save energy, aims at energy saving, motivations and demotivations in energy saving. In the second place, the results of to what extend the household users perform their abilities have been obtained. In the third place,

household users' preferences of products and particular features of these products are examined. In the final place, household users have reallocated their abilities to get the maximum benefit from a sacrificed ability. Yet, improved data analysis has not been published in the final part. The summary and a clear version of the reallocation of abilities will be introduced in the conclusion part as it addresses the main question of the study.

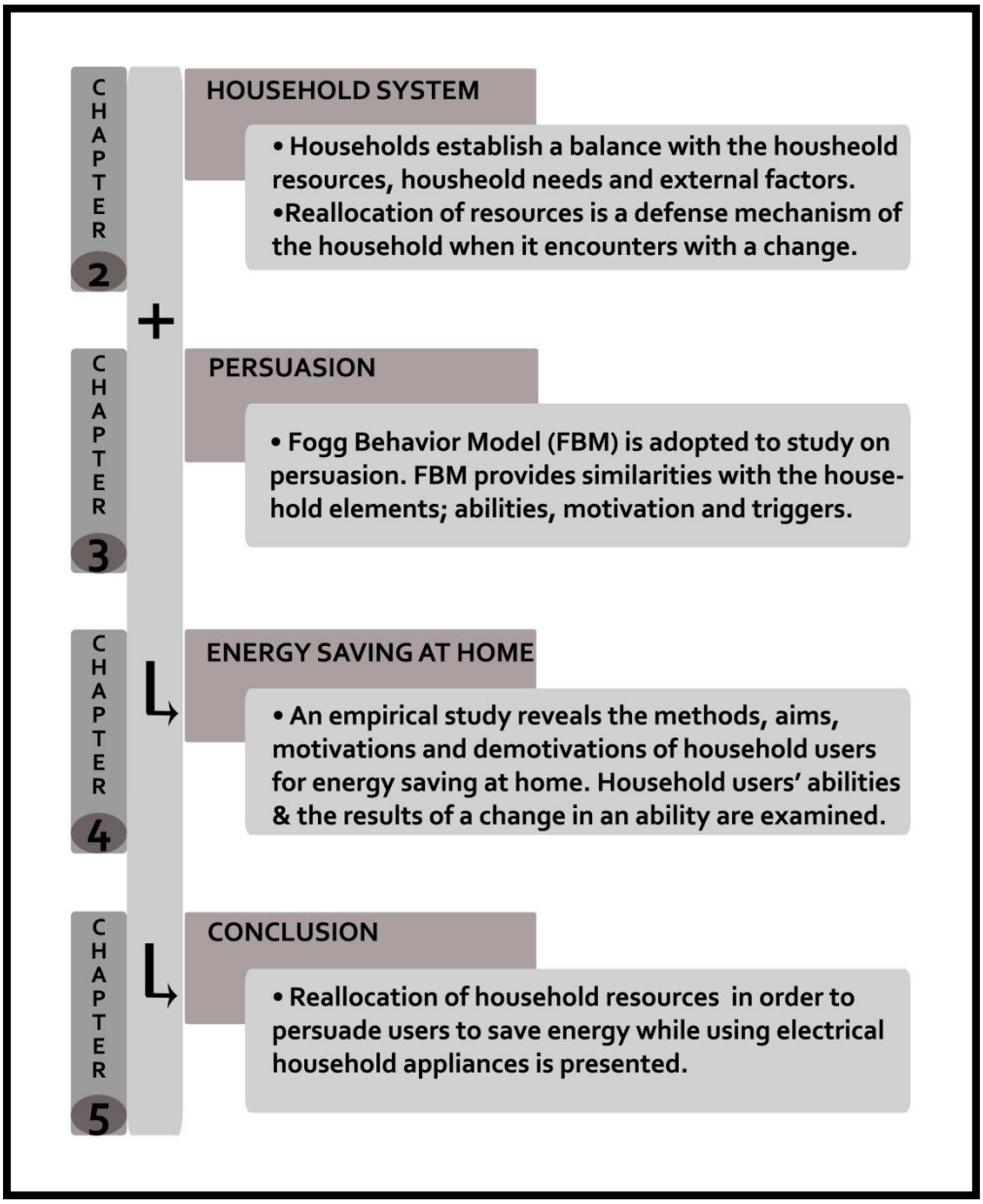


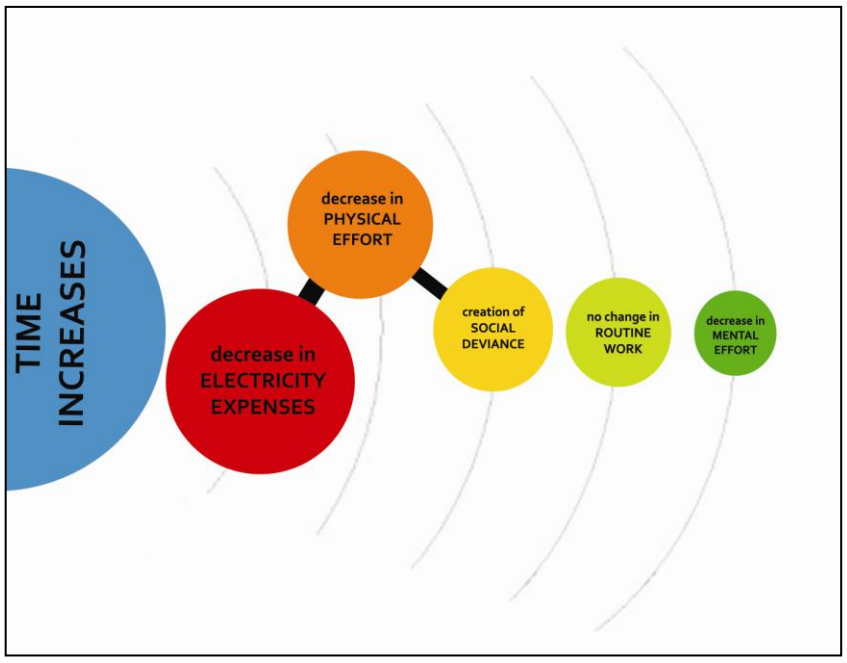
Figure 5-1 Diagram of the Conclusion

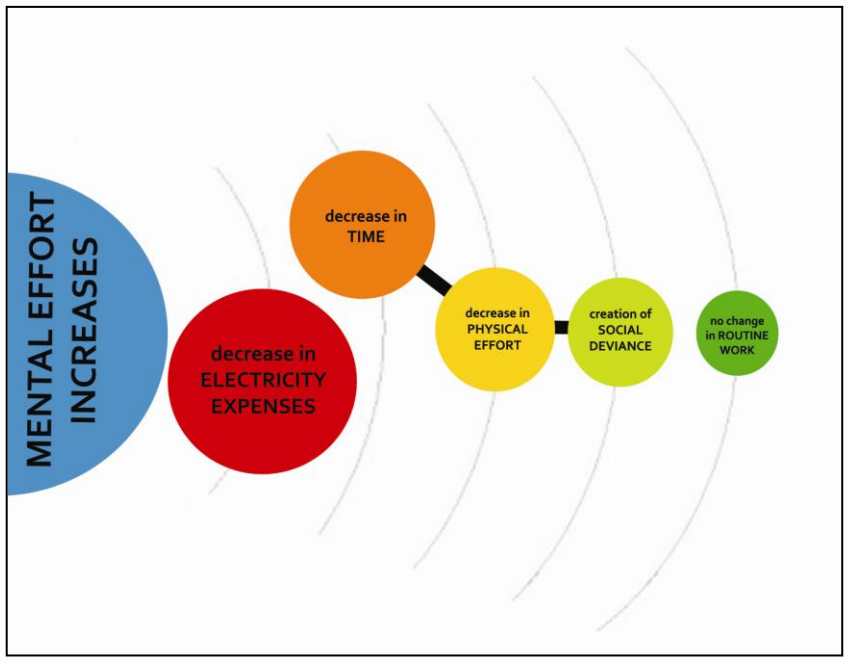
5.1 Reallocation of Household Abilities

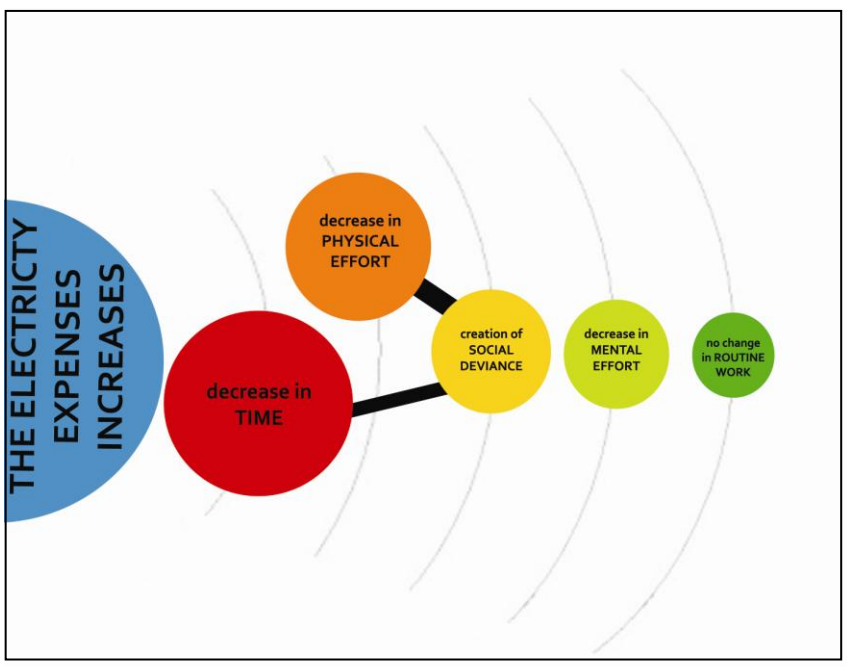
The results and the analysis of the reallocation of the abilities have been introduced in Chapter 4. However, those results do not give clear directions to how to make a reallocation, but just significant suggestions. Therefore, an interpretation of the results, derived from SPSS data (see Appendix C), is needed with a useful visualization so that one can look at the visualized data and understand what kind of a reallocation of the abilities is the best to persuade household users to save energy while using electrical household appliances for the housework. In the following pages illustrations of the reallocation of abilities are presented (see Figure 5.2, 5.3, 5.4, 5.5, 5.6 and 5.7) and discussed.

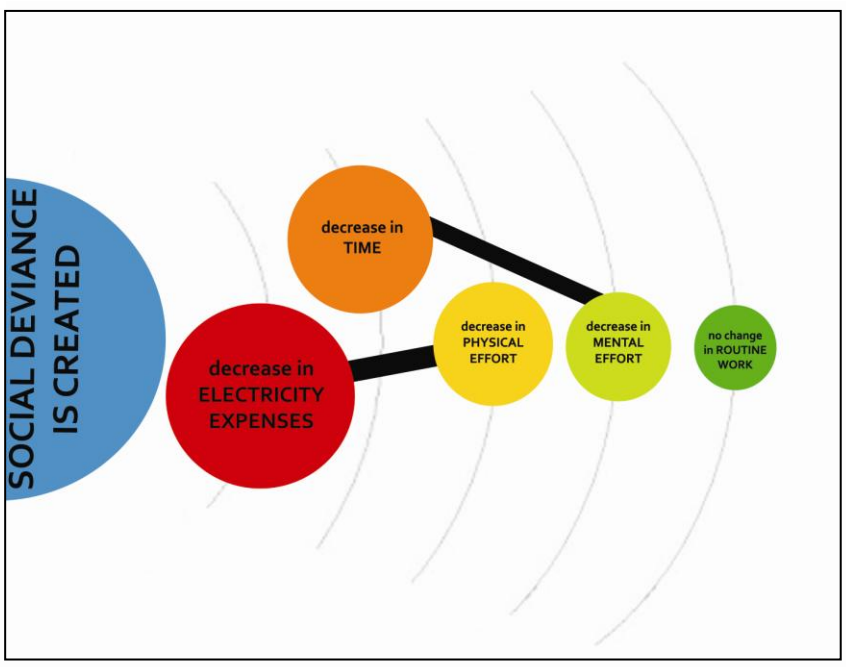
In the discussion part, the data is visualized with the metaphoric usage of the Sun System similar to the planets on orbits surrounding the Sun. The changing element, the Sun in this metaphor, is represented with the color blue where the reallocated elements, the planets, are colored respectively with red, orange, yellow, light green and dark green representing the closeness. The closest element of ability (red one) to the changing element of ability (blue one) is the most preferred ability, which enables reallocation to take place efficiently.

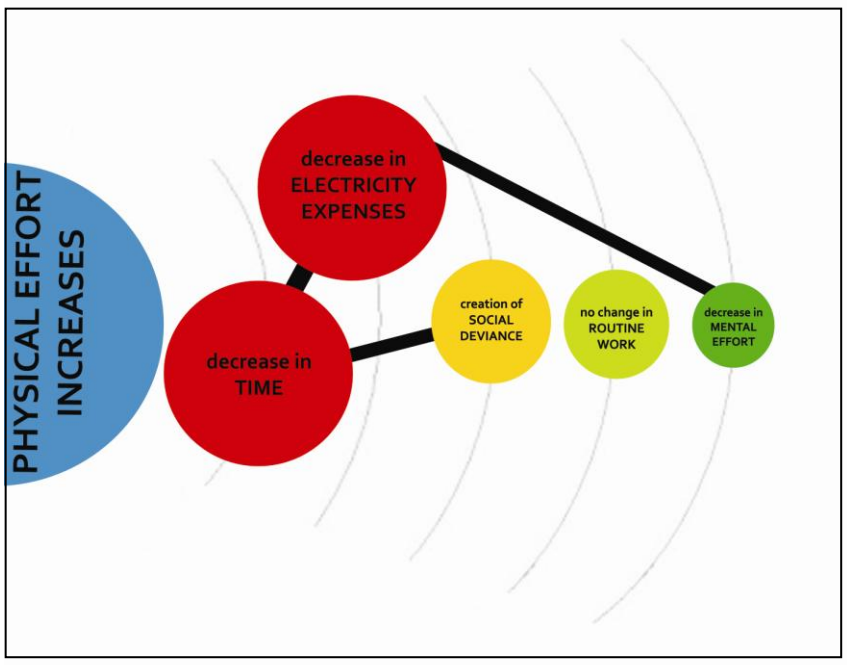
There are also attachments between some of the elements of abilities, which mean that those abilities are connected to each other and they can compensate for one another. In case of the lack of reallocation of an ability; the attached element of ability can be replaced with it. The magnitude of the boundaries is lined according to the statistics of the correlations between them. In other words; the thicker the line, the stronger the compensation preference, and vice versa.











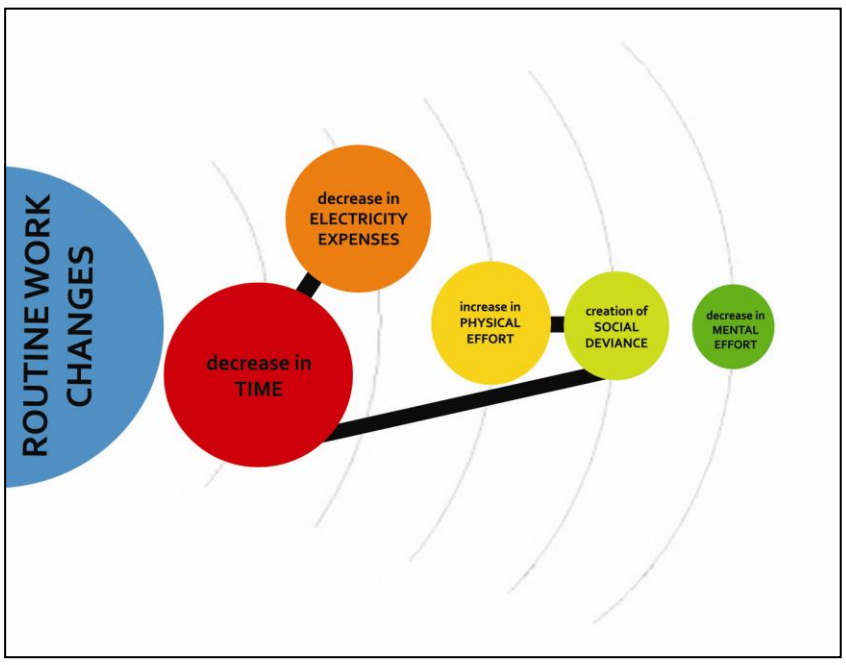


Figure 5-2 Reallocation Preferences

There are several similarities and differences between the reallocation preferences of elements of abilities when an element of ability changes. The preferences are similar between physical effort and time, and mental effort and social deviance. It is obvious that the elements of abilities chosen to reallocate when the time spent increases are the same as the ones when the physical effort increases. The preferences in reallocating the elements of abilities when the mental effort increases and social deviance is created are the same.

The change in the electricity expenses shows both common and uncommon reallocation preferences when there is an increase in the time spent and physical effort performance. The first three choices of element of abilities when the electricity expenses increase are the same as time and physical effort changes. However, the preferences of a 'decrease in mental effort' and 'no change in routine work', when an increase in electricity bill takes place, differ with the increase in time and physical effort cases.

Below, the compensation preferences of household users are presented in an order of importance determined by the frequency of mentioning and the correlation of the attachment.

The decrease in physical effort is primarily compensated by the social deviance creation, secondarily by the decrease in electricity expenses and thirdly by the decrease in time spent for the housework. If a decrease in time of an electrical household appliance cannot be designed, the designer can replace it primarily with the creation of a social difference, secondarily with a decrease in electricity expenses, thirdly with a decrease in mental effort and lastly with a decrease in physical effort. The decrease in electricity expenses can be compensated primarily by the decrease in physical effort, secondarily by the decrease in time spent and thirdly by the decrease in mental effort.

5.2 Conclusive Remarks

In conclusion, as mentioned in Chapter 3, designers of persuasion should write a script for the product. This script is of designer's intention and the persuasive ways to achieve the target behavior. In the study, intent of the designer is energy saving and the target behavior is to save

energy while using electrical household appliances for the housework. Persuasive ways, the designer should take into account, are presented below.

Persuasive ways derived from the study Part 1 are listed as;

- Products should **inform** users about the methods, programs and outcomes of energy saving,
- Products should provide the same or even more **efficiency** with better performance **quality**.

Persuasive ways derived from the study Part 3 are listed as;

- **Time** taking and **physical effort** requiring products are the most problematic ones. Therefore, new design of these products should demand less time and physical effort from users in order persuade them to save energy.
- **Vacuum cleaner**, **iron** and **washing machine** seem to be the most promising household appliances for behavioral change.

Persuasive ways derived from the study Part 4 are listed as;

- Independent from persona types, decrease in **time spent** and **electricity expenses** of the electrical household appliances are the most influential ways to persuade users to save energy,
- Subsequently the decrease in **physical effort** performance and the creation of a **social deviance**, respectively, are affective persuasive ways for energy saving,
- Decrease in **mental effort** performance and the maintenance of **routines** have the minimum impact on persuasion for energy saving,
- If the designer lacks of reallocating one of these persuasive ways, he/she should regard the commentaries on compensations (see the previous page).

5.3 Limitations and Recommendations

5.3.1 Limitations of the Study

There are several limiting facts about the study concerning the literature review and the number of participants.

Most of the household energy-saving studies on behavior change are based on energy feedbacks, information systems and goal-settings. Therefore, it has been difficult to find out about household resource reallocation for energy-saving behavior and study on reallocation of resources and persuasion together.

The empirical study could have been conducted with more participants. However, since making an interview takes a lot of time and is difficult to reach out more than 30 participants to conduct an interview, the number of participants attending to an interview has become limited.

5.3.2 Recommendations for Further Research

In order to conduct a study with more than thirty participants, the researcher may exclude the ability measurement part of the interview as online and/or offline survey. As a result, creating personas would have been much easier and statistically more reliable since there will be more than 30 groups of data collected.

The ability measuring questions can be formed with related sub-questions in order to measure the subjective and relative view of spent abilities in a more credible way.

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APPENDIX A

EXAMPLE FOR THE TRANSTHEORETICAL MODEL

A.1 Stages of Change

"An addict starts out happily addicted, but then gradually becomes aware of the down-side addiction. They think for a long time about doing something and eventually decide they must act. There is still a while before they take action. It is difficult to keep going and many others being treated drop out and go back to addiction. With support, however, the addict gets to the end of the treatment and transitions to a new life" (changingminds, 2011).

A.2 Processes of Change

Table A.1 The processes of change with alternative labels and sample items from smoking cessation, taken from (Velicer, Prochaska, Fava, Norman, & Redding, 2011)

Processes of Change	Examples
Consciousness Raising [Increasing awareness]	I recall information people had given me on how to stop smoking
Dramatic Relief [Emotional arousal]	I react emotionally to warnings about smoking cigarettes
Self Reevaluation [Self reappraisal]	My dependency on cigarettes makes me feel disappointed in myself
Environmental Reevaluation [Social reappraisal]	I consider the view that smoking can be harmful to the environment
Self Liberation [Committing]	I make commitments not to smoke
Social Liberation [Environmental opportunities]	I find society changing in ways that make it easier for the nonsmoker
Counter Conditioning [Substituting]	I find that doing other things with my hands is a good substitute for smoking
Stimulus Control [Re-engineering]	I remove things from my home that remind me of smoking
Reinforcement Management [Rewarding]	I reward myself when I don't smoke
Helping Relationship [Supporting]	I have someone who listens when I need to talk about my smoking

APPENDIX B

RÖPORTAJ

Cinsiyet: **K** ☐ **E** ☐

Yaş:

Eğitim Durumu:

Meslek:

Merhabalar, ben Ayşe Çelebi, ODTÜ Endüstri Ürünleri Tasarımı yüksek lisans öğrencisiyim. Yüksek lisans tezim, ev işi yaparken kullanıcıyı çevreci bir davranışa ikna etmek üzerine. Bu nedenle ev işinde kullandığınız elektrikli ev aletlerine dair alışkanlıklarınız ve yapılabilecek değişiklikler üzerine sorular soracağım.

1. Kullanıcının Evde Enerji Tasarrufu Motivasyonu

Enerji tasarrufu yapıyor musunuz?

Enerji tasarrufunda neyi amaçlıyorsunuz?

Daha fazla enerji tasarrufu yapmanız için sizi ne motive eder?

Daha fazla enerji tasarrufu yapmanızı ne tip durumlar engeller?

2. Kullanıcının mevcut durumu

Bu kısımda ev işinde kullandığınız elektrikli ev aletlerine yönelik sorulara 1 hiç 5 çok olmak üzere 1 ile 5 arasında puan vermeniz gerekiyor.	**Hiç**		**Orta**		**Çok**
	1	**2**	**3**	**4**	**5**
Kullandığınız elektrikli ev aletlerini düşünürsek bir gün içerisinde ev işine harcadığınız zamanı nasıl değerlendiriyorsunuz?					
Ev işinde elektrikli ev aletleri kullanırken enerji tüketimi açısından harcamalarınızda dikkatli bir tutum sergiliyor musunuz?					
Ev işi yaparken fiziksel olarak ne kadar güç harcadığınızı düşünüyorsunuz?					
Ev işi yaparken kullanımı anlamak, doğru kullanımı bulmak gibi nedenlerle ne kadar zihinsel güç harcadığınızı düşünüyorsunuz?					
Ev işinde elektrikli ev aleti kullanımınızda toplumdan ne kadar farklılık gösteriyorsunuz?					
Ev işi sırasında elektrikli ev aleti kullanımınızda alışkanlıklarınızın dışına ne kadar çıkıyorsunuz?					

3. Kullanıcının değişiklikleri kabul edebileceği ürünlerin seçimi

1. Harcadığınız zamanı değiştirebilecek olsak, zamanın en fazla hangi ürünün kullanımında değişmesini istersiniz? Nasıl bir değişim istersiniz? Neden?

2. Ev işinde elektrikli ev aletleri kullanırken enerjiye harcadığınız parayı değiştirebilecek olsak, en çok hangi üründe değişiklik yapılmalı? Neden?

3. Ev işinde elektrikli ev aletlerine harcadığınız fiziksel emeği değiştirebilecek olsak, harcadığınız fiziksel emeğin en fazla hangi ürün kullanımı için değişmesini istersiniz? Neden?

4. Ev işinde elektrikli ev aletlerine harcadığınız zihinsel emeği değiştirebilecek olsak, harcadığınız zihinsel emeğin en fazla hangi ürün kullanımı için değişmesini istersiniz? Neden?

5. Etrafınızdaki kullanıcılardan daha farklı kullanımlar uygulamanız gereken bir ürün olsa, en fazla hangi ürün için bunu kabul edersiniz? Neden?

6. Ev işinde elektrikli ev aletleri kullanımınızdaki alışkanlıklarınız tümüyle değişecek olsa hangi üründe bunu kabul edebilirsiniz? Neden?

4. Ürün Seçimi

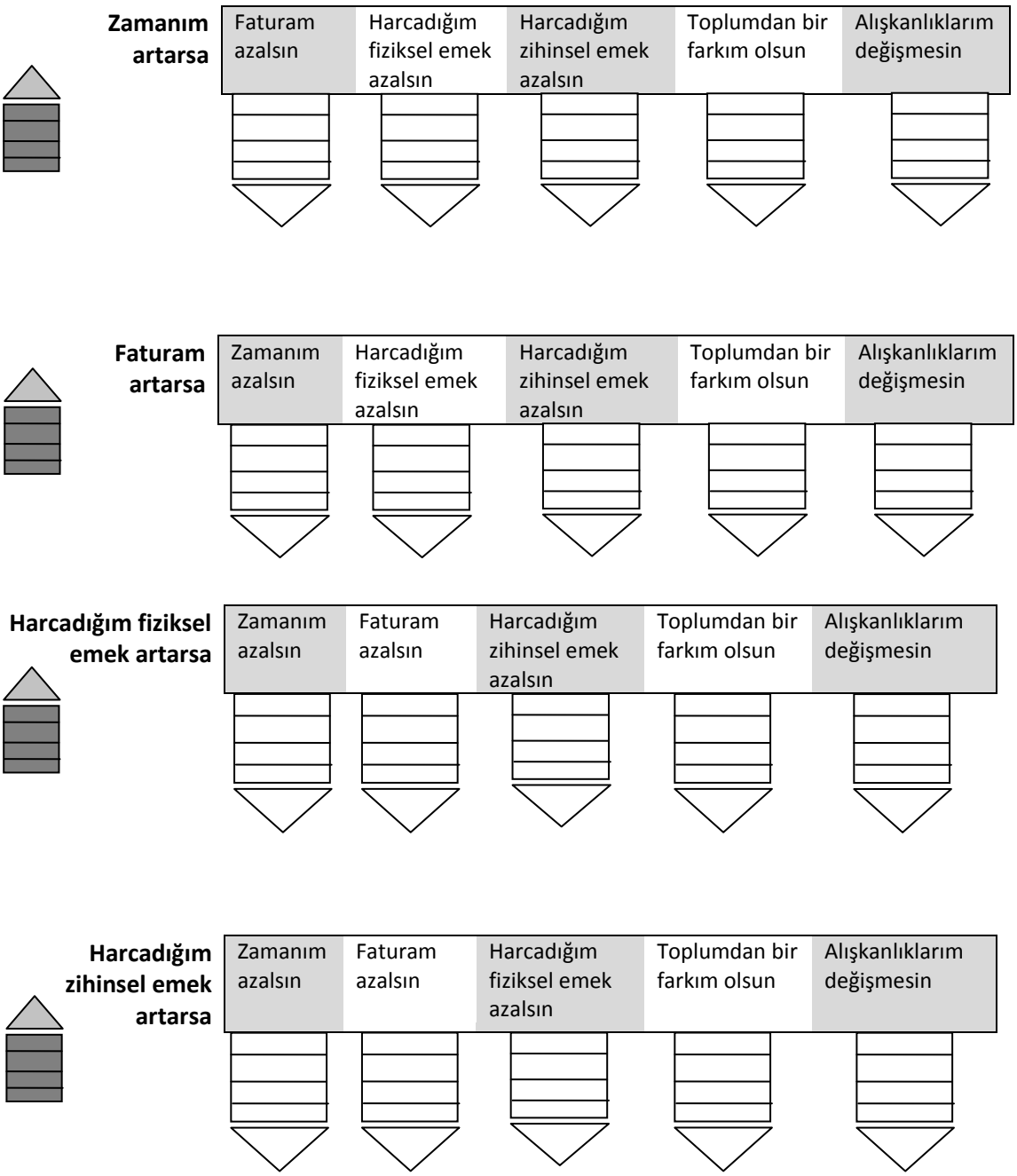
Seçtiğiniz ürünle ilişkinizi hangi kelimeyle tanımlarsınız?

5. Kullanıcının seçtiği ürün kullanımındaki mevcut durumu

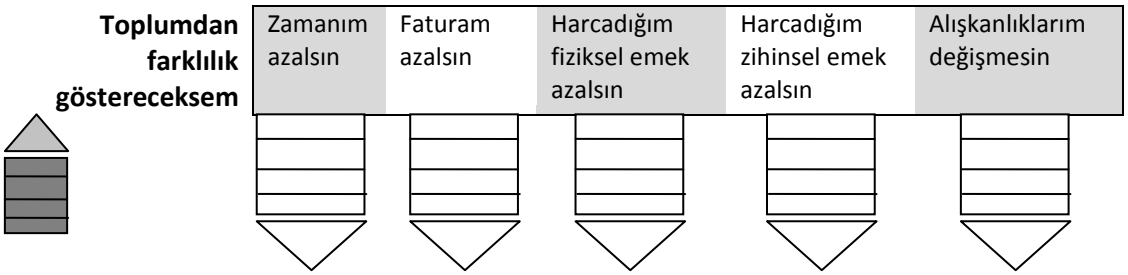
Bu kısımda ev işinde kullandığınız elektrikli ev aletlerinden birini seçmelisiniz. Seçtiğiniz ürüne yönelik sorulara 1 hiç 5 çok olmak üzere 1 ile 5 arasında puan vermeniz gerekiyor.	**Hiç**		**Orta**		**Çok**
	1	**2**	**3**	**4**	**5**
_____ kullanırken ne kadar zaman harcadığınızı düşünüyorsunuz?					
_____ kullanırken harcadığınız parayı nasıl değerlendiriyorsunuz?					
_____kullanırken ne kadar fiziksel güç harcıyorsunuz?					
_____kullanırken ne kadar zihinsel güç harcıyorsunuz?					
Ev işi sırasında _____ kullanımınızda toplumdan ne kadar farklılık gösterdiğinizi düşünüyorsunuz?					
Ev işi sırasında _____ kullanımınızda alışkanlıklarınızın dışına ne kadar çıkıyorsunuz?					

6. Kullanıcının üründeki değişikliği kabul edebileceği noktalar

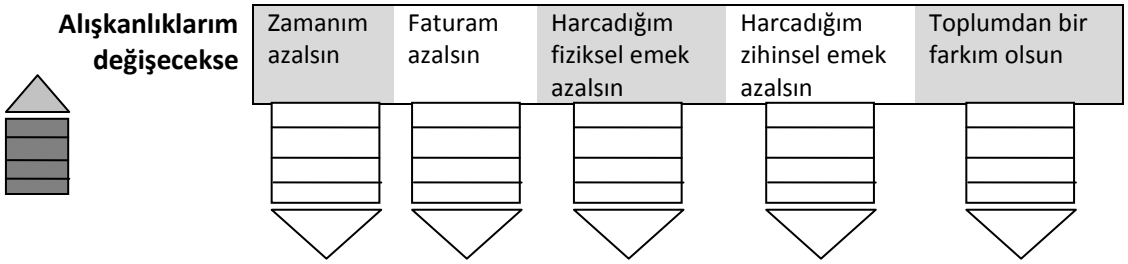
Şimdi sizden bu ürünlerin kullanımı sırasında bazı fedakârlıklarda bulunmanızı isteyeceğim, bu fedakârlıklar aynı zamanda çevre için iyileştirme niteliğindeler. Bu zorluğun karşılığında hangi kriterlerin ne ölçüde azalması sizi tatmin edebilir bunlara bakacağız. Fedakârlıkta bulunacağınız miktar kadar, diğer kriterlerde değişiklik yapabilirsiniz.



Toplumdan farklılık göstereceksem



Alışkanlıklarım değişecekse



APPENDIX C

SPSS DATA OF THE REALLOCATIONS

Table C.1 Reallocation data for Time

Correlations

		FaturaÖzalışın	FizikselGüçÖzalışın	ZihinselGüçÖzalışın	ToplumdanFarklılıkOlsun	AlışkanlıklarımDeğişmesin
FaturaÖzalışın	Pearson Correlation	1	-,513	-,358	-,206	-,062
	Sig.(2-tailed)		,001	,052	,276	,743
	N	30	30	30	30	30
FizikselGüçÖzalışın	Pearson Correlation	-,513	1	,231	-,399	-,235
	Sig.(2-tailed)	,001		,109	,029	,211
	N	30	30	30	30	30
ZihinselGüçÖzalışın	Pearson Correlation	-,358	,131	1	-,269	-,329
	Sig.(2-tailed)	,052	,489		,151	,076
	N	30	30	30	30	30
ToplumdanFarklılıkOlsun	Pearson Correlation	-,206	-,399	-,269	1	-,128
	Sig.(2-tailed)	,276	,029	,151		,499
	N	30	30	30	30	30
AlışkanlıklarımDeğişmesin	Pearson Correlation	-,062	-,235	-,329	-,128	1
	Sig.(2-tailed)	,743	,211	,076	,499	
	N	30	30	30	30	30

Descriptive Statistics

	Mean	Std. Deviation	N
FaturaÖzalışın	1,7500	1,00644	30
FizikselGüçÖzalışın	1,0667	,97143	30
ZihinselGüçÖzalışın	,3500	,65850	30
ToplumdanFarklılıkOlsun	,4167	,85181	30
AlışkanlıklarımDeğişmesin	,4167	,81105	30

Table C.2 Reallocation data for Expenses

Correlations

		Zamanım azalsın	Harcadığım fiziksel emek azalsın	Harcadığım zihinsel emek azalsın	Toplumdan bir farkım olsun	Alışkanlıklarım değişmesin
Zamanım azalsın	Pearson Correlation	1	-,305	-,286	-,400	-,025
	Sig. (2-tailed)		,101	,125	,029	,894
	N	30	30	30	30	30
Harcadığım fiziksel emek azalsın	Pearson Correlation	-,305	1	-,126	-,592	-,192
	Sig. (2-tailed)	,101		,507	,001	,310
	N	30	30	30	30	30
Harcadığım zihinsel emek azalsın	Pearson Correlation	-,286	-,126	1	-,097	-,185
	Sig. (2-tailed)	,125	,507		,610	,327
	N	30	30	30	30	30
Toplumdan bir farkım olsun	Pearson Correlation	-,400	-,592	-,097	1	-,044
	Sig. (2-tailed)	,029	,001	,610		,817
	N	30	30	30	30	30
Alışkanlıklarım değişmesin	Pearson Correlation	-,025	-,192	-,185	-,044	1
	Sig. (2-tailed)	,894	,310	,327	,817	
	N	30	30	30	30	30

Descriptive Statistics

	Mean	Std. Deviation	N
Zamanım azalsın	1,3767	,96550	30
Harcadığım fiziksel emek azalsın	1,2433	1,10662	30
Harcadığım zihinsel emek azalsın	,3433	,59751	30
Toplumdan bir farkım olsun	,8267	1,11632	30
Alışkanlıklarım değişmesin	,2100	,39684	30

Table B.3 Reallocation data for Physical Effort

Correlations

		Zamanım azalsın	Faturam azalsın	Harcadığım zihinsel emek azalsın	Toplumdan bir farkım olsun	Alışkanlıklarım değişmesin
Zamanım azalsın	Pearson Correlation	1	-,541	-,121	-,395	-,351
	Sig. (2-tailed)		,002	,523	,031	,057
	N	30	30	30	30	30
Faturam azalsın	Pearson Correlation	-,541	1	-,364	-,085	-,186
	Sig. (2-tailed)	,002		,048	,655	,324
	N	30	30	30	30	30
Harcadığım zihinsel emek azalsın	Pearson Correlation	-,121	-,364	1	-,347	,376
	Sig. (2-tailed)	,523	,048		,060	,041
	N	30	30	30	30	30
Toplumdan bir farkım olsun	Pearson Correlation	-,395	-,085	-,347	1	-,201
	Sig. (2-tailed)	,031	,655	,060		,287
	N	30	30	30	30	30
Alışkanlıklarım değişmesin	Pearson Correlation	-,351	-,186	,376	-,201	1
	Sig. (2-tailed)	,057	,324	,041	,287	
	N	30	30	30	30	30

Descriptive Statistics

	Mean	Std. Deviation	N
Zamanım azalsın	1,4833	,96921	30
Faturam azalsın	1,4833	,85585	30
Harcadığım zihinsel emek azalsın	,2750	,51003	30
Toplumdan bir farkım olsun	,4500	,72338	30
Alışkanlıklarım değişmesin	,3083	,45336	30

Table C.4 Reallocation data for Mental Effort

Correlations						
		Zamanım azalsın	Faturam azalsın	Harcadığım fiksel emek azalsın	Toplumdan bir farkım olsun	Alışkanlıklarım değişmesin
Zamanım azalsın	Pearson Correlation	1	-,182	-,389	-,316	-,213
	Sig. (2-tailed)		,335	,034	,089	,256
	N	30	30	30	30	30
Faturam azalsın	Pearson Correlation	-,182	1	-,352	-,210	,031
	Sig. (2-tailed)	,335		,056	,150	,871
	N	30	30	30	30	30
Harcadığım fiksel emek azalsın	Pearson Correlation	-,389	-,352	1	-,382	-,102
	Sig. (2-tailed)	,034	,056		,037	,591
	N	30	30	30	30	30
Toplumdan bir farkım olsun	Pearson Correlation	-,316	-,210	-,382	1	-,092
	Sig. (2-tailed)	,089	,150	,037		,630
	N	30	30	30	30	30
Alışkanlıklarım değişmesin	Pearson Correlation	-,213	,031	-,102	-,092	1
	Sig. (2-tailed)	,256	,871	,591	,630	
	N	30	30	30	30	30

Descriptive Statistics			
	Mean	Std. Deviation	N
Zamanım azalsın	1,2333	,82681	30
Faturam azalsın	1,2361	,89851	30
Harcadığım fiksel emek azalsın	,7861	,93215	30
Toplumdan bir farkım olsun	,6333	,81302	30
Alışkanlıklarım değişmesin	,7500	,35510	30

Table C.5 Reallocation data for Social Deviance

Correlations						
		Zamanım azalsın	Faturam azalsın	Harcadığım fiziksel emek azalsın	Harcadığım zihinsel emek azalsın	Alışkanlıklarım değişmesin
Zamanım azalsın	Pearson Correlation	1	-,301	-,181	-,500	-,287
	Sig. (2-tailed)		,106	,339	,005	,125
	N	30	30	30	30	30
Faturam azalsın	Pearson Correlation	-,301	1	-,626	-,299	-,139
	Sig. (2-tailed)	,106		,000	,109	,465
	N	30	30	30	30	30
Harcadığım fiziksel emek azalsın	Pearson Correlation	-,181	-,626	1	,102	-,023
	Sig. (2-tailed)	,339	,000		,590	,902
	N	30	30	30	30	30
Harcadığım zihinsel emek azalsın	Pearson Correlation	-,500	-,299	,102	1	-,042
	Sig. (2-tailed)	,005	,109	,590		,826
	N	30	30	30	30	30
Alışkanlıklarım değişmesin	Pearson Correlation	-,287	-,139	-,023	-,042	1
	Sig. (2-tailed)	,125	,465	,902	,826	
	N	30	30	30	30	30

Descriptive Statistics			
	Mean	Std. Deviation	N
Zamanım azalsın	1,1167	,81031	30
Faturam azalsın	1,2167	,89137	30
Harcadığım fiziksel emek azalsın	,9167	,64971	30
Harcadığım zihinsel emek azalsın	,5000	,62146	30
Alışkanlıklarım değişmesin	,2500	,39719	30

Table C.6 Reallocation data for Routines

Correlations

		Zamanım azalsın	Faluram azalsın	Harcadığım ilaiksel emek azalsın	Harcadığım zihinsel emek azalsın	Toplumdan bir farkım olsun
Zamanım azalsın	Pearson Correlation	1	-,501	-,185	-,112	-,135
	Sig. (2-tailed)		,005	,321	,557	,476
	N	30	30	30	30	30
Faluram azalsın	Pearson Correlation	-,501	1	-,213	-,355	,136
	Sig. (2-tailed)	,005		,257	,054	,474
	N	30	30	30	30	30
Harcadığım ilaiksel emek azalsın	Pearson Correlation	-,185	-,213	1	,110	-,461
	Sig. (2-tailed)	,321	,257		,561	,010
	N	30	30	30	30	30
Harcadığım zihinsel emek azalsın	Pearson Correlation	-,112	-,355	,110	1	-,191
	Sig. (2-tailed)	,557	,054	,561		,311
	N	30	30	30	30	30
Toplumdan bir farkım olsun	Pearson Correlation	-,135	,136	-,461	-,191	1
	Sig. (2-tailed)	,476	,474	,010	,311	
	N	30	30	30	30	30

Descriptive Statistics

	Mean	Std. Deviation	N
Zamanım azalsın	1,1800	,38480	30
Faluram azalsın	1,1133	,32180	30
Harcadığım ilaiksel emek azalsın	,8633	,63815	30
Harcadığım zihinsel emek azalsın	,2633	,44893	30
Toplumdan bir farkım olsun	,5800	,50306	30