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THE WORLD AS A BURNING CANDLE:

The influence of complexity of visual metaphors on their persuasive power

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Abstract

The research explained in this thesis investigated the persuasive impact of visual metaphors that differ in complexity, across cultures. In a taxonomy proposed by Philips and McQuarrie (2004), visual metaphors were categorized by complexity. We argued that visual metaphors will have stronger persuasive effects as they become more complex, that is, as the meaning is still comprehensible. Relatedly, recent research (e.g. Le Pair and Van Mulken, 2008) suggested that visual metaphors are understood better in high context cultures. Therefore, we expected that the persuasive power of visual metaphors might be stronger in high context cultures (versus low context cultures). In two studies (the Netherlands, and Japan), we investigated the persuasive effects of a visual metaphor that communicated energy consumption feedback during several (virtual) energy consumption tasks. Trends were found indicating that persuasive effects were stronger when visual metaphor becomes more complex. Persuasive effects were in general stronger among the Japanese. However, among the Japanese energy consumption increased within the most complex visual metaphor. Further investigation indicated that people had difficulties to comprehend the meaning, which could explain the effect found.

Preface

By writing this preface I am putting the finishing touch on my thesis, and ending over one year of hard work. This thesis will serve as a partial fulfillment of the requirements of the degree of Master of Science in Human-Technology Interaction, which included a collaboration of Eindhoven University Technology (the Netherlands) and Waseda University (Japan).

The past year had its ups and downs, but the most important part is that I gained a lot of new experiences. Especially in the field of cultural differences. When entering an unknown world it is easy to have prejudices that may seem obvious and logical from a distance, but over time it becomes clear that you can be so wrong. Things may not always as they seem. Living in another country have made me change my perspective on the world. Most importantly it made me realize to never stop asking the most annoying, but most rewarding question: why?

This thesis would not have been possible without the guidance and support of my supervisors at Eindhoven University of Technology, prof. Cees Midden and dr. Jaap Ham. I also want to thank my supervisors at Waseda University, prof. Tatsuo Nakajima and dr. Hiroaki Kimura, for giving the opportunity to conduct the research in Japan and letting me use the facilities of their laboratory.

My special thanks goes out to Akihito Yoshii for his effort in making the experiment available in Japan by translating all the parts into Japanese and extensive support during the execution. Francisco Lepe, Yoshio Funabashi, and Renji J Lie for their contribution to gather participants for my experiment in Japan. I also want to thank the two graphical designers, Sabrina Hoondert and Regien Donders, who supported me in the creation of the visual metaphors with their refreshing view on graphical design and Rob Hulleman for his constructive feedback. I want to thank all the new wonderful people I have met, contributing to the pleasant time I had during my period abroad. Last but not least, I want to thank Yangji Lee for broadening my view on the world.

As usual the beloved ones, the ones who are closest, had to suffer most from this path I took. Thank you for your unconditional support and understanding. I owe you.

Bruce.

Index

1. Introduction

The entire world is affected by a variety of environmental problems caused by human behavior. Only a few societies are still left untouched by major environmental problems, but for how long? If we do not take action it might be just a matter of time before our precious environment is irreparably damaged. As globalization continues, the earth's natural processes transform local problems into internationals issues.

For the last couple of decades, the world has encountered massive growth in its population. According to estimations of the United States Census Bureau (2011) the current world population is estimated to be 6.93 billion people and is still continuously growing. This massive growth in population has its consequences; the world's energy consumption increases. With that, the need for energy rises too. Our natural environment is suffering by this increasing use of energy. Indications of The Energy Outlook 2010 (Energy Information Administration 2010) show that the world's energy consumption will grow with 49% in 2035. That if, no measures are taken.

Scientific research suggests that the core of the environmental problems is traceable to human activities that consume natural resources, resulting in the production of pollution. The seriousness of the environmental problems seems to have been acknowledged by the authorities. Nowadays, many governments and environmental authorities are trying to make their societies aware of the increasing environmental problems underlying the current way of energy usage. By using structural solutions, as well as investing in efficient systems and devices and the development of renewable energy sources, nations worldwide are trying to seek ways that provide substantial reductions in energy consumption among consumers. The effects of these methods are questionable. Structural solutions might not be effective in a sense that it does not increase awareness. As research has suggested, the use of green technologies might have its drawbacks. When people are using green technologies, there is a chance that they will take it back by higher consumption. Midden and Meijnders (2001) described this effect as the "rebound effect".

It goes without saying that developing safe and environmentally friendly technologies plays an important role in the reduction of pollution. However, the focus of

encouraging environmental friendly behavior seems not only to be within promoting certain technologies, but more importantly to change people's behavior. In order to increase awareness, we have to search for effective ways to change people's behavior alongside introducing environmentally friendly technologies.

The next paragraphs will provide background information of the components used in this study to increase people's awareness to achieve behavioral change across cultures.

1.1 Persuasive Technologies

As previously discussed, we have to seek ways to change people's behavior in order to increase environmental awareness. A powerful tool to accomplish this is with persuasion, which implies a voluntary change of behavior, attitude or both. Where it is part and parcel of human interaction, humans are without a doubt the strongest persuaders. As IJsselsteijn, De Kort, Midden, Eggen and Van den Hoven (2006) point out about human persuaders:

"They have an unmistakable social presence and impact, can sense the appropriate timing, mood and context as opportunities for another person to be persuaded, and have a keen, mostly intuitive sense of the social psychological principles of persuasion, such as praise, reciprocation, similarity, or authority" (*p.* 1).

In this ever evolving world where technologies are becoming more and more advanced and sophisticated in such a way that they are becoming embedded into our lives, technology can become a powerful tool in the persuasion process. When allowing persuasive techniques to be interactive, the key of successful persuasion may lie between the interaction of human and technology. That is, letting these techniques to alter and adjust the pattern of interaction based on the characteristics or actions of the persuaded party (IJsselsteijn et al., 2006). This notion has led to the investigation of persuasive technologies. Persuasive technologies are broadly defined as technologies that are designed to change attitudes or behaviors of the users through persuasion and social influence, but importantly not through coercion or deception (Fogg, 2003).

Fogg (2003) points out that computer-mediated persuasion can have advantages over human persuaders. Such as: computers can be more persistent, can allow anonymity, can access and control a virtually unlimited store of data, can use many modalities to create a seamless and convincing experience, and can adapt to the context. Meaning that computers can gain access to areas where human persuaders would not be welcomed and to areas where human persuaders are physically unable to go. Furthermore, persuasive software that has been proven successful can easily be replicated and distributed.

As research has shown already, persuasive technologies can play an important part in changing people's behavior. For example; using interactive feedback as a persuasive technology by embedding it in user-system interaction has already shown successfully (e.g. McCalley & Midden, 2002). Fischer (2008) compared studies assessing effects of feedback on energy consumption and concludes that feedback indeed promotes energy conserving behavior. Giving feedback on a task can lead to energy savings up to 20% (Fischer, 2008).

Different interactive forms to present feedback can be thought of. For example; McCalley and Midden (2002) used an energy meter reflecting the user's energy consumption. Most of the research on feedback is using some kind of verbal feedback displaying either the consumption (e.g. kWh), costs, or both (for an overview see Fischer, 2008). The attention of users seem to shift to the verbal aspects of the feedback, but as seen in the domain of advertisement visual aspects can be just as, if not even more, important and therefore can play an important part in the process of persuasion.

1.2 Visual metaphors as a persuasive technology

"Un bon croquis vaut mieux qu'un long discours."

- Napoleon Bonaparte

Or "A good sketch is better than a long speech" and sometimes even translated as "A pictures is worth a thousand words", they are all referring to the fact that a complex idea can be conveyed with a single image. When used correctly, a visualization of a complex idea makes it possible for a person to easily absorb a large amount of data.

The visual properties of these visualizations can be distinguish in two forms; rhetoric and non-rhetoric figures. As research on visualizations indicate, rhetoric figures such as visual metaphors are found to be appreciated more over non-rhetorical figures (e.g. McQuarrie & Mick, 1992; 1999; 2003). Meyers-Levy and Malaviya (1999) found that a more complex figure contributes to higher appreciation. A meta-analysis of Brown and Staymann (1992) of 33 experiments showed that there is a relationship between appreciation of advertisements and the underlying brand. According to Van den Berg, Duijnisveld, and Smit (2004) a higher brand appreciation can influence buyers intention. This indicates that visual rhetoric can have strong persuasive effects.

Different kind of rhetoric figures can be distinguished, such as; metaphor, rhyme, puns, irony, and antithesis, along with other more obscure devices, such as ellipsis, metonym, and anti-metabole. Probably the best known in the series of rhetoric figures is metaphor. A metaphor can be defined as an artful deviation from audience expectation that occurs at the level of style, not content, and is not judged as an error by the audience (McQuarrie & Mick, 1996). The difference between metaphor and other styles of rhetoric figures is that metaphor compares two objects through analogy by suggesting that one object is figuratively like another, although they are literally quite different (Stern, 1990). The similarity between the two objects becomes understood as reasonable, once the comparison is made (Salomon, 1979).

Despite studies focusing on persuasive effects of visual rhetoric, still little is known about the actual effect of different visual and verbal properties of images. As McGuire (2000) noted about current research:

"students of persuasion, including those in consumer research, should give more attention to the neglected topic of how message style variable of figurative language affects the perception and persuasive impact of a communication" (*p.* 113).

1.2.1 Benefits of visual metaphors

Over time, visual metaphors are being used increasingly in the field of advertisement. Philips and McQuarrie (2001) found in a study of rhetorical figures over time (1954 – 1999) that visual metaphors appeared in all of the time periods. Three main reasons has been identified by previous research why advertisers benefit from the use of visual metaphors; attention, elaboration, and pleasure.

Under low-involvement magazine reading and normal cluttered viewing conditions, McQuarrie and Mick (2002) found that ads with visual metaphors are more likely to be noticed by readers. According to them, this greater consumers' attention is due to their deviation of expectation in these ads.

Visual metaphors also elicited greater elaboration because they require completion by the consumer. By drawing an inference from the ad's image, a consumer tries to comprehend a visual metaphor. By using message information to generate assumptions and integrate them with prior knowledge, inference occurs through elaboration (Malaviya, Kisielius, & Sternthal, 1996). People commonly tend to do as little effort as possible to process stimuli (Heath, 2001). Therefore, consumers will search for a simple inference that associates the two objects. Whenever a simple inference fails to be found, alternatives are being sought for. However, the number of possible inferences considered is likely restricted to the limited capacity of the working memory (Sawyer & Howard, 1991).

Accessibility of the inference in memory improves due to the cognitive effort involved in drawing an inference from a visual metaphor. Meaning that accessible inferences are held with more confidence, are resistant to change, and exert a strong influence on behavior (Kardes, 1993). However, when cognitive effort are expended by consumers, fewer cognitive resources become available to create counter arguments for the ad's claims. Resulting in an easier acceptance of the ad's message (Kardes, 1993).

Ads with visual metaphor may produce deeper elaboration and a more positive attitude toward the ad than a similar ad without the usage of visual metaphor (McQuarrie & Mick, 1999). According to Peracchio and Meyers-Levy (1994), many consumers enjoy and get a sense of pleasure from figuring out the meaning of visual metaphor. Visual metaphors are most pleasurable if they are perceived as apt. That is, clever, appropriate,

and insightful (Ward & Gaidis, 1990). As stated by Ward and Gaidis (1990), the most pleasurable metaphors are those which show large overlapping attributes between two widely separate domain categories. A metaphor is seen as trite and obvious when it is comparing two objects with closely related domains. Due to the fact that apt metaphors make use of a comparison of two widely different objects, the problem occurs that there is a chance that they are less likely to be comprehended than metaphors which are more obvious in their comparison (Ward & Gaidis, 1990). Visual metaphors which are not comprehended are less likely to be liked by consumers (McQuarrie & Mick, 1992; 1999). The challenge of creating visual metaphors seems, therefore, to find a balance between making them sufficiently apt to induce pleasure, but simple enough to be comprehended.

1.3 Taxonomy of visual metaphors

A visual image can consist rhetorical or non-rhetorical figures. Studies have shown that images consisting of rhetorical figures are appreciated higher and rated more likeable (McQuarrie & Mick, 1999; 2003). As stated by McQuarrie and Mick (1999) rhetorical figures are:

"artful deviations, relative to audience expectation, that conform to a template independent of the specifics of the occasion where they occur" (*p*. 38)

McQuarrie and Mick (1996) defined a taxonomy to categorize figures of verbal rhetoric. As shown in Figure 1 the mode of figuration divide rhetorical figures into two categories; schemes and tropes. Each constitutes a distinctive kind of deviation. Schemes are straightforward and do not need further explanations. They are excessively regular or ordered. Tropes, however, are more complex and meaningful. They are irregular or disordered. Both schemes and tropes, however, function as text marking. They both produce incongruity and provide a pleasure of the text, but they do so by using different means. The rhetorical operation is the final level of the taxonomy that makes an internal distinction within schemes and tropes, each having simple and complex varieties.

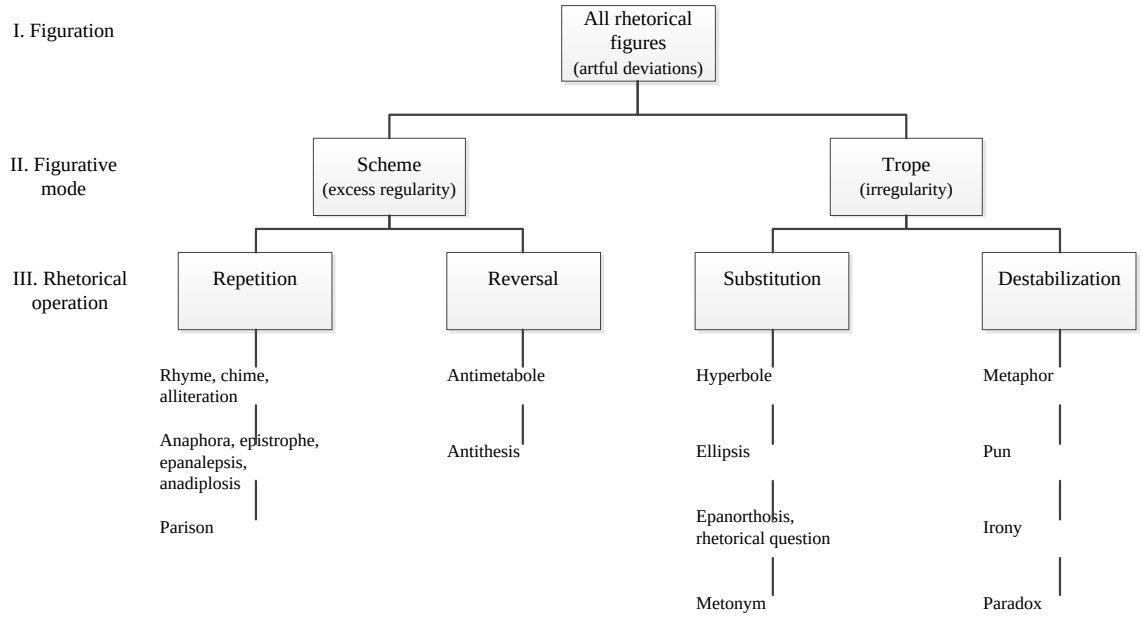


Figure 1. Rhetorical framework McQuarrie and Mick (1996)

Within the rhetorical framework of schemes and tropes, McQuarrie and Mick (1996) tried to combine meaning operations of both visual and verbal rhetoric. However, verbal communication contains more often schematic figures, while visual communication contains more often tropical figures (Van Mulken, 2003). As Phillips and McQuarrie (2004) noted:

''because pictures are not speech, we shall argue that existing taxonomies designed for verbal rhetorical figures (e.g., McQuarrie and Mick, 1996) do not adequately capture important differentiations within the visual domain'' (*p*. 114).

Phillips and McQuarrie (2004) argue that there is a need for a more refined framework within the field of visual rhetoric. Therefore, they defined a framework for visual rhetoric (Figure 2) based on earlier work of Durand (1987) and Forceville (1996). Amongst others, this framework distinguishes three levels of visual structure; Juxtaposition, Fusion, and Replacement. Juxtaposition refers to an alignment where the source and target domain are placed separately. The source and target domain are combined, fused together, with the Fusion metaphor, and Replacement refers to an alignment where the target domain is completely replaced by the source domain.

Besides visual structure, Phillips and McQuarrie (2004) also distinguish three levels of meaning operation; connection, similarity, and opposition. Here consumer inferences are directed toward how the depicted elements (A and B) can be associated to create a link between them (Figure 2).

		Richness →		
		Meaning Operation		
	Visual Structure	**Connection** (‘A’ is associated with ‘B’)	**Comparison**	
			Similarity (‘A’ is like ‘B’)	**Opposition** (‘A’ is not like ‘B’)
Complexity ↓	**Juxtaposition** (Two side-by-side images)			
	Fusion (Two combined images)			
	Replacement (Image present points to an absent image)			

Figure 2. Topology visual metaphor Phillips and McQuarrie (2004)

Phillips and McQuarrie (2004) argue that within the levels of visual structure an increasing degree of complexity occurs. According to them it will cost the consumer more effort to process a visual metaphor that is based on Fusion than a visual metaphor based on Juxtaposition. This because the identity of the depicted items within Juxtaposition is clearer, while that is less clear within Fusion. The most complex metaphor, however, is Replacement. Not only does the consumer have to identify that there is a second depicted item, she also have to identify it.

The framework proposed by Phillips and McQuarrie (2004) seems promising and is used in this study to investigate the persuasive power of visual metaphors used as

feedback. This study, however, will not use the entire framework, but will only focus on different levels of complexity within the level of similarity.

1.4 Universality of visual metaphors

The question then arises whether visual metaphors can be of universal nature. That is, do visual metaphors elicit the same persuasive effects across cultures. Kövecses (2005) mentioned that a broader cultural context can override universal mapping in metaphors and therefore universality can be questioned. Earlier research also suggests that the impact of visual metaphors differs between cultures (e.g. Fogg & Iizawa, 2008; Gaumer & Shah, 2004; Johansson, 1994; Le Pair & Van Mulken, 2008). That is, Le Pair and Van Mulken (2008) found differences among Spanish, French, and Dutch population on appreciation of visual metaphors. Therefore strategies using visual metaphors cannot be assumed universal.

According to Le Pair and Van Mulken (2008) this finding is due to cultural differences in communication style, which has been first defined by Hall (1976; Hall & Hall, 1990). Spanish and French communicate in a more implicit and indirect way in which information is part of the physical context, as seen in a high context culture. The Dutch, however, communicate more explicitly and directly. This communication style is typical for low context cultures.

De Mooij (2008) tried to explain these effects of differences in communication styles with the fact that “People can derive different meanings from the same message because contextual [high-context] people will 'see' more in the message [...]” (*p*. 208). Indeed, as Callow and Schiffmann (2002) have shown in their study, consumers from a high context culture are more proficient at deriving implicit meaning from visual metaphors than those from a low context culture.

1.4.1 High vs. Low context cultures

Hall (1976) was one of the first who suggested a categorization of cultures into high and low context in order to understand their basic differences in communication style and cultural issues. Communication style refers to the way of expressing oneself using culture typical communication patterns. Cultural issues, however, include certain societal factors, such as country's status, history, religion, and traditions. Also, Hofstede's (2008) individualism and collectivism dimension is included within cultural issues.

As stated by Hall (1976) about high context (HC) communication:

"a high-context communication or message is one in which most of the information is either in the physical context or internalized in the person, while very little is in the coded, explicit, or transmitted part of the message" (*p.* 91).

The communication style in HC cultures is influenced by the closeness of the human relationships, well-structured social hierarchy, and strong behavioral norms (Kim, Pan & Park; 1998). Within a HC culture not everything is explicitly stated in writing or when spoken. The internal meaning is usually embedded deep in the information. Therefore, the listener is expected to able to read *"between the lines"* in order to understand the unsaid with the already contained background knowledge.

According to Gudykunst and Ting-Toomey (1988) communication in HC cultures is indirect, ambiguous, harmonious, reserved, and understated. In a conversation the speaker is seldom interrupted, people tend to speak one after another in a linear way. Communication involves more of the information in the physical context or internalized in the person; greater confidence is placed in the non-verbal aspects of communication than the verbal aspects (Hall, 1976). As cultural issues concern in a HC culture, they are very stable, unified, cohesive, and conservative. People tend to rely on their history, status, and relationships (Nishimura, Nevgi & Tella, 2009).

Low context (LC) cultures are characterized by their direct and explicit meanings stated through language. When something remains unclear, people anticipate an explanation. Most information is expected to be in the transmitted message in order to compensate for what is missing in the internal or external context (Hall, 1979).

Gudykunst and Ting-Toomey (1988) describe LC communication as direct, precise, dramatic, open, and based on feelings or true intentions. LC cultures typically favor individualism over collectivism and group harmony. Individualism is characterized by members prioritizing individual needs and goals over those of the group (Triandis, Brislin & Hui, 1988). Furthermore, the notion of politeness also seems to differ between these two contextual cultures. In an LC culture, it is thought to be polite to ask questions that in an HC culture often seem too personal and even offensive (Tella, 2005).

1.5 Additional predictors

Phillips and McQuarrie (2004) defined a new typology for visual metaphors. With that they proposed moderator and mediator variables as an individual difference factor, which may influence the persuasive effects of the visual metaphor. Such as: Need for Cognition, Style of Processing, and people's attitude towards the visual metaphor. Besides these variables as an individual difference factor, an effect of people's General Ecological Behavior may occur since this study is concentrating on ecological behavior.

1.5.1 Need for Cognition

Need for cognition (NFC) is conceptualized as the tendency to engage in and enjoy effortful cognitive activities (Cacioppo & Petty, 1982). Different people exhibit varying levels of NFC. These different levels of NFC can help to predict how people deal with tasks and social information (Cacioppo & Petty, 1982). Studies of NFC link it to information-seeking behavior. Carenini (2001), for example, showed that people's willingness to use complex interface systems and applications is influenced by NFC. Those who score high on NFC are usually the ones who prefer cognitive challenging activities and do not seem to need external motivation for that. They are fully considering all the relevant information before making any judgment. However, those who score low on NFC usually only engage in cognitive challenges only when they need to. They are more likely to rely on simple cues (Haugtvedt, Petty, & Cacioppo, 1992) and stereotypes when making judgments.

To measure NFC, Cacioppo and Petty (1982) developed a 34-items scale. This scale which is being used here is the revised 18-item NFC scale developed by Cacioppo, Petty and Kao (1984).

1.5.2 Style of Processing

The Style of Processing (SOP) conceptualize processing as a preference and propensity to engage in either verbal or visual modality of processing information. Individuals who score high on the verbal scale tend to prefer verbal constructs, while individuals who score high on the visual scale tend to have a preference for visual constructs. These scales do not only indicate the preference of an individual, but also reflects the ability of information processing.

To validate the processing style of people, the 22-item SOP scale is being used by Childers, Houston, and Heckler (1985), based on Vividness of Visual Imagery Questionnaire (Marks, 1973), Visual Imagery Control (Bower, 1970), and Verbalizer Visualizer Questionnaire (Richardson, 1977).

1.5.3 Attitude towards the visual metaphor

As earlier studies already indicate, different kind of visualizations can elicit different levels of appreciation towards that visualization (e.g. Brown & Staymann, 1992; Meyers-Levy & Malaviya, 1999; McQuarrie & Mick, 1992; 1999; 2003). That is, McQuarrie and Mick (1992; 1999; 2003) found that rhetoric figures are more appreciated than non-rhetoric figures. Meyers-Levy and Malaviya (1999) argue that a more complex figure contribute to a higher appreciation.

1.5.4 General Ecological Behavior

General Ecological Behavior (GEB) scale assesses people's ecological behavior through different six domains; energy conservation, mobility and transportation, waste avoidance, consumerism, recycling, and behaviors towards conversation (Kaiser, 1998).

To validate people's GEB, the 50-item scale is being used by Kaiser (1998).

1.5.4.1 Rasch model

The General Ecological Behavior scale developed by Kaiser (1998) applies an item response theory model; Rasch model (Wright & Matters, 1982). The Rasch model reduces problems of self-report because results are interpreted in terms of probabilities.

The Rasch model describe the expected relationship between people's self-reports, individual susceptibilities, and the invariant processing demands in a mathematical form (Bond & Fox, 2007);

$$\ln\left(\frac{p(x_{ni}=1)}{1-p(x_{ni}=1)}\right)=\theta_n-\delta_i$$

The model reflects the probability that person *n* agrees to have encountered a certain behavior *i* (e.g. *n* washes dirty clothes without prewash). This probability is governed by two factors: *n*'s susceptibility to the ecological behavior (θ_n), and the specific processing demand required to act to the desired behavior *i* (δ_i). By using conventional maximum-likelihood estimations, individual susceptibility and the processing demands of each experiential effect could be estimated. Therefore, it is important that the data fit the model to a reasonable extent for the estimated susceptibility to be meaningful.

2. The current research

As Philips and McQuarrie (2001) have found in a study of rhetorical figures in advertisements that visual metaphors are being increasingly used. Most of the available research on visual metaphors has focused on appreciation (e.g. McQuarrie & Mick, 1992; 1999; 2003) and sometimes including verbal anchoring (Le Pair & van Mulken, 2010). However, appreciation is not persuasion. As McGuire (2000) noted, still little is known about how message style variable of figurative language affects the persuasive impact of a communication. Research that did investigate persuasive effects, such as Jeong (2008), have been mainly focusing between differences of metaphorical and non-metaphorical visualizations and seems to neglect the fact that differences in the categorization of visual metaphors can also exist.

According to Phillips and McQuarrie (2004), visual metaphors can be categorized by complexity. Meyers-Levy and Malaviya (1999) found that a more complex figure contributes to higher appreciation. By varying the complexity of visual metaphors, differences in persuasive effects can occur. Therefore, eliciting the appropriate amount of complexity in visual metaphors, persuasive effects can be maximized.

The current research will focus on the persuasive effects within visual metaphors. That is, visual metaphors with differences in complexity are used according to the framework of Phillips and McQuarrie (2004).

Kövecses (2005) noted that universality of visualizations can be questioned due to a broader cultural context that can override universal mapping in metaphors. As different studies indicated (e.g. Fogg & Iizawa, 2008; Gaumer & Shah, 2004; Johansson, 1994; Le Pair & Van Mulken, 2008), metaphors can have different effect across cultures. Therefore, not only differences in complexity of visual metaphors are investigated, but also across cultures with a pronounced difference in communication style. We decided to go along with the categorization of high and low context cultures proposed by Hall (1976, Hall & Hall 1990) in this study. Two cultures with a pronounced difference in communication style are chosen; the Netherlands (low context culture) and Japan (high context culture).

2.1 Difference between the Netherlands and Japan

Western countries as the Netherlands are characterized by their direct way of communicating and therefore seen as typical low context cultures. Within Eastern countries as Japan, on the other hand, indirect communication is more pronounced and therefore seen as typical high context cultures (Hall, 1976; Hall & Hall, 1990).

To ensure that both cultures are sufficiently different, Hofstede's (2008) cultural dimensions are consulted. The five dimensions of cultural differences defined by Hofstede (2008) indicate large dissimilarities between the Netherlands and Japan. Almost on every dimension in the model of Hofstede (2008), the Netherlands and Japan score in opposite directions, which gives ample evidence to believe that the Netherlands and Japan are indeed different enough to assume that visual metaphors can have different persuasive effects.

Therefore, the following research question is defined:

What is the influence of metaphor's visual complexity and cultural communication style on the persuasive power of a metaphor used to give feedback?

According to Meyers-Levy and Malaviya (1999) there is a relationship between complexity of a figure and appreciation towards the figure. A higher appreciation towards a figure can have influence on its persuasive effects (Duijnisveld & Smit, 2004). We hypothesize that persuasive effects are stronger when a visual metaphor gets more complex for both countries (H1). That is, if people are still able to comprehend the meaning of the visual metaphor (McQuarrie & Mick, 1992; 1999).

As for the persuasive strength of visual metaphors in a high versus low context culture, persuasion of visual metaphors will be stronger among the Japanese, caused by differences in communication style (H3). Because Asian countries like Japan communicate in a more implicit way, they are already more used to find the meaning behind a message such as with a metaphor. The Dutch, however, are more used to explicit communication. Therefore, the persuasive effects of visual metaphors will be less strong among Dutch participants. A high context culture will find in general visual

metaphors more joyful to comprehend due to their attitude towards the visual metaphor and therefore persuasive effects are expected stronger among the Japanese (H2).

2.2 Need For Cognition

Higher NFC indicates people's tendency to engage in more cognitive challenging activities, whereas people with lower NFC tend to have a more superficial view. When visual metaphor is becoming more complex, stronger persuasive effects of visual metaphor are being expected. With that, it is expected when visual metaphor is more complex it will demand more of people's NFC (H4). Due to the fact that more complex visual metaphor require more cognitive demanding processing to be comprehended.

2.3 Style of Processing

Since the visual metaphors used in this study only consist visual information, a moderator effect is expected of the persuasive power of the visual metaphors used. It is expected that when visual metaphor is becoming more complex, it will require more of people's SOP (H5).

2.4 General Ecological Behavior

This study explores the influence of different kind of visual metaphors on people's energy consumption. Therefore, people's General Ecological Behavior (GEB) can explain part of the variance and is controlled for. It is expected that people who already have a more ecological attitude will also show more energy conservative behavior during the study. That is, people who score high on the GEB scale already show more ecological behavior in their daily life and awareness is already present, providing them a foreknowledge advantage of environmental friendly behavior and might be more motivated to improve their performance when negative feedback is given. Expected is that people who score high on the GEB scale result in better performance in this study compared to those who score low on the GEB scale (H6).

3. Methods

Two studies were conducted; the Netherlands and Japan. In both studies, participants were asked to participate in a computer application with energy consumption tasks during 7 virtual days. Participants had to adjust different variables in each tasks as such that as much as energy would be saved, but still feel comfortable about it. On each day different tasks included: washing machine, thermostat, travel, and laptop. Furthermore, a weather condition is given on each new day with the note that this can influence the outcome of each task.

Corresponding to the experimental condition participants were placed in, feedback was given with a visual metaphor indicating their performance after each task. At the end of the experiment, participants were asked to fill in questionnaires about different moderator effects mentioned in the previous chapter.

As an incentive, every participant was rewarded with €10,- for non-students and €7,50 for students of the Dutch participants. The Japanese participants received an incentive of ¥500,-.

3.1 Pre-test

To be sure that the visual metaphors being used have the required complexity, a pre-test was conducted using different sets consisting of; Juxtaposition, Fusion, and Replacement. Four sets consisting of three visual metaphors depicting different kinds of complexity have been created by several graphical designers. The set that showed the most variance in complexity between the three types of metaphors, was used in the experiment.

The pre-test was conducted in an online application amongst people with no pre-knowledge of the study. Participants were exposed to in total 12 visual metaphors (4 x 3 categories). Each visual metaphor was shown for 5 seconds whereas participants were asked complexity questions about the just seen visual metaphor afterwards.

Set 1 and set 4 were the only sets returning significant (table 1). Set 4 showed the most variance in complexity and therefore used in this study (figure 3, for a more detailed view of the visual metaphors see Appendix III).

Table 1. Marginal means of the different sets used in the pre-test

	Juxtaposition	Fusion	Replacement
Set 1	0*	-1.455*	-2.468*
Set 2	0	0.254	-0.012
Set 3	0	-0.166	-0.663
Set 4	0*	-1.156*	-2.453*

* $p < 0.001$

Figure 3. Visual metaphors (Juxtaposition, Fusion, and Replacement)

3.2 Design

The experiment consisted of a 2x3 between subjects experimental design (table 2); culture context (high/low) x complexity (Juxtaposition, Fusion, and Replacement) on energy consumption. The manipulation of cultural context has been done by conducting half of the experiment in a low context culture (the Netherlands), whereas the other half of the experiment took place in a high context culture (Japan). Participants were placed in one of the visual metaphor complexity conditions, where they had to do several tasks concerning energy consumption. After each task, the participant received feedback according to one of the experimental conditions.

	Juxtaposition	Fusion	Replacement
The Netherlands			
Japan			

Table 2. Experimental design

Evaluations of different moderator effects and independent variable were done by having participants fill in questionnaires; General Ecological Behavior (Kaiser, 1998), Need for Cognition (Cacioppo & Petty, 1982), Style of Processing (Childers, Houston & Heckler, 1985), and people's attitude toward the visual metaphors.

3.2.1 General Ecological Behavior

Applying the Rasch model, the GEB scale consist 50 statements that represents an achievement test of a person's overall ecological behavior by considering different ecological and pro-social behaviors.

For 32 of the 50 statements participants were asked to indicate the frequency that they perform the ecological behavior by means of six response categories, labeled "Never", "Seldom", "Occasionally", "Often", "Always", and "NA". The use of a polytomous response format is more convenient for participants to answer. According to Kaiser and Wilson (2000) however, the subjective use of response categories can cause arbitrary and less reliable answers. In line with Linacre (2009) we decided to recode the 32 statements into a less measurement error-sensitive dichotomous format. This causes the interpretation of the subsequent calibrations to be more straightforward without affecting the scale's intended meaning. Therefore, "Never", "Seldom", and "Occasionally" are merged into a single category as well as "Often", and "Always". A "NA" answer indicate that the statement is not applicable to the participant. This response cannot be considered meaningful, and therefore treated as missing value.

The remaining 18 statements participants are asked to indicate whether they do a certain behavior or not by answering "Yes", "No", or "NA". Since this is already a dichotomous scale, recoding is not necessary. Again, a "NA" answer is treated as a missing value because this cannot be considered as meaningful.

To ensure validity, the data will be complemented with existing datasets of the GEB when necessary. Whereas the participants of the experiment can be filtered out again after validating. A complementing dataset for the Dutch population is already available, while a separate questionnaire have to be spread among the Japanese population.

3.3 Participants

The Dutch sample was drawn from the participant database of the JF Schouten School at Eindhoven University of Technology, Eindhoven, the Netherlands. Eighty-four people participated, consisting students as well as non-students. The mean age was 24.07 (*SD* = 7.338; range 18 to 57) and were all of Dutch nationality. Students received €7.50 as compensation and non-students €10,-.

Participants for the Japanese study were recruited throughout Waseda University, Tokyo, Japan. The mean age of the Japanese sample was 20.889 (*SD* = 2.398; range 18 to 25). Eighty-four people participated consisting only students. Just as for the Dutch sample, the Japanese sample also included only native people. Whereas the Dutch sample consisted a mixture of students and non-students, the Japanese sample only consisted students. Students received ¥500,- as compensation for their participation.

3.4 Procedure

Since the experiment in both countries only used native people, the experiments were conducted in the participant's native language. English questionnaires for the Dutch study were translated. Whereas, the Dutch experiment was translated for the Japanese version of the experiment. To ensure that the Japanese version was an exact replicate of the Dutch version, translation was improved by using a back-translation procedure (Brislin, 1970).

Participants were invited to participate in a study on energy consumption. Four cubicles were available for the participants to take place. Each cubicle was randomly

assigned to one of the three experimental conditions. After the participants were guided to one of the cubicles, further instructions were given on the screen.

One of the expected effects on energy consumption is people's ecological behavior. The participants were asked about their ecological behavior prior to the start of the experiment by using the General Ecological Behavior scale (Kaiser, 1998). It was decided to ask these questions beforehand to prevent biased results due to the energy consumption tasks which can cause a more ecological attitude afterwards.

After the GEB questionnaire, participants were instructed about the experiment. Participants were told that they were going to perform tasks regarding energy consumption and that feedback is given on their task performance by different kind of visualizations after each task. Examples of such feedback followed. After these examples the experiment started.

Participants were told that the experiment is conducted in a simulated environment including four tasks about energy consumption for seven virtual days. A weather prediction was given before each day started. The experiment included simulated everyday tasks (28 task for the Netherlands, 21 task for Japan). A pre-test was conducted in Japan to ensure that the tasks were interpreted the same way as in the Netherlands. The interpretation for the washing machine task was to different, therefore it was decided to exclude task. A weather prediction was given before each day started. It was told that this weather condition can have influence on the task, and that they should consider this when adjusting the settings of each task. On each day different kind of energy consumption tasks were performed including; washing machine, thermostat, travel, and laptop (figure 4, for a more detailed view of the energy consumption tasks see Appendix IV).

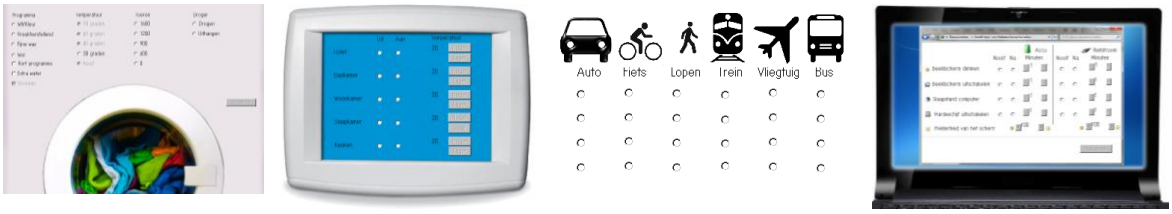


Figure 4. Energy consumption task (washing machine, thermostat, travel, and laptop)

On each of the seven days, participants had to perform all of the four tasks. Besides the changing weather condition, each task was a little different as compared to the same task on another day. Such as; washing clothing on one day and towels on another day, travel to school on one day and travel to a friend on another day, or on one day it is rainy while on a another day it is sunny. However, the thermostat task had a fixed influencing factor included. It was told that beside the weather condition which could have influence on the task, also the size of the room should be taken into account. That is, a larger room will cost more energy to heat up compared to a smaller room. This to simulate a real-life situation as good as possible.

While tasks could be slightly different as compared to another day, the main goal for each tasks remained the same. That is; save as much as energy, but still feel comfortable about it. Obviously, when it is freezing, turning all the heaters off will not contribute to a comfortable feeling even though this is the most efficient way to save energy.

After completion of each task, participants were given feedback corresponding to the experimental condition they were placed in (Juxtaposition, Fusion, or Replacement). The visual metaphors used as feedback showed in a dynamical way the task performance of the participants, by using ten steps the image of the visual metaphor dynamically changed to the result corresponding to the participant's task performance.

After finishing all the tasks, participants were asked four questions about their attitude towards the feedback. Questions included "Do you think the feedback was useful?". To assess moderator effects, two questionnaires followed after that; Need for Cognition (Cacioppo & Petty, 1982), Style of Processing (Childers, Houston & Heckler, 1985).

Participants were paid at the end of the experiment and could fill in a form if they wanted to be informed about the results. Furthermore, they were asked about their experiences for possible errors in the experiment.

4. Results

Results of both studies, as described in chapter 3, are shown in the next paragraphs. Presenting first the results of the study done the Netherlands, followed by the results of Japan and concluding with the comparative results of both.

The replication of the experiment involved a pre-test of the energy consumption tasks. This pre-test indicated that the washing machine task used in the Netherlands was not representative for Japan. Therefore, this task was excluded from the experiment.

A preliminary two-way mixed ANOVA analysis was conducted to investigate any significant effects of complexity of the visual metaphors on the tasks. An effect was found only on the travel task (Table 3) and will therefore be used in the analyses in the next chapters.

	The Netherlands		**Japan**	
	***F*(12, 486)**	**Sig**	***F*(12, 486)**	**Sig**
Thermostat	2.080	*Ns*	0.807	*Ns*
Washing machine	0.576	*Ns*	-	-
Laptop	2.153	*Ns*	2.323	*Ns*
Travel	1.790	.047	2.115	.015

Table 3: F-values and significance of the interaction between complexity and tasks

4.1 Study 1, the Netherlands

We hypothesized that persuasive effects are stronger when a visual metaphor gets more complex (H1). To find support for Hypothesis 1 a two-way mixed ANOVA was conducted with complexity (Juxtaposition, Fusion, Replacement) as a between-groups variable and each day that a participant had to do the task (day 1 to day 7) as the within-participants variable.

The main effect of conditions on energy consumption did not gave support for Hypothesis 1, $F(2, 81) = 1.139$, *ns*. Participants did not significantly differ across the conditions of visual metaphor complexity on energy consumption. However, a decline in energy consumption is noticeable (Figure 5). Exploration of this effect with a trend analysis indicate a linear trend, $F(1, 81) = 22.749$, $p < .001$.

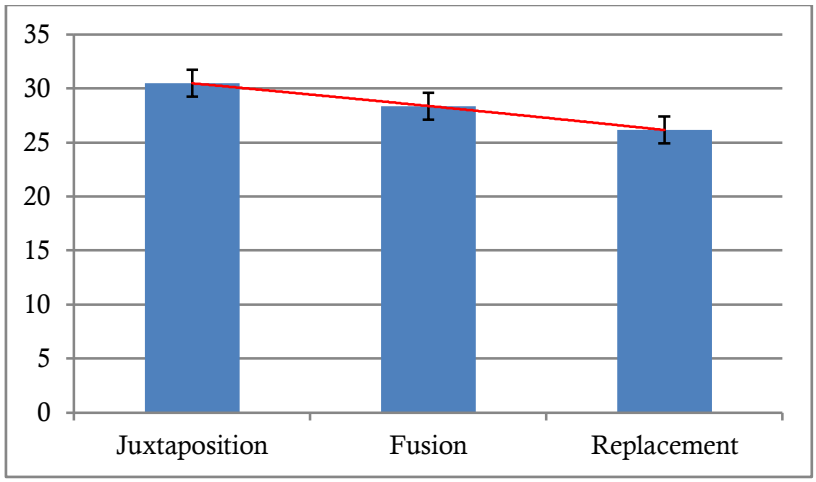


Figure 5: Total average energy consumption per condition

4.1.1 Explorative analyses

A negative linear trend is noticeable between different level of visual metaphor complexity. To further investigate this effect over time, explorative analyses were conducted.

The results of the first explorative analysis show that energy consumption is significantly different over time, $F(6, 428) = 4.715$, $p = .001$. Table 4 report the means and standard deviations of the different days.

Days	Mean	Standard deviation
1	30,976	13.281
2	31,071	15.342
3	30,774	16.102
4	28,536	16.591
5	26,298	14.447
6	25,893	14,556
7	24,810	14.897

Table 4: Means and Standard deviations by day

The main effect of time show a decline of energy consumption (Figure 6). Energy consumption of participants at the beginning of the experiment (M = 30.976, SD = 13.281) were higher than at the end of the experiment (M = 24.81, SD = 14.897).

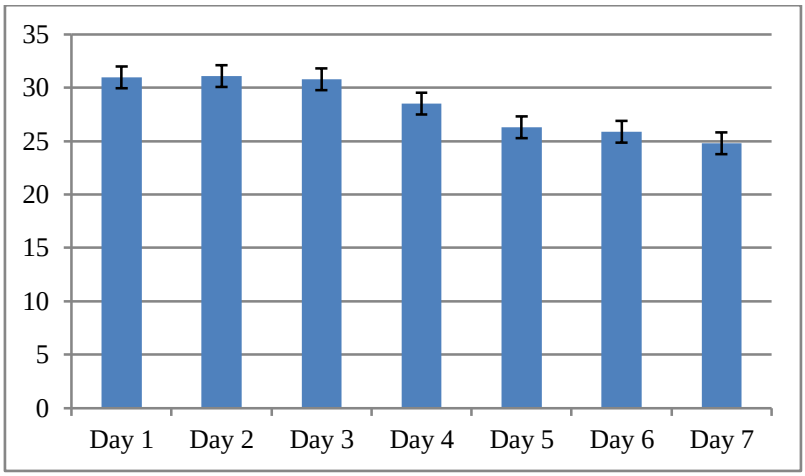


Figure 6: Total average energy consumption per day

To investigate whether this declination of energy consumption over time is also significantly different within different level of visual metaphor complexity, a second explorative analysis was conducted. The interaction Days x Complexity interaction is significant, $F(12, 486) = 1.79$, $p < 0.05$. Decline in energy consumption over time is significantly different across the conditions of complexity (Figure 7).

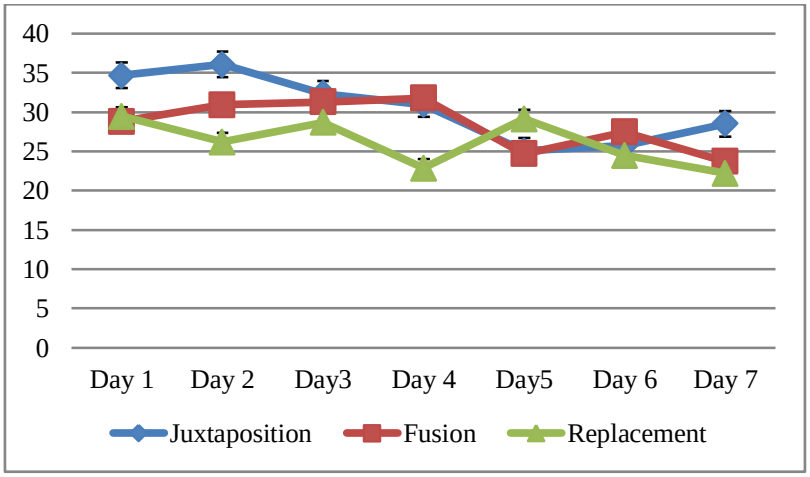


Figure 7: Average energy consumption per day per condition per day

Further investigation of the days indicate that only significant effects occur on Day 2, Day 3, and Day 7 (Table 5). The persuasive effects of the visual metaphors are most effective at the beginning of the experiment. After that no significant effects were

found. This might imply that participants get used to the exposure to the visual metaphors, which diminish the persuasive effects.

Table 5: F-values per day

Day	$F(2, 81)$
1	.597
2	1.866*
3	3.214*
4	.012
5	.474
6	.920
7	5.051**

*$p < .05$, **$p < .01$

To be able to asses different moderator effects, a linear regression analysis was conducted. Energy consumption of the seven days were averaged and dummy variables of the conditions were created.

4.1.2 Need for Cognition

A hierarchical regression was conducted to find support for Hypothesis 4, which stated that a more complex visual metaphor will demand more of people's Need for Cognition (NFC). Table 5 show the results for each step of the hierarchical regression predicting inclination to engage in more energy conservative behavior with Juxtaposition as the baseline variable. There was a significant increment in R^2, $\Delta R^2 = .064$, $F(5, 83) = 12.125$, $p < .001$, indicating that the two interaction effects were significant additional predictors of energy consumption. Together the predictors accounted for 43.7% of the variance in energy consumption.

Table 6. Moderated regression of perceived visual metaphor complexity and the Need for Cognition on energy consumption with Juxtaposition as the baseline

	β	SE β
Step 1		
Constant	29.528	1.643
Fusion	-2.792	2.317
Replacement	-8.036**	2.381
Need for Cognition	-0.666***	0.100
Step 2		
Constant	29.902	1.582
Fusion	-4.030	2.295
Replacement	-10.268***	2.559
Need for Cognition	-0.404**	0.131
NFC x Fusion	-0.631*	0.263
NFC x Replacement	-0.527*	0.222

Results show that for Juxtaposition, the slope of the effect of NFC on energy consumption is statistically significant (p = .003) and negative, as expected. Indicating that a higher NFC has a negative effect on energy consumption for Juxtaposition. This means, energy consumption is decreasing for people with a higher NFC. The interaction effect of NFC on Fusion shows that there is a significant moderator effect ($p < .05$) on energy consumption. In line with Hypothesis 4, the negative slope of this interaction is steeper compared to the slope of NFC on Juxtaposition, NFC has a bigger negative effect on energy consumption for Fusion than for Juxtaposition. Also, the interaction effect of NFC on Replacement on energy consumption is significant ($p < .05$). Although the slope of this interaction effect is bigger than the slope of NFC on Juxtaposition, it is smaller than the slope of the interaction effect of NFC on Fusion. This gives evidence that with Juxtaposition as the baseline variable, NFC has a stronger negative effect on energy consumption for both Fusion and Replacement compared to Juxtaposition. Which is in line with Hypothesis 4, stating that when a visual metaphor will be more complex, it will demand more of people's NFC.

To investigate whether differences between Fusion and Replacement condition is significant, another hierarchical regression was performed with Fusion as the baseline

variable (Table 7). There was a significant increment in R^2, $\Delta R^2 = .064$, $F(5, 83) = 12.166$, $p < .001$, indicating that the two interaction effects were significant additional predictors of energy consumption. Together the predictors accounted for 43.8% of the variance in energy consumption.

Table 7. *Moderated regression of perceived visual metaphor complexity and the Need for Cognition on energy consumption with Fusion as the baseline*

	β	SE β
Step 1		
Constant	26.737	1.655
Juxtaposition	2.792	2.317
Replacement	-5.245**	2.359
Need for Cognition	-0.666***	0.100
Step 2		
Constant	25.803	1.670
Juxtaposition	4.101	2.300
Replacement	-6.169*	2.613
Need for Cognition	-1.045***	0.231
NFC x Juxtaposition	0.642*	0.265
NFC x Replacement	0.113	0.292

*Note: $R^2 = .438$ for Step 1, $\Delta R^2 = .064$ for Step 2. *p < .05, **p < .01, and ***p < .001.*

In line with the previous results, there is a significant interaction effect ($p < .05$) of NFC and Juxtaposition. The slope of this interaction effect is positive whereas the slope of NFC on Fusion is negative. This indicates that NFC on Juxtaposition have a more positive effect on energy consumption than Fusion, which is in line with the previous result. However, the slope for NFC on Replacement is not significantly different from the slope of NFC on Fusion. There are no statistical differences of the effect of NFC on energy consumption between Fusion and Replacement.

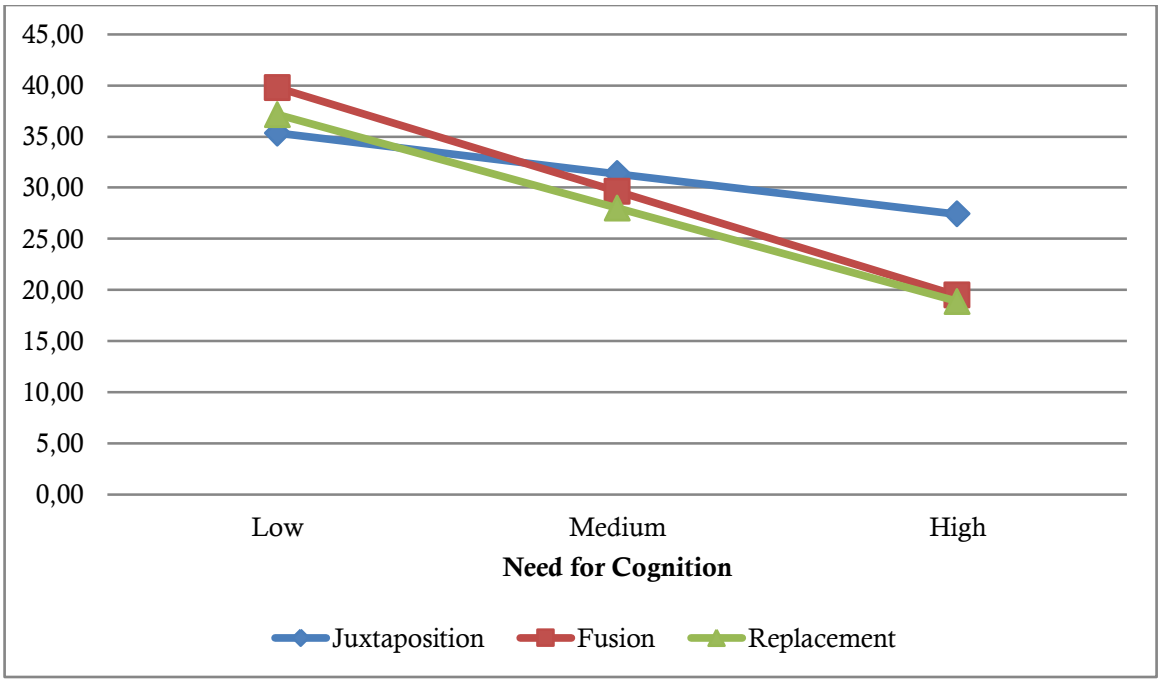


Figure 8. Moderator effect of Need for Cognition on the conditions on energy consumption

As seen in Figure 8, people's Need for Cognition plays a more prominent role when a visual metaphor is more complex.

4.1.3 Style of Processing

Exploration of people's Style of Processing did not resulted in any significant effects. There was no significant increment in R^2, $\Delta R^2 = .028$, $F(5, 83) = 1.471$, *ns.* Adding the moderator effects to the model did not result in a significant improvement of the model. Therefore, no support has been found for Hypothesis 5.

4.1.4 General Ecological Behavior

As mentioned before, the GEB makes use of the Rasch model to describe the expected relationship between people's self-reports, individual susceptibilities, and the invariant processing demands. Appendix I shows the estimated processing demands required to develop each of the 50 statements. The processing demands were estimated with a reliability of .95. Items with mean square values (*MS*) ≤ 1.20 fit the idea of invariant item order perfectly. Only two of the 50 items resulted in a just misfit (*MS* = 1.21): "I buy

bleached and colored toilet paper" (item 19) and "I use an oven cleaning spray to clean my oven" (item 30). Mean square value is referring to the weighted average of squared standardized residuals in which each residual is weighted by its variance. A mean square values of 1.20 stand for a 20% excess in variation between the observed responses and the model's predictions. Values up to 1.20 are considered to be good and values up to 1.50 are still considered acceptable (Wright & Linacre, 1994).

Looking at the guideline of what is considered a good mean square value, it can be concluded that the fit statistics for the 50 items can be considered to be good in general. This conclusion is complemented by the overall item fit statistics: mean of mean squares [$M(MS)$] = 0.99, standard deviation of mean squares [$SD(MS)$] = 0.12, mean of t-values [$M(t)$] = 0.1, and standard deviation of t-values [$SD(t)$] = 0.6. Ideally , mean of mean squares should be 1.0. No general reference can be given for the standard deviation of mean squares. The t-values, however, are standardized fit statistics and represent the statistical significance of the mean squares statistics. The mean of t-values should be 0, and standard deviation should be 1.0, ideally. On the basis of self-reports, this is a perquisite of a meaningful measurement of individual susceptibility.

Individual susceptibilities to their General Ecological Behavior were estimated with a reliability of .72. The average susceptibility was M = -.21 logits (SD = .86; range -2.25 to 3.23). The model's prediction did not fit the data for 7 of the 84 participants (5.88%), indicated by a significant t-value of $t \geq 1.96$. For the participants, an overall fit statistics were found to be: mean of mean squares [$M(MS)$] = 0.01, standard deviation of mean squares [$SD(MS)$] = 0.25, mean of t-values [$M(t)$] = 0, and standard deviation of t-values [$SD(t)$] = 1.1. It can be concluded from these statistics that people can be reliably differentiated with regard to their susceptibility to their General Ecological Behavior.

Adding the GEB as an covariant had a significant effect. In line with Hypothesis 5 GEB significantly explained part of the variance of the different conditions on energy consumption scores, β = -6.152, $t(83)$ = -5.051, $p < .001$. The negative value of the slope indicates that people who show more ecological behavior, consume less energy during the tasks. GEB explained a significant proportion of variance in energy consumption scores, R^2 = .263, $F(1, 83)$ = 25.517, $p < .001$.

4.1.5 Conclusion

No support was found for Hypothesis 1. However, a linear trend was noticeable indicating a decline in energy consumption when a visual metaphor is more complex. The means of the conditions acknowledged this. Decline of energy consumption between Juxtaposition and Fusion is steeper than the decline of energy consumption between Fusion and Replacement.

A moderator effect has been found of people's Need for Cognition. This moderator effect gives support to Hypothesis 4, which stated that a more complex visual metaphor demands more of people's Need for Cognition. The results show that people's Need for Cognition play a more prominent role on the persuasive impact when visual metaphors are becoming more complex.

No effect was found of people's Style of Processing as a moderator. Therefore, no support for Hypothesis 5 has been found. According to McQuarrie and Mick (1999), people's Style of Processing is more about visual richness instead of visual complexity. This give implications why no effects have been found of people's Style of Processing as a moderator on the complexity of visual metaphors.

An effect has been found when controlling for people's General Ecological Behavior as a covariant. Implicating that people with a more ecological behavior prior to participation in this study are showing more ecological behavior in general. This gives support to Hypothesis 6.

The results of the explorative analyses are indicating that the most effective persuasion occurs at the beginning of the experiment. This might suggest that the persuasive effects of visual metaphors are of temporarily nature and will be reduced over time.

4.2 Study 2, Japan

Just as with the Dutch sample, we hypothesized that persuasive effects are stronger when a visual metaphor gets more complex (H1) among the Japanese. To find support for Hypothesis 1 another two-way mixed ANOVA was conducted with complexity (Juxtaposition, Fusion, Replacement) as a between-groups variable and each day that a participant had to do the task (day 1 to day 7) as the within-participants variable.

As with the Dutch sample, when ignoring the different days, no support for Hypothesis 1 was found for the different conditions on energy consumption, $F(2, 81) = 1.958$, *ns*. Participants did not significantly differ across the conditions of visual metaphor complexity on energy consumption. A decline in energy consumption is noticeable (Figure 9) between Juxtaposition and Fusion. However, energy consumption increased at Replacement. Exploration of this effect with a trend analysis indicate a cubic trend, $F(2, 81) = 3.791$, $p = .027$.

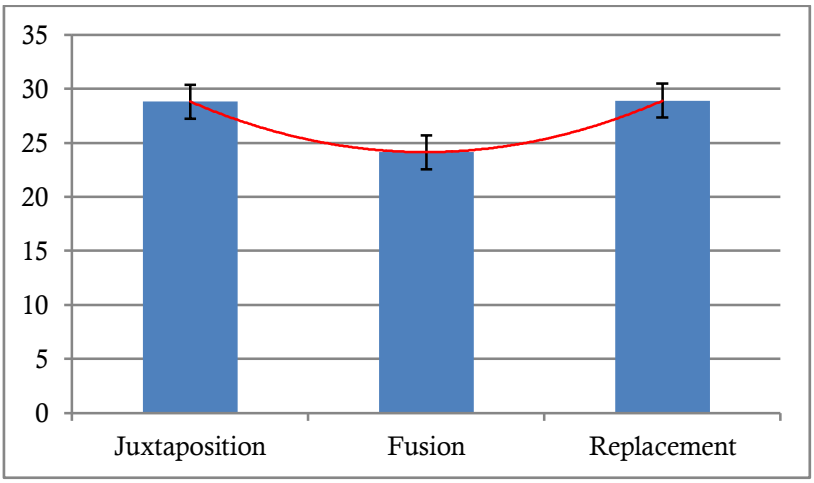


Figure 9: Total average energy consumption per condition

4.2.1 Explorative analyses

The cubic trend indicates a decline and increase of energy consumption. A declination trend is noticeable between Juxtaposition and Fusion, whereas energy consumption increased for Replacement. To further investigate this effect over time explorative analyses were conducted.

As with the results of the study in the Netherlands, the explorative results are presented for Japan. Results show that energy consumption is significantly different over time, $F(6, 486) = 8.529$, $p < .001$. Table 8 reports the means and standard deviations of the different days. This without taking the different conditions into account.

Days	Mean	Standard deviation
1	32.464	17.716
2	32.024	19.772
3	31.143	19.767
4	25.179	19.227
5	25.631	15.861
6	26.512	21.088
7	18.048	15.828

Table 8: Means and Standard deviations by day

The main effect of time shows a decline of energy consumption (Figure 10). Energy consumption of participants at the beginning of the experiment ($M = 32.464$, $SD = 17.716$) was higher than at the end of the experiment ($M = 18.048$, $SD = 15.828$).

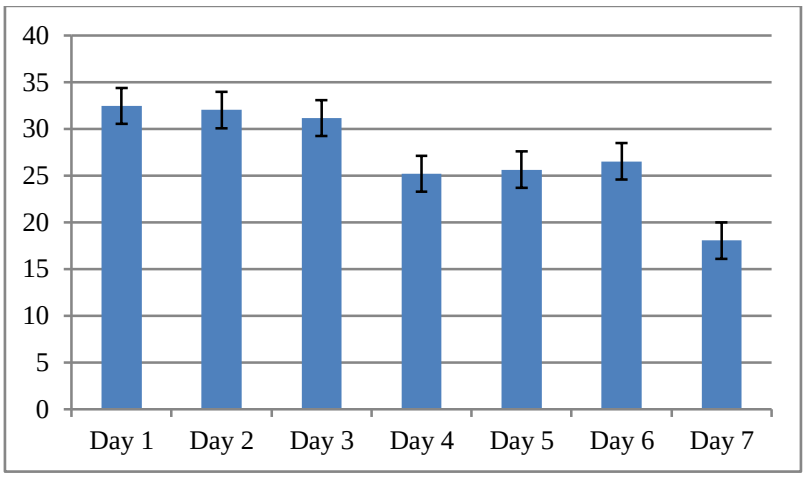


Figure 10: Total average energy consumption per day

To investigate the course of energy consumption over time within different levels of visual metaphor complexity, a second explorative analysis was conducted. The interaction Days x Complexity is significant, $F(12, 486) = 3.794$, $p < .001$. Decline in

energy consumption over time is significantly different across the conditions of complexity (Figure 11).

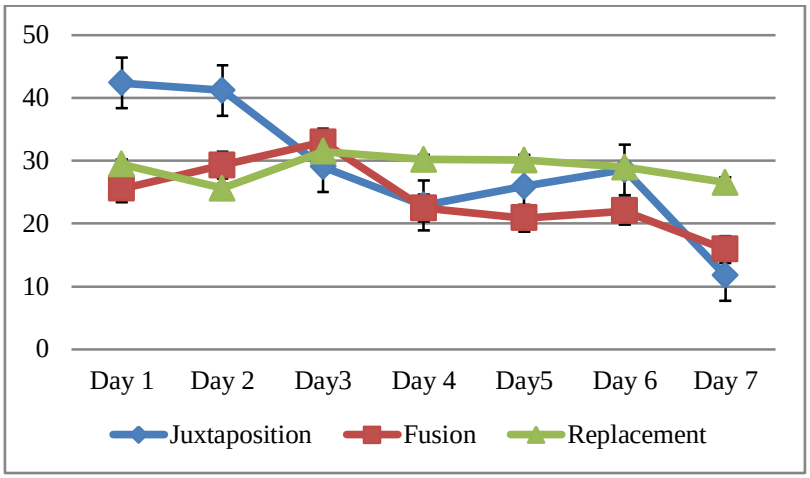


Figure 11: Average energy consumption per day per condition per day

Further investigation of the days indicate that only significant effects occur on Day 1, and Day 2 (Table 9). As with the results of the Netherlands, the persuasive effects of the visual metaphors are most effective at the beginning of the experiment. After that, no significant effects were found. This might imply that participants got used to the exposure to the visual metaphors, which diminished the persuasive effects. The persuasive effect is fluctuating for Replacement, which may be the consequence of the lack of understandability of the visual metaphor by participants.

Table 9: F-values per day

Day	$F(1, 81)$
1	5.867*
2	3.791**
3	1.734
4	.922
5	.506
6	.535
7	.934

*$p < .05$, **$p < .01$

Again, to assess different moderator effects, a linear regression analysis was conducted. To be able to conduct a linear regression analysis, energy consumption of the seven days were averaged.

4.2.2 Need for Cognition

To explore whether visual metaphor complexity require more of people's Need for Cognition (NFC) when it is getting more complex (H4), a hierarchical regression analysis was conducted. Table 9 displays the results for each step of the hierarchical regression predicting inclination to engage in more energy conservative behavior with Juxtaposition as the baseline variable. There was a significant increment in R^2, $\Delta R^2 = .146$, $F(5, 83) = 17.269$, $p < .001$, indicating that the two interaction effects were significant additional predictors of energy consumption. Together the predictors accounted for 49.5% of the variance in energy consumption.

Table 9. *Moderated regression of perceived visual metaphor complexity and the Need for Cognition on energy consumption with Juxtaposition as the baseline*

	β	SE β
Step 1		
Constant	31.523	1.631
Fusion	-5.834*	2.239
Replacement	-7.617*	2.522
Need for Cognition	-0.984***	0.150
Step 2		
Constant	30.018	1.482
Fusion	-3.783	2.083
Replacement	-11.376***	2.509
Need for Cognition	-0.437*	0.179
NFC x Fusion	-0.895**	0.327
NFC x Replacement	-1.585	0.339

*Note: $R^2 = .495$ for Step 1, $\Delta R^2 = .146$ for Step 2. *p < .05, **p < .01, and ***p < .001.*

Results show that for Juxtaposition, the slope of the effect of NFC on energy consumption is statistically significant ($p < .01$) and negative, as expected. Meaning that a higher NFC has a negative effect on energy consumption for Juxtaposition. This means, energy consumption is decreasing for people with a higher NFC. The interaction effect of NFC on Fusion indicate that there is a significant moderator effect ($p < .01$) on energy consumption. The negative slope of this interaction is steeper compared to the slope of NFC on Juxtaposition, indicating that NFC has a bigger negative effect on energy consumption for Fusion than for Juxtaposition. Also, the interaction effect of NFC on Replacement on energy consumption is significant ($p < .001$). An increasing influence of NFC is noticeable when visual metaphor is becoming more complex (H4).

Another hierarchical regression is performed with Fusion as the baseline variable to investigate whether differences between Fusion and Replacement condition is significant (table 10). There was a significant increment in R^2, $\Delta R^2 = .146$, $F(5, 83) = 17.269$, $p < .001$, indicating that the two interaction effects were significant additional predictors of energy consumption. Together the predictors accounted for 49.5% of the variance in energy consumption.

Table 10. Moderated regression of perceived visual metaphor complexity and the Need for Cognition on energy consumption with Fusion as the baseline

	β	SE β
Step 1		
Constant	25.690	1.596
Juxtaposition	5.834*	2.239
Replacement	-1.783	2.444
Need for Cognition	-0.984***	0.150
Step 2		
Constant	26.235	1.463
Juxtaposition	3.783	2.083
Replacement	-7.593**	2.497
Need for Cognition	-1.332***	0.274
NFC x Juxtaposition	0.895**	0.327
NFC x Replacement	-0.691	0.398

*Note: R^2 = .495 for Step 1, ΔR^2 = .146 for Step 2. *p < .05, **p < .01, and ***p < .001.*

In line with the previous results, there is a significant interaction effect ($p < .01$) of NFC and Juxtaposition. The slope indicates a positive effect whereas the slope of NFC on Fusion is negative. This shows that NFC on Juxtaposition has a more positive effect on energy consumption than Fusion, which is in line with the previous result. The slope for NFC on Replacement is marginal significant ($p = .086$), indicating a larger negative influence of NFC on energy consumption for Replacement.

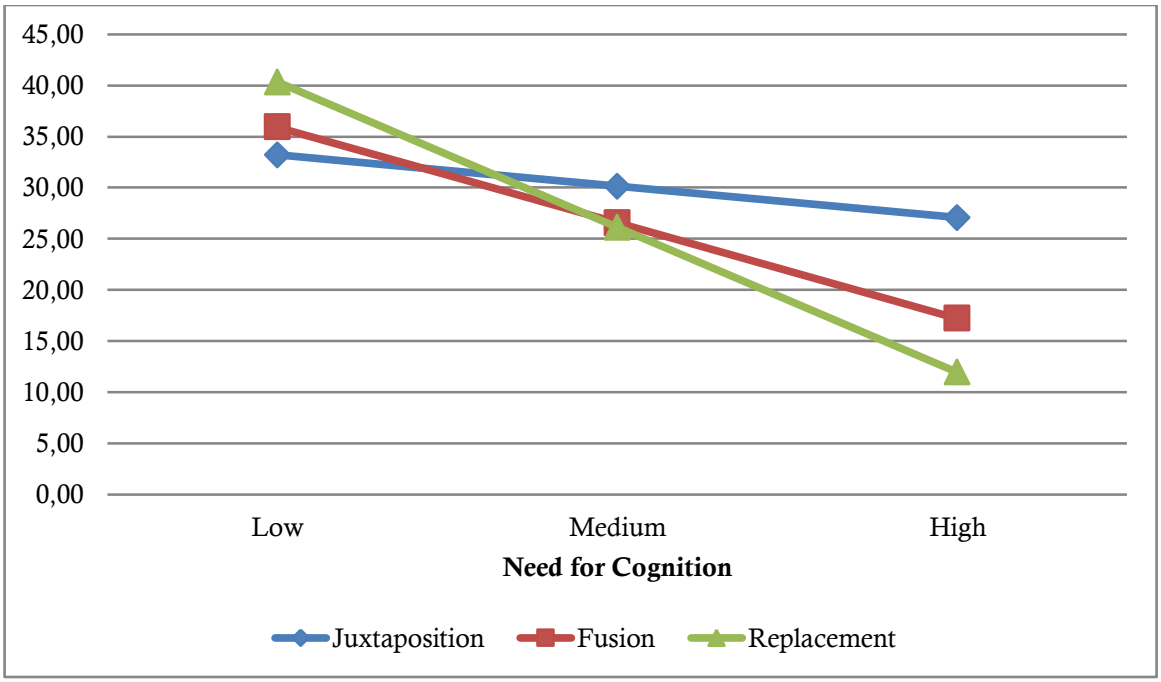


Figure 12. Moderator effect of Need for Cognition on the conditions on energy consumption

As seen in Figure 12, people's Need for Cognition plays a more prominent role when a visual metaphor is more complex.

4.2.3 Style of Processing

No significant effects have been found when exploring people's Style of Processing. There was no significant increment in R^2, ΔR^2= -.004, $F(5, 83) = .941$, *ns*. Adding the moderator effects to the model did not result in a significant improvement of the model and therefore, no support for Hypothesis 5 has been found.

4.2.4 General Ecological Behavior

Since the GEB scale has never been used before, a validated Japanese version of the GEB was not available. A translated GEB scale is created based on the English GEB scale of Kaiser (1998) and was improved with use of a back-translation procedure (Brislin, 1970). Since this Japanese GEB scale has never been validated before, an additional amount of 31 people were approached to fill in the GEB scale. With this additional amount of people it is tried to ensure validity of the scale. Including the participants of the

experiment that filled in the GEB scale and the additional amount of people that have been approached, a total amount of 115 people that filled in the GEB scale was achieved and were used in the Rasch model to validate the scale. Participants of the experiment are filtered out after validation of the scale for further analyses.

The Rasch model was applied to the data to describe the expected relationship between people's self-reports, individual susceptibilities, and the invariant processing demands. Appendix II shows the estimated processing demands required to develop each of the 50 statements. The processing demands were estimated with a reliability of .94. Items with mean square values (MS) $\leq$ 1.20 fit the idea of invariant item order perfectly. There were no items with a mean square values above 1.20, meaning that all the items meet the requirement of invariant item order.

Mean of mean squares [$M(MS)$] = 1.00, standard deviation of mean squares [$SD(MS)$] = 0.06, mean of t-values [$M(t)$] = 0.1, and standard deviation of t-values [$SD(t)$] = 0.8. The mean of mean squares corresponds to the ideal value of 1.0. The mean of t-values almost fits the ideal value of 0, just as the standard deviation which is ideally 1.0. From the values given, it can be concluded that the self-reports are a perquisite of a meaningful measurement of individual susceptibility.

Individual susceptibilities to their General Ecological Behavior were estimated with a reliability of .46. The average susceptibility was M = -.59 logits (SD = .54; range -1.88 to .97). Indicated by a significant t-value of $t \geq 1.96$, the model's prediction did not fit the data for 11 of 115 participants (12.65%). Overall fit statistics were found to be: mean of mean squares [$M(MS)$] = 1.00, standard deviation of mean squares [$SD(MS)$] = 0.20, mean of t-values [$M(t)$] = 0.00, and standard deviation of t-values [$SD(t)$] = 1.1. Looking at the mean (M = -.21) and standard deviation (SD = .86) of the measured person response, it can be concluded that the Japanese participants find it more difficult to respond to the items and are a bit more homogeneous compared to the Dutch sample. With regard to their susceptibility to their General Ecological Behavior, it can be concluded that an average reliability of people were able to be differentiated.

As expected, the GEB as a covariant had a significant effect. GEB significantly explained part of the variance of the conditions on energy consumption scores, β = -6.886, $t(83)$ = -2.956, $p < .01$. The negative value of the slope indicates that people who

show more ecological behavior, in general show lower energy consumption during the tasks. GEB also explained a significant proportion of variance in energy consumption scores, $R^2 = .134$, $F(1, 83) = 8.739$, $p < .01$. These results indicate a more ecological behavior for people in this study as expected (H6).

4.2.5 Conclusion

We hypothesized that the persuasive impact of visual metaphors increases when it becomes more complex (H1). No support for Hypothesis 1 has been found. A cubic trend was found. The cubic trend represents a decrease and increase of energy consumption. A decrease in energy consumption between Juxtaposition and Fusion and an increase of energy consumption between Fusion and Replacement is noticeable. This might imply that participants were starting to not understand the meaning of the metaphor anymore within the most complex visual metaphor; Replacement. By further investigating this increment of energy consumption within Replacement, it seems that the Japanese did not understand the most complex visual metaphor. Participant responded with “Only vague images” and “Do not know”. This might explain why the visual metaphor did not have the expected effect on energy consumption for Replacement.

The effect of people’s Need for Cognition (NFC) have the same effect on energy consumption as for the Dutch sample. That is, only for the conditions Juxtaposition and Fusion. For the Japanese study there is an significant increasing negative moderator effect of NFC between all conditions of visual metaphor complexity (H4).

As already concluded among the Dutch sample, people’s Style of Processing for the Japanese sample did also not returned significant (H5). This can be explained due to that people’s Style of Processing have influence on visual richness rather than visual complexity (McQuarrie & Mick, 1999).

Just as with the Dutch sample, adding people’s General Ecological Behavior as a covariant, people that already show more ecological behavior beforehand, show more energy conservative behavior during the tasks (H6).

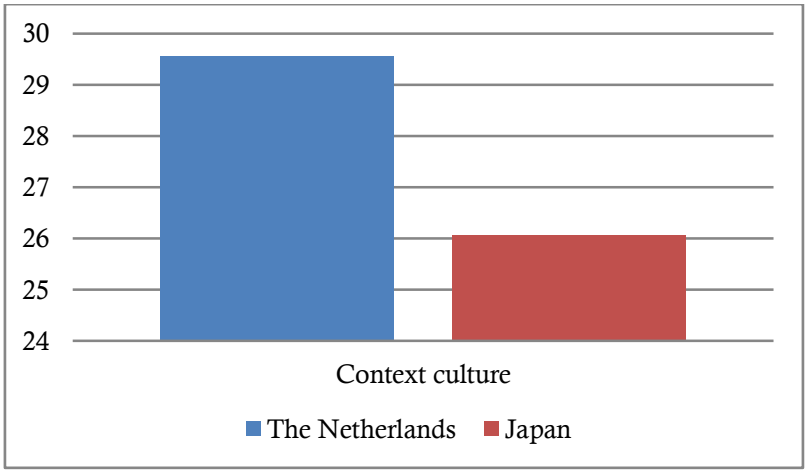
The cubic trend that has been found with the explorative analyses indicate a decline and increase in energy consumption. Between Juxtaposition and Fusion there is a decline in energy consumption. An increase of energy consumption is noticeable within

Replacement. Further investigation of this increase of energy consumption showed that participants were not able to comprehend the meaning of the visual metaphor anymore and therefore the intended message was not carried out.

4.3 The Netherlands vs. Japan

We hypothesized that persuasive strength of visual metaphors is stronger among the Japanese than among Dutch people, caused by their different communication style (H3). Since the Japanese people (high context culture) already communicate in an indirect way, it is expected that the persuasive power is therefore stronger among the Japanese. To find support for Hypothesis 3, a 3-way mixed ANOVA was conducted with the days as the within factor, context culture (the Netherlands, and Japan) and the conditions (Juxtaposition, Fusion, Replacement) as the between factor.

No interaction effect has been found of Conditions x Context Culture on energy consumption, $F(2, 168) = .451$, *ns*. This implies that there were no differences between the conditions and a specific context culture. However, the main effect of context culture on energy consumption indicates that there are differences in the effect of visual metaphors on people's energy usage, $F(1, 168) = 5.060$, $p < .05$. Comparing the persuasive impact of visual metaphors on energy usage of both countries, it can be noticed that the Japanese ($M = 26.058$) use less energy than Dutch people ($M = 29.564$).



Graph 9: Average energy consumption per condition per country

A mediation analysis was conducted to find support for Hypothesis 2. To test the influence of people's attitude on the persuasive effects of the visual metaphors between countries in general, a nonparametric bootstrapping analyses (see Preacher & Hayes, 2004; Preacher, Rucker, & Hayes, 2007) was used to test the meditational model of

people's attitude towards visual metaphors as a mediator of the relationship between context culture (high/low) and energy consumption. In these analyses, mediation is significant if the 95% Bias Corrected and accelerated confidence intervals for the indirect effect do not include 0 (Preacher & Hayes, 2004; Preacher et al., 2007). Results based on 10000 bootstrapped samples indicated that the direct effect of context culture on energy consumption is not significant (*DE* = -.80, *SE* = 1.18, *p* = .498). The effect of context culture to people's attitude was marginal significant (*AE* = .384, *SE* = .229, *p* = .09). Direct effect of people's attitude on persuasion is significant (*BE* = -3.671, *SE* = .474, *p* = .00). Figure 5 shows that people's attitude towards visual metaphors fully mediated the relationship between context culture and energy consumption (*IE* lower 95% *CI* = -2.816, upper 95% *CI* = .133). In line with Hypothesis 3 it can concluded that in general, Japanese compared to Dutch people show a more positive attitude towards visual metaphors which result in stronger persuasive effects.

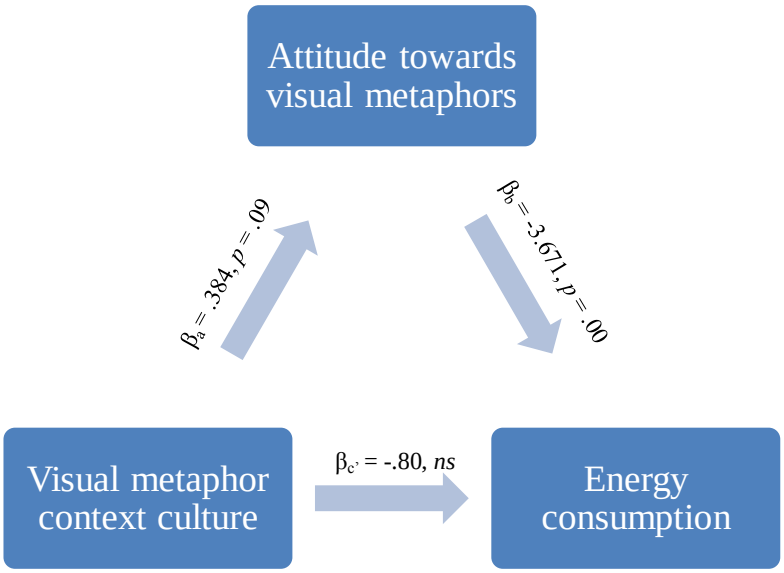


Figure 5. Mediation effect of attitude towards visual metaphors on the relation of context culture on energy consumption

4.3.1 Conclusion

We hypothesized that visual metaphors will have stronger effects on a high context culture, such as Japan (H3). Results give support for this hypothesis. An effect was found of context culture on energy consumption, which implies that the Japanese are more reactant to visual metaphors than the Dutch.

Furthermore we expected that people's attitude towards the visual metaphor will mediate the relationship between context culture and energy consumption (H2). This because high context cultures as Japan already communicate in an indirect way. Therefore, these cultures have a more positive attitude towards visual metaphors. As expected, there is an full mediation effect of people's attitude towards visual metaphors on the persuasive power across context cultures (high/low). Support for Hypothesis 2 has been found. Japanese people are more positive towards visual metaphors than the Dutch. A more positive attitude contributes to stronger persuasive effects of the visual metaphors.

5. Discussion

The discussion is divided into three parts; conclusion, limitations, and summary. The conclusion sums up all the results of the different analyses. At the limitations section the limitations of this study will be discussed.

5.1 Conclusion

In this study, two experiments are conducted to investigate the influence of a metaphor's visual complexity and people's cultural communication style on the persuasive power of a visual metaphor (used to give feedback). In order to explore the persuasive power of visual metaphors due to different cultural communication styles, the study was conducted in two different countries with a pronounced difference in communication styles. According to Hall (1976; Hall & Hall, 1990), cultures can be distinguish into two categories: high context culture and low context culture. A high context culture communicates in a more implicit and indirect way and therefore the context plays an important role to understand the meaning of the message. On the contrary, a low context culture communicates more explicit and direct in such a way that the meaning of the message is unambiguous and straightforward. Based on this categorization defined by Hall (1976; Hall & Hall, 1990), two countries were chosen for this study: Japan (high context culture) and the Netherlands (low context culture). Because figuring out the meaning of a visual metaphor requires the same insight as understanding the implicit communication style in high context cultures, it is expected that persuasive effects of visual metaphors will be stronger among the Japanese. This expectation is in line with recent findings of Le Pair and Van Mulken (2004) who found differences between high and low context cultures on appreciation of visual metaphors.

Not only differences between context cultures can occur, but also within visual metaphors. Therefore, there is not only variation in context culture in this study to explore the different persuasive impact of visual metaphors, but also in complexity. The complexity variations of the visual metaphors are based on the taxonomy of Philips and McQuarrie (2004) in which they argue that the elicitation of complexity depends on different kinds of visual propositions. As previous research has shown: the complexity of

a figure is related to the persuasive impact in a way that a more complex figure will contribute to stronger persuasive effects (e.g. Meyers-Levy and Malaviya, 1999; Van den Berg, Duijnisveld & Smit, 2008). Expected is that persuasive impact of a visual metaphor is stronger when it is more complex. The persuasive impact of a different kind of complexity in this study has been investigated by communicating energy consumption feedback during several (virtual) energy consumption tasks.

The communication style of cultures does have a different influence on the persuasive impact of visual metaphors. As expected, within a high context culture such as Japan, the persuasive effect of visual metaphors is stronger compared to a low context culture such as the Netherlands (H3). The stronger persuasive effects of visual metaphors can be explained by the more positive attitude towards visual metaphors in general. As expected, the Japanese show a more positive attitude towards visual metaphors in general compared to the Dutch (H2). No support for Hypothesis 1 was found. There was no effect between different conditions of complexity. However, trend analyses indicate energy conservative behavior when the visual metaphor was more complex.

McQuarrie and Mick (1992; 1999) argue that a visual metaphors will not be liked by consumers when they are not able to comprehend the meaning. Therefore, a visual metaphor will only have the desired effect when it is still comprehendible by its audience. In this study, the point for participants not being able to comprehend the meaning is present for both countries. This crossover point seems to be between Fusion and Replacement. Although the results of the Netherlands at Juxtaposition still indicate a decline in energy consumption, the results were not significant as compared to Fusion. This indicate that energy consumption is not significantly different and might even increase when a visual metaphor is becoming more complex. As for the results of Japan the crossover point is clearer. There are clear signs that energy consumption increases, as visual metaphor is in it most complex form (Replacement). Further investigation of this effect indicated that participants did not understand the visual metaphor. These findings are in line with previous studies of Le Pair and Van Mulken (2008) who found an inverted u-curve on appreciation when visual metaphors became more complex.

As a visual metaphor is becoming more complex, different moderator effects are playing a more prominent role in the relationship between complexity and energy

consumption. The results of both countries show that people's Need for Cognition (NFC) plays a more prominent role when a visual metaphor is becoming more complex, which is in line with the expectations (H4). More cognitive processing is needed to comprehend the visual metaphor as it becomes more complex. Therefore, the difference between people with high NFC and those with a low NFC become more distinctive, as those with a high NFC are usually the ones who prefer cognitive challenging activities (Haugtvedt, Petty, & Cacioppo, 1992).

The Style of Processing had no significant effect, which was not in line with our hypothesis (H5). However, this finding is not surprising according to McQuarrie and Mick (1999), which are stating that the Style of Processing is rather about visual richness than visual complexity.

People's General Ecological Behavior was assessed as a covariant. With the use of the GEB scale of Kaiser (1998), results show that people who already have a more ecological behavior in their daily life show more energy conservative behavior in the experiment (H6).

5.2 Limitations

This study is about cultural differences of the persuasive impact of visual metaphors, which differs in complexity. To be able to make a good comparative study, it was tried to make the experiments identical to each other by using a back-translation procedure (Brislin, 1970).

The visual metaphors were created in such a way that they could be used in both experiments. Despite the universal intention for the visual metaphors, they were created by Dutch graphical designers which might gave a more Western interpretation to the visualizations. This can explain why for the Dutch the most difficult visual metaphor still had the expected effect while for the Japanese the most difficult visual metaphor became too difficult to comprehend for the participants. It seems impossible to create universal visual metaphors which elicit the same meaning across cultures. The visual metaphors might have had the same expected persuasive effect in Japan as in the Netherlands if they were more orientated towards common Japanese visualizations. This is in line with the

argument of Kövecses (2005) that the universality of visualizations can be questioned caused by a broader cultural context, which can override universal mapping in metaphors.

Furthermore, it was difficult to recruit a broad audience for the Japanese sample. Only students participated, which caused a more homogenous sample as can be seen from the results of the Rasch analysis. The participant database of the JF Schouten School at Eindhoven University of Technology, Eindhoven, the Netherlands, was consulted for the Dutch sample which resulted in a more broader audience.

5.3 Summary

Experiments were conducted in two countries with a difference in context culture (the Netherlands, Japan). As expected in a high context culture (Japan) persuasive effects of visual metaphors were in general stronger when used as feedback in energy consumption tasks. This effect can be explained by the already more implicit way of communicating in high context cultures. A high context culture is, therefore, already used to the kind of communication as used in metaphors.

As results of this study have shown, more complex visual metaphors induces stronger persuasive effects. That is, the meaning of the visual metaphor still needs to be comprehendible by its audience. When a visual metaphor is too difficult to comprehend, people will not understand the meaning and therefore the visual metaphor will not have the desired effect.

Furthermore, not only visual propositions are important, but culture can play an important role too. Cultural characteristics can override universal mapping and therefore it cannot be assumed that visual metaphors can be of universal nature (Kövecses, 2005). To maximize the persuasive effect it is important to adjust the visual metaphor to typical cultural characteristics where it is going to be used in.

Investigating visual properties provides opportunities to create better goal directed visualizations. A visual metaphor that is too easy for people will not induce pleasure in figuring out the meaning, while a visual metaphor that is too difficult to comprehend cannot communicate the intended message. By finding a balance between the complexity of a visual metaphor and people's ability to comprehend, persuasion can be maximized.

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Appendix I – GEB The Netherlands

Behavior	δ	*MS*
1. Als ik ga wandelen, ga ik met de auto naar het startpunt van de wandeling.	-0,85	0,26
2. Ik koop groenten en fruit van het seizoen.	-0,2	0,23
3. Ik koop melk in statiegeldflessen.	4,62	1,03
4. In de omgeving (tot 30 kilometer) gebruik ik het openbaar vervoer of de fiets.	-2,45	0,35
5. Ik boycot bedrijven die zich milieuonvriendelijk gedragen.	4,64	1,03
6. Ik koop producten in navulverpakkingen.	3,16	0,54
7. Iemand die zich milieuonvriendelijk gedraagt, spreek ik daarop aan.	2,17	0,38
8. Ik bestrijd insecten met een chemisch insecticide.	-1,74	0,31
9. Ik was vuile kleding zonder voorwas.	-1,86	0,33
10. ’s Winters zet ik de verwarming laag als ik mijn woning voor langer dan 4 uur verlaat.	-1,7	0,29
11. Als ik voor een rood verkeerslicht sta, laat ik de motor lopen.	3,25	0,62
12. ’s Winters laat ik de ramen langere tijd open voor frisse lucht.	0,62	0,25
13. Ik laat de motor lopen als ik moet wachten voor een spoorwegovergang of in een file.	0,68	0,28
14. Ik rijd met mijn auto in of naar de binnenstad.	-1,13	0,27
15. Ik gebruik een wasdroger.	-0,86	0,25
16. Ik lees over milieuproblematiek.	1,32	0,29
17. Ik praat met vrienden over milieuproblemen.	2,68	0,45
18. Ik zet de wasmachine pas aan als ik een volle trommel heb.	-2,83	0,44
19. Ik koop ongebleekt of ongekleurd toiletpapier.	0,85	0,28
20. Ik neem liever een douche in plaats van een bad.	-2,43	0,35
21. Ik ga met het openbaar vervoer, de fiets of te voet naar school of werk.	-4,94	1,01
22. Ik verzamel oud papier en geef het mee aan de ophaaldienst.	-2,41	0,35

23. Ik koop drinken in blikjes.	-1,08	0,25
24. Als ik in de winkel een plastic zak krijg, neem ik die aan.	1,47	0,31
25. Ik koop meubels van tropische houtsoorten.	-3,03	0,53
26. Ik koop levensmiddelen met een eco-label.	2,29	0,4
27. Ik geef geld aan milieuorganisaties.	2,89	0,49
28. Ik rijd op de snelweg niet harder dan 100 kilometer per uur.	3,84	0,74
29. Ik koop kant-en-klaarmaaltijden.	-0,62	0,24
30. Ik gebruik een ovenspray om mijn oven schoon te maken.	-2,42	0,37
31. Voor lange reizen (langer dan 6 uur) neem ik een vliegtuig.	0,48	0,25
32. Ik breng lege flessen naar de glasbak.	-2,84	0,41
33. Ik ben lid van een milieuorganisatie.	2,18	0,38
34. ‘s Winters zet ik de verwarming zo hoog dat ik binnen geen trui hoef te dragen.	-1,79	0,29
35. Na een picknick laat ik de picknickplaats schoon achter.	-6,06	1,83
36. In hotels laat ik de handdoeken dagelijks vervangen.	-0,99	0,27
37. Ik heb een offerte gevraagd voor het installeren van eigen zonnepanelen.	4,39	1,04
38. Ik gebruik boodschappentassen meerdere keren.	-4,23	0,72
39. Ik heb al geïnformeerd over de voor- en nadelen van eigen zonnepanelen.	1,36	0,32
40. Ik gebruik wasverzachter.	-0,39	0,24
41. Ik heb energiezuinige huishoudelijke apparatuur.	0,6	0,26
42. Ik gebruik een chemische luchtverfrisser in mijn toilet.	-0,48	0,24
43. Ik heb zonnepanelen gekocht om elektriciteit op te wekken.	5,84	1,84
44. Ik doe lege batterijen bij het huisvuil.	-3,05	0,43
45. Ik heb een energiezuinige auto (die 1 op 14 of zuiniger rijdt).	0,04	0,43
46. Ik weiger een auto te kopen.	2,48	0,46

47. Na de maaltijd spoel ik etensresten zoals soep, saus en vla door het toilet.	-1,65	0,28
48. Met mijn rijgedrag probeer ik het brandstofverbruik zo laag mogelijk te houden.	-0,93	0,26
49. Ik gebruik groene stroom.	0,65	0,28
50. Ik doe aan carpoolen.	0,25	0,3

Appendix II – GEB Japan

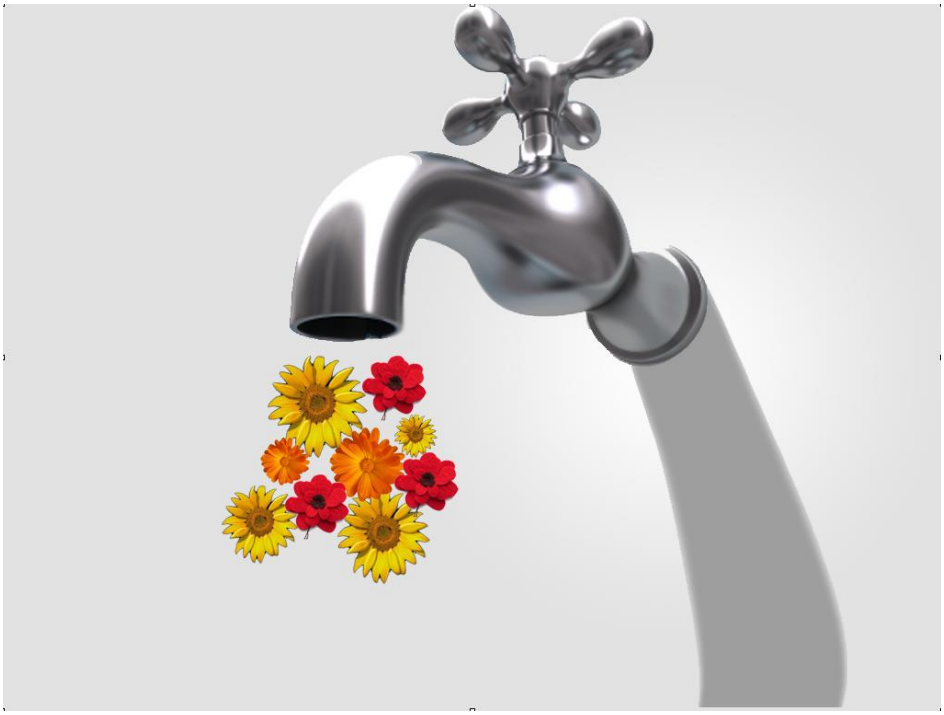
Behavior	δ	*MS*
1. 通勤、通学にて公共の交通手段もしくは自転車を使う。	-3,15	0,35
2. 食品はエコラベルが付いたものを購入する。	2,57	0,46
3. 風呂よりシャワーを好む。	-0,46	0,19
4. 飲み物は缶入りのものを購入する。	-0,48	0,19
5. オーブンを洗浄する時クリーニングスプレーを使う。	-2,35	0,31
6. 国産の木材を使用した家具を購入する。	-1,48	0,25
7. 洗濯機が洗濯物で満杯になる迄使用しない。	-0,24	0,2
8. 都内、市内に行くのに車を使用する。	-1,65	0,22
9. 冬場、空気を入れ替えるために窓を長い時間開ける。	0,33	0,21
10. より汚い洗濯物でも日頃と同じ程度に洗濯する	-0,61	0,2
11. 高速道路を時速100キロ以下で走行する。	0,09	0,24
12. 長距離移動（６時間以上）は飛行機を使う。	-0,91	0,21
13. もしビニール袋をお店で薦められた場合、使用する。	1,78	0,32
14. 近距離（３０キロ範囲）の移動は公共の交通手段もしくは自転車を使 用する。	-2,22	0,25
15. 使用した紙をリサイクルもしくは集めている。	-0,04	0,2
16. 空のボトルをリサイクルしている。	-0,39	0,19
17. 誰かが環境に悪い行動をした時、注意している。	2,13	0,37
18. 環境保護団体に金銭面において貢献している。	5,48	1,83
19. リサイクル可能なボトルを使用している牛乳を購入している。	0,86	0,25
20. 漂白されたもしくは色のついたトイレットペーパーを購入する。	0,77	0,24
21. インスタント食品を購入する。	1,19	0,26
22. 詰め替え可能パッケージを使用した製品を買う。	-1,28	0,2
23. 環境に悪いバックグラウンドのある会社の製品に対し不買同盟する。	2,57	0,46
24. 季節物の製品を買う。	-0,62	0,19

25. 乾燥機を使用する。	-1,26	0,2
26. 環境問題についての記事、本等を読む。	1,78	0,32
27. 環境問題について友人と話す。	1,88	0,34
28. 踏切、交通渋滞においてエンジンを切らない。	0,5	0,26
29. 赤信号でエンジンを切らない。	0,77	0,28
30. 化学殺虫剤で虫を殺す。	-0,41	0,2
31. 冬場、外出（４時間以上）する時は暖房を切る。	-6,67	1,83
32. ハイキングをする所迄、車で行く。	-0,33	0,22
33. ショッピングバックを再利用する。	-0,62	0,2
34. 冬場、暖房をつけているのでセータを着なくても良い。	-1,26	0,2
35. 柔軟剤を洗濯する時に使用する。	-0,49	0,2
36. 通常のゴミ箱に使用後の電池を捨てる。	-2,66	0,29
37. *食後に食べ残しをトイレに捨てる。*	-4,02	0,51
38. トイレで化学的消臭剤を使用する。	-0,35	0,2
39. 環境保護団体に所属している。	2,42	0,42
40. ホテルにて、毎日タオルを交換してもらう。	0,6	0,24
41. 家庭で、省エネ製品を使用している。	-0,73	0,2
42. ピクニックの後、その場を元の通りにきれいに片付けて帰る。	-6,65	1,83
43. ソーラーパネル（太陽電池パネル）を使用している。	2,62	0,46
44. ソーラーパネルの個人的に持つ長所と短所を理解している。	-1,1	0,21
45. ソーラーパネルを所有するための見積もりを頼んだ事がある。	2,83	0,51
46. 再生可能な電力源を使おうとしている。	-0,18	0,2
47. 車を所有する事を遠慮している。	0,18	0,21
48. 自動車相乗りのメンバーに登録している。	4,2	1,01
49. 燃料消費量をできるだけ低くするように心がけている。	-1,58	0,23
50. 低燃費自動車（１リットル当たり１４**km**走行）を使用している。	0,78	0,29

Appendix III – Visual metaphors

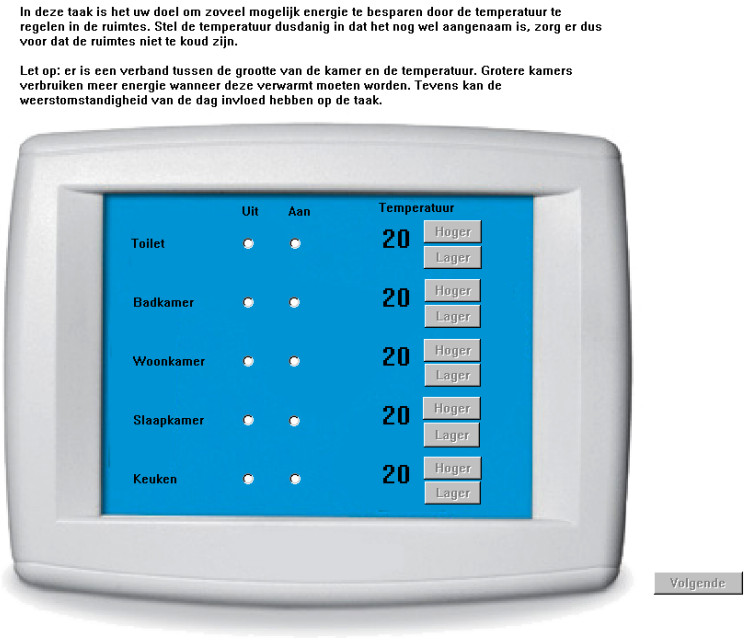
Juxtaposition

Fusion



Replacement

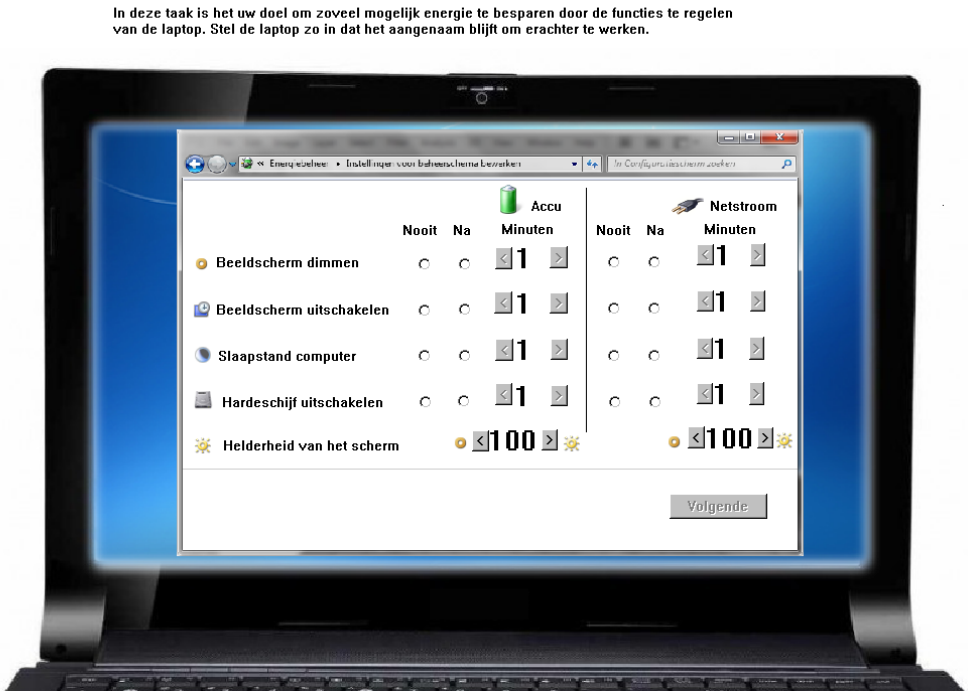
Appendix IV – Energy consumption tasks



Heater

Washing machine

Travel



Laptop