The Persuasiveness of a Smiling Embodied Conversational Agent

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PREFACE

The end of this thesis heralds a new beginning. From student I am almost changed into a graduate. This thesis fitted perfectly to the reason why I had chosen to apply to the master Business Communication and Digital Media; Persuasion in combination with computers / online media. Since ‘persuasion’ and ‘Embodied Conversational Agents’ were the two magical terms in this thesis, it gave me the opportunity to learn and develop myself in a subject of interest.

I wish to express my gratitude to the following people for supporting me during the process.

First, I would like to thank prof. dr. Eric Postma for his supervision while writing my thesis. Thank you Eric, for your constructive feedback and your clear advise. The freedom that you gave me to work on my own and to express my own ideas, has ensured that I had a very enjoyable and instructive experience.

Second, I cannot thank Eric without thanking dr. Marie Postma. After a conversation with you about my interests, I decided to contact Eric to ask for his supervision during my thesis. Furthermore, I would like to thank you for your thorough review of my thesis with special attention to the method and result section. I would also like to express my gratitude to Ruud Mattheij, MA, for his last-minute review of my thesis.

Finally, I would like to thank my family and my girlfriend Lindsay for their support during the ‘tough’ moments and my friend Bram for his patience and hospitality in order to use his computer.

ABSTRACT

The focus of this thesis is on three characteristics of Embodied Conversational Agents (ECA), namely: the persuasive effects of the presence of an Embodied Conversational Agent, the persuasive effects of the addition of expressions (i.e., visual cues such as a smile) and the influence of the receiver's gender on the effects of persuasion. Previous studies often focused on the persuasive effect of an ECA on one behavioral variable. Therefore, this thesis examines by means of an environmental approach, whether an ECA can have a persuasive effect on two behavioral variables: (1) pro-environmental behavior intention and (2) purchase intention. Subsequently, the following research questions are addressed: a) What is the persuasive effect of a message conveyed by an ECA on the pro-environmental behavior intention and purchase intention? b) And what is the effect of adding an expression in the form of a smile to the ECA and the effect of the gender of the receiver?

To answer these questions, two ECAs were developed: an ECA with a smiling expression and an ECA with a neutral expression. These ECAs were integrated in an experiment that was performed with 60 participants. These participants were assigned to one of three conditions where a persuasive message would be conveyed by: (1) text, (2) an ECA with a neutral expression or (3) an ECA with a smiling expression.

The results of the experiment revealed that a persuasive effect occurs when conveying a message by an ECA and that this persuasive effect is stronger for women than for men. On the other hand, the persuasive effect of a smile in combination with an ECA has not been found in this study. Finally, the persuasive effect was significant for the intention to show pro-environmental behavior, but this effect did not occur in case of purchasing products.

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1. INTRODUCTION

Embodied Conversational Agents are increasingly used to interact with online consumers (Dehn & van Mulken, 2000). An Embodied Conversational Agent (ECA) is a humanlike computer character that shows interactive behavior with a human (Schulman & Bickmore, 2005). Figure 1 shows an example of a male ECA. ECAs can be utilized to create the illusion of a face-to-face conversation. An ECA exhibiting nonverbal behavior (Cassell, 2000; Takeuchi, Watanabe & Katagiri, 2003) can raise the social influence and the persuasion of a message (Takeuchi, Watanabe & Katagiri, 2003). Persuasion can be defined as an attempt to influence other people's thoughts, attitudes or actions (Reardon 1991).

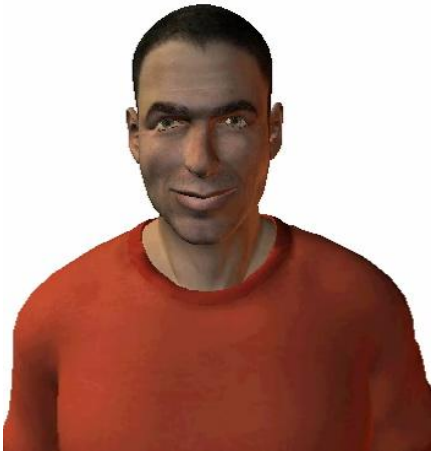

Figure 1. An example of an ECA

In this study the focus will be on three characteristics of ECAs, namely: the persuasive effects of the presence of ECAs, the persuasive effects of the addition of expressions (i.e., visual cues such as a smile) and the influence of the receiver's gender on the effects of persuasion. These three persuasive characteristics will be described below. Firstly, due to their social and persuasive potential, ECAs are increasingly used in various application domains such as educational (Annetta & Holmes, 2005) and online shopping (Holzwarth, Janiszewski & Neumann, 2006). In the latter case the focus is on the persuasive effect of using an ECA. The persuasive effect of an ECA was also examined in a study by Andersen and Guerrero (1998), which showed that ECAs are very useful because they can persuade clients to purchase goods. The second characteristic (persuasion of a smile) is interesting because previous studies (Gong, 2007; Brave *et al.*, 2005) have shown that the addition of a smile can also cause a persuasive effect. The third

characteristic focuses on the gender of the receiver. Research from Zanbaka *et al.* (2006) showed that there were cross-gender effects of persuasiveness when a message was conveyed by a male or female ECA. The study of Zanbaka *et al.* (2006) revealed that the persuasive effect of the ECA was higher for women compared to men. Further results of these studies will be described in the paragraphs below.

Various studies have investigated the relationship between ECA usage and persuasion (Mazotta, Novielli, De Carolis, 2009; Bauer & Neumann, 2005; Holzwarth, Janiszewski & Neumann, 2006), and more specifically, the persuasive effect of adding a smile to the ECA (Gong, 2007; Maldonada *et al.*, 2005; Brave *et al.*, 2005) and the persuasive effect of the gender of an ECA (Zanbaka *et al.*, 2006; Swint & Blascovich, 2001). The persuasive effects in these studies were determined by considering output variables in the form of behavior or purchase intention. However, none of these studies examined the persuasive effect of an ECA on two behavioral variables; behavior intention and purchase intention. In persuasive settings in practice these variables are commonly influenced to create a desired behavior. An example can be a goal to create environmental friendly behavior or to purchase a commercial good. This study will use environmental improvement as a mean to test whether an ECA can have a persuasive effect on behavior intention and purchase intention. Therefore, the variable behavior intention will be specified as pro-environmental behavior intention and the focus of purchase intention will be on the purchase of environmental friendly products. Pro-environmental behavior intentions are intentions that "consciously seek to minimize the negative impact of one's actions on the natural and built world" (Kollmuss & Agyeman, 2002, p. 240). Purchase intention is the willingness to buy a product. It is interesting to examine the persuasive effect of an ECA conveyed message on pro-environmental behavior intention and purchase intention because of the impact this can have on the receiver's behavior. It is also interesting to study this effect because the results can be used at persuasive settings in practice. In order to examine the persuasive effects of an ECA, the research questions are addressed as follows:

a) What is the persuasive effect of a message conveyed by an ECA on the pro-environmental behavior intention and purchase intention?

and

b) And what is the effect of adding an expression in the form of a smile to the ECA and the effect of the gender of the receiver?

In what follows, the hypotheses will be formulated. By testing these hypotheses an answer will be given to the research question.

1.1 Persuasion by an Embodied Conversational Agent

Various studies provided evidence that use of an ECA can have a positive effect on the persuasiveness of a message (Bauer & Neumann, 2005; Mazotta, Novielli, De Carolis, 2009; Holzwarth, Janiszewski & Neumann, 2006). Bauer and Neumann (2005) showed that participants who interacted with an ECA had a higher level of persuasion and subsequently had a higher intention to purchase a travel-insurance than participants who not interacted with an ECA. This was in line with a study conducted by Mazotta, Novielli and De Carolis (2009), which showed that a message that is conveyed by means of an ECA is perceived as more persuasive and more reliable than a text-only message. Other findings suggested that the use of ECAs contributes to consumer satisfaction in an online shopping environment and that they help to create a more positive attitude towards the product (Holzwarth, Janiszewski, & Neumann, 2006). Likewise, the findings of Holzwarth, Janiszewski, & Neumann (2006) suggested that the use of ECAs raises the purchase intention of the product. Overall, these studies suggest that the persuasive effect of a message is stronger when it is conveyed by an ECA than when it is conveyed in the traditional text-only format. Based on this suggestion, the following hypotheses are formulated:

H1a: The use of an ECA will have a positive effect on the intention to show pro-environmental behavior.

and

H1b: The use of an ECA will have a positive effect on the purchase intention.

1.2 The Persuasive Effect of Adding a Smile

According to previous research from Carnegie (1936), people believe that a smile can be used to influence other people. Although little research has been performed on the effects of smiling in human-ECA interaction, results from a study from Gong (2007) showed that using an

ECA to convey a message can have a positive effect on the attitude of the receiver of that message. In Gong's study (2007), book reports were presented by a smiling ECA, resulting in increased positive attitudes of the participants towards the books than when the book reports were presented by a sad ECA. Previous research (Fishbein & Azjen, 1975) has shown that the attitude of the receiver of a persuasive message is the most important antecedent for the following behavior intention. In other words, when people have a positive attitude towards a product it is more likely that they also have the intention to buy the product. With the study of Gong (2007) in mind it can be suggested that when there is, for example, a goal to sell products in an online shop using a smiling ECA would be valuable. This was also the conclusion in a previous study from Brave *et al.* (2005) where information was conveyed by means of an ECA. In this study the presence of a happy expression had a significant positive effect on the attitude and the judgments of the participants towards the presented information (Brave *et al.*, 2005).

In summary, a smiling ECA can have a positive effect on the attitude towards the message (Gong, 2007; Brave *et al.*, 2005). Subsequently, this lead to the suggestion that the attitude of the receiver of a message will be more positive and the persuasive effect will be stronger when this message is conveyed by a smiling ECA instead of an ECA with a neutral expression. Therefore, the following hypotheses are formulated.

> *H2a: The addition of an expression in the form of a smile to the ECA will have a positive effect on the intention to show pro-environmental behavior.*
>
> and
>
> *H2b: The addition of an expression in the form of a smile to the ECA will have a positive effect on the purchase intention.*

1.3 The Persuasive Effect of Gender

Previous research has shown that persuasion attempts by women are less effective than persuasion attempts by men (Propp, 1995). Differences between men and women can also be found in communication style during interactions; where men want to attain independence by being assertive, women want to attain consensus by means of collaboration (Tannen, 1990). This implies that women are more willing to be cooperative with the sender of a message than men. This is consistent with previous research that showed that men are less willing (than women) to

change their attitudes and that they are more likely to respond negatively when incentives try to persuade them (Alvaro & Burgoon, 1995). This is confirmed in a persuasive setting with ECAs by a study from Zanbaka *et al.* (2006). In this study, a male or female ECA conveyed a persuasive message to either male or female participants. The results revealed a cross-gender effect where the persuasive effect was higher when the gender of the ECA and the gender of the receiver differed than when it was the same. Similar results were found in a study of Swint & Blascovich (2001) where women were more likely to conform than men when they thought they interacted with an ECA. Taking the studies mentioned before into account, and since in this study only a male ECA will be used[1], it may be proposed that the persuasive effect will be higher for female participants than for male participants. Therefore a third hypothesis is formulated:

H3a: The use of a male ECA will have a more positive effect on the intention to show pro-environmental behavior for women than for men.

and

H3b: The use of a male ECA will have a more positive effect on the purchase intention for women than for men.

2. THEORETICAL BACKGROUND

In this chapter theoretical background information will be given. In order to do this, first a clear explanation of what an ECA is will be given. This will proceed into background information about ECAs and persuasion and the persuasive effect of a smile.

2.1 Embodied Conversational Agents

In this study an ECA will be used. ECAs are often confused with avatars and vice versa. To amplify why in this study is chosen for an ECA; first, an explanation will be given of the difference in meaning between the two. The word avatar is derived from the Hindu word avatāra and can be translated into and interpreted as ‘appearance’ or ‘manifestation’ (Freda, 2001). This term is later on applied in computer science and obtained several definitions including: “a representation of the user as an animated character in virtual worlds” (Loos, 2003, p. 17) and

[1] See page 17 in the method section for a motivation regarding the choice for a male ECA.

"digital models of people that either look or behave like the users they represent" (Ballenson *et al.*, 2006). These definitions are about the aspect of avatars to represent the person that uses the avatar. On the other hand, Embodied Conversational Agents (ECA) can be explained by means of the following definition from Hartmann, Mancini and Pelachaud (2006): "ECAs are virtual embodied representations of humans that communicate multimodally with the user trough voice, facial expression, gazing gesture and/or body movement". This definition and the definition from Schulman and Bickmore (2005) who state that ECAs are human-like characters, show that ECAs are not used to represent a specific user but represent humans in its general form. This differentiation can be made clearer by an example of avatar and ECA usage in practice. An avatar is, for example, very often used in an online community interface to offer the user the option to express who they are by *creating* an avatar (Kim, 2000). In contrast, an ECA is very often *imposed* to the user in an online shopping application where it can raise the perception of the interface as being social by adding social cues (Nass & Steuer, 1993). The focus of this study is on imposing a human-like character to a participant with the option to add an expression. Therefore, in this study an ECA will be used and not an avatar.

2.2 The Persuasive Effect of an Embodied Conversational Agent

Studies about persuasion already existed before there was any human-ECA interaction. To make a translation from those studies to persuasion in human-ECA interaction it is important to give a structured view about what persuasion is and how this translation to human-ECA interaction can be made.

2.2.1 Persuasion. Fishbein and Azjen (1975) state that attitude is the most important antecedent for behaviour. First, it has to be clear what an attitude is. The scientific approach towards attitude is defined by Fishbein and Ajzen (1975) as: "A learned predisposition to respond in a consistently favourable or unfavorable manner with respect to a given object". Later on Petty *et al.* (1997) exemplifies that attitudes can be described as the learning evaluations of an object (own person, other persons, or issue) who influences the thoughts of an individual. The latter definition is the definition that will be used in this study together with the knowledge of attitude being the most important antecedent for behavior (Fishbein & Azjen, 1975). In other words, in this study it will be taken in account that an attitude is the most important antecedent for behavior and that it can be influenced by others.

2.2.2 *Persuasion and Social Influence.* A definition in a study from Miller (2007, p12)

about persuasion is: ‘‘any message that is intended to shape, reinforce, or change the responses of another, or others.’’ Response shaping in this framework can be seen as something that occurs when specific stimuli are new to an individual and an attitude has not yet been formed. Response reinforcing is when an existing attitude needs to be reinforced, e.g. when someone constituted an attitude after a jail sentence and wants an honest life, then going to counseling is a way of response reinforcing. Response changing is the change of an existing attitude or behavior and the best-known aspect of persuasion (Miller, 2007). When the goal of a message is to change an existing attitude, the persuasive effect can be stronger when an individual is socially influenced by the source of that message (Wood, 2000). The occurrence of this persuasive effect is consistent with previous research from social psychologist Allport (1954) who stated that “the behavior and feelings of individuals are influenced by the presence of others”. This is consistent with other research which showed that attitude change can emerge from the need to adapt the attitude to others (Lundgren & Prislen, 1998). Furthermore, research from (Bond & Smith, 1996) has shown that this accommodation to others occurs in public as well as in private situations. This ‘influence by presence of others’ often occurs in a sales environment where sales agents try to persuade others face-to-face. In such an environment the social influence of a sales agent, also contributes to the effect that the message will be believed easier (Soldow & Thomas, 1984) and hereby has a stronger persuasive effect.

According to research from Korgaonkar and Wolin (1999) effects of human to human agent mediated communication can also be extended to human to ECA mediated communication. This is consistent with other studies that showed that the social influence of ECAs on other humans can be similar to the influence of humans on other humans (Nass & Steuer 1993; Reeves & Nass 1996; Nass & Moon 2000).

2.2.3 *Social influence and ECAs.* Knowing the previous discussed studies of social influence it can be assumed that when a participant would feel the presence of an ECA, responses in favor of the ECA would also emerge. This is consistent with a study conducted by Takeuchi, Watanabe and Katagiri (2003) where the effect of social influence by an ECA was measured. The results of this study showed that the presence of an ECA can stimulate social responses and social presence by expressing social cues (Takeuchi, Watanabe & Katagiri, 2003). This stimulation of social responses can contribute to a more positive response when people are confronted with statements about social issues.

2.2.4 *ECA characteristics.* The power of the influence of a persuasive message is dependent on how people process this message. Within the Elaboration Likelihood Model (Petty & Cacioppo, 1986) there are two routes by which people process communication and which can lead to a change of attitude; the central route and the peripheral route. Within the central route the receiver is concentrating on the message and is willing and able to process the message. The qualities of the arguments are very important within the central route (Petty & Wegener, 1999). When the message is processed centrally the arguments will be carefully considered. As a result of this rational consideration the receiver will develop a strong attitude which can be positive or negative. Within the peripheral route the receiver is hardly paying any attention to the message. In this case an attitude will be formed mostly by simple cues (Petty & Wegener, 1998) and is less strong than the attitude that is formed by centrally processing. Examples of simple cues are when a receiver of a message can administrate specific traits to the sender in the form of trustworthiness, attractiveness and likeability (Petty & Cacioppo, 1986). The administration of these specific traits can have a positive effect on the attitude from the receiver pertaining to a message (Petty & Cacioppo, 1986).

In previous research administrating traits to a person such as trustworthiness, likeability and attractiveness is examined in an ECA-context (Sprout *et al.*, 1996; Bauer & Neumann, 2005; Holzwarth, Janiszewski & Neumann, 2006; Baylor, 2009). This research has proven that the use of ECAs can have a positive effect on the perceived trustworthiness (Sprout *et al.*, 1996; Bauer & Neumann, 2005) attractiveness (Holzwarth, Janiszewski & Neumann, 2006; Baylor, 2009) and likeability (Holzwarth, Janiszewski & Neumann, 2006). In other words, when a message was conveyed by means of an ECA, the message was more liked, more attractive and more trustworthy. Sproull et al. (1996) examined whether the trustworthiness was more stimulated in an ECA interface compared to a text-based interface. The results showed that the interface with the ECA scored significant higher on trustworthiness than the text-based interface. The fact that trustworthiness is an important trait regarding the persuasive effect of a message (Petty & Cacioppo, 1986) has also been shown in research about persuasion in an ECA context by Bauer and Neumann (2005). They showed that an ECA can be an important tool in electronic commerce because of the ability to gain a positive effect on the trust of a consumer which eventually could lead to an increase of purchases. Another trait that is important for persuasion is likeability (Petty & Cacioppo, 1986). Research about this trait showed that the likeability of an

ECA can have a positive effect on the attitude towards a product and the purchase intention of a product (Holzwarth, Janiszewski & Neumann, 2006). Looking at these studies, the assumption can be made that using an ECA could have a positive effect on the persuasiveness of a message.

2.3 The Persuasive Effect of a Smile

The administration of important persuasive characteristics such as trustworthiness, attractiveness and likeability can occur by means of various tactics. In this study the focus will be on only one tactic: the use of a smile. Previous research give examples in which way the use of a smile can influence the perceived trustworthiness (Krumhuber *et al.* 2007) the attractiveness (Forgas & Bower, 1987) and the likeability (Clore & Byrne, 1974) of the sender by the receiver. These studies were about human-human interaction but (as stated before) these effects may be translated to ECA-human interaction (Korgaonkar and Wolin, 1999). This is in line with a study from Maldonada *et al.* (2005) who found in case participants interacted with an ECA with a smiling expression, the trustworthiness of the message was higher than when the participants interacted with an ECA with a neutral expression. This result showed that perceived trustworthiness can be achieved by means of an ECA by which a persuasive effect can be achieved (Petty & Cacioppo, 1986). In summary, in situations with low involvement[2] the use of a smiling ECA can have a positive effect on the attitude of the receiver of the message.

Finally, some attention in this thesis will be given to the effect of novelty of a persuasion attempt. According to the Persuasion Knowledge Model (PKM) from Friestad and Wright (1994) persuasion is seen as something you develop knowledge about throughout the years. In their study they also talk about persuasion coping knowledge what includes the ability to recognize, interpret and remember persuasion attempts. This has the consequence that when a persuasion attempt is relatively new to the receiver it becomes hard to recognize it as a persuasion attempt (Friestad & Wright, 1994). .On the other hand, when people are relatively familiar with a persuasion attempt they will recognize it rather quick as an attempt to influence their attitude or behavior. This could influence the way people react to a persuasive message that is conveyed by an ECA. When a participant experienced several persuasion attempts by an ECA in the past, the persuasive effect will probably lower compared to receiving a message by an ECA is relatively

[2] The persuasive effect of characteristics such as trustworthiness, attractiveness and likeability are especially applicable in situations with low involvement (Petty & Cacioppo, 1986).

new to the receiver. Therefore, in this study will be measured whether this aspect affects the results.

3. METHOD

3.1 Participants

Data were collected from 60 students from Tilburg University. Participation was on voluntary basis, while eight students received course credits for their participation. The group consisted out of 30 males (*M age* = 24.2, *SD* = 2.0) and 30 females (*M age* = 23.6, *SD* = 1.9). Furthermore, 20 university students from applied university education participated in a pre-test to test the statements and the products. This group of participants consisted out of 12 males (*M age* = 23.8, *SD* = 2.1) and 8 females (*M age* = 23.1, *SD* = 1.1) and all participated voluntary.

3.2 Design

A between subject design with two independent variables (ECA versus no ECA, Expression versus no Expression) was used. By means of a between subjects design it was secured that the purpose of the experiment would not be detected by the participants.

The participants were randomly assigned to the text-only group, the neutral-ECA group or the smiling-ECA group. The gender composition was held constant at 10 females and 10 males per condition to control for potential gender effects. All the participants were confronted with exactly the same arguments, statements and products, and all in the same order. Furthermore, the pre-attitude in all the conditions was measured in a similar manner and before the experiment started. The only question that both the ECA conditions had to answer and the text-only condition not, was a question that measured the familiarity with ECAs. This was because this condition would not contain data gathered after seeing an ECA.

The independent variable of the experiment was the way the participants were confronted with the arguments; by Text, by an ECA with a Neutral Expression or by an ECA with a Smiling Expression. The dependent variable was the willingness to show environmental friendly behavior, divided into two sub dependent variables: pro-environmental behavior intention and purchase intention. The variables were measured by means of 15 statements and 7 products.

3.3 Instrumentation

Statements were proposed to participants to measure their willingness to show environmental friendly behavior. The statements that have been created for the experiment are based on an environmental study from Straughan and James (1999). A selection was used to create 20 new statements for this experiment and 10 ecological products were chosen. These statements and products first had to be tested by means of a pre-test whether there was room for persuasion. When a statement or product was already positive received in a pre-test there was no room left for persuasion and it could not be used during the experiment. Arguments in favor of the statements and the products were drawn in order to persuade the participants. The goal was to have at least 10 usable statements and 5 usable products after the pre-test, so enough data would be available to conduct a statistical analysis. The measurements were done on a five-point Likert scale, ranging from strongly disagree to strongly agree. This scale measured the intention to show pro-environmental behavior and the purchase intention. When the mean of the intention was less than 3.0, then the item could be used for the experiment. In case the mean of intention was equal to or higher than 3.0, the item was deleted from the questionnaire because there would be little room for persuasion since the participants already were positive about the statement or product. Eventually, 15 statements and 7 products scored a mean less than 3.0 and met the requirements to be used in the experiment[3].

Ten of the participants were also used to test two types of smiles regarding the ECA. The 10 participants had to rate the smiling ECA on friendliness, trustworthiness and likeability. Those three traits can be influential factors when it comes to persuasion (Petty & Cacioppo, 1986) and therefore the best scoring smile would be used during the experiment. Although there was no significant difference between the traits[4], one smiling ECA that scored on every trait better than the other and was therefore used during the experiment.

3.3.1 Reliability of Item Scores. After the experiment, the reliability of the item scores were tested by using Chronbach's alpha. This has been done for all the items together as one scale (environmental friendly behavior) and for the two item sets separately as two separate subscales (pro-environmental behavior intention and purchase intention). Both groups together contained 22 items ($\alpha = .86$), the group pro-environmental behavior intention contained 15 items

[3] Appendix 1 shows the statements and products that were used during the experiment.
[4] Appendix 4 shows the two ECAs and descriptive statistics of the traits.

(α = .79) and the group purchase intention contained 7 items (α = .72). The data was therefore reliable enough for further analyses.

3.3.2 Manipulation check. To test whether any significant effects were caused by the manipulation instead of by differences between the environmental attitudes from the participants, a pre-environmental attitude measurement was formulated. This measurement was based on a selection of the Environmental Concern Scale (ECS) (Scott & Willits, 1994; Straughan & James, 1999). Nine attitude measurements were translated into the Dutch language in order to test the pre-environmental attitude from the participants[5].

3.3.3 Reliability of manipulation check. Initially, a factor analysis was performed on the 9 ECS items regarding the pre-attitude. By conducting a factor analysis there could be determined whether there are patterns in the relationships among the ECS items. An extraction was made with a fixed number of factors of two. By this analysis, the data could be validated in terms of meaning. Firstly, the Kaiser-Meyer-Olkin measure of sampling adequacy was .60, which is also the minimum recommended value. Secondly, the outcome of the Bartlett's test of sphericity was significant (χ^2 (36) = 74.10, p < .005). Furthermore, the component analysis showed that from the initial eigen values, the first two factors explained 42.6% of the variance where the other 7 factors explained each less than 13%, which motivated the choice for the fixed number of factors of two. All the items scored above .3 (see table 1,) so the factor analysis was conducted with all 9 items.

[5] The nine attitude measurements based on the ECS can be found in table 1.

Table 1. *Factor loadings and communalities based on a principle component analysis for 9 items from the Ecological Concern Scale (ECS) (N=60)*

	1	2
Planten en dieren bestaan primair om gebruikt te worden door mensen.	.77	
De aarde is als een ruimteschip met enkel beperkte ruimte en bronnen	.15	.61
De balans van de natuur is erg delicaat en is gemakkelijk verstoord.	.33	-.35
Wanneer mensen schade berokkenen aan de natuur heeft dit vaak desastreuze gevolgen.	.45	-.22
Mensen moeten in harmonie leven met de natuur om te kunnen overleven.	.28	.49
Mensen hebben het recht om hen natuurlijke omgeving zo aan te passen dat het bij hun behoeften past.	.52	-.35
De mensheid is het milieu zwaar aan het misbruiken.	.73	-.10
De mensheid is ontstaan om over te heersen over de natuur.	.66	.23
We bereiken het maximum van het aantal mensen dat de aarde nog aan kan.	.21	.78

Table 1 shows six items that have a score above .3 for subscale 1 and three items for subscale 2. In other words, there is a relation between the six items of subscale 1 and there is a relation between the three items of subscale 2. Subsequently, labels can be addressed to both of these relational items of the two subscales Based on factor labels for the subscales from previous research (Scott & Willits, 1994) the factor label for subscale 1 is 'Humans/balance with nature', and for subscale 2 'Limits to growth'. Reliability for both the scales was tested by using Chronbach's Alpha. The subscale 'Humans/ balance with nature' contained 6 items ($\alpha = .65$) and the subscale 'Limits to growth' contained 3 items ($\alpha = .48$). The alpha of subscale was not reliable. This could not be increased by deleting items and is the items of subscale two are therefore eliminated from the data. Because previous research from Scott and Willits (1994) stated the subscales "Humans-with nature" ($\alpha = .67$) and "Balance-of nature/Limits-of growth" ($\alpha = .76$) as reliable, it is plausible to think that something went wrong for the subscales. A

possible explanation could be that the items were translated from English to Dutch what may have caused friction with the original meaning of the items[6].

3.4 Materials

The experiment was conducted by means of a laptop (HP Compaq Presario CQ61, screen size 15.6 ") or a standard desktop computer from the Tilburg University. The introduction of the experiment was presented on the computer screen, so no other materials than a computer or laptop were used.

The experimental environment was created by means of open source software (Limesurvey). LimeSurvey allows users to quickly create online question-and-answer surveys with the option of adding movie clips. Regarding the layout of the experiment a standard LimeSurvey template was used that is called "eirenicon"[7].

3.4.1 Creation of the ECA. For the creation of the ECAs commercial software was used (eFrontier Poser 7). As stated before, previous research has shown that persuasion attempts by women are less effective than persuasion attempts by men (Propp, 1995), which was the motivation to create only a male ECA. The standard ECA (included in the Poser software) met the requirement of a male person with a standard appearance and was therefore, after some adjustments, usable for the experiment. Figure 2 shows a comparison of the standard ECA from Poser and the ECA after the adjustments. First, the eyes of the ECA were changed in a soft green color, because the bright blue eyes of the standard ECA could attract too much attention. This adjustment is created by selecting the material tab, library, materials Simon G2 and replacing the blue eyes with eye hazel no ref. Second, the pose of the ECA was changed into a pose with the arms downwards, to create a normal standing position. Third, the camera was set up in a medium close up position, in order to focus on the face and its expression. After that, the expression was added to the face of the ECA. Within relation to the ECA with the neutral expression[8], no changes in the parameters were made because the standard expression is neutral. Every change that would have been made to the parameters would have added a form of expression.

[6] Appendix 2 shows the Dutch and English version of the ECS in order to compare the translation.
[7] Appendix 3shows the layout that is used for the experiment.
[8] Appendix 5 shows the ECA with a neutral expression.

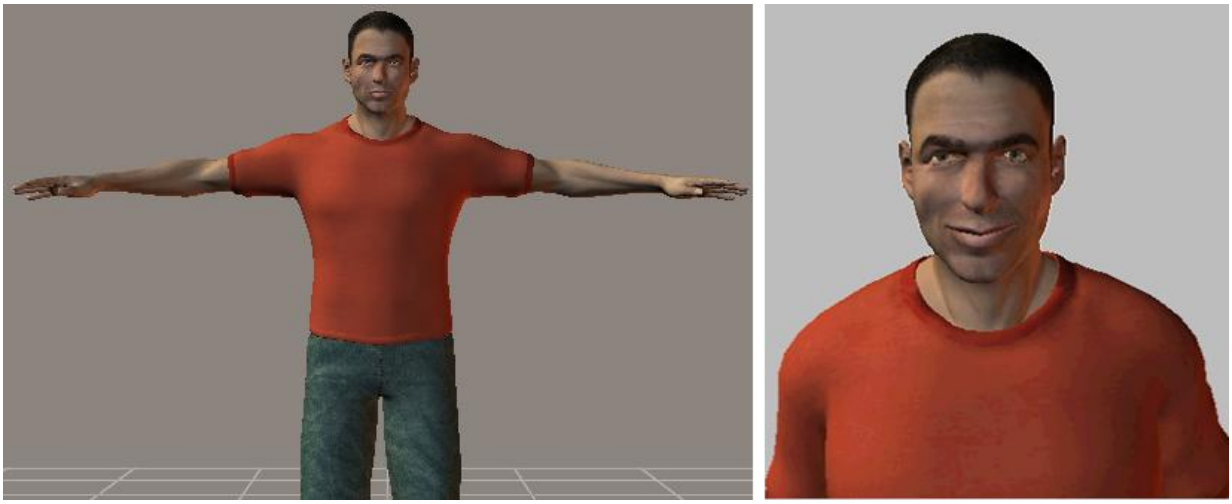

Figure 2. On the left the standard ECA, on the right the adjusted ECA that was used in favor of the experiment.

The expression in the form of a smile was added by creating a Duchenne smile[9] by the means of the Facial Action Coding System (Ekman & Friesen, 1978; Surakkaa & Hietanen, 1998). The smile that was used for the experiment was created by manipulating Action Unit (AU) 6 i.e. cheek raiser, AU 12, i.e. lip corner puller, AU 43, i.e. eyes closed and AU 4, i.e. eyebrow lowerer. This is translated into changing the following parameters in Poser: AU6 manipulated by parameter SmileThin 0.140, AU 12 is manipulated by LipCornerDepressorsLeft -0.240 and LipCornerDepressorsRight -0.240, AU 43 is manipulated by EyesWide -0.057 and AU 4 is manipulated by BrowUpCenter -300 EyesSmile 0.700. Finally, the background is changed into plain white because hereby the background of the ECA would blend with the background of the experimental environment (eirenicon-template)[10].

3.4.2 Editing the ECA clips. After the ECAs were created, they were edited with commercial software (Adobe After Effects CS5.5). The text of the ECA was not transmitted in spoken words but by text balloons. Since a voice can also have a persuasive effect (Hall & Hopkins, 1980; Gelinas-Chebat & Chebat, 1996), the two variables (smiling expression and voice) could not be used simultaneously. When doing so, any significant effect could not have been subscribed to one of the variables because the cause would have been unknown. Therefore,

[9] When showing a Duchenne smile the cheeks muscles pull the lip corners up and the corner of the eyebrows are pulled slightly downwards (Ekman & Friesen, 1978). When the cheek muscles activate a pull up of the lip corners but there is an absence of activation of the eyebrow muscles a non-Duchenne smile is showed (Ekman & Friesen, 1978). According to the literature, a Duchenne smile will create a more positive attitude towards the message compared with a non-Duchenne smile (Frank, Ekman and Friesen, 1993) and is therefore chosen to create within this experiment.

[10] Appendix 3 shows a screenshot of the experimental environment.

text balloons[11] were created with standard Windows software (Paint) and subsequently pasted into the ECA clips in Adobe After Effects. Every text balloon appeared for 5 seconds on screen in order to keep it consistent and to give the participants enough time to read the lines. Between every new text-balloon there were three seconds to give the participants the opportunity to look at the ECA. When all the clips were finished they were converted with commercial software (Any Video Converter) into .swf-clips, in order to integrate them into Limesurvey.

3.5 Procedure

The experiments were all conducted on a laptop or desktop computer in a quiet place so the focus of the participants would be on the experiment. The instructions told the participants that it was important to read carefully and to pay attention to the screen. Thereafter, the participants automatically started with the experiment. The introduction, arguments regarding the statements, arguments regarding the products and the thanks for participation all consisted out of ECA clips. The clips prior to every statement and product contained arguments in the form of text balloons in favor of the upcoming statement or product. At the end of the clip, the ECA asked the participant to click on the next button in order to proceed. The pace was in such a manner that every participant could easily read every text balloon. Still, when the participant missed something and wanted to watch the clip again, it automatically replayed by waiting 5 seconds. This possibility was communicated in the introduction and therefore known by the participant. There was the ability to type down any remarks regarding the experiment and the participants were again thanked for their participation at the end of the experiment. The total duration of the experiment was approximately 20 to 25 minutes.

3.6 Statistical analysis

The distribution of the items was examined by conducting a test of normality in order to check which statistical tests could be used. This was done for the scale environmental friendly behavior (N=60, M = 2.78, SD = .57) the subscale pro-environmental behavior intention (N=60, M = 2.55, SD = .56), the subscale purchase intent (N=60, M = 3.26, SD = .70) and the scale familiarity with an ECA (N=40, M = 3.23, SD = 1.23). The results of the Shapiro-Wilk test were that the three scales environmental friendly behavior (p = .37), pro-environmental behavior intention (p = .47) and purchase intent (P = .05) were normally distributed and that the scale

[11] Appendix 3 shows a screenshot of a talking ECA by means of a text balloon.

familiarity with an ECA was not normally distributed ($p < .001$).

To examine the research question, the ECA condition (N = 40) was compared with the text-only condition (N = 20) and the smile condition (N = 20) was compared with the no emotion condition (N = 40). To know whether these groups could be compared, a test of homogeneity was conducted $F(2, 57) = .38$, $p = .69$. Since the test of homogeneity was not significant and the behavioral scales were normally distributed a Univariate Analysis of Variance was used to examine the effect of using an ECA and the effect of adding a smile.

To focus more on the differences between the three groups (text-only, neutral ECA, smiling ECA), a multivariate analysis of variance (MANOVA) with a post-hoc Boneferroni-test was conducted. Furthermore, the data was grouped into two sets and the initial set was compared to the last test with a paired sample T-test. This test was conducted in order to make sure that any significant effects did not occur because of the timeline of the experiment. Finally, there was analyzed whether participants who were more familiar with ECAs were less persuaded by the ECA. The correlation between the familiarity with ECAs and the willingness to show environmental friendly behavior was tested by a Spearman's Rho test because the distribution was not normal.

4. RESULTS

Below the gathered data will be statistically analyzed in order to test the hypotheses. The results of these statistical analyses will be further discussed in chapter 5.

4.1 Pre-attitude measurements

To check whether any significant effects that would occur were caused by the manipulation instead of the pre-attitude about the environment, statistical analyses were performed. The data on the pre-attitude measurements, were not normally distributed thus any differences between the conditions had to be analyzed with a non parametric analysis of variance. Therefore, a Kruskal-Wallis test was conducted to evaluate differences among the three version conditions: No-ECA (*Mdn* = 3.75), Neutral-ECA (*Mdn* = 3.83) and Smiling-ECA (*Mdn* = 3.58) on median change in the pre-attitude about the environment. There were no significant differences between the medians χ^2 (2, N = 60) = .07, p = .97. The pre-attitude measurements did not differ, so any following results would not have to be assigned to the pre-attitude about the environment.

4.2 The Persuasive Effect of an Embodied Conversational Agent

A univariate analysis of variance was conducted to compare the effect of using an ECA or using no ECA on the willingness to show environmental friendly behavior. The results (for means see table 2) [between-subjects factor: version-ECA (text only, ECA)] revealed a significant main effect of version, $F(1, 57) = 5.29$, $p < .05$, on the willingness to show environmental friendly behavior.

Subsequently, the univariate analysis of variance was conducted to compare the effect of using an ECA or using no ECA on the two subscales separately (pro-environmental behavior intention and purchase intention). The results (for means see table 2) [between-subjects factor: version-ECA (text-only, ECA)] revealed significant main effect of version-ECA, $F(1, 57) = 5.10$, $p < .05$, on the intention to show pro-environmental behavior. However, the results revealed no significant effect of version, $F(1, 57) = 3.93$, $p = .05$ on the purchase intention.

Table 2. *Means Version on Environmental Friendly Behavior, Pro-environmental behavior intention and Purchase Intent (N=60)*

	Environmental Friendly Behavior	Pro-environmental behavior intention	Purchase Intent
Text only	2.50 (SD = .55)	2.28 (SD = .49)	2.96 (SD = .81)
ECA	2.92 (SD = .52)	2.69 (SD = .54)	3.41 (SD = .58)

4.3 The Persuasive Effect of a Smiling Embodied Conversational Agent

A univariate analysis of variance was conducted to compare the effect of using a expression in the form of a smile or using no emotion on the willingness to show environmental friendly behavior. The results [between-subjects factor: version-expression (no emotion, smile)] revealed no significant main effects of version-expression, $F(1, 57) = .14$, $p = .71$, on the willingness to show environmental friendly behavior.

4.4 The Persuasive Effect of an Embodied Conversation Agent and Gender Differences

A multivariate analysis of variance, MANOVA was conducted to compare the effect of the three versions (text-only, neutral-ECA and smiling ECA) and the side effect of gender on the

willingness to show environmental friendly behavior. The results of the MANOVA [between-subjects factor: version (text only, neutral ECA, smiling ECA)] revealed significant main effects of version(for means, see table 3), $F(2, 54) = 4.80$, $p < .05$, and effects of gender(for means, see table 4), $F(1, 54) = 7.80$, $p = < .01$, and no interaction between version and gender, $F(2, 54) = 1.75$, $p = .18$. Post hoc pair wise comparisons using the Bonferroni test indicated that the mean score for text only ($M = 2.55$, $SD = .55$) on environmental friendly behavior significantly differed from smiling ECA ($M = 2.95$, $SD = .51$), $P < .05$. However, the text only condition did not significantly differed from the neutral ECA condition ($M = 2.89$, $SD = .55$) $p = .05$, as well as the smiling ECA and the neutral ECA conditions did not differed significantly from each other. The results suggested that the use of a smiling ECA has a significant effect on the willingness to show environmental friendly behavior compared with the text only condition.

Table 3. *Means Version on Environmental Friendly Behavior, Pro-environmental behavior intention and Purchase Intention (N=60)*

	Environmental Friendly Behavior	Pro-environmental behavior intention	Purchase Intent
Text only	2.50 (SD = .55)	2.28 (SD = .49)	2.96 (SD = .81)
Smiling ECA	2.95 (SD = .51)	2.72 (SD = .53)	3.45 (SD = .57)
Neutral ECA	2.89 (SD = .55)	2.66 (SD = .57)	3.39 (SD = .62)

Table 4. *Means Version with Gender on, Environmental Friendly Behavior (N=60)*

	Male (N = 30)	Female (N = 30)
	Environmental Friendly Behavior	*Environmental Friendly Behavior*
Text only	2.46 (SD = .52)	2.54 (SD = .61)
Neutral ECA	2.55 (SD = .63)	3.23 (SD = .39)
Smiling ECA	2.79 (SD = .49)	3.11 (SD = .29)

4.5 Comparing the Effect on Pro-environmental Behavior Intention and Purchase Intention

A multivariate analysis of variance, MANOVA was conducted to compare the effect of the three versions (no-ECA, neutral-ECA and smiling ECA) and gender on the willingness to show environmental friendly pro-environmental behavior intention (statements) versus

environmental friendly products purchase intention (products). The results (for means, see table 3) of the MANOVA revealed a significant main effect of version on pro-environmental behavior intention, $F(2, 54) = 5.16$, $p < .01$, and no significant effect of version on purchase intent, $F(2, 54) = 3.05$, $P = .06$. Post hoc pair wise comparisons using the Bonferroni test indicated that the mean score for text only ($M = 2.28$, $SD = .49$) on pro-environmental behavior intention significantly differed from the smiling ECA ($M = 2.66$, $SD = .57$), $P < .05$ and significantly differed from the neutral ECA ($M = 2.72$, $SD = .53$), $P < .05$.

These results suggest that the general significant persuasive effect is merely caused by the willingness to show environmental friendly pro-environmental behavior intention. Both of the conditions with the ECAs scored significantly better on the willingness to show environmental friendly pro-environmental behavior intention scale then the no-ECA condition. This was not the case for the scores on the purchase intention scale where there were no significant differences.

Furthermore, the results of the MANOVA revealed a significant difference of gender (see table 5 on pro-environmental behavior intention, $F(1, 54) = 14.20$, $p < .001$, and no significant difference of gender on purchase intent, $F(1, 54) = .83$, $P = .37$. These results suggest that the female participants were more persuaded by both of the ECA conditions then the male participants, knowing that there was a significant difference between the male and female participants on the pro-environmental behavior intention scale.

Table 5. *Means Version with Gender on, Pro-environmental behavior intention and Purchase Intent (N=60)*

	Male (N = 30)		Female (N = 30)	
	Pro-environmental behavior intention	Purchase Intent	Pro-environmental behavior intention	Purchase Intent
Text only	2.19 (SD = .48)	3.03 (SD = .78)	2.37 (SD = .51)	2.90 (SD = .88)
Neutral ECA	2.29 (SD = .42)	3.11 (SD = .68)	3.03 (SD = .44)	3.47 (SD = .42)
Smiling ECA	2.50 (SD = .63)	3.41 (SD = .68)	2.95 (SD = .27)	3.66 (SD = .47)

4.6 Effect of Experiment Duration and Novelty Effects

A paired-samples t-test was conducted to compare the first range of reactions of the

participants to the item scale pro-environmental behavior intention (statement 1 to 8) with the second range of reactions (statement 9 to 15). This has been done to check whether the participants got more positive as the experiment continued; knowing that there is a difference between the scores on pro-environmental behavior intention and purchase intention. There was no significant difference in the scores for the statement 1 to 8 (M = 2.51, SD = .61) and statement 9 to 15 (M = 2.57, SD = .63) conditions; t(59) = -.84, p = .41. These results may suggest that any differences regarding the results on pro-environmental behavior intention and purchase intention were not caused by more positivity as the experiment continued.

Furthermore, a Spearman's Rho test was conducted to measure the correlation between the familiarity with ECAs (M = 3.23, SD = 1.23) of the participants and the willingness to show environmental friendly behavior (M = 2.92, SD = .52). The results of this test revealed no significant correlation, r (38) = .03, p = .89. These results may suggest, in contrary to the expectation, that the effect of using an ECA will not be stronger when using an ECA is relatively new to the participants.

5. DISCUSSION

In this chapter the results of the statistical analysis will be further discussed. First, a summary of the results will tell whether the hypotheses were supported or not. Hereafter, the tested hypotheses will be further discussed and compared to previous research.

5.1 Summary of the results

This study demonstrated that the persuasive effect was stronger for an ECA conveyed message than a textual message. The participants were more willing to show environmental friendly behavior when an ECA tried to persuade them. However, the effect only implied to pro-environmental behavior intention and not to purchase intention. The participants in the ECA condition had a higher intention to show pro-environmental behavior than the participants in the text-only condition (H1a is supported). This result was not found for purchase intention: the willingness to purchase an environmental friendly product did not differ between the conditions (H1b is not supported). On the other hand, the persuasive effect of using an ECA was stronger for men than for women. In line with the expectations women had a higher intention to show pro-environmental behavior intention when they were persuaded by the ECA than men (H3a is supported). Again this was not the case for the purchase intention where there was no significant

difference between men and women (H3b is not supported). The results also revealed that the addition of a smile had not the persuasive effect that was expected (H2a and H2b are not supported). Finally, familiarity with ECAs did not affect persuasion.

5.2 The Persuasive Effect of an Embodied Conversational Agent

Prior research from Mazotta, Novielli and De Carolis (2009) has shown that an ECA conveyed message can have a positive effect on persuasion compared to a text-only message. This study also compared an ECA condition to a text-only condition when conveying a message and subsequently examined the persuasive effect. The results of the study from Mazotta, Novielli and De Carolis (2009) are in line with the results of this study. The analysis of the experiment showed that the ECA had a positive effect on persuasion. However, a distinction can be made between the pro-environmental behavior intention and purchase intention. In case of pro-environmental behavior intention, a message in the form of an argument was presented and the participant was then asked about the willingness to show behavior in favor of the argument. In such a situation the ECA can contribute to the perceived trustworthiness of the message (Sprout *et al.*, 1996) which is an important trait when there is a persuasive goal (Petty & Cacioppo, 1986). This can also be seen in the results where the intention to show pro-environmental behavior was higher in the ECA condition compared to the text-only condition. On the other hand, were the results regarding purchase intention not in line with the results from previous studies. Prior research has shown that using an ECA in a shopping environment raises the purchase intention of the visitors (Holzwarth, Janiszewski & Neumann, 2006; Bauer & Neumann, 2005). However, the results of this study showed that the participants were not more persuaded by an ECA conveyed message compared to a text-only message, to purchase environmental friendly products. A possible explanation could be the virtual environment where the ECA was used. In this study the participant was shown a message in the form of an argument in favor of the upcoming product. Subsequently the participant had to indicate his or her willingness to purchase the product. In other words, the willingness to purchase a product was measured in a questionnaire setting. This differs from the environments that were used in the previous mentioned studies. The environments in the studies from Holzwarth, Janiszewski and Neumann (2006) and Bauer and Neumann (2005) were both more designed as online shop environments which may increase the effect of using an ECA to persuade the participant. Chen *et al.* (2002)

state that the design of an online shop can have a positive effect on purchase intention. So when the use of an ECA will be tested in an online shop environment other results can possibly occur.

5.3 The Persuasive Effect of Adding a Smile

The lack of a persuasive effect when adding a smiling expression to the ECA was not in line with previous research and the prior expectations. Previous studies showed that an expression in the form of a smile can have a persuasive effect in a human-human interaction (Carnegie, 1936; Krumhuber, Manstead & Kappas, 2006) as well as in a human-ECA interaction (Maldonada *et al.*, 2005; Gong, 2007). Therefore, the expectation was that a smiling ECA would stimulate the persuasive effect of the message. However, the persuasive effect of a smiling expression did not occur in the human-ECA interaction in this study. The participants that were confronted with a smiling ECA were not more persuaded than the participants that were confronted with a neutral expression. The use of a neutral expression versus a smiling expression is a possible explanation for not fulfilling the expectations. In the studies from Gong (2007) and Maldonada *et al.* (2005) a sad expression was compared with a smiling expression which are expressions that have a big contrast in valence as well as in arousal (Ekman, 1992). It is possible that the contrast between the neutral expression and the smiling expression was not big enough to have a significant result. Another explanation can be given by means of previous research by Midden and Ham (2009). The study of Midden and Ham (2009) revealed that participants changed their ongoing behavior more when they received negative feedback than when they received positive feedback. The difference between the study of Midden and Ham (2009) and this study is that the ECA in this study tried to influence behavioral intentions instead of ongoing behavior. Despite the just mentioned difference between the two studies, it would be interesting to examine the effect of a happy expression versus a sad expression on behavioral intentions.

5.4 The Persuasive Effect of Gender

There was a clear difference between the group of female and the group of male participants. Namely, the female participants were more persuaded by the ECA than the male participants. It is important to note that only a male ECA was used to convey the messages and persuade the participants. This is important to mention because previous research has shown a cross gender effect can occur when using an ECA. Women tend to be easier persuaded by a male ECA and men tend to be easier persuaded by a female ECA (Zanbaka *et al.*, 2006). This cross-

gender effect could be the reason that the female participants were more persuaded than the male participants. Women are also more willing than men to change their attitudes when incentives try to achieve an attitude change and men tend to respond more negatively (Alvaro & Burgoon, 1995). Therefore, the effect could have occurred that women were more willing to change their attitude in favor of the incentive (in this study the message of the ECA) than men. Furthermore it is important to mention, although the effect was not significant, that women were more persuaded by a neutral ECA compared to a smiling ECA and men vice versa.

Finally, in contrast with previous research (Friestad & Wright, 1994) the novelty of the way the message was transmitted did not stimulated the persuasive effect of that message. Participants that were less familiar with ECAs in general were not more persuaded than participants that were familiar with ECAs. This is positive for the results because the persuasive effect that occurred was caused by the ECA and not by the familiarity or unfamiliarity with persuasion attempts by ECAs. However, the correlation between (lack of) familiarity and persuasion was measured with only one question about familiarity. Therefore, in the future to really test the persuasive effect of familiarity with persuasion attempts by an ECA, more data about previous experiences regarding persuasion attempts with an ECA have to be gathered.

5.5 Improvements

This study could be improved in four aspects, namely: generalization, the amount of tested smiles, cross-gender effects and the design.

Firstly, by attempting precision for control and measurement of variables related to the behavior that was measured, compromises were made for generalization of the results to the 'real-life world'. The purpose of this study is to measure the persuasive effect of a message that is conveyed by an ECA. This has been done with students in a controlled environment. By using merely students, it becomes harder to generalize.

Secondly, only one smile was tested on its persuasiveness. In the pre-test two smiles were tested on their likeability, attractiveness and trustworthiness. The smile that scored the best was used during the experiment and was a subtle smile. To optimize the smile it could be useful to test more smiles in a future experiment. Possibly, a more exaggerated smile enhances the contrast between a neutral and smiling condition and can yield other results.

Thirdly, only a male ECA was used to convey the message to the participants. As stated before, previous research has shown that persuasion attempts by women are less effective than

persuasion attempts by men (Propp, 1995) and by the available amount of time it was only possible to make one ECA. However, to measure cross gender effects in optima forma the addition of a female ECA condition would be necessary. To really measure possible cross gender effects male and female participants have to be confronted with male ECAs as well as female ECAs.

Finally, the design of the study could be improved. In the present design the participants could be assigned to one of the three conditions, e.g. the text-only condition, the ECA with a neutral expression condition and the ECA with a smiling expression condition. This is a difficult design to compare the data of the smiling ECA condition to the data of the no-expression conditions and the no-ECA to the ECA conditions. The reason that this was difficult was because there are three conditions with 60 participants equally divided and two of those conditions have to be compared to one other condition. This means that 40 participants had to be compared with 20 participants. Fortunately, in this study the data could still be compared because of the non significant results from the test of homogeneity. Although the data could still be compared, a better design would have been to have two conditions, an ECA and a text-only condition. Within this ECA condition the participants could be assigned to either a smiling ECA or a neutral ECA. Afterwards the data could be compared to see if there are any differences within that condition and thus between a smiling expression and a neutral expression.

6. CONCLUSIONS

This study demonstrates that a persuasive effect can occur when conveying a message by an ECA. The results of this study also viewed a stronger persuasive effect for women compared with men. On the other hand, the persuasive effect of a smile in combination with an ECA has not been found in this study. This unexpected result can be explained by a moderated contrast between the neutral condition and the smiling condition. Finally, the persuasive effect was significant for the intention to show pro-environmental behavior, but this effect did not occur in case of purchasing products. However, there must be noted that in a different virtual environment other effects may occur. To summarize, the overall conclusion could be that a male ECA can be very valuable to convey a persuasive message, especially with a female target group.

6.1 Implications and Future Research

In addition to ECAs and persuasion in the academic field, researchers now have greater

knowledge about ECAs and their effect on persuasion. This study adds knowledge to the field about the different gender effects that occur when an ECA tries to persuade participants. From a practical oriented perspective the results of this study can contribute to the field of persuasion in a virtual environment. When there is a goal to persuade people to show specific behavior, using an ECA to convey the message can be very useful. In light of this study it can be especially useful, for example, when there is a (virtual) campaign to make people more conscience about their behavior. Subsequently, an ECA can be used to persuade the target group into behavior that is in line with the message of the campaign.

To broaden the knowledge of the use of ECAs for persuasion, further research is needed. Regarding purchase intention, it would be interesting to examine the effect of an ECA in an online shop environment. In such a setting it would interesting to study the effect of an expression when the ECA is promoting a product. Furthermore, it would be interesting to replicate the current study with different types of expressions to see whether another expression can enhance the persuasive effect.

Furthermore, when this study would be replicated in the future the design has to be adjusted. In future studies it would be better to design the experiment in such a way that the conditions could be easily compared. This will depend on whether the goal of the study is to examine the persuasive effect of an ECA in general or to examine the persuasive effect of several expressions. As stated in the discussion section, when the goal is to examine the effect of no-ECA compared with an ECA this will have to be the only two conditions.

The approach was based on a method which measured the persuasive effect of a smiling ECA merely by its expression. This is done because the goal of this study was to purely measure the effect of the expression. In practice on the other hand, it is likely that a message that is send by and ECA will be transmitted verbal as well as nonverbal. Since, persuasion can be achieved by voice (Hall & Hopkins, 1980; Gelinas-Chebat & Chebat, 1996) as well as the expression (Gong, 2007) a combination of these two could possibly lead to other results regarding a neutral ECA versus a smiling ECA.

Finally, it would also be interesting to further examine the effect that occurred regarding the gender differences. This can be done by conducting an experiment where a female ECA is added to examine the cross gender effects. When the participants interact with a female as well as a male ECA, the cross gender effect can be examined in an extended manner.

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APPENDIX 1 – QUESTIONNAIRE STATEMENTS AND PRODUCTS

Wat doe jij voor het milieu?

In dit experiment wordt bepaald in hoeverre je bereid bent om milieuvriendelijke keuzen te maken. In het experiment wordt je geconfronteerd met stellingen. Vervolgens geef je op een schaal van 1 (geheel oneens) tot 5 (geheel eens) je mening over de stelling.

***Voorbeeld* - Stelling: Ik ben bereid om vroeg op te staan.**

1. Betekent dat je het hier helemaal mee oneens bent
2. Betekent dat je het hier mee oneens bent
3. Betekent dat het je niet uitmaakt
4. Betekent dat je het hier mee eens bent
5. Betekent dat je het hier helemaal mee eens bent

Denk rustig na over wat je wilt antwoorden en geef op iedere stelling antwoord.
Bij voorbaat dank voor je medewerking.

Leeftijd: _____

Geslacht: **O** Man **O** Vrouw

Hoogst genoten opleiding.

O HBO
O WO

Algemene attitude ten aanzien van het milieu.

	1 Geheel oneens	2 Oneens	3 Geen voorkeur	4 Eens	5 Geheel eens
Planten en dieren bestaan primair om gebruikt te worden door mensen.	O	O	O	O	O
De aarde is als een ruimteschip met beperkte ruimte en bronnen.	O	O	O	O	O
De balans van de natuur is erg delicaat en is gemakkelijk verstoord.	O	O	O	O	O
Wanneer mensen schade berokkenen aan de natuur heeft dit vaak desastreuze gevolgen.	O	O	O	O	O
Mensen moeten in harmonie leven met de natuur om te kunnen overleven.	O	O	O	O	O
Mensen hebben het recht om hun natuurlijke omgeving zo aan te passen dat het bij hun behoeften past.	O	O	O	O	O
De mensheid is het milieu zwaar aan het misbruiken.	O	O	O	O	O

De mensheid is ontstaan om te heersen over de natuur.	○	○	○	○	○
We bereiken het maximum van het aantal mensen dat de aarde nog aan kan.	○	○	○	○	○

Nu volgt de rest van het onderzoek.

Wanneer je gaat reizen is het beter voor het milieu om gebruik te maken van het openbaar vervoer of de fiets. Tegenwoordig zijn veel plekken bereikbaar met het openbaar vervoer en is het niet nodig om hiervoor met de auto te reizen. Voor de kleine afstanden is de fiets weer een goed alternatief voor de auto. Met deze manieren van reizen ontzie je het milieu. Het zou daarom goed zijn om je manier van reizen te baseren op welke manier het beste is voor het milieu.

Voortaan als ik ga reizen, kies ik voor de manier die het beste is voor het milieu.
1 Geheel oneens
2 Oneens
3 Niet eens / niet oneens
4 Eens
5 Geheel eens

Minder warm water verbruiken is goed voor het milieu. De douche is één van de grootste waterverbruikers van het huis. Als je een douche neemt kun je beslissen om minder warm water te gebruiken. Hierdoor bespaar je energie en ontzie je het milieu.

Ik zal vanaf nu minder warm water verbruiken wanneer ik een douche neem.
1 Geheel oneens
2 Oneens
3 Niet eens / niet oneens
4 Eens
5 Geheel eens

Er zijn verschillende manieren om producten te produceren. Dit kan o.a. door bij de productie het milieu te ontzien of juist extra te belasten. Vaak brengt de milieuvriendelijke manier extra kosten met zich mee die zich vertalen in de aankoopprijs voor de consument.

Ik ben bereid om voor een milieuvriendelijk geproduceerd product te kiezen, ook als dit product iets duurder is.
1 Geheel oneens
2 Oneens
3 Niet eens / niet oneens
4 Eens
5 Geheel eens

Om in de toekomst gebruik te kunnen blijven maken van energie, zijn er innovaties nodig. Er zijn veelorganisaties die onderzoek doen naar het op een milieuvriendelijke manier opwekken van energie. Hierbij wordt veel gekeken naar onuitputtelijke energiebronnen die niet schadelijk zijn voor het milieu. Dergelijke organisaties kunnen altijd geld gebruiken voor onderzoek. Als jij dit belangrijk vindt, kun je ook steent je bijdragen door geld te doneren.

Ik ben bereid om geld te doneren aan onderzoek naar energiebesparing.
1 Geheel oneens
2 Oneens
3 Niet eens / niet oneens
4 Eens
5 Geheel eens

Werken aan een beter milieu kan ook door op te letten wat voor voedsel je koopt. Zo kunnen bijvoorbeeld groente en fruit op verschillende manieren worden gekweekt. Groent e en fruit van het seizoen zijn beter voor het milieu dan groente en fruit uit een kas. Dit is iets waar je op kunt letten tijdens het boodschappen doen.

Ik koop voortaan seizoensgroenten omdat deze niet in een kas zijn geteeld maar uit de volle grond komen, wat dus bet er is voor het milieu.
1 Geheel oneens
2 Oneens
3 Niet eens / niet oneens
4 Eens
5 Geheel eens

Een andere manier om water te besparen is door minder vaak onder de douche te gaan. Je zou in plaats van iedere dag bijvoorbeeld om de dag onder de douche kunnen gaan. Dit is net zo gezond en veel milieuvriendelijker.

Ik ben bereid om voortaan om de dag onder de douche te gaan.
1 Geheel oneens
2 Oneens
3 Niet eens / niet oneens
4 Eens
5 Geheel eens

Indien je een auto aan wil schaffen of al een auto hebt, kun je er voor kiezen om geen auto aan te schaffen of de auto weg te doen. In plaats hier van kun je een auto met anderen delen via een bedrijf die een auto bij jou in de buurt heeft staan (autodaten). Je reserveert online en betaalt per rit waardoor je veel bewuster de auto pakt. Uit onderzoek blijkt dat men hierdoor veel minder kilometers in een jaar rijdt wat dus beter is voor het milieu. Daarnaast zijn er minder auto's dus minder grondstofgebruik, minder afval en minder ruimtegebruik.

Ik ben bereid om te autodaten in plaats van zelf een auto in mijn bezit te hebben.
1 Geheel oneens
2 Oneens
3 Niet eens / niet oneens
4 Eens
5 Geheel eens

Het eten van vlees zorgt voor heel veel CO2 uitstoot. Het zorgt in Nederland zelfs voor meer CO2 uitstoot dan het verkeer. Om dit te minderen zou het goed zijn om de helft minder vlees te eten dan nu het geval is. Eet je normaal gesproken 4 keer per week vlees, dan zou je dit nog maar 2 keer per week moeten doen.

Ik ben bereid om de helft minder vlees te eten dan dat ik nu doe.
1 Geheel oneens
2 Oneens
3 Niet eens / niet oneens
4 Eens
5 Geheel eens

Er zijn tegenwoordig allerlei apps te downloaden voor je mobiel. Zo zijn er eveneens 'groene' apps beschikbaar. Een voorbeeld van een groene app is de groente en fruit kalender. Middels deze app kun je tijdens het boodschappen doen bekijken of de soort groente en fruit die je van plan bent om te kopen, ook een milieuvriendelijke keuze is. Hierdoor weet je altijd welke keuze je moet maken om milieuvriendelijk bezig te zijn.

Ik ben bereid om deze app te downloaden en altijd te gebruiken tijdens het boodschappen doen.
1 Geheel oneens
2 Oneens
3 Niet eens / niet oneens
4 Eens
5 Geheel eens

Een grotere televisie verbruikt meer energie dan een kleinere televisie. Anders gezegd: hoe groter de beelddiagonaal hoe groter het energieverbruik. Het is dus beter voor het milieu om een televisie aan te schaffen met een kleine beelddiagonaal.

Ik ben bereid als ik een televisie koop, om te kiezen voor een televisie met een kleine beelddiagonaal.
1 Geheel oneens
2 Oneens
3 Niet eens / niet oneens
4 Eens
5 Geheel eens

Vliegen is door de grote CO2 uitstoot bij een vlucht, niet goed voor het milieu. Toch gaan veel mensen ieder jaar met het vliegtuig op vakantie. Het zou goed zijn voor het milieu om dit te minderen en er vaker voor te kiezen om in Nederland op vakantie te gaan. Je zou bijvoorbeeld er voor kunnen kiezen om, om het jaar in Nederland op vakantie gaan en dus dat jaar niet te vliegen.

Ik ben bereid om minder te vliegen en in plaats daarvan om het jaar in Nederland of omgeving op vakantie te gaan.
1 Geheel oneens
2 Oneens
3 Niet eens / niet oneens
4 Eens
5 Geheel eens

Met klimaat compensatie wordt er een activiteit CO2- of klimaat neutraal gemaakt. Dit kan door de aanplant van bossen waardoor een deel van de huidige CO2 uit de lucht wordt gehaald. Maar dit kan ook door investeringen in duurzame energie waardoor CO2-uitstoot in de toekomst wordt voorkomen. Een dergelijke klimaatcompensatie wordt bepaald door uit te rekenen voor hoeveel CO2 uitstoot je verantwoordelijk bent en hier vervolgens een compensatiebedrag voor te betalen aan een non-profit organisatie die de eerder genoemde compensatiemaat regelen treft. Een indicatie: voor 20.000 km autorijden, betaal je € 29.95.

Ik ben bereid om de CO2-uitstoot waar ik voor verantwoordelijk ben, uit te laten rekenen en hier een compensatiebedrag voor te betalen.
1 Geheel oneens
2 Oneens
3 Niet eens / niet oneens
4 Eens
5 Geheel eens

Milieuvriendelijk leven is een belangrijk onderwerp om de mensen bewust van te maken. Er bestaan verschillende organisaties die voorlichting geven over milieuvriendelijk leven. Deze organisaties zoeken vaak vrijwilligers om ondersteuning te bieden in hun missie. Door dit vrijwilligerswerk te doen ben je zeer actief bezig met het verbeteren van het milieu.

Ik ben bereid om vrijwilligerswerk te doen om op deze manier een bijdrage te leveren aan het verbeteren van het milieu.
1 Geheel oneens
2 Oneens
3 Niet eens / niet oneens
4 Eens
5 Geheel eens

Het kopen van gerecyclede producten heeft een positief effect op het milieu. Dit geldt eveneens voor de meubels die je koopt bij het inrichten van je huis. Je kunt bij het inrichten er namelijk voor kiezen om enkel gebruik te maken van tweedehands meubelen. Zo ben je goedkoper uit en daarnaast milieuvriendelijk bezig.

Ik ben bereid om mijn huis voornamelijk met tweedehands meubelen in te richten.
1 Geheel oneens
2 Oneens
3 Niet eens / niet oneens

4 Eens
5 Geheel eens

Daarnaast hoeven de meubelen die je koopt helemaal niet altijd van materiaal gemaakt te worden dat slecht is voor het milieu. In plaats van deze meubelen zijn er bijvoorbeeld ook kasten en tafels van gerecycled karton. Op het gebied van design is er vooralsnog minder mogelijk, maar het produceren van deze meubelen en het materiaalgebruik is veel milieuvriendelijker.

Ik ben bereid om kasten en tafels te kopen van gerecycled karton.
1 Geheel oneens
2 Oneens
3 Niet eens / niet oneens
4 Eens
5 Geheel eens

Hieronder volgen enkele milieuvriendelijke producten met uitleg wat voor producten het zijn. Je dient vervolgens op dezelfde manier antwoord te geven zoals je hierboven hebt gedaan.

Drukverminderaar

Douchen is iets dat gepaard gaat met het verbruik van veel water. Dit verbruik kan verlaagd worden door een product te kopen en te installeren dat de waterdruk verlaagd. Het resultaat van het gebruiken van dit product zal zijn dat je minder water consumeert.

Ik ben bereid om dit product aan te schaffen en te installeren.
1 Geheel oneens
2 Oneens
3 Niet eens / niet oneens
4 Eens
5 Geheel eens

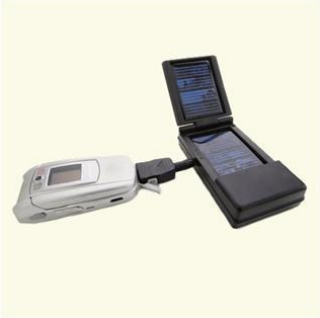
Afvalpers

Dit product is een product dat van vuilnis een klein pakket kan maken. Door van vuilnis een klein pakket te maken, bespaar je ruimte als je het weggooit. Door ruimte te besparen als je het weggooit zul je minder vuilniszakken nodig hebben. Het verbruiken van minder vuilniszakken heeft een positief effect op het milieu.

Ik ben bereid om dit product aan te schaffen en te gebruiken.
1 Geheel oneens
2 Oneens
3 Niet eens / niet oneens
4 Eens
5 Geheel eens

Telefoonoplader op zonne-energie

Het hierboven afgebeelde product is een telefoonoplader op zonne-energie. Deze oplader gebruikt zonlicht als milieuvriendelijke energiebron en draagt op deze wijze niet bij aan de chemische verontreiniging van het milieu. Voor ieder type telefoon is een oplader op zonne-energie te verkrijgen.



Ik ben bereid om dit product aan t e schaffen en wanneer mogelijk dit product te gebruiken voor het opladen van mijn telefoon.
1 Geheel oneens
2 Oneens
3 Niet eens / niet oneens
4 Eens
5 Geheel eens

Levensmiddelen met een milieukeurmerk

Als je boodschappen gaat doen, kun je kiezen uit een scala aan producten. Je kunt hierbij kiezen voor producten die een keurmerk dragen die stellen dat deze producten bijvoorbeeld onder milieuvriendelijke omstandigheden zijn geproduceerd. Deze producten met een dergelijk keurmerk dienen te voldoen aan hoge milieueisen. De productie, kwaliteit en de functionaliteit moet en voldoen aan hoge milieustandaarden maar zijn dikwijls wel iets duurder in aanschaf.

Ik ben bereid om deze producten aan te schaffen, ondanks dat deze producten iets duurder zijn.
1 Geheel oneens
2 Oneens
3 Niet eens / niet oneens
4 Eens
5 Geheel eens

Kleding van organisch katoen

Organisch of biologisch geteelde katoen is katoen van niet genetisch gemodificeerde planten. Die zijn gekweekt zonder bijvoorbeeld chemische bestrijdingsmiddelen en kunstmest. Daarnaast worden insecten bestreden met milieuvriendelijke middelen en wordt het katoen hand geplukt. Dit zorgt voor een milieuvriendelijker proces maar tegelijkertijd een duurder proces.

Als ik een keuze moet maken tussen twee t -shirts die er hetzelfde uitzien, dan kies ik voor het t –shirt dat gemaakt is van organisch katoen ondanks dat deze duurder is.
1 Geheel oneens
2 Oneens
3 Niet eens / niet oneens
4 Eens
5 Geheel eens

Douchecoach
De douchecoach zorgt voor een herinnering zodat je niet te lang onder de douche blijft staan. Deze douchecoach geeft een alarmpje wanneer je langer dan vijf minuten onder de douche staat en is ook nog voor een kortere tijd dan vijf minuten in te stellen. Een dergelijk product houdt je bewust van het feit dat t e lang douchen slecht is voor het milieu.

Ik ben bereid om dit product aan te schaffen en te gebruiken.
1 Geheel oneens
2 Oneens
3 Niet eens / niet oneens
4 Eens
5 Geheel eens

Collegeblok van gerecycled papier
Een collegeblok kun je van 'gewoon' papier kopen maar ook van gerecycled papier. Dit gerecycled papier met bijvoorbeeld een milieukeurkenmerk bestaat voor honderd procent uit hergebruikt materiaal. Dit is beter voor het milieu omdat de productie van gewoon papier het milieu zwaar belast.

Ik ben bereid om een collegeblok van gerecycled papier aan te schaffen ondanks dat deze duurder is dan een collegeblok van 'gewoon' papier.
1 Geheel oneens
2 Oneens
3 Niet eens / niet oneens
4 Eens
5 Geheel eens

Bekendheid met Embodied Conversational Agents
1Geheel onbekend
2 Onbekend
3 Niet onbekend / Niet bekend
4 Bekend
5 Geheel bekend

Eventuele opmerkingen naar aanleiding van de enquête kunnen hieronder worden ingevuld.

Hartelijk bedankt voor je medewerking!

APENDIX 2 - ECOLOGICAL CONCERN SCALE – DUTCH AND ENGLISH VERSION

Ecological Concern Scale – Dutch Version

Planten en dieren bestaan primair om gebruikt te worden door mensen.

De aarde is als een ruimteschip met enkel beperkte ruimte en bronnen.

De balans van de natuur is erg delicaat en is gemakkelijk verstoord.

Wanneer mensen schade berokkenen aan de natuur heeft dit vaak desastreuze gevolgen.

Mensen moeten in harmonie leven met de natuur om te kunnen overleven.

Mensen hebben het recht om hen natuurlijke omgeving zo aan te passen dat het bij hun behoeften past.

De mensheid is het milieu zwaar aan het misbruiken

De mensheid is ontstaan om over te heersen over de natuur.

We bereiken het maximum van het aantal mensen dat de aarde nog aan kan.

Ecological Concern Scale – English Version

The balance of nature is very delicate and easily upset.

When people interfere with nature, it often produces disastrous consequences.

People must live in harmony with nature to survive.

Humans are severely abusing the environment.

We are approaching the limit of the number of people the earth can support.

The earth is like a spaceship with only limited room and resources.

There are limits to growth beyond which our industrialized society cannot expand.

To maintain a healthy economy, we will have to develop a “steady-state” economy where industrial growth is controlled.

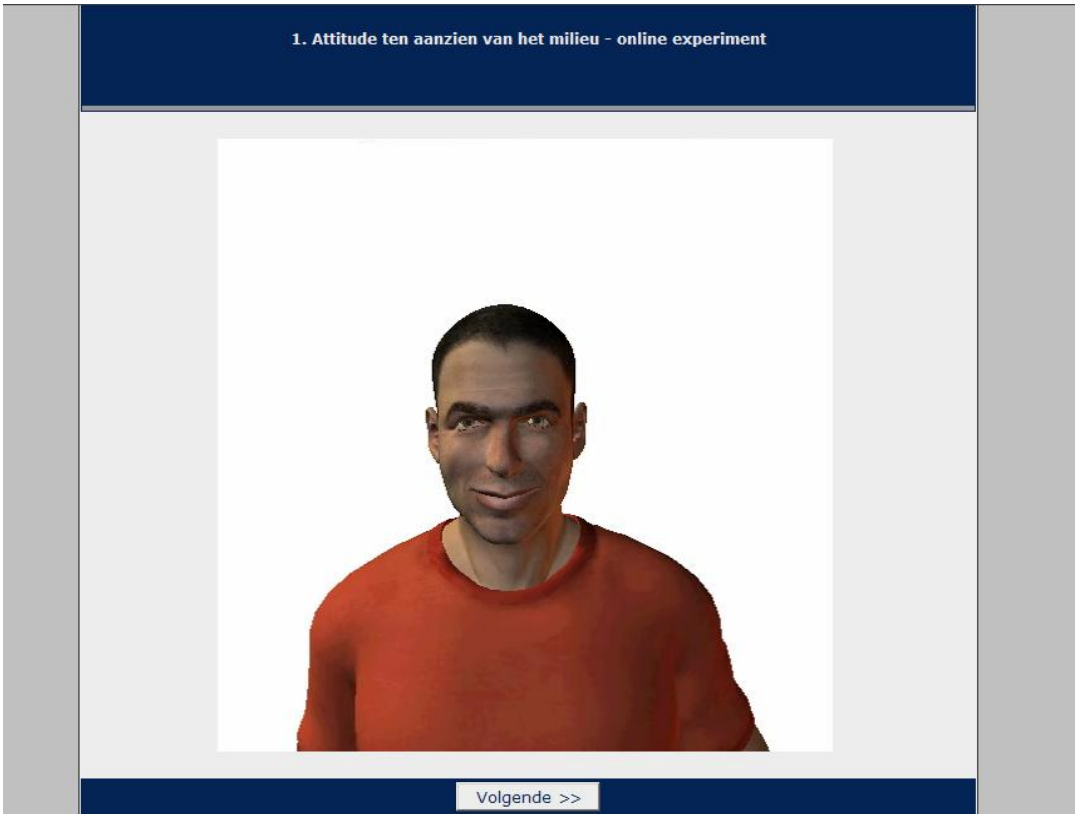
Humans were created to rule over the rest of nature.

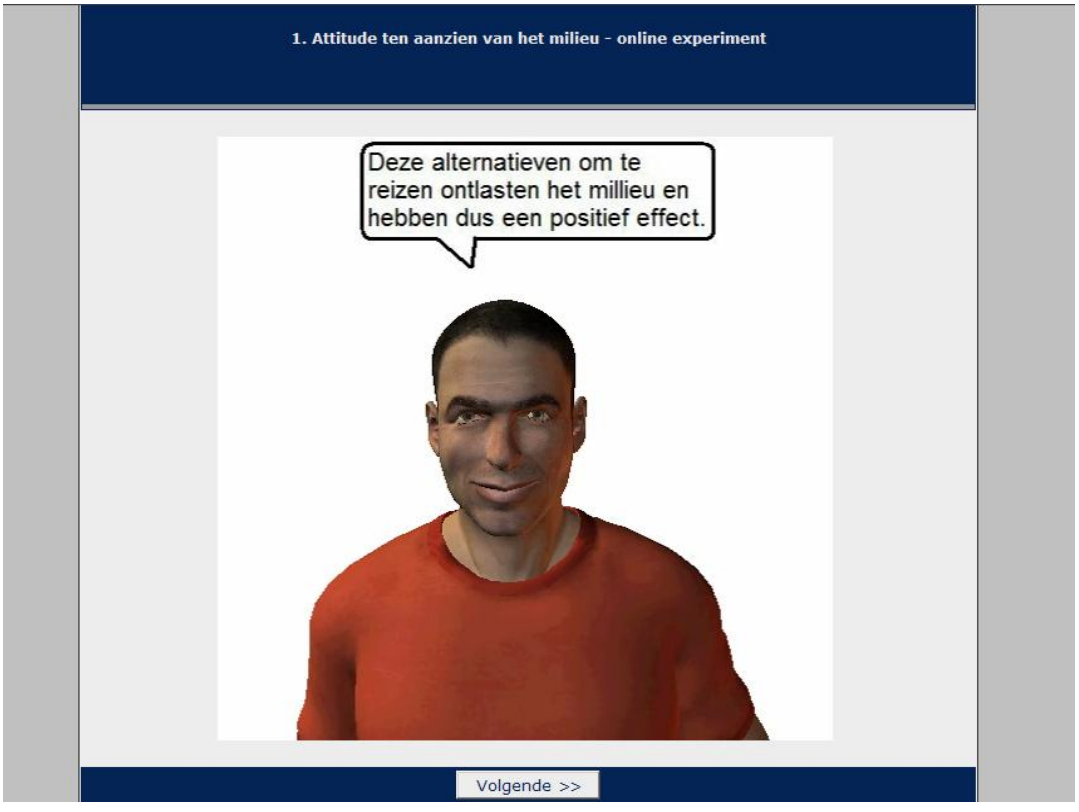
People have the rights to modify the natural environment to suit their needs.

Plants and animals exist primarily to be used by people.

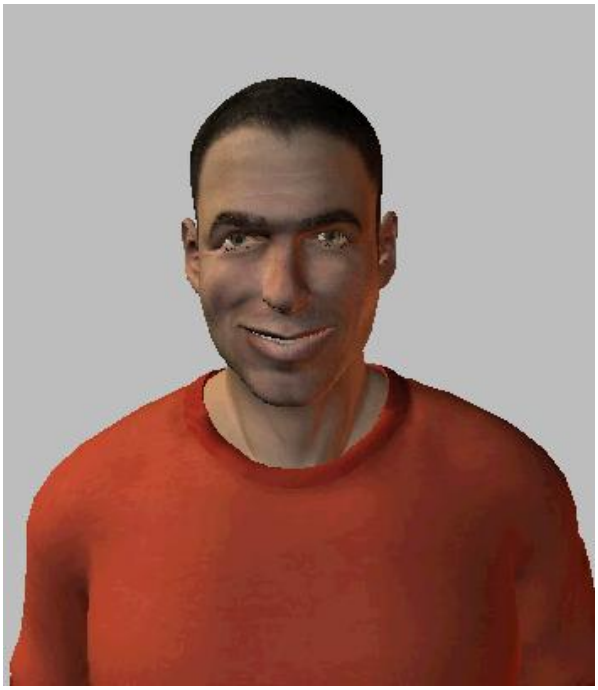
People need not adapt to the natural environment because they can remake it to suit their needs.

APPENDIX 3 – SCREENSHOTS OF THE EXPERIMENTAL INTERFACE

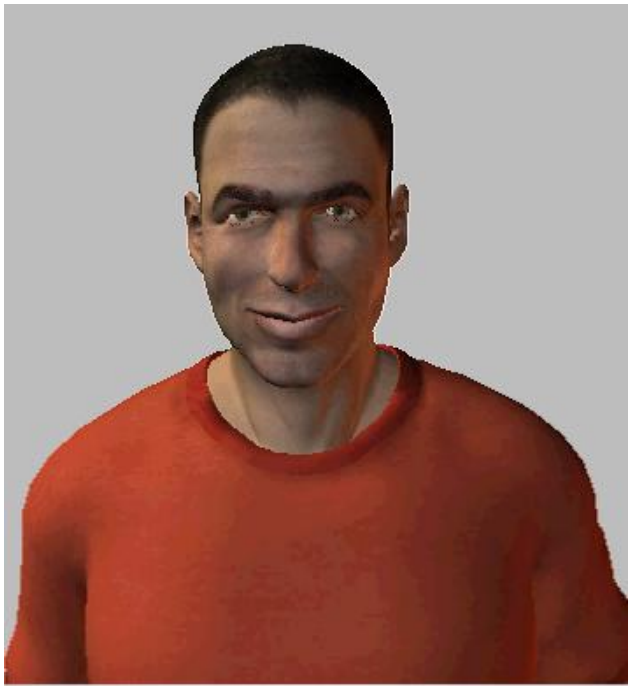




APPENDIX 4 – EXAGERATED SMILE vs. SUBTILE SMILE



ECA with exaggerated smile

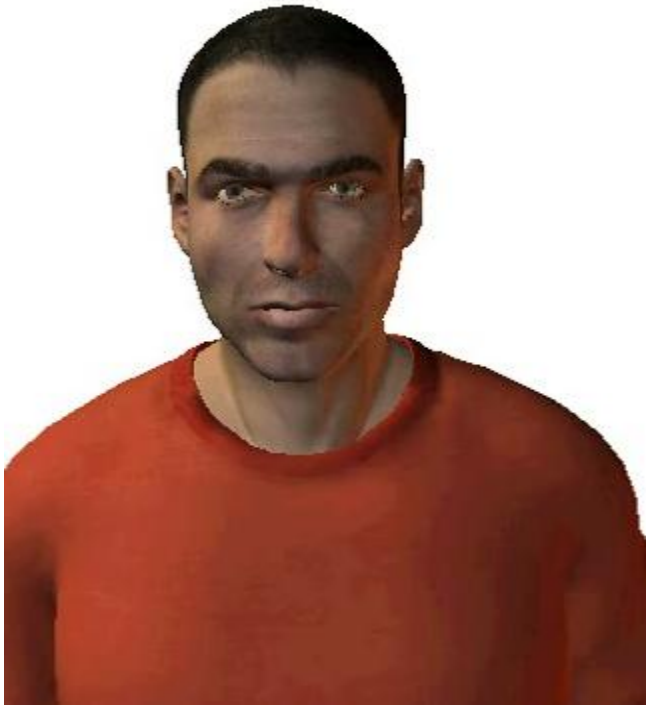


ECA with subtle smile

Scores exaggerated smile vs. subtle smile on trustworthiness, likeliness and friendliness (N = 10)

	Trust	Like	Friendly
Subtle smile	2.70	2.80	3.10
Exaggerated smile	2.50	2.60	3.10

APPENDIX 5 – NEUTRAL EXPRESSION



ECA with a neutral expression