

# The role of emotion in the perception of CO2 risks and the acceptance of solutions

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# **The role of emotion in the perception of CO<sub>2</sub> risks and the acceptance of solutions**

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## Preface

This report reviews the theoretical and empirical work which has been done so far within the framework of the NRP project "Cognitive versus emotion oriented public information on environmentally friendly behaviour". This four year project started in March 1993 and is conducted at the Eindhoven University of Technology, Faculty of Philosophy and Social Sciences. The purpose of the project is to increase our comprehension of the role of emotional factors in enhancing public understanding of global environmental risks and increasing the motivation to cooperate with solutions to these risks. Because the project started rather late in NRP I, a substantial part of the empirical work has yet to be done. Therefore the report should be read as an interim report.

The report is divided into two parts. The first part of the report contains a discussion of the literature and describes the theoretical framework of this project. The second part of the report describes the experimental work which has been done so far in this project and concludes with an outline of the studies yet to do. The experimental work is in a stage too early to allow us to formulate policy recommendations. However, whenever possible, we present policy conclusions derived from the theoretical framework and the literature discussed in part 1 of the report.

## Summary

This report reviews the theoretical and empirical work which has been done so far within the framework of the NRP project "Cognitive versus emotion oriented public information on environmentally friendly behaviour". The purpose of this project is to increase our understanding of the role of emotional factors in enhancing public understanding of global environmental risks and increasing the motivation to cooperate with solutions to these risks. Because the project has started rather late in NRP I, a substantial part of the empirical work has yet to be done. Therefore the report finishes with an outline of the studies which are scheduled for the remaining part of the project.

The report is divided into two parts. Part I starts with a review of the literature on lay perceptions of global warming. In order to educate the public about the risks of global warming and how to reduce these risks, it is important to first check what people already know and how they think about this issue. Recent studies show that people tend to interpret global warming literally, as a hot and steamy climate. Also, the concepts of weather and climate are often confused. People relate global warming to their own experiences of daily and seasonal temperature swings, and hence perceive an increase of global mean temperature of a few

degrees as not very harmful. In addition, the tendency to use information about local weather to draw inferences about global climate may lead to weather-related fluctuations in public concern about global warming.

There is a widespread confusion between the concepts of global warming and stratospheric ozone depletion, leading to consistent misunderstandings about causes (aerosol spray cans) and effects (skin cancer) of global warming, as well as effective actions (banning aerosol spray cans). People have a poor understanding of the relationships between energy use, the burning of fossil fuels, carbon dioxide emissions and global warming. Accordingly, they generally fail to emphasize energy saving as an effective action against global warming, but instead focus on general pollution control. The well-being of future generations appears to be an important value underlying attitudes towards environmental protection.

It can be concluded from these studies, that it is necessary to educate the public about the risks of global warming and measures to reduce these risks. It is important that knowledge gaps are filled and biases are corrected, so that people will be able to differentiate between adequate and inadequate actions. Part 1 of the report continues with a description of the theoretical framework that forms the basis of our experimental work: a dual-process approach of persuasion. According to this dual-process framework, people can process a persuasive message more or less thoroughly, depending on how motivated and capable they are of doing so. Careful elaboration of the contents of a message requires high motivation and information processing capacity, and results in relatively stable attitudes and relatively strong attitude-behaviour relationships. More limited cue-based forms of message processing require less motivation and capacity, but may nevertheless have an effect on attitudes. However, this effect will be only temporal and the resulting attitude will be less firmly related to behaviour.

Considered from a dual-process perspective, affect may serve multiple roles in the persuasion process, depending on how motivated and capable people are to systematically process information before forming an attitude. Whereas affective states such as feelings and emotions may serve a highly desirable role in the persuasion process, it is also possible that affective reactions have an undesirable effect. Hence it is concluded that emotion oriented persuasive messages should be applied with the greatest caution. To ensure that an emotionally appealing message produces the intended effects while undesirable effects are avoided, it should be designed according to theoretically and empirically founded principles. In addition, before applying a message, its effects should be thoroughly pretested.

Part I of this report concludes with a review of the literature on fear appeals. We learn from early studies on the effects of fear appeals, that the relationship between fear and persuasion can best be comprehended by studying how fear arousal influences the cognitive processes that mediate message acceptance. Different levels of fear arousal are assumed to have different effects on these cognitive processes, and hence on message acceptance. Furthermore, we learn that in order to accomplish persuasion, a fear appealing message must provide information not only on the threat, but also on how to reduce the threat. More specifically, it is important that people are not only provided with information on the severity and probability of the threat, but receive information on feasible and effective solutions to the threat as well.

In a number of recent studies the relationship between fear and persuasion has been studied from a dual-process point of view. These studies show that fear may have an impact on attitudes by influencing the extent to which people process information, and that inducing fear may lead to more extensive processing of relevant information, whereas the processing of irrelevant information may be inhibited by fear. It is concluded that under carefully specified

conditions it may be useful to apply fear appeals in order to motivate people to systematically process information on environmental issues.

The second part of the report starts with an overview of the experimental work which has been done so far within the framework of this project, and finishes with an outline of the laboratory and field studies which are in preparation.

The first experimental study of this research project examined whether a fear appealing presentation of environmental risks, motivates people to pay careful attention to information on environmentally friendly behaviour. The following variables were manipulated in a 3 x 2 experimental design: fear Level (no fear vs moderate fear vs. high fear) and argument quality (weak vs strong arguments). Subjects in the moderate fear condition were exposed to a slightly threatening message on global warming, and subjects in the high fear condition were exposed to a highly threatening message on global warming. Next, subjects were exposed to either a weak or a strong persuasive argumentation in favour of a new type of energy saving light bulbs. Subjects in the no fear condition received no message on global warming, but merely received either a weak or a strong persuasive message on the new bulb. Following these manipulations, subjects completed a questionnaire, containing measures of the dependent variables (cognitive responses, attitudes towards using the new bulb, and recall of arguments respectively) and manipulation check measures. The results showed that fear of environmental risks may influence attitudes towards environmentally friendly behaviour in two different ways, depending on the level of fear. Relatively high levels of fear may directly lead to more positive attitudes without further information processing. Relatively moderate levels of fear may have an indirect impact on attitudes, by influencing the extent of information processing. To further validate this post-hoc hypothesis about the relationships between fear level, information processing, and attitudes, at least one more laboratory experiment is on the programme. Recently a pilot study was conducted to prepare for this experiment, in which we successfully pretested an additional manipulation which is necessary to examine the impact of fear in situations in which people are provided not only with arguments, but also with simple cues which allow them to form an attitude in a relatively effortless way.

Parallel to this laboratory study a field experiment is prepared, in which the practical applicability and external validity of the insights obtained in the laboratory, are tested. In a natural setting, the impact of an emotion oriented presentation of global warming on actual energy saving behaviour is studied, in comparison with a purely informative presentation of the risks of global warming. For this purpose, two video spots on global warming are developed with the help of a professional audio-visual production organisation: an emotionally appealing video spot and a comparable, though strictly informative spot.

## Introduction

In a report of the Intergovernmental Panel on Climate Change (IPCC) published in 1990, it is stated with certainty that "emissions resulting from human activities are substantially increasing the atmospheric concentrations of the greenhouse gases: carbon dioxide, methane, chlorofluorocarbons (CFCs) and nitrous oxide. These increases will enhance the greenhouse effect, resulting on average in an additional warming of the Earth's surface.". Departing from

these facts IPCC predicts under a business-as-usual scenario an increase of global mean temperature of about 0.3 °C per decade during the next century, climate changes, and a rise of global mean sea level of about 6 cm per decade over the next century. However, IPCC warns that there are many uncertainties in their predictions, particularly with regard to the timing, magnitude and regional patterns of climate change.

The policy approach to this situation of uncertainty has been the introduction of the precautionary principle. This principle holds, that in spite of existing uncertainties actions have to be undertaken to minimize risks. In the Netherlands, the precautionary principle takes shape in the aimed carbon dioxide (CO<sub>2</sub>) emission reduction of 3 % in 2000, as compared with 1990, and the stabilisation of CO<sub>2</sub> emissions after 2000 (Nationaal Milieubeleidsplan 2: Milieu als maatstaf, 1993). Although prevention may be a wise strategy of risk management, it unavoidably raises questions about the justification of controversial policy measures with a strong impact on society. The introduction of policy measures that are not acceptable to the public is likely to have no effect. Even if less drastic behavioural changes are required, a certain amount of problem awareness is necessary for people to reflect on their behaviour and to undertake action.

According to Wilke's Greed-Efficiency-Equity (GEE) hypothesis, individual choice behaviour in a social dilemma situation (i.e. a situation which is characterized by a conflict between individual and collective interests) is determined by three motives (Wilke, 1990). The first motive, greed, is the desire to benefit from the collective good as much as possible. The second motive, efficiency, is the desire to treat the collective good as efficient as possible. The third motive, equity, is the desire to profit in approximately the same amount as other people. The GEE hypothesis holds that the greed motive is curbed by the efficiency motive and the equity motive.

It can be deduced from the GEE hypothesis, that problem awareness increases the tendency to behave in a cooperative way (Midden, 1993). For the efficiency motive implies that an individual will be motivated to behave in a cooperative way if he or she believes that the continuance of the collective good is threatened. From that perspective it is crucial for environmental policy, that the possible threats of global warming can be presented in such a way as to create sufficient problem awareness among the people who have to behave cooperatively, i.e. among those whose support of environmental policy is required and who have

to change their behaviour. Two elements are important in achieving this goal. First, research should be undertaken to reduce uncertainty about the process of global warming and its consequences. Second, it is essential that possible risks are communicated in a way that the public does not tend to downgrade the consequences of risky behavioural choices.

The present research project examines the role of affect in communicating possible risks of global warming and the need for action. Because the project has started rather late in NRP I and its completion has been scheduled in 1997, the present report should be read as an interim report. The structure of the report is as follows. In the first part of the report a theoretical framework of persuasive communication is presented. Departing from this framework, the role of affect in the persuasion process is discussed. The second part of the report describes the experimental work which has been done so far, and outlines the studies yet to do. The experimental work is in a stage too early to allow us to formulate policy recommendations. However, whenever possible, we present policy recommendations inferred from the theoretical framework and based on the literature.



## PART 1: THEORETICAL FRAMEWORK

Before describing the theoretical framework which forms the basis of our work, it is important to give a short overview of recent studies on lay perceptions of global warming. In order to educate the public about the risks of global warming and how to reduce these risks, we must first inform ourselves about what they already know and how they think about this issue.

### Lay perceptions of global climate change

A central issue in research on risk perception has been the difference between lay and expert judgments of risks. Experts base their judgments on accident rates, whereas laypeople's judgments also are influenced by factors such as personal experience and media attention (Meertens, van der Pligt, & Vlek, 1994).

Based on empirical findings and theoretical analyses, Vlek and Keren (1992), and Meertens et al. (1994) have identified the following dimensions underlying perceived riskiness of an activity or situation: potential degree of harm or fatality; physical extent of damage; social extent of damage; time distribution of damage; probability or ambiguity of undesired consequence; controllability of consequence; experience with, familiarity, or imaginability of consequence; voluntariness of exposure; extent and clarity of expected benefit; social distribution of risks and benefits; harmful intentionality. These judgmental dimensions often are dimensions of acceptability as well (Meertens et al.).

To assess lay perceptions of global warming, Kempton (1991) interviewed 14 United States residents with diverse demographical back-grounds. The interviews consisted of three parts. During the first part the interviewer asked questions about weather, environmental protection in general, and global warming. During the second part the interviewer gave a short presentation on global warming. Following this, the respondent was asked for reactions to this presentation and a set of policy proposals.

To start with the weather, Kempton's data suggest that people tend to believe that the weather is influenced by human activities, particularly activities that occur in the atmosphere

and are viewed as unnatural or immoral. Also, the majority of the respondents believed that climate has already changed. Some reported their own observations of changed weather conditions, such as milder winters, less predictable weather patterns and an increase in violent weather. However, historical and empirical evidence shows, that at any moment in history people believe that they have observed weather changes. Kempton therefore states that the current publicity about global warming merely provides people with an appropriate framework for interpreting their own observations.

On the whole, attitudes towards environmental protection were positive. The well-being of future generations and particularly of one's descendants, was identified as the most important value underlying these attitudes. Species preservation was not appreciated as a value in itself, but only for purposes of pleasure and utility.

Kempton also asked respondents whether they had heard of the greenhouse effect, and if so, what they had heard. It appeared that respondents understood global warming by relating it to existing concepts. Many respondents saw global warming as a subset or an effect of stratospheric ozone depletion. Also, greenhouse gas emissions were conceived as just another instance of air pollution. Thirdly, respondents related the greenhouse effect to prior knowledge on photosynthesis, which led them to believe that deforestation will lead to a decrease of atmospheric ozone. And finally, respondents related the greenhouse effect to their own experiences of daily and seasonal temperature swings, which led them to perceive a temperature rise of a few degrees as not very harmful, without realizing that small changes in mean global temperature can have large geophysical and ecosystem effects. Also, subjects interpreted global warming simply as hotter weather. According to Kempton, this is an argument for referring to the anticipated changes as global climate changes, instead of global warming.

Prior to and following the interviewer's presentation on the greenhouse effect, respondents were asked whether the United States should do something about the greenhouse effect, and if so, what. Prior to the presentation, respondents' policy suggestions seemed to be based primarily on the model of global warming as a subset or an effect of stratospheric ozone depletion. Respondents had virtually no idea of the potential global climate change policies actually being debated. Only one respondent mentioned energy solutions. After the presentation, several respondents mentioned alternative energy sources, leading Kempton to

assume that it is much easier for lay people to conceptualize alternative energy sources replacing carbon sources, than it is to conceptualize energy efficiency. Respondents broadly supported the energy efficiency proposal that was described to them. Kempton concludes that in order to promote energy efficiency as a solution to global warming, the connection between energy efficiency and global warming needs to be spelled out, which is a difficult task, because the public neither understands energy efficiency, nor believes that energy use is a major contributor to the greenhouse effect. A proposal for adaption without prevention was widely rejected. A proposal calling for a 100 % energy tax on electricity, natural gas, and gasoline also received many negative reactions, which were immediately followed by statements about own inability to reduce personal gasoline consumption.

Bostrom, Morgan, Fischhoff, & Read (1994) conducted a series of exploratory studies to assess what laypeople already know about global climate change, and what missing information is most critical to their decisions. In these studies various data collection techniques were applied, such as open-ended interviews and questionnaires. A total of 95 individuals participated in these studies.

Participants generally regarded global warming as both bad and highly likely. It was often believed that global warming has already occurred. Participants tended to interpret the greenhouse effect literally, as the cause of a hot and steamy climate, or that there is a cap on the atmosphere that prevents noxious gasses from escaping. The concepts of weather and climate were often confused. Participants tended to perceive global climate change as a consequence of increased ultraviolet light entering the atmosphere due to stratospheric ozone depletion. Apart from these more fundamental errors, the relative importance of various causes of global warming was also misunderstood. For example, participants tended to exaggerate the importance of deforestation as a cause of climate change. Other frequently mentioned causes of global warming were pollution in general, the use of aerosol spray cans, automobile use, and industrial emissions.

A wide range of possible effects of global warming was identified by the participants, many of which are in accordance with expert models of global warming. However, they also mentioned a variety of ultra-violet-related health effects, such as skin cancer. Participants focused on general pollution control as a strategy to prevent global warming, with few references to energy use.

Drawing on the results of these exploratory studies, a questionnaire was developed to further examine laypeople's knowledge about global climate change (Read, Bostrom, Morgan, Fischhoff, & Smuts, 1994). This questionnaire was administered to 177 well-educated citizens.

Although scientists disagree about whether or not global climate change has already occurred, as much as 37 % of the lay persons participating in this study believed with certainty that it has. An additional 61 % of the participants thought that it was at least somewhat likely that human actions have changed global climate. Also, subjects' estimates of the amount of warming that has already occurred and will occur in the future, were much higher than the estimates published by IPCC. The confusion between weather and climate, which was observed in the preceding studies, appeared to be symptomatic for a general lack of knowledge about weather and climate processes. Read et al. warn that the tendency to use information about local weather to draw inferences about global climate, may contribute to weather-related fluctuations in public concern about global warming. They therefore recommend that risk communicators explicitly point out this potential confusion and draw a clear distinction between weather and climate.

The leading contributor to global warming according to the participants, is the loss of biomass. Aerosol cans and the hole in the ozone layer were also seen as important causes, as well as pollution in general. Fossil fuel consumption was mentioned spontaneously as a cause of global warming by only 18 % of the participants in response to an open-ended question. However, when causes were rankordered according to subjects' responses to closed-form questions, fossil fuel consumption was ranked the third most important cause of global warming. Subjects, when asked about the things they personally do that might cause global warming, most frequently mentioned driving and using aerosol cans.

Based on the observation that subjects tended to affirm any statement about the effects of global warming, Read et al. suggest that people probably are predisposed to view any future ecological or political disaster as a plausible consequence of global warming. Subjects, when asked about the most effective actions that they themselves could take to help prevent global warming, most frequently proposed cutting back on their driving (43 %), undertaking political action (34 %), increasing personal awareness (25 %), and recycling (20 %). Only 11 % of the subjects suggested saving energy as an action to limit climate change.

Read et al. conclude that the relatively well-educated lays participating in this survey study, had a poor understanding of two basic facts which are essential to the issue of global warming, that (1) if global warming occurs, it will primarily be the result of an increase in the concentration of CO<sub>2</sub> in the earth's atmosphere, and (2) the single most important source of increased atmospheric CO<sub>2</sub> concentrations, is the combustion of fossil fuels. In addition, Read et al. conclude that subjects' understanding of global climate change is encumbered with secondary, irrelevant and incorrect beliefs, such as confusion with other environmental problems in general, and with stratospheric ozone depletion in particular. Also, subjects failed to differentiate between more general good environmental practice, and actions which help to prevent global climate change.

Löfstedt (1991) studied climate change perceptions and the motivation to reduce energy in Sweden. Telephone interviews with 100 randomly selected individuals revealed that people mainly save energy because of economic reasons. Even if environmental reasons for saving energy were reported, the link between global climate change and energy use often was not perceived. Most citizens had heard of the greenhouse effect, but had little knowledge about causes, consequences and reduction measures. CFCs and emissions in general were perceived as the main causes of global warming. Accordingly, it was believed that removing CFCs from aerosol cans, reducing emissions in general, and driving less are the best ways to reduce the risk of global climate change. Although 77 % of the respondents believed that the greenhouse effect will produce undesirable consequences, the percentage of respondents who believed that they personally or their families will be affected by the greenhouse effect, was much lower, namely 52 %.

#### *Section summary and policy conclusions*

In summary, we learn from the studies discussed in this section, that people tend to interpret global warming literally, as a hot and steamy climate. Also, the concepts of weather and climate are often confused. People relate global warming to their own experiences of daily and seasonal temperature swings, and hence perceive an increase of global mean temperature of a few degrees as not very harmful. In addition, the tendency to use information about local weather to draw inferences about global climate may lead to weather-related fluctuations in public concern about global warming.

There is a widespread confusion between the concepts of global warming and stratospheric ozone depletion, leading to consistent misunderstandings about causes (aerosol spray cans) and effects (skin cancer) of global warming, as well as effective actions (banning aerosol spray cans). People have a poor understanding of the relationships between energy use, the burning of fossil fuels, CO<sub>2</sub> emissions and global warming. Accordingly, they generally fail to emphasize energy saving as an effective action against global warming, but instead focus on general pollution control. The well-being of future generations appears to be an important value underlying attitudes towards environmental protection.

Assuming that these findings can be generalized to the Dutch situation, the following policy conclusions can be formulated:

- ❑ Educating the public about global climate change seems necessary. There are knowledge gaps which have to be filled and biases which have to be corrected, so that people will be able to differentiate between adequate and inadequate actions.
- ❑ The relationships between energy use, the burning of fossil fuels, CO<sub>2</sub> emissions and global warming should be clarified.
- ❑ It should be explained what is meant by energy efficiency and the importance of energy efficiency as a strategy against global warming should be emphasized.
- ❑ The distinction between weather and climate should be clarified. It should be made clear that local weather is unsuitable as a source of information about global climate.
- ❑ The confusion between the greenhouse effect and stratospheric ozone depletion should be tackled explicitly.

#### Dual-process theories of persuasion

In the early nineties, a large scale information campaign on global warming was directed at the Dutch population. The goal of this campaign was to provide people with a clear description of the characteristics, causes, and consequences of the greenhouse effect, and to enhance problem awareness and knowledge of solutions. The first phase of the campaign had a duration of about three months, and the instruments used were billboards, TV spots, advertisements in newspapers and magazines, and freely available brochures. During this first

phase, acquaintance with diverse parts of the campaign was assessed at three different moments (Staats & Midden, 1991). The last measurement took place near the end of the first phase, and revealed that 60 % of a sample of 702 respondents had watched the television spot, 43 % had read the advertisement and 4 % had obtained the brochure. A different sample of 704 respondents was used to assess the effects of the campaign's first phase. Prior to and following the campaign, these respondents completed a questionnaire measuring among other things knowledge, emotional involvement, problem awareness, attitudes towards policy measures, and behaviour. The results showed that although knowledge about the greenhouse effect slightly increased as a consequence of the campaign, misunderstandings continued to exist unabatedly. Emotional involvement remained fairly low and problem awareness did not increase either, although problem awareness was fairly high to start with. Hardly any effects on attitudes towards policy measures and self-reported behaviour were found.

The impact of large information campaigns, such as the one that was discussed in the foregoing, appears to be limited (see Tertoolen, 1994). Information often is insufficiently elaborated and attitudinal changes do not come about, let alone behavioural changes. According to dual-process theories of persuasion, the extent to which information on a certain issue is elaborated, depends on how motivated and capable information receivers are to do so (Chaiken, 1980; Chaiken, Liberman, & Eagly, 1989; Petty & Cacioppo, 1981, 1986). The Elaboration Likelihood Model (ELM) assumes that when people are confronted with a persuasive message, their main motivation is to attain accurate attitudes that are in accordance with the facts (Petty & Cacioppo). Their primary processing goal therefore is to assess the validity of the message. This goal can be achieved by processing the message in either one of two ways: the central way or the peripheral way. When message receivers are highly motivated to process the message, and in addition possess sufficient information processing capacity, they will process the message centrally, which means that they elaborate the contents of the communication extensively. If attitude change occurs under these circumstances, it will be the result of careful thinking about the persuasive arguments presented in the message. When message receivers lack the motivation to put that much effort in processing the message, or when they possess insufficient information processing capacity, they will process the message only peripherally. Under these circumstances attitude change may still occur, but it will not be the result of thinking about the arguments presented in the

message. Instead, persuasion will then be the result of peripheral cues, such as for example source expertise (Petty & Cacioppo, 1984) or message length (Wood, Kallgren, & Preisler, 1985).

Like the ELM, the Heuristic-Systematic Model (HSM) distinguishes between two modes of information processing: a systematic mode and a heuristic mode (Chaiken, 1980; Chaiken et al., 1989). The systematic mode can be equated with ELM's central route processing and contains determining the validity of the message by critically processing all relevant information and thinking about this information in relation to existing knowledge (Chaiken et al.). Heuristic information processing corresponds with ELM's peripheral route processing in that it is a more limited form of information processing, making low demands upon motivation and capacity. However, whereas peripheral route processing refers to any mechanism that produces persuasion in the absence of argument scrutiny, heuristic information processing refers to persuasion that is mediated by simple decision rules or heuristics, such as "credible communicators' statements are valid" (Chaiken & Maheswaran, 1994), or "consensus implies correctness" (Maheswaran & Chaiken, 1991). Whether heuristic processing occurs, depends on the presence of heuristic cues and on the cognitive availability of their associated heuristics (Eagly & Chaiken, 1993). A heuristic cue is a variable the impact of which is assumed to be mediated by a heuristic. For example source expertise may have an impact by triggering the use of the heuristic "experts' statements can be trusted".

As contrasted with the ELM, the HSM explicitly assumes that in situations conducive to both processing modes, both modes occur. It is postulated that heuristic and systematic information processing can exert both additive and interactive effects on attitudes.

Both ELM and HSM assume that attitudes formed or changed through thorough information processing are assumed to be more stable and enduring, than attitudes which are the result of more limited modes of information processing. In addition, it is assumed that attitudes formed or changed through systematic or central route processing are more strongly related to actual behaviour, than attitudes formed or changed through superficial information processing. Therefore it is not surprising that a great deal of research effort has been dedicated to identifying the factors that determine whether or not information is systematically processed.

Recently a growing interest in the impact of affective factors can be observed, as appears



from the large number of publications on the role of affect in persuasion (see Eagly & Chaiken, 1993). Also, in daily life we are confronted with a growing number of advertisements as well as non-commercial communications which appeal to affective states such as feelings and emotions. After Cohen and Areni (1991) we use the term affect as a general descriptor of a feeling state. Emotions and moods are specific examples of such feeling states, with emotions being more intense and stimulus specific than moods.

Affect may serve multiple roles in the persuasion process. The specific role in which affect serves, depends according to Petty, Gleicher and Baker (1991) on the extent to which people are motivated and able to process information on a certain issue. When motivation and information processing capacity are high, affect may serve as a persuasive argument, providing information as to the merits of the issue under consideration. This requires that the affective response is relevant to the issue, such as when admiration for natural beauty serves as an argument to join a nature-protection organisation, or when fear of fall-out serves as an argument to demonstrate against nuclear power-stations. Irrelevant affective responses may bias information processing, such as when a humoristic TV spot on littering positively biases thinking about this issue, and thereby leads to an underestimation of the problem (see also Midden & Louw, 1994).

When motivation or information processing capacity is low, affect may function as a simple cue, allowing attitude formation in the absence of careful consideration of the merits of the issue. For example, a feeling of irritation elicited unintentionally by a moralizing brochure on energy saving may be directly associated with this topic, leading to an aversive attitude towards energy saving behaviour.

A third way in which affect can have an impact, is by affecting the extent or direction of information processing, such as when a fear appealing message on global warming motivates people to look for and carefully process information on possible ways to reduce this risk.

### *Section summary and policy conclusions*

In summary, according to dual process theories of persuasion, people can process persuasive messages more or less thoroughly, depending on how motivated and capable they are of doing so. Careful elaboration of the contents of a message requires high motivation and information processing capacity, and results in relatively stable attitudes and relatively strong

attitude-behaviour relationships. More limited cue-based forms of message processing require less motivation and capacity, but may also have an effect on attitudes. However, this effect will be only temporal and the resulting attitude will be less firmly related to behaviour.

Considered from a dual-process perspective, affect may serve multiple roles in the persuasion process, depending on how motivated and capable people are to systematically process information before forming an attitude. Whereas affective states such as feelings and emotions may serve a desirable role in the persuasion process, it is also possible that affective reactions have an undesirable effect.

Based on the theoretical framework presented in this section, the following policy conclusions can be formulated:

- ❑ In order to realize stable attitudes which are firmly related to behaviour, people should be stimulated to form their attitudes through careful thinking and systematic information processing.
- ❑ Peripherally induced changes of attitudes can be useful as well, but are only temporal and should be consolidated.
- ❑ Because emotion and other affective responses can serve multiple roles in the persuasion process, some of which are less desirable than others, emotion oriented persuasive messages should be applied with the greatest caution. To ensure that a message produces the intended effects while undesirable effects are avoided, it should be designed according to theoretically and empirically founded principles. In addition, before applying a message, its effects should be thoroughly pretested.

In the next section we focus our attention on a class of emotion oriented persuasive messages, the effects of which have been studied extensively since the early fifties, namely fear appeals.

### Fear appeals

In the field of health education, there is a long tradition of studying the impact of fear appealing messages on health-related behaviours such as smoking, performing breast self-

examinations, using condoms etc. (Maddux & Rogers, 1983; Rippetoe & Rogers, 1987; Tanner, Day, & Crask, 1989). Little is known about the applicability of fear appeals in the field of environmental information (but see Hass, Bagly, & Rogers, 1975; Shelton & Rogers, 1981). The present study examines whether people can be motivated to carefully process environmental information, by employing fear appeals.

A fear appeal is a message that attempts to influence attitudes and behaviours through the threat of some danger (Tanner, et al., 1989). Eagly and Chaiken (1993) distinguish between two categories of theories of fear appeals. The first category consists of theories that try to explain the persuasive effects of fear-inducing messages by assuming that fear arousal influences the cognitive processes that mediate message acceptance. The second category consists of theories that try to explain the persuasive effects of fear-inducing messages by analysing the types of information that are provided by such messages.

To start with the first category of theories on fear and persuasion, the earliest systematic theory on the effects of fear-arousing communications dates from 1953. In that year, Hovland, Janis and Kelly presented the Drive Reduction Model of fear appeals (Hovland, Janis & Kelly, 1953). According to the Drive Reduction Model, fear acts as an unpleasant drive state, that motivates people to respond in such a way, either cognitively or behaviourally, as to reduce emotional tension. This principle implies that the responses that are elicited by a fear-inducing communication serve to reduce fear. Some of these fear-reducing responses may facilitate persuasion, whereas others may have an inhibiting effect on persuasion. According to the Drive Reduction Model, a fear-inducing communication will produce mainly persuasion-facilitating responses (e.g. thinking about the message's recommendations) and hence greater acceptance of the recommendations when the following conditions are fulfilled: First, the communication arouses a level of fear sufficiently high to function as a drive state, and second, the communication includes recommendations the acceptance of which reduces fear. However, fear-inducing communications that arouse too much fear, are assumed to mainly produce persuasion-inhibiting responses (e.g. discounting the threat's importance, denying its personal relevance), and hence will fail to produce attitudinal and behavioural change. Thus, the Drive Reduction Model assumes an inverted U-shaped relation between fear and persuasion, with moderate levels of fear leading to more persuasion, and low and high levels of fear having a negative impact on persuasion, as can be seen in figure 1.

McGuire (1969) and Janis (1967) further elaborated the inverted U-shaped relation between fear and persuasion implied by the Drive Reduction Model. McGuire assumes that fear has opposing effects on two processes that according to his Reception-Yielding Model mediate persuasion, reception and yielding. McGuire argues that the reception process is negatively influenced by fear, whereas fear has a positive impact on the yielding process. This implies

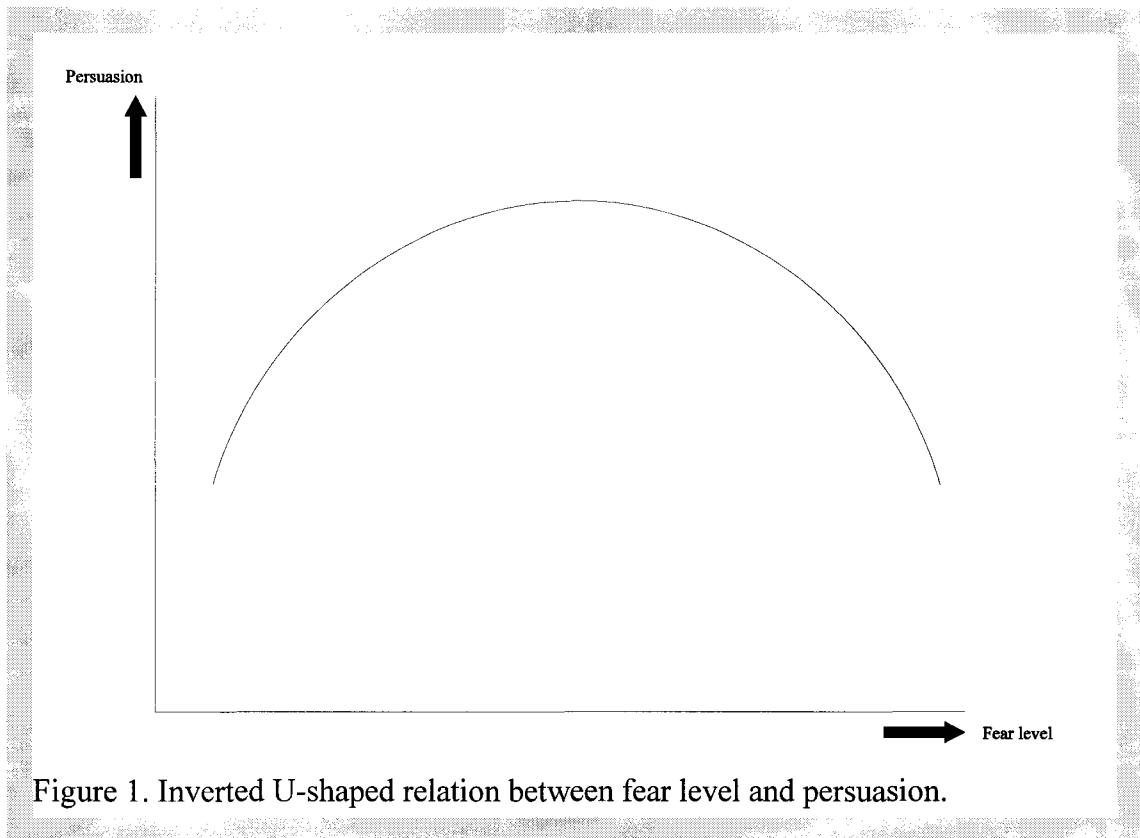


Figure 1. Inverted U-shaped relation between fear level and persuasion.

that the relative importance of these processes in producing persuasion determines what level of fear produces maximal persuasion. According to the Reception-Yielding Model's principle of situational weighting, the relative importance of the reception and yielding processes varies with individual difference and situational variables, such as message complexity or source credibility. In broad outline, Janis' Family-of-Curves Model (1967) comes to the same as McGuire's model. Like McGuire, Janis assumes that fear has a negative impact on message reception, but only when fear is high. However, Janis disagrees with McGuire's assertion that the impact of fear on message yielding is solely positive. Instead, Janis proposes that two types of responses are elicited by fear-inducing communications: Responses that facilitate message yielding and responses that interfere with yielding to the message. Janis' complex

ideas of how fear impacts on reception and yielding in different regions of the fear dimension, can be briefly summarized by stating that his model, just like McGuire's model, predicts an inverted u-shaped relation between fear and persuasion. The point at which persuasion begins to decrease as fear increases is according to the Family-of-Curves Model dependent on individual difference and situational variables.

In the models discussed so far, fear arousal serves a central role in explaining the persuasive effects of fear-inducing communications. In Leventhal's opinion however, the persuasive effects of fear appeals are not mediated by fear arousal, but instead, by a desire to ward off danger (1970). According to Leventhal's Parallel Response Model, which is the first theory of the second category of theories on the role of fear in the persuasion process, threatening communications initiate two parallel processes: a fear control process that attempts to reduce the fear response elicited by the depicted danger, and a danger control process that attempts to cope with the danger. This latter process is primarily responsible for the persuasive effects of fear appeals.

Rogers (1975) assigned even less importance to fear arousal in explaining the relationship between fear and persuasion. According to his Protection Motivation Theory a threatening message will be effective to the extent that it convinces a recipient that (1) the threat is serious (2) the recipient is susceptible to the threat and (3) the recommended coping response will be effective in avoiding the threat. Hence, the three crucial components of a fear appeal are (1) seriousness of a threat (2) probability of the threat's occurrence and (3) coping response efficacy. Each of these components initiates a corresponding appraisal process. The outcome of these appraisal processes is a motivation to protect the self, and it is this protection motivation that leads to persuasion. In 1983 Rogers expanded the theory by stressing the importance of a fourth component, self efficacy. In order to be effective, a threatening communication should convince a recipient that he or she is capable of performing the recommended behaviour.

In the foregoing an overview was presented of earlier theories of fear appeals. These theories offer two important insights regarding the relationship between fear and persuasion (see Eagly & Chaiken, 1993). First, we learn from the Protection Motivation Model and related models what types of information a threatening message should provide in order to accomplish acceptance of the message's recommendations. A second insight is provided by

the Drive-Reduction Model and related models that the relationship between fear and persuasion can best be comprehended by studying how fear arousal influences the cognitive processes that mediate message acceptance. The dual-process theories of persuasion may provide us with a proper theoretical framework for this purpose.

In a number of recent studies the relationship between fear and persuasion has been investigated from a dual-process point of view. Some of these studies examined the effect of fear on the degree to which *irrelevant* information is processed, i.e. information that has nothing to do with the threat (Wilder & Shapiro, 1989; Baron, Inman, Kao & Logan, 1992). These studies showed that fear can interfere with systematic processing of irrelevant information. For example, in one of the experiments reported by Baron et al., it appeared that fear of an upcoming dental treatment interfered with the processing of information about raising sales taxes.

Evidence that *relevant* information is more carefully processed when fear is aroused, comes from another study of Baron and colleagues (Baron, Logan, Lilly, Inman, & Brennan, 1994). The results of this study showed that arousing fear of a dental treatment leads to more careful processing of information on fluoridated water as a preventive measure for tooth decay. Gleicher and Petty (1992) found that whether or not frightened subjects systematically processed relevant or irrelevant information, depended on their expectations of the reassurance that would be provided by the information. When subjects' expectations were unclear, they processed the information carefully. When subjects were presented with a clear cue that the information would provide reassurance, however, they failed to engage in systematic information processing.

Gleicher and Petty explain the results of their experiment by arguing that fear elicits a motivation to seek reassurance. Driven by this motivation, people will systematically process information, unless reassurance can be achieved in a less effortful way. In terms of the Heuristic Systematic Model, fear motivates people to process information systematically, unless heuristic processing suffices to achieve reassurance.

### *Section summary and policy conclusions*

In summary, we learn from the early theoretical and empirical work on fear appeals discussed in this section, that the relationship between fear and persuasion can best be

comprehended by studying how fear arousal influences the cognitive processes that mediate message acceptance. Different levels of fear arousal are assumed to have different effects on these cognitive processes, and hence on message acceptance. Furthermore, we learn that in order to accomplish acceptance of recommendations, a fear appealing message must provide information not only on the threat, but also on how to reduce the threat. More specifically, it is important that people are not only provided with information on the severity and probability of the threat, but receive information on feasible and effective solutions to the threat as well.

Recently in a number of studies the relationship between fear and persuasion has been investigated from a dual-process point of view. These studies show that fear may have an impact on attitudes by influencing the extent to which people process information, and that inducing fear may lead to more extensive processing of relevant information, whereas the processing of irrelevant information may be inhibited by fear.

When the insights offered by the theories and studies discussed in this section are generalized to the field of environmental education and information, the following policy conclusions can be formulated:

- ❑ The persuasive impact of fear appealing messages seems to depend on the level of fear aroused and how fear influences the cognitive processes that mediate message acceptance. Although it is evident that extremely high levels of fear should be avoided, it is to a certain extent an empirical question what level of fear is optimal in producing persuasion.
- ❑ In order to be effective, a fear appealing message should not only provide people with risk information, but people should also be informed about feasible and effective solutions.
- ❑ Under specified conditions, fear appeals may be useful in motivating people to think about environmental issues and to carefully process information on these issues.

## PART 2: EXPERIMENTS

The second part of this report discusses the experimental work which has been done so far, and the experiments which are scheduled for the next two years. The first experiment conducted within the framework of this project, examined whether presenting environmental risks in a fear appealing way motivates people to systematically process information on environmentally friendly behaviour. As was explained in the section on dual-process theories of persuasion, systematic information processing is assumed to result in relatively stable and enduring attitudes which are firmly related to actual behaviour. According to early models of fear appeals, the relationship between fear and persuasion is not a linear one, but instead is curvilinear (Hovland et al., 1953; McGuire, 1969; Janis, 1967). Moderate levels of fear are assumed to have a net positive effect on the cognitive processes that mediate message acceptance, thereby leading to more persuasion. Relatively high levels of fear are assumed to have a net negative effect on these cognitive processes, thereby leading to less persuasion. Therefore in the experiment presented below, we studied message processing and persuasion with moderate and high levels of fear, in comparison with a no fear control condition.

### Method

#### *Design*

To examine whether fear of environmental risks increases the tendency to elaborate information on environmentally friendly behaviour, the following variables were manipulated in a 3 x 2 between-subjects factorial design: Fear level (no fear vs. moderate fear vs. high fear) and argument quality (weak arguments vs. strong arguments). The manipulation of argument quality is assumed to be an effective way of locating differences in message processing (Petty & Cacioppo, 1981). The underlying idea is that only when a persuasive message is carefully processed, the arguments presented in the message can have an impact on attitudes towards the message topic. This implies, that the effect of argument quality on attitudes can be considered an indication of the degree to which the message has been elaborated. Other widely employed indicators of message processing are: The number of



issue-relevant cognitive responses generated during message exposure, the evaluative content of these cognitive responses, and the number of message arguments recalled afterwards. The idea is, that the more a message on a certain issue is elaborated, the more issue-relevant thoughts will be generated during message exposure, and the stronger attitudes will be determined by the evaluative content of these responses. Also, greater message elaboration is assumed to result in higher recall of message content.

### *Subjects*

Subjects were 120 inhabitants of Eindhoven, the Netherlands, who received a financial compensation for participating in the experiment. The number of subjects per condition varies between 18 and 22.

The total number of female participants is twice as high as the number of male participants, 81 and 39 respectively. A chisquare test showed that the proportion of female and male subjects does not vary systematically across conditions (Pearson  $X^2 = 2.08$ ,  $p = 0.84$ ).

Mean age of the total group of participants is 53, the youngest participant is 13, the age of the oldest participants is 76. An ANOVA with age as dependent variable and fear level and argument quality as independent variables, revealed that age systematically varies over conditions (main effect fear level,  $F(2,114) = 3.53$ ,  $p = 0.033$ ). Pairwise comparisons of the three fear conditions according to the Tukey-HSD method showed, that mean age of subjects in the moderate fear condition is significantly higher ( $p = 0.05$ ) than mean age of subjects in the no fear condition ( $M = 57$  and  $M = 49$  respectively). All analyses of variance described in this report were repeated with age as covariate, but this appeared to have no effect on the outcomes. Therefore we will further ignore the age difference between the moderate fear and the no fear condition.

Regarding educational background of the participants, 39.2 % of the participants enjoyed an education which was qualified as low, another 39.2 % of the participants received an education of an intermediate level, and 21.7 % of the participants are highly educated. It appeared from a chisquare test that the proportion of subjects who enjoyed an education that was qualified as low , subjects with an education of an intermediate level, and highly educated subjects does not vary systematically over conditions (Pearson  $X^2 = 8.91$ ,  $p = 0.54$ ).

### *Procedure*

Subjects were informed that they were to participate in a study on consumer reactions to new products. Subjects were invited to the laboratory in groups of at most four persons. Subjects were seated in cubicles containing a personal computer, on which all instructions and manipulations were provided and by means of which their responses were measured. The experimental procedure was as follows. First, subjects in the moderate and high fear conditions were exposed to either a slightly or a highly frightening message on global warming. Next, they received either a weak or a strong persuasive message arguing for the use of a new type of energy saving light bulbs. Subjects in the no fear condition received no information on global warming, but were only exposed to either a weak or a strong message about the new energy saving bulb. After having read these messages, subjects completed a questionnaire. The most important measures in this questionnaire were measures of the dependent variables (cognitive responses, attitudes towards using the new bulb, and recall of arguments respectively) and manipulation check measures. After having completed the questionnaire, subjects were debriefed and then dismissed.

### *Stimulus materials*

After Gleicher and Petty (1992), we disconnected the manipulations of fear level and argument quality by employing different messages to bring about these manipulations. The message on the greenhouse effect presented the manipulation of fear level. As was already mentioned, subjects in the no fear condition received no message about the greenhouse effect. The slightly frightening message that was presented to the subjects in the moderate fear condition, described the process of global warming and its possible negative consequences, whereas in addition in the highly frightening version five black and white photographs of the possible negative consequences of global warming (e.g. floods) were shown. These photographs were impoverished by means of a computer to such a degree, that risk imagination was tickled without providing extra information.

Similar manipulations of fear level have been employed by Rogers and colleagues, who showed in a number of studies that fear level and perceived threat can be successfully manipulated by varying message vividness. (Sherer & Rogers, 1984; Rippetoe & Rogers, 1987). A widely cited definition of vividness comes from Nisbett and Ross (1980) who stated

that: "Information may be described as vivid, that is, as likely to attract and hold our attention and to excite the imagination to the extent that it is (a) emotionally interesting, (b) concrete and imagery-provoking, and (c) proximate in a sensory, temporal, or spatial way".

According to Taylor and Thompson (1982) researchers have treated vividness as a communication characteristic, inherent in the stimulus qualities of information itself. In Taylor and Thompson's review article on vividness studies, the following methods are mentioned which are employed by researchers to make communications more vivid: concrete and specific language, pictures and videotaped presentations, first-hand information, and case history information. Most studies reviewed by Taylor and Thompson failed to show any effect of vividness on attitudes, regardless of how vividness was operationalized. However, in these studies the direct persuasive effects of message vividness were investigated. We on the contrary, are interested in message vividness as a means to manipulate fear, and, as was already stated, Rogers and colleagues showed that it is indeed possible to induce different levels of fear by varying message vividness.

To avoid falling into the trap of introducing variations in message informativeness as a side effect of varying message vividness (as was for example the case in Janis and Feshbach's classical dental health experiment (1953)) we decided to keep the text of the moderate fear and the high fear version of the message exactly the same. Literally translated, the part of the text that dealt with the consequences of global warming ran as follows:

.....the consequences of the greenhouse effect. As was already stated, the greenhouse effect may result in a rise of the mean temperature on earth, and consequently the polar ice as well as the glacier-ice may melt. In addition water (the greater part of the earth's surface) expands with higher temperatures. As a consequence the sea-level may rise, which may lead to a flooding of low areas. This can only be prevented by building and heightening dikes. However, it is a question whether this will be technically and financially possible.

The greenhouse effect may not only affect sea-level, but may also influence the earth's climate. Global warming could result in a climate change, with all consequences for plants, animals and human beings, because everything in nature is coherent, everything is in balance. The greenhouse effect may disturb this balance. If the atmosphere warms up, the climate zones will move up. This will have consequences for agriculture and natural ecosystems, for the climate zones may move up, but woods will not be able to keep pace with the climate zones. Certain animal species will have difficulties in adapting to the changing conditions of life as well. Other animal species, such as for example insects, will flourish on higher temperatures. Insects will spread over greater areas if the mean temperature on earth rises.

In some areas the greenhouse effect will lead to more precipitation, because more water will evaporate as a consequence of the higher temperatures, and when more vapour is in the air, more rain will fall. In other areas the greenhouse effect will lead to less precipitation. This dryness may lead to difficulties with water supply and food production.....

The persuasive message on energy saving bulbs presented the manipulation of argument quality. This message consisted of a description of a new (fictitious) type of energy saving light bulbs and four arguments in favour of purchasing and using this new type of bulbs. In the weak version of the message four weak arguments were presented, whereas in the strong version four strong arguments were presented. These arguments were selected from a larger pool of arguments which were pretested in a pilot study on 8 subjects. Each of the weak arguments received significantly lower ratings of strength in the pilot study, than each of the strong arguments. The following arguments were presented in the weak version of the message:

- (1) The bulb consists of two separate parts, which has the advantage that you can clean it up easily.
- (2) Thanks to its special design you can lay the bulb on the table without having to be afraid that it will fall off the table.
- (3) The new bulb contains little glass, so if you accidentally smash it up, you will need to clear away only a few glass splinters.
- (4) The new energy saving bulb nearly gets warm, so you can change the bulb without burning your fingers.

The strong version of the persuasive message included the following arguments:

- (1) Thanks to its special design the light tube provides a well-diffused light.
- (2) Because the new energy saving bulb is hardly any bigger than the common electric bulb, it can be used in almost every lamp-shade without protruding.
- (3) The fairly high initial expense will pay itself back, because the bulb uses less electricity and has a longer life span.
- (4) The fact that the new bulb uses less energy is better for the environment.

## Results

### *Manipulation checks*

*Fear level.* To check on the success of the manipulation of fear level, subjects in the moderate and high fear conditions were asked to rate on four 7-point scales (anchored at 1 = not at all and 7 = extremely) the extent to which they thought the message on global warming they were previously exposed to, was frightening, alarming, shocking, and gripping. Ratings on these four items, which were correlated with one another (Pearson correlations ranged from 0.47 to 0.67), were averaged to create a composite measure of frightfulness (Cronbach's alpha = 0.85). Next, this composite measure was analysed in a 2 (moderate versus high fear) x 2 (weak versus strong arguments) between-subjects ANOVA. This analysis yielded a significant effect of fear level ( $F(1,71) = 7.06, p = 0.01$ ). Subjects in the high fear condition rated the message on the greenhouse effect as significantly more frightening ( $M = 5.56$ ) than subjects in the moderate fear condition ( $M = 4.80$ ).

In addition to the above-mentioned manipulation check, we examined whether the manipulation of fear level affected subjects' perceptions of the greenhouse effect. To check whether exposing subjects to information on global warming sec or in combination with pictures, affected their risk perceptions, subjects in all conditions were asked to rate the probability that undiminished emissions of CO<sub>2</sub> and other so-called greenhouse gasses will have the following consequences: a rise of the mean temperature on earth, a climate change, and a rise of the sea-level. Subjects were asked to rate the probability of each of these consequences on 7-point scales anchored at 1 = very small chance and 7 = very big chance). In addition, subjects were asked to rate the seriousness of these consequences on 7-point scales anchored at 1 = not at all serious and 7 = very serious). For each consequence, ratings of probability and seriousness were multiplied, and these products were averaged over the three consequences, to create a composite measure of perceived risk. Next, this composite measure of perceived risk was analysed in a 3 (no versus moderate versus high fear) x 2 (weak versus strong arguments) between-subjects ANOVA. This analysis yielded a significant effect of the manipulation of fear level ( $F(2, 112) = 4.58, p < 0.012$ ). Pairwise comparisons of the three fear conditions according to the Tukey-HSD method showed, that perceived risk was significantly higher at the  $p = 0.05$  level in the high fear condition ( $M = 35.89$ ) than in the

no fear condition ( $M = 29.16$ ). The difference between the no fear condition and the moderate fear condition ( $M = 32.91$ ) was not significant, neither was the difference between the moderate fear condition and the high fear condition.

The same pattern of results was found regarding subjects' ratings of how vividly they could imagine the greenhouse effect. Subjects were asked to rate on 7-point scales (anchored at 1 = and 7 = ) the extent to which they agreed with 5 statements such as "I can vividly imagine the consequences of the greenhouse effect" or "to me the greenhouse effect remains a rather vague phenomenon". Ratings on these five scales were correlated after having been recoded (correlations varied from 0.20 to 0.77) and were averaged to create a composite measure of vividness (Cronbach's alpha = 0.78). This measure of vividness was analysed as a dependent variable in an ANOVA with fear level and argument quality as independent variables. The manipulation of fear level turned out to have a significant effect on vividness ( $F(2, 112) = 3.65, p < 0.029$ ). Pairwise comparisons of the three fear conditions using the Tukey-HSD method showed, that vividness was significantly higher at the  $p = 0.05$  level in the high fear condition ( $M = 3.55$ ) than in the no fear condition ( $M = 3.01$ ). The difference between the no fear condition and the moderate fear condition ( $M = 3.40$ ) was not significant, neither was the difference between the moderate fear condition and the high fear condition.

*Argument quality.* To check on the success of the manipulation of argument quality, subjects in all conditions were asked to rate the strength of each of the arguments presented to them on a 7-point scale (anchored at 1 = not at all and 7 = extremely). Judgments of the four arguments were summarized to create a composite measure of argument quality. Next, the composite measure was analysed in a 3 (no versus moderate versus high fear) x 2 (weak versus strong arguments) between-subjects ANOVA. This analysis yielded a significant effect of argument quality ( $F(1, 113) = 42.63, p < 0.0001$ ). The strong arguments received significantly higher ratings of strength ( $M = 22.47$ ) than the weak arguments ( $M = 16.02$ ).

As a second check on the manipulation of argument quality, subjects were asked to rate the extent to which they found the bulb message as a whole convincing. For this purpose they were provided with a 7-point scale (anchored at 1 = not at all convincing and 7 = very convincing) which they could use to finish the sentence: "In my opinion, the message on the new bulb I was previously exposed to, was:" A 3 (no versus moderate versus high fear) x 2

(weak versus strong arguments) between-subjects ANOVA revealed no main effect of argument quality, but a main effect of fear level on this measure ( $F(2, 113) = 4.47, p = 0.034$ )<sup>1</sup>. However, it might be argued that we are here dealing with a measure of persuasion, rather than a check on the manipulation of argument quality.

### *Effects on attitudes*

To assess subjects' attitudes towards using the new energy saving bulb, they were asked to rate on four 7-point scales (ranging from 1 = not at all to 7 = extremely) the extent to which they thought the bulb was a good, attractive, suitable, useful and appealing bulb to use in their own households. A reliability analysis revealed that the appealing item contributed negatively to Alpha. Therefore, it was decided to remove this item. The remaining four items were averaged to create a composite measure of attitude towards using the new bulb (Alpha = 0.89).

The composite measure of attitude was then analysed in a 3 (no versus moderate versus high fear) x 2 (weak versus strong arguments) between-subjects ANOVA. This analysis yielded a significant main effect of fear level ( $F(2,114) = 3.27, p = 0.042$ ) and a marginally significant interaction-effect of fear level and argument quality ( $F(2,114) = 2.72, p < 0.07$ )<sup>2</sup>.

The main effect of fear level was studied in more detail by performing pairwise comparisons of the three fear conditions using the Tukey HSD method. It appeared that no

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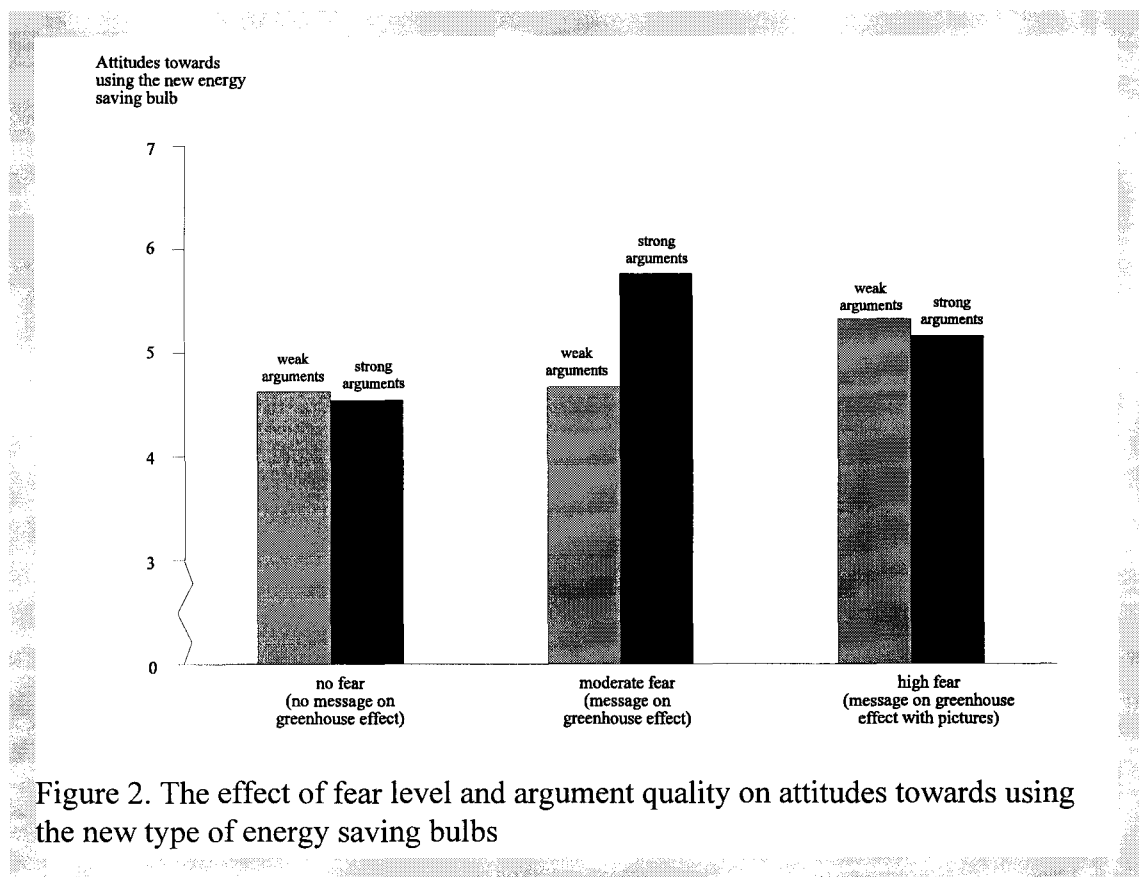
<sup>1</sup> main effect argument quality  $F(1,113) < 1$ , n.s., interaction-effect argument quality and fear level  $F(2, 113) = 1.70, p = 0.188$ .

<sup>2</sup>It appeared from a regression analysis that perceived risk severity (see section 3.1) forms a significant predictor of attitudes towards using the energy saving bulb (Beta = 0.34,  $p = 0.0001$ ). Therefore the analysis of variance described in the text, was repeated with perceived risk severity as covariate. This resulted in a main effect of fear level on attitudes that was no longer significant ( $F(2, 111) = 1.36, p = 0.262$ ). However, the interaction effect of fear level and argument quality became more significant, although the level of significance remained marginal ( $F(2,111) = 2.97, p = 0.055$ ). Thus, it seems that the main effect of fear level on attitudes is mediated by perceived risk severity, whereas the interaction effect of fear level and argument quality is not.

Recall from section 3.1 that we also measured vividness of risk perception as a possible confound of our fear manipulation. However, a regression analysis revealed that vividness had no predictive value for attitudes (Beta = 0.02,  $p=0.861$ ). Therefore we did not study the impact of adding vividness as covariate to the analysis of variance, described in the text.

two conditions were significantly different at the  $p = 0.05$  level. Also, a complex comparison was carried out between the no fear condition on the one hand and the moderate and high fear condition on the other hand, using the Scheffé method. This contrast neither proved to be significant ( $T(86.8) = 2.51$ , Scheffé test statistic = 3.51), although the results pattern seems to suggest that exposing subjects to a message on global warming leads to more positive attitudes towards using the energy saving bulb, than offering subjects no information on global warming (in the no fear condition attitude towards using the bulb is  $M = 4.59$ ,  $S.D. = 1.39$ , in the moderate fear condition  $M = 5.23$ ,  $S.D. = 1.36$  and in the high fear condition  $M = 5.26$ ,  $S.D. = 1.30$ ).

In spite of its marginal significance, we decided to further analyze the interaction effect of fear level and argument quality on attitudes towards using the new bulb, because of its



relevance to our research question. Simple effects analyses showed, that in the no fear condition, the manipulation of argument quality had no impact on subjects' attitudes towards using the new bulb (simple  $F(1,42) < 1$ , n.s.), as can be seen in figure 2. In the high fear



condition, argument quality also failed to have an effect on attitudes (simple  $F(1,35) < 1$ , n.s.). In the moderate fear condition however, subjects did make a distinction between weak and strong arguments to use the new light bulb (simple  $F(1,37) = 7.30$ ,  $p < 0.01$ ). Exposure to strong arguments resulted in attitudes that were significantly more positive, than attitudes which were measured following exposure to weak arguments ( $M = 5.76$ ,  $S.D. = 1.25$  and  $M = 4.67$ ,  $S.D. = 1.28$  respectively).

### *Effects on cognitive responses*

To assess subjects' cognitive responses to the persuasive message, they were requested to complete a thought-listing task immediately after message exposure. Subjects were asked to write down all the thoughts that came to mind while reading the persuasive message on the energy saving bulb. For this purpose, subjects were provided with a form containing numbered boxes, and they were instructed to write down only one thought per box.

As was already explained earlier in this report, the number of issue-relevant cognitive responses generated during message exposure may be considered to form an indication of the degree to which the message is systematically processed. Also, the evaluative content of these responses is assumed to form an indicator of systematic information processing. The underlying idea is, that the more a message on a certain issue is elaborated, the more issue-relevant thoughts will be generated during message exposure, and the stronger attitudes towards the issue will be determined by the evaluative content of these responses.

The thoughts listed by the subjects were categorized by two independent judges, who rated the relevance of the responses (issue-relevant or issue-irrelevant, 95 % agreement between the judges) and the evaluative direction of the responses (positive, negative or neutral, 76 % interrater agreement). Mean scores for the two judges were analysed. The number of issue-relevant cognitive responses was analysed in a 3 (no versus moderate versus high fear) x 2 (weak versus strong arguments) between-subjects ANOVA. A main effect of fear level was found ( $F(2,113) = 4.34$ ,  $p = 0.015$ )<sup>3</sup>. Figure 3 shows that subjects in the high fear condition

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<sup>3</sup>A regression analysis with perceived risk severity as predictor and attitude towards using the bulb as criterium variable, did not give rise to add perceived risk severity as covariate to the analysis of variance, described in the text ( $Beta = 0.14$ ,  $p = 0.134$ ). The same applies to vividness of risk perception ( $Beta = 0.12$ ,  $p = 0.223$ ).

generated significantly more issue-relevant cognitive responses ( $M = 4.33$ ,  $S.D. = 2.32$ ) than subjects in the moderate fear condition ( $M = 3.40$ ,  $S.D. = 1.66$ ;  $T(73) = 2.02$ ,  $p = 0.047$ )<sup>4</sup> and subjects in the no fear condition ( $M = 3.16$ ,  $S.D. = 1.48$ ;  $T(56.97) = 2.63$ ,  $p = 0.011$ ). The difference between the number of issue-relevant cognitive responses generated in the moderate fear condition and in the no fear condition was not significant ( $T(81) < 1$ , n.s.).

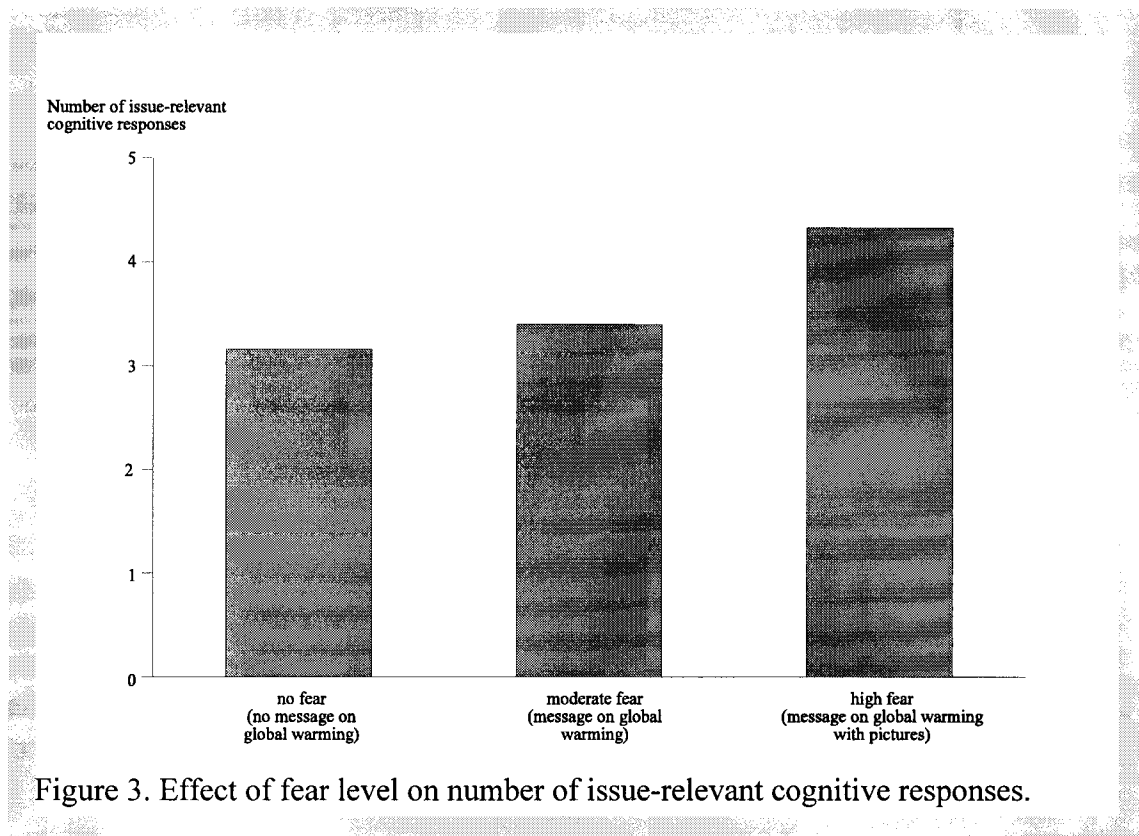


Figure 3. Effect of fear level on number of issue-relevant cognitive responses.

The evaluative direction of cognitive responses was operationalized as the number of positive minus the number of negative cognitive responses. As was explained before, it is assumed that when a message is processed systematically, message evaluation as expressed in cognitive responses is related to attitudes. We therefore examined whether fear level influenced the strength of the relation between the evaluative content of cognitive responses and attitudes. This relation was operationalized as the correlation between attitudes and the number of positive minus the number of negative cognitive responses. Before calculating this correlation we first removed the effect of argument quality from both variables, by subtracting

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<sup>4</sup> When Bonferroni is applied, this contrast is no longer significant.

row means for argument quality from cell means. After this, the correlation between attitudes and the number of positive minus the number of negative cognitive responses was 0.39 in the no fear condition, 0.43 in the moderate fear condition, and 0.53 in the high fear condition. The difference between these correlations was tested by transforming the correlation coefficients to Z values ( $Z = 0.41$ ,  $Z = 0.46$ , and  $Z = 0.59$ , respectively) and carrying out Z-tests. No significant differences were found.

### *Effects on argument recall*

To assess subjects' recall of the arguments that were presented in the persuasive message, they were requested to write down everything they remembered about the persuasive message on a blank sheet of paper.

As was explained before, the number of correctly remembered message arguments forms another indicator of the extent to which the message is systematically processed. It is assumed that higher recall of message arguments reflects greater message elaboration.

Two independent judges rated the number of correctly remembered message arguments. Agreement between the judges was 89 %. Mean scores for the two judges were analysed in a 3 (no versus moderate versus high fear) x 2 (weak versus strong arguments) between-subjects ANOVA. No significant effects on this indicator of systematic information processing were found (Main effect fear level  $F < 1$ , n.s.; main effect argument quality  $F < 1$ , n.s.; interaction effect fear level and argument quality  $F(2,113) = 1.19$ ,  $p = 0.31$ ).

### *Effects on behaviour*

Although this experiment was mainly conducted to learn more about the effect of fear level on information processing, from a practical point of view the behavioural effects of fear appealing messages are also of high importance. Therefore, measurements of behavioural intention and behaviour were included in the present study. Both intention to purchase as well as intention to use the new energy saving bulb were measured. Intention to purchase was measured by asking subjects to rate on a 7-point scale (anchored at 1 = certainly not and 7 = certainly) whether they intended to buy the bulb as soon as possible. Intention to use the new energy saving bulb was measured by asking subjects to rate on a 7-point scale (anchored at 1 = certainly not and 7 = certainly) whether they intended to put the bulb into use as soon as

possible. These measures of behavioural intention were analysed in a 3 (fear level: no versus moderate versus high fear) x 2 (argument quality: weak versus strong arguments) between-subjects MANOVA. The multivariate test revealed a marginally significant main effect of fear level ( $F = 2.01, P < 0.093$ ). It appeared from the univariate tests that fear level only had a main effect on purchase intention ( $F(2,114) = 3.29, p < 0.041$ ). This effect was studied in more detail by performing pairwise comparisons of the three fear conditions using the Tukey HSD method. Subjects in the moderate fear condition appeared to have a significantly higher purchase intention ( $p < 0.05$ ), than subjects in the no fear condition ( $M = 5.31$  and  $M = 4.39$  respectively). Subjects in the high fear condition appeared not to differ from subjects in the other two fear conditions, regarding purchase intention ( $M = 4.92$ ).

The behavioural measurement was operationalized as follows: At the end of the experiment, subjects were given the opportunity to order the new energy saving bulb. Thus, behaviour is operationalized as a dichotomous choice. A chisquare test revealed, that there was no systematic difference in behaviour between the three fear conditions (Pearson  $X^2$  ( $df=2$ ) = 2.37,  $p < 0.31$ ). The number of subjects that ordered one or more bulbs was 22 (=19.8%) in the no fear condition, 14 (=12.6%) in the moderate fear condition, and 17 (=15.3%) in the high fear condition.

According to dual-process theories of persuasion, attitudes that are the result of systematic information processing, form better predictors of behaviour, than attitudes which are the result of more superficial forms of information processing (Chaiken, 1980; Chaiken et al., 1989; Petty & Cacioppo, 1981, 1986). Therefore we carried out logistic regression analyses with the dichotomous measure of behaviour as dependent variable and attitude as independent variable for each of the three fear conditions separately. It appeared that in none of the three fear conditions attitude was entered into the regression equation. Thus, in none of the three fear conditions, ordering the bulb yes or no could be predicted from attitudes towards using this new type of bulbs. Following Fishbein and Ajzen's theory of reasoned action (Ajzen & Fishbein, 1980) one could assume that the relation between attitudes and behaviour is mediated by behavioural intention. However, although behavioural intention could be predicted from attitude in each of the three fear conditions, as can be seen in table I, behavioural intention appeared to have no predictive value for behaviour, with the exception of the high fear condition, in which purchase intention appeared to have some predictive value

for behaviour.

Table I: Standardized regression coefficients of attitude as predictor of purchase and use intention and of purchase and use intention as predictor of behaviour.

	no fear condition	moderate fear condition	high fear condition
standardized coefficient of attitude as predictor of purchase intention	0.66** (R <sup>2</sup> = 0.43)	0.74** (R <sup>2</sup> = 0.55)	0.66** (R <sup>2</sup> = 0.43)
standardized coefficient of attitude as predictor of use intention	0.49** (R <sup>2</sup> = 0.24)	0.74** (R <sup>2</sup> = 0.55)	0.53** (R <sup>2</sup> = 0.28)
standardized coefficient of purchase intention as predictor of behaviour	-	-	0.45* (R <sup>2</sup> = 0.20)
standardized coefficient of use intention as predictor of behaviour	-	-	-

\* p < 0.05; \*\* p < 0.0001

### *Regression analyses*

When we line up the results presented in the sections on attitudes, cognitive responses and argument recall, we arrive at the following interpretation of the relationships between fear, information processing and attitudes. The finding that attitudes depended on argument quality only in the moderate fear condition, suggests that only in this condition subjects critically processed message content. In the high fear condition attitudes towards using the bulb were nonsignificantly more positive, than attitudes in the no fear condition, irrespective of argument quality.

We suspect, that the message on global warming presented to subjects in the high fear condition was alarming to such an extent, that it made subjects accept the new energy saving bulb right away, regardless of the specific information they received on the bulb. It should be noticed however, that subjects in the high fear condition did process the bulb information, as appears from the high amount of issue-relevant cognitive responses they reported.

In other words, we hypothesize that in the high fear condition, the alarming content of the global warming message directly led to more positive attitudes towards using the new energy

saving bulb. In the moderate fear condition, the somewhat less alarming content of the global warming message motivated subjects to systematically process the bulb message. Depending on the strength of the arguments presented in this message, this could result in more positive attitudes.

We tested this post hoc hypothesis by conducting a regression analysis using the data from the moderate and high fear condition. The dependent variable in this regression analysis was attitude towards using the new energy saving bulb, abbreviated as A. As independent variables we included the manipulation check measures of fear level and argument quality, i.e. perceived frightfulness of the global warming message, abbreviated as F, and perceived quality of the arguments presented in the bulb message, abbreviated as Q. In addition, an interaction term of these two factors was included as an independent variable, abbreviated as F\*Q. In developing the regression equation, we used the forced entry method. This method holds that all independent variables are entered in a single step. The correlations between the A, F, Q, and F\*Q terms appear in table II.

Table II: Correlations between attitudes towards using energy saving bulb, measurements of frightfulness global warming message and quality of bulb arguments

	A	F	Q	F*Q
A (Attitude)				
F (Frightfulness)	0.41**			
Q (Argument Quality)	0.32*	0.26		
F*Q (Interaction between F and Q)	0.41**	0.72**	0.83**	

\*  $p < 0.05$ ; \*\*  $p < 0.01$

The F term tests for the attitudinal impact of receiving a global warming message that is to a greater or lesser degree frightening. The Q term tests for the attitudinal impact of receiving a bulb message containing arguments that are in a greater or lesser degree convincing. The F\*Q term tests whether this effect of argument quality varies with fear level. For F, we found a standardized regression coefficient of 1.00,  $p = 0.007$ . For Q, we found a standardized regression coefficient of 1.05,  $p = 0.02$ . For F\*Q, we found a standardized regression coefficient of -1,19,  $p = 0.06$ . This results in the following regression equation ( $R^2 = 0.26$ ):

$$A = F + 1.05 Q - 1.19 F*Q$$

As can be deduced from this equation, both F and Q have an effect on A. However, the effect of Q on A varies with the height of F. If F approaches the maximum of 1, the contribution of Q to the prediction of A becomes  $1.05 - 1.19 = -0.14$ . If F approaches the minimum of 0, the contribution of Q to the prediction of A becomes  $1.05 - 0 = 1.05$ . In other words, with lower values of F, A is mainly determined by Q. With higher values of F however, A is mainly determined by F. Thus, the regression equation corresponds with our hypothesis that in the high fear condition attitudes towards using the new energy saving bulb were determined by fear, whereas in the moderate fear condition attitudes were based on argument quality.

### Conclusion and discussion

The results presented in the former sections can be summarized as follows. A main effect was found of fear level on attitudes towards using the new energy saving bulb. Compared with control subjects who only read a persuasive message in favour of using the bulb, subjects who received a message on global warming prior to reading the bulb message, reported a more positive attitude towards using the bulb. In addition a marginally significant interaction effect was found of fear level and argument quality on attitudes towards using the new bulb. Only if the bulb message was preceded by a slightly frightening message on global warming, subjects based their attitudes on the quality of the arguments presented in the bulb message. Systematic processing of the bulb message resulted in more positive attitudes only if the message contained strong and convincing arguments in favour of using the bulb. No evidence was found that these attitudes had more behaviour-predicting value, than attitudes formed through less systematic ways of information processing.

The finding that in the moderate fear condition information was systematically processed, is consistent with the outcomes of an experiment reported by Baron et al. (1994), who found that arousing a moderately high level of fear of a dental treatment facilitated systematic processing of information on fluoridated water, which suggests that moderate fear stimulates systematic processing of relevant information, i.e. information that is related to the threat.

Whether subjects in the high fear condition failed to distinguish between weak and strong

arguments in favour of using the new energy saving bulb because they were unable to make this distinction, or because they were already fully convinced by the highly alarming global warming message, is a question that cannot be answered with certainty on the basis of the results of this experiment. However, it is unlikely that information processing capacity was impeded in the high fear condition, because precisely in this condition subjects produced the highest amount of cognitive responses with regard to the bulb message, indicating that they were able to think about the arguments presented in this message. Possibly the pictures presented to the subjects in the high fear condition communicated the risk of global warming so vividly, resulting in a high perceived risk, that no further information was needed for the subjects to accept the new type of energy saving bulbs. In terms of dual process theories of persuasion (Chaiken, 1980; Chaiken et al., 1989; Petty & Cacioppo, 1981, 1986), possibly the message on global warming, presented to subjects in the high fear condition, functioned as a decisive persuasive argument in favour of using the new energy saving bulb, dominating all other arguments that were subsequently presented.

According to the Protection Motivation Theory of fear appeals, the impact of fear on attitudes is mediated by a threat appraisal process, i.e. a process of appraising the seriousness and probability of occurrence of a threat (Rogers, 1975, 1983). If a threat is perceived as severe, protection motivation is aroused, provided that a coping response is available that is perceived as feasible and effective. As was mentioned in the section on manipulation checks, subjects in the high fear condition rated the consequences of the greenhouse effect to be more severe, than subjects in the no fear condition. Unfortunately, we have no information about subjects' confidence in using the energy saving bulb as an effective means of saving energy and reducing the risk of global warming.

It is not impossible that the pictures presented to the subjects in the high fear condition absorbed so much information processing capacity, not because the pictures aroused fear or initiated a threat appraisal process, but because cognitive capacity was needed to interpret them, that insufficient capacity was left to carefully process the bulb message. However, as was mentioned before, subjects in the high fear condition reported the highest amount of cognitive responses relevant to the bulb message. So apparently subjects in this condition were not unable to think about the bulb message. But then it is still possible that the pictures, because of their capacity-absorbing or distracting effects, interfered with subjects' capacity to



*critically* think about the bulb message and to make a distinction between weak and strong message arguments. However, in our opinion the most logic interpretation of the results of this experiment is, that the impact of fear on the extent to which information is systematically processed, varies with the level of fear. The results suggest, that a moderately frightening presentation of environmental risks motivates people to carefully process information about environmentally friendly behaviour. Depending on the quality of this information this may lead to more positive attitudes towards performing the recommended behaviour. High levels of fear seem to have a direct positive effect on attitudes towards performing the recommended behaviour, regardless of the specific arguments that are presented in favour of performing the behaviour. This interpretation needs to be further tested in future research.

### Planned studies

As was mentioned in the introduction, the present NRP project on cognitive versus emotion-oriented public information on environmental risks and environmentally friendly behaviour is not finished yet. On the contrary, the greater part of the experimental work is scheduled for the period from now till 1997.

The programme is to conduct at least one more laboratory experiment, in order to increase our understanding of the various roles affect may serve in enhancing public understanding of global environmental risks and the necessity of action. In June we conducted a pilot study to prepare for this experiment, which aims to further test the hypothesis that fear appeals may influence attitudes towards environmentally friendly behaviour either directly or indirectly, by influencing the extent of systematic information processing, depending on the level of fear aroused.

As was explained in the section on dual-process theories of persuasion, the Heuristic Systemic Model holds that circumstances which are conducive to systematic information processing, have a facilitating effect on heuristic information processing as well. Our first experiment showed that moderate levels of fear regarding environmental risks foster systematic processing of information on environmentally friendly behaviour. In the next experiment we examine whether moderate levels of fear are conducive to more superficial forms of information processing as well.

Although attitudes formed or changed through cue-based information processing are assumed to be relatively unstable and only weakly related to actual behaviour, this more superficial way of information processing may still be of use, as a preparation for a more profound change of attitudes and behaviour. In many real-life situations people lack the motivation, capacity or opportunity to carefully consider each piece of information before making a decision. Due to factors as time pressure and information overload we are forced to process the greater part of the many hundreds of persuasive messages that come to us every day only superficially. In these circumstances, emotion may function as a cue, permitting attitude change or decision making in the absence of careful information processing.

If time permits, another laboratory experiment will be conducted, in which the effects of positive emotion oriented messages will be studied, which appeal to emotions such as admiration for natural beauty, or hope of a healthy environment for our children.

Parallel to these laboratory experiments, a field study is prepared, in which the practical applicability and external validity of the insights obtained in the laboratory, are tested. In a natural setting, the impact of an emotion oriented presentation of global warming on actual energy saving behaviour is studied, in comparison with a purely informative presentation of the risks of global warming. For this purpose, two video spots on global warming are developed with the help of a professional audio-visual production organisation: an emotionally appealing video spot and a comparable, though strictly informative spot.

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