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MASTER

Communication on bio-energy

a study on involvement as moderator of the effect of message sidedness on attitude

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COMMUNICATION ON BIO-ENERGY

a study on involvement as moderator of the
effect of message sidedness on attitude

Masters thesis
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"It's good to have an end to journey toward,

but it's the journey that matters in the end."

- Ursula K. Le Guin

SUMMARY

Bio-energy is a form of sustainable energy that has a great deal of potential for the Netherlands. It is meant to become the main contributor to the 10% of annual energy consumption that should be provided by sustainable energy in 2020. Bio-energy is a complex technology with many aspects. First there is biomass, an umbrella term used for the fuels for bio-energy, e.g. forest trimmings and chicken manure. Second, there are the conversion methods to generate energy out of the biomass, e.g. gasification and fermentation. Last, there are the bio-energy products, like electricity, pyrolysis oil, and syngas. For the general public to accept any new technology, they need information about it. Thus, communication on bio-energy is needed, especially since it is so complex. Projectbureau Duurzame Energie (the Dutch Office for Renewable Energy) aims to promote bio-energy, and wanted to know how to communicate information about bio-energy to counter the negative messages of other sources and realize public support for bio-energy. This question instigated this masters thesis.

A literature study of social psychological aspects of communication was done. It revealed that the effect a message has on the receiver's attitude depends, among other things, on its sidedness, i.e. whether it only contains pro arguments (one-sided) or both pro and con arguments (two-sided), and whether presented counterarguments are refuted. In addition, involvement was found to influence information processing with regard to formation and change of attitudes because it is a motivator. The Elaboration Likelihood Model (ELM; Petty & Cacioppo, 1986) states a person needs motivation and ability to elaborate on the message content, i.e. to process information centrally. When either of the two is insufficient, the message content is not taken into consideration, but peripheral cues are. Several studies (Hale et al., 1991; Kamins & Assael, 1987) suggest the processing route moderates the effect of message sidedness and refutation on attitude. In other words, other effects were expected under low than under high involvement. This assumption was tested with an experiment.

In the experiment a manipulation was used to increase or decrease a subject's involvement. Subjects received either a one-sided, two-sided nonrefutational or two-sided refutational message about bio-energy, after which they were given a list of questions about their attitude about bio-energy, about several characteristics of the message, and about its source. Under high involvement, and thus motivation, a person's attitude toward bio-energy was expected to be most positive for the two-sided refutational message, because it showed both sides of the story, and at the same time discounted the counterargument. The first aspect was expected to enhance the credibility of the message, the second to lead to a generalized refutation of possible counterarguments. The two-sided nonrefutational message would lead to a slightly less positive attitude, because the counterargument remained unrefuted. The one-sided message ignored the possibility of counterarguments, and under high involvement this was expected to lead to a less positive attitude. Under low involvement this message type was expected to lead to the most positive attitude toward bio-energy because this message was easiest to understand when information was processed peripherally. The results of this study

provided no support for these expectations. No significant main or interaction effects were found for involvement manipulation and message type on subjects' attitude toward bio-energy. The two-sided refutational message was perceived as more credible than the one-sided message by subjects in the high involvement condition, as hypothesized, and also by those in the low involvement condition, for whom the reverse was expected. The source of the two-sided refutational message was also trusted more and was judged to be more competent than the source of the one-sided message. We did find a significant interaction effect of message type and involvement on the number of positive thoughts a person had while reading the bio-energy message. This was higher for the two-sided message compared to the one-sided message for subjects in the high involvement condition, but it was the other way around for subjects in the low involvement condition. No differences between experimental conditions were found for the persuasiveness of the message, its clarity, the subject's behavioral intention directed for or against bio-energy, or attitude strength. The experiment also tried to confirm two ELM-based expectations. First, a more positive attitude toward bio-energy was expected to correspond with less behavioral intention directed against bio-energy. In line with the ELM, this negative correlation was only found in the high involvement condition. The second expectation was that attitude strength was higher when people were involved or motivated than when they were not. Though this effect does not show in the manipulated involvement conditions, a positive correlation was found between the level of involvement and motivation on the one hand and attitude strength on the other. The data thus point in the expected direction.

The manipulation that was used was not successful in influencing involvement. It did however produce two groups that had significantly different levels of motivation to process information. Because of this effect, and because involvement was expected to influence motivation, the results could still be used to test the hypotheses based on the ELM.

As most hypotheses about the effects of message type, moderated by motivation, were not supported by the data, the results of the experiment do not provide many suggestions as to which message type leads to a more positive attitude under high or low involvement or motivation. However, when the motivation to process is high, either because of involvement or for other reasons, a two-sided refutational message is preferable over other messages because it is judged to be more credible, and the source is trusted more and judged more competent. A two-sided refutational message also leads to more positive thoughts that are relevant to the message or the topic when motivation is high. Yet when motivation is low, no one message is preferred on the basis of all measures. For while a two-sided refutational message scores better on message credibility, and trust in and competence of the source, it induces less positive relevant thoughts than a one-sided message. While no suggestions can be made with regard to the effect on attitude, when increasing trust is the objective, a two-sided refutational message is favored over a one-sided message.

In the end, the answer to the question "to refute or not to refute" seems clear. Whether it influences people's attitude and how motivation fits in the process, that still is the question.

PREFACE

Ambivalence is defined as the degree to which a person holds both positive and negative beliefs and feelings about an attitude object (Thompson, Zanna, & Griffin, 1995). Though I did not measure ambivalence in my experiment, I am experiencing it now. Ambivalence regarding the end of my graduation project, which is also the end of my study Technology and Society. After having been a student at this department for seven years, I feel very happy that I'll soon almost done. At the same time I feel somewhat sad about leaving. Finishing + leaving = happy + sad = ambivalence.

What I do not feel ambivalent about is my graduation project itself. I have been able to combine different fields of interest, i.e. social psychology, in the shape of information processing and attitude formation, sustainable energy, in the shape of bio-energy, and communication, an aspect of life that, in my opinion, is always important but often neglected. Of course I would have liked to find more significant results; to have more conclusive evidence with which I could help Projectbureau Duurzame Energie promote sustainable energy. to have more conclusive evidence for a model on message sidedness and information processing. But nonetheless I am satisfied with the process. While even though everybody wanted conclusive results (and rightfully so), for a graduation project, it is the journey that matters in the end.

Many people accompanied me on parts of the journey that is graduation. To all of them I say: thank you! Some I want to thank explicitly here. First of all my graduation committee: Anneloes Meijnders, for making sense of my sometimes incoherent ideas; Ria Kalf, for her down-to-earth realism and her commitment to bio-energy; and Kees Daey Ouwens, for the patience in waiting for my technical chapter and for looking at this project from a different angle. Besides these three people, I would like to thank the people at Projectbureau Duurzame Energie for their support, as well as Wouter van den Hoogen at the Human Technology Interaction group, for being a friend and sounding board at the same time. And last, but never least, Frauke van der Pas, my girlfriend, for being there, and more.

Peter van der Heijden
September 2004

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TU/e technische universiteit eindhoven

1 INTRODUCTION

In 2020 renewable energy has to provide 10% of the total annual energy consumption in the Netherlands (Brinkhorst, 2003). Bio-energy is the spearhead of this sustainable energy policy of the Dutch government. It views bio-energy as the form of renewable energy with the largest potential for the future in the Netherlands. Figure 1-1 below shows how much of the energy consumption of 2002 was provided by sustainable energy sources in the Netherlands, Figure 1-2 shows how much of this was bio-energy. The success of the ambitious plans mentioned above depends not only on technological advances and economic circumstances, but also on their acceptance by the general public. If the public does not acknowledge the usefulness and necessity of bio-energy, they may resist bio-energy projects, regardless of the technological and economic aspects of these projects (Rohracher, Späth, & Faber, 2003).
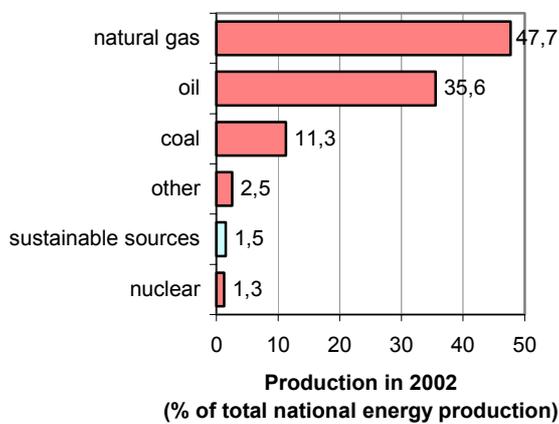
Figure 1-1 *Percentages of energy production per source in 2002.*

Note. From *Ontwikkeling Duurzame Energy in Nederland [Development of Sustainable Energy in the Netherlands]* (p. 38), by Projectbureau Duurzame Energie, 2003, Arnhem. Copyright 2003 by Projectbureau Duurzame Energie. Adapted with permission.
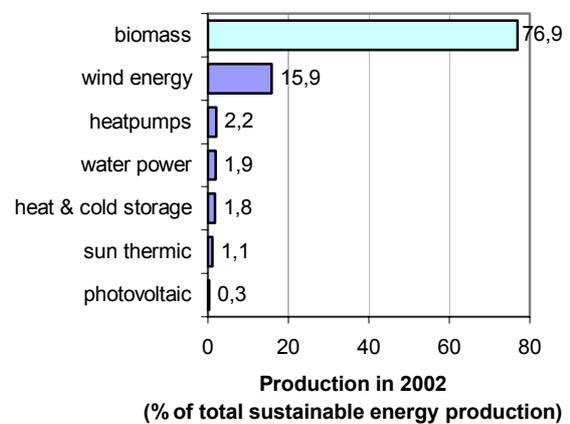
Figure 1-2 *Percentages of sustainable energy production per source in 2002.*

Note. From *Duurzame energie monitor 2003 [Sustainable energy monitor 2003]*. By Centraal Bureau voor de Statistiek and Nederlandse Organisatie voor Energie en Milieu, 2004. Copyright 2003 by Centraal Bureau voor de Statistiek. Adapted with permission.

Projectbureau Duurzame Energie (PDE, the Dutch Office for Renewable Energy) aims to promote the awareness and use of renewable energy in the Netherlands. It tries to accomplish this by being promoter, bridge-builder and national source of information. PDE has found that bio-energy is a non-interest topic for the general public (Projectbureau Duurzame Energie, 2002; Rohracher et al., 2003) and that most of the media attention bio-energy receives is negative. When people form an attitude about bio-energy they do so based on the, mostly negative, information they have about the technology. As a result of the negative attention, this attitude will probably be negative as well. This is why PDE asked the following question:

"How to communicate about bio-energy to counter the negative messages of other sources and realize broad public support for this form of renewable energy?"

This question was the starting point of my research. A literature study and much deliberation led to the following research question, which was tested with an empirical study:

"What is the role of message sidedness and possible refutation on one's attitude regarding bio-energy and how does involvement moderate this effect? "

Message sidedness is whether the arguments only are in favor of the advocated position or also against. Refutation occurs when counterarguments that are mentioned are contested. Although this is just one aspect of communication, it is an important one, because it is thought to influence perceived credibility and persuasiveness of the message, which, in turn, influences attitude toward the topic (Crowley & Hoyer, 1994; Kamins & Assael, 1987). Focusing on this aspect allows a thorough exploration of it. This research thereby contributes to the answer to the original question that PDE asked.

This report describes how the research question was answered. For a better understanding of bio-energy, Chapter 2 gives an overview of the various aspects of this technology, from fuel source to end product. The chapter concludes with a discussion of the relevance of technology for the present research. The next chapter deals with the psychological background (Chapter 3). It describes what an attitude is composed of and how it is formed. The different aspects of communication that are of interest for this research are discussed and linked together in a conceptual model. In chapter 4 the design of the empirical study is described, followed by the hypotheses that were formulated before the empirical study was done. The objectives and relevance of the present study are also given in this chapter, which ends with definitions of the concepts that feature in the hypotheses. The methodology of this study is discussed next (Chapter 5). The participants, the procedure, the stimulus material, and the measures are all reviewed in this chapter. Chapter 6 contains the results of the study and compares them with the hypotheses that were formulated in Chapter 4. The report ends with the conclusions of the empirical study and its implications for actual practice (Chapter 7). The results as well as the procedures are discussed and suggestions for further research are given.

2 TECHNICAL BACKGROUND: BIO-ENERGY

Bio-energy, i.e. energy from biomass, has many aspects. The term bio-energy not only represents a collection of energy types but also the conversion methods that can be used to generate these forms of energy and the many different materials that are categorized as biomass. This chapter provides an overview of these three aspects of bio-energy. The first section of this chapter starts out with an explanation of what bio-energy is, why it can be categorized as renewable energy, and what the reasons are for generating it on a large scale. After that, examples of types of biomass are given. The chapter then goes on to review the different techniques to convert these types of biomass into energy. And for each technique the bio-energy products that can be generated with it are discussed. Finally, the role bio-energy plays in this research is discussed.

2.1 INTRODUCTION

Bio-energy is energy generated from biomass. Biomass is an umbrella term used for a very heterogeneous group of materials. They all share that the carbon used as building blocks for the material was taken from the atmosphere only a relatively short time ago. Before that, it was in the atmosphere in the form of carbon dioxide (CO_2). The carbon dioxide is taken from the atmosphere during the process of photosynthesis where, together with water, it is converted into organic matter under the influence of sunlight. The sun provides the energy needed for photosynthesis (Equation 2-1). This energy is later released by conversion of the biomass. This conversion produces carbon dioxide, or another carbon compound, which is released into the atmosphere from which it initially came (Equation 2-2).

$$CO_2 + H_2O + sunlight \xrightarrow{photosynthesis} biomass \tag{2-1}$$

$$biomass \xrightarrow{conversion} CO_2 + H_2O + energy \tag{2-2}$$
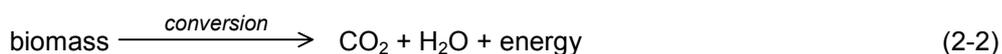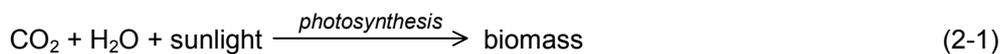
When the material putrefies the energy is lost to the atmosphere. Conversion of biomass however can also produce usable energy like electricity or bio-diesel. In the latter cases the energy is called bio-energy. Because photosynthesis and conversion form a closed cycle, no net CO_2 is produced. Biomass is thus said to be part of a closed, short carbon cycle. Therefore bio-energy is renewable. And as long as the amount of biomass that is grown per unit time equals the amount of biomass used for energy generation in that unit, the generation of bio-energy does not enhance the greenhouse effect. Then, it is not only a renewable form of energy, but also a sustainable one. This is not the case for the majority of the energy produced in the Netherlands, for which fossil fuels are used. The formation of fossil fuels takes hundreds of millions of years to form (Encyclopædia Britannica, 2004), while the speed of conversion is 100,000 times as fast (White, 2004), causing a great net production of CO_2. Because no such discrepancy between formation and conversion exists for bio-energy, it is a good alternative for fossil fuels from an environmental point of view.

In addition to the environmental reason, there is a number of other reasons why it is advisable to replace energy from fossil fuels with bio-energy. The four most prominent ones will be discussed here. First of all, currently 40% of the cheap fossil fuels comes from the Middle East, which has 80% of the proven reserves (Prime Minister's Strategy Unit, 2001). Europe, including the Netherlands, is therefore reliant on this part of the world for their energy production. Since the Middle East is not the most stable region, being dependent of it brings along high risks. Increasing the production of bio-energy means less need for fossil fuels and thus less dependency of the Middle East. The second reason is agricultural; Europe has large quantities of agricultural and fallow land. At the same time, there is an overproduction of food. If the superfluous food crops are substituted by, and the fallow land grown with, biomass crops, there would be no more overproduction while employment in this sector would remain the same or, in case of previously fallow land, would even increase (C. Daey Ouwens, personal communication, September 2, 2004). The third reason is related to the no net carbon dioxide production aspect of bio-energy. In 1997, the Kyoto protocol was drawn up, which aims to limit the greenhouse gas emissions. Being one of the driving forces behind it, Europe has to make sure it meets the obligations of the protocol. The generation of bio-energy can help to do so. The last major reason for bio-energy is the exhaustion of the oil reserves. The current world reserves are estimated to last only 41 years (BP, 2004). Even though this estimated reserve to production ratio has been roughly the same for thirty years due to previously undiscovered reserves and better extraction technologies, the oil reserves will eventually be depleted. A decrease of the oil production due to substitution by biomass will put off exhaustion of the oil reserves, i.e. increase the world reserve to production ratio.

2.2 BIOMASS

As was mentioned before, biomass is an umbrella term. There is a great diversity of sorts of biomass. As a result there are many ways to categorize them. For instance, from a technical point of view, biomass can be categorized according to the characteristics that define the amount of energy that can be produced per unit of biomass, e.g. the water or ash content. Here a categorization is made on the basis of the origin of biomass. By and large it follows the formal definition of biomass of the European Parliament (2001): "The biodegradable fraction of products, waste and residues from agriculture (including vegetal and animal substances), forestry and related industries, as well as the biodegradable fraction of industrial and municipal waste" (p.1). Figure 2-1 is a graphic representation of this categorization. Examples of biomass types are listed for each category.

Most biomass is rest material that has other uses besides feedstock for bio-energy, e.g. food, fodder, building and construction materials, and fertilizer (Wereko-Brobby & Hagen, 1996). For maximum energy efficiency a material should not be used for energy generation until it has no other high-grade purpose. This principle is called cascading. An example of cascading is the recycling of paper. Paper is first made from wood, which can also be used for energy generation. After its first use the paper can be recycled into paper and used again.

```
                              Biomass

            Products                          Waste & residues
          (energy crops)                       (rest materials)

     Food        Wood & grass      Agriculture   Forestry    Municipal    Industry
```

Food	Wood & grass	Agriculture	Forestry	Municipal	Industry
sugar cane	*poplar*	*straw*	*forest trimmings*	*used paper*	*sawdust*
grains	*willow*	*beet residue*	*shrubs*	*sewage sludge*	*rice husks*
rape seed	*miscanthus*	*chicken manure*	*bark*	*vegetable, fruit*	*coffee shells*
	hemp	*pig manure*		*& garden waste*	

Figure 2-1 *Overview of biomass types.*

This recycling can be done a number of times before the quality is no longer sufficient for paper. Only then should it be used to generate bio-energy.

On the other hand, biomass can also be grown for the sole purpose of energy production, so-called energy crops. For energy crops used for combustion, plants are used that produce a large quantity of dry matter in their leaves and stems in a short period of time and have a relatively high energy content (Scottish Agricultural College, 2004). The dry matter is the fuel and because it is above ground (in leaves and stems) it is easy to harvest. Examples of suitable plants are coppiced wood species like poplar and willow, and herbaceous plants like miscanthus and hemp. Besides combustion of energy crops, some crops can be converted in to secondary energy carriers like bio-oil. This physical-chemical conversion process is described in the next section. Energy crops are grown on are very small scale in the Netherlands. Reasons for this are the large quantities of land needed for this sort of biomass. For this land it has to compete with existing agriculture. In addition, because of this small scale, nobody is willing to invest in appropriate harvesters. Due to this, growers of energy crops have to get foreign contractors for the harvest, increasing the already high cost price of energy crops. Another reason that not many energy crops are grown in the Netherlands is that they cost money, while biomass in the shape of waste and residues are often free.

As this section has shown, there are many types of biomass. Likewise, there are many techniques available to convert these types into energy. These are discussed in the following section.

2.3 CONVERSION METHODS AND BIO-ENERGY TYPES

Just as there are many types of biomass, there are many methods to convert them into bio-energy. Biomass can be either converted into usable energy directly via combustion, or it can be converted into a secondary (bio-)fuel, which can be solid, liquid, or gaseous. The main reason for this latter method of conversion is that it yields a fuel that has more convenient characteristics than the primary fuel, the biomass. For instance, transportation of a liquid or

gaseous fuel is often easier than transportation of the original biomass. In addition, the secondary fuel is almost always more homogeneous than the original biomass, which enables more stable processing. The conversion methods that turn biomass into a secondary fuel can be grouped into three categories, i.e. thermo-chemical, biochemical, and physical-chemical conversion (see Figure 2-2). After an explanation of combustion, the conversion methods within each of these categories will be reviewed as well. With each conversion method, the corresponding secondary fuel will be discussed.
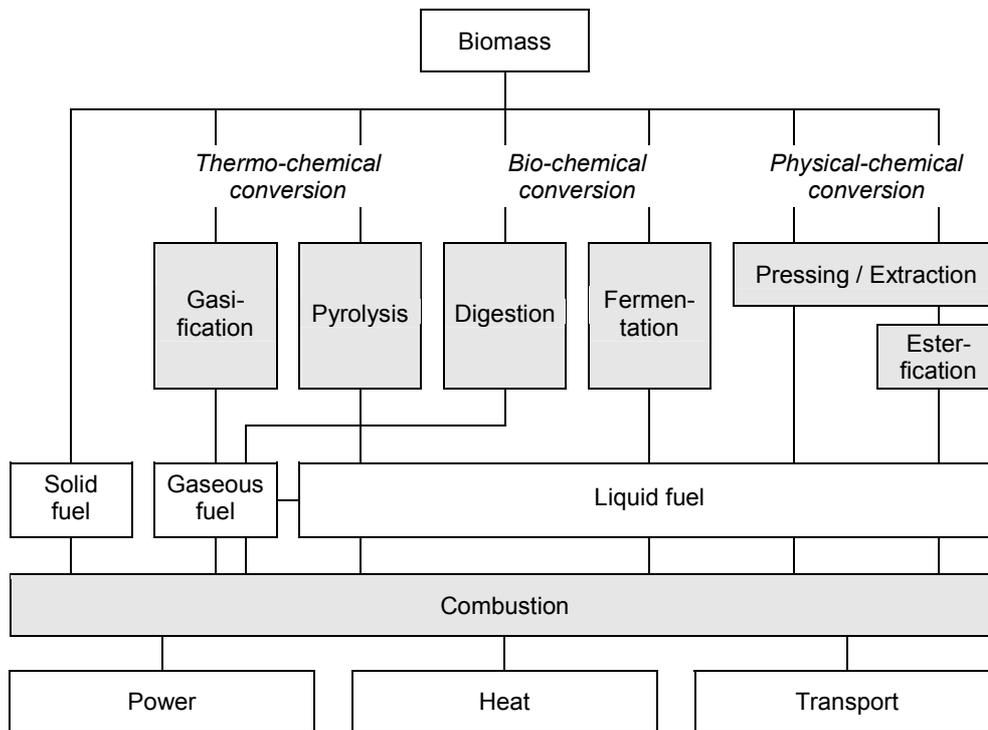
Figure 2-2 *Routes for energy generation from biomass.*

Note. From *Energy from biomass: status and opportunities*. by the Institute for Energy and Environment, 2003, p. 5. Copyright 2003 by A. Scheuermann & M. Kaltschmitt.

2.3.1 COMBUSTION

Energy can be generated from biomass by combustion, just like coal. The hot gases that are produced by this combustion turn water into steam, which is led into a steam turbine. In this turbine the steam drives an axis, which generates electricity. The steam can also be used for heating, in which case neither steam turbine nor generator is needed. Biomass can be combusted on a small scale (e.g. for domestic heating) as well as on a large scale (100 MW$_e$ or more). Biomass can be the only fuel used for combustion, or it can be used to replace a part of the fossil fuels. In these latter cases we speak of co-combustion. The bio-energy plant in Cuijk is an example of a stand-alone bio-energy plant; it is fueled solely with biomass and has a capacity of 25 MW$_e$. Co-combustion occurs in several power plants in the Netherlands, e.g. in unit 8 of the Amercentrale in Geertruidenberg. There, 5 to 10% of the feeding material is biomass.

Combustion of biomass not only produces electricity, but also heat. This heat is often dispersed unused but can be put to good use too, for instance, by using it for district heating

of a nearby residential area. This use of excess heat increases the overall efficiency of the plant. An example of such a combined heat and power system is the bio-energy plant in Lelystad where 25,000 metric tons of wood is combusted annually. The plant has an electric capacity of 1.7 MW_e and a thermal capacity of 6.5 MW_{th}. The heat is distributed to the local district heating, while the electricity goes into the grid (Nederlandse Organisatie Voor Energie en Milieu, 2003).

Virtually any biomass is suitable for combustion as long as it can be dried sufficiently prior to combustion. The bio-energy plant in Cuijk, for instance, uses wood with a moisture content of 50%, Lelystad 45%. A higher moisture content results in less energy yield because energy is needed to evaporate the moisture and to heat the resulting vapor. Efficiencies of biomass combustion are in the range of 20 to 40%. The upper end of efficiencies can be achieved in large scale plants and with co-combustion in coal fired power plants (Faaij, 1997).

2.3.2 THERMO-CHEMICAL CONVERSION

In thermo-chemical conversion processes biomass is converted into a gaseous, liquid, or solid fuel under the influence of heat. In this section, two of these processes will be discussed, i.e. gasification and pyrolysis. There is a third thermo-chemical conversion process, namely charcoal production. This process is used to produce active carbon and barbecue fuel. Because large scale application of this process for the purpose of energy generation is energetically impractical, it will not be discussed here.

► GASIFICATION   >   SYNGAS

Gasification is thermal degradation of the biomass in the presence of an externally supplied reactant (Van Loo & Koppejan, 2002). As the name implies, the main goal of this process is to maximize the gas production. There are four phases in the gasification process. Whether or not these occur simultaneously depends on the type of reactor that is used. Here, the gasification process will be explained with the help of a co-current fixed bed reactor, because there the four phases of the gasification process take place in four distinct locations in the reactor. This as opposed to a fluid bed reactor, where the phases coincide.

First the biomass is dried at a temperature range of up to about 160^oC. After the biomass is dried, it is thermally decomposed in the absence of oxygen. This second phase is called pyrolysis. Temperatures in this phase range from 120 to 500^oC. Main products of this decomposition are tar, char, oil, and gases. In the third phase, which is called the oxidation phase, air is introduced as an oxidizing agent. Here, the carbon and hydrogen are converted into carbon dioxide and water, respectively. These reactions are exothermic, i.e. energy is generated. Temperatures in this phase have to be in excess of 1000^oC for the process to be sustained. In the last phase, the reduction or gasification phase, the char reacts with water (H_2O) and carbon dioxide (CO_2). In this phase most of the tars are cracked as well (Daey Ouwens, 2003). The main gaseous products of this phase are carbon monoxide (CO), hydrogen (H_2), and methane (CH_4). Together these gases are called synthesis gas, or just syngas.

Table 2-1 *Main characteristics of the four gasification phases in a co-current fixed bed reactor.*

Phase	T (in ^{o}C)	O_2 present	Products	Energy
1. Drying	~160	yes	dry biomass, volatiles	input
2. Pyrolysis	120-500	yes	tar, char, oil, gases	
3. Oxidation	>1100	yes	CO_2, H_2O	output
4. Reduction	~700	no	CO, H_2, CH_4	

Syngas can be combusted to generate electricity, heat or mechanical energy. The advantage of gasifying the biomass before combustion is that a homogeneous gas can be combusted instead of an inhomogeneous mass (Babcock & Wilcox Volund R&D Centre, 2002). Another option is to convert the syngas into Fischer-Tropsch oil or methanol with the use of a catalyst. The methanol can than be used as transportation fuel.

The major drawback of this type of bio-energy is its tar content, which causes several problems. For one, the combination of this tar and particulates in the synthesis gas cause downstream equipment to get fouled and plugged due to tar condensation and soot formation. It also contaminates the waste streams, making large scale cleaning necessary (Energie Centrum Nederland, 2004).

Gasification is a suitable conversion method for biomass with a low water content (<20%) (Instituut voor Milieuvraagstukken, 2003). Examples are wood chips, forest wastes, saw dust, rice straw and peat (Organisations for the Promotion of Energy Technologies, 2002).

► PYROLYSIS   >   PYROLYSIS OIL

Another thermo-chemical conversion method is pyrolysis. This process is aimed at maximizing the production of liquid energy carriers. Pyrolysis happens in the absence of an oxidizing agent and is done at temperatures of 300°C and higher. The biomass is thermally decomposed into oil, char, and gases. This oil, which is called pyrolysis oil, is not immediately usable as (transportation) fuel because it is highly acidic, toxic, and not stable. It has to be upgraded to bio-diesel first (Daey Ouwens, 2003). A wide range of biomass material can be used for pyrolysis, e.g. wood, agricultural residues, and urban wastes (Wereko-Brobby & Hagen, 1996).

As there is little experience with pyrolysis oil, and technologies for upgrading are not fully developed yet, it will not be produced commercially in the next couple of years (Projectbureau Duurzame Energie, 2003).

2.3.3 BIOCHEMICAL CONVERSION

Biochemical conversion methods produce gaseous and liquid fuels like biogas and ethanol. These methods use the bio-chemistry of the biomass, and microbial organisms to produce these bio-fuels (United Nations Environmental Programme, 2004). The two conversion techniques discussed in this section are digestion and fermentation.

► DIGESTION   > BIOGAS

Digestion is a biochemical conversion method that takes place in the absence of oxygen. Because of this it is also called anaerobic digestion. In this process bacteria convert the biomass into biogas. The main components of this biogas are methane (CH_4) and carbon dioxide (CO_2). It is very similar to natural gas and can be used in existing gas installations without major adjustments. The energy content of biogas is one half to two thirds of the energy content of natural gas. The main feeding materials for anaerobic digestion are wet or liquid biomass resources, i.e. with a water content of about 85%, like manure. Often an organic agricultural or industrial waste product is added to manure because this addition improves the biogas production (Wereko-Brobby & Hagen, 1996). This co-digestion is still in the experimental phase in the Netherlands, but in Denmark and Germany numerous successful installations are in operation (Nederlandse Organisatie Voor Energie en Milieu, 2003).

Digestion of biomass has an extra advantage besides the production of an energy carrier. The raw material looses none of its properties that qualify it as fertilizer and is therefore still useful after digestion. In addition, the digestion process kills several pathogenic bacteria, thereby increasing the quality of the fertilizer (Projectbureau Duurzame Energie, 2004).

► FERMENTATION   > ETHANOL

The other bio-chemical conversion method that is discussed here is fermentation. Fermentation is appropriate for biomass with a water content of up to 85%. Microorganisms break down the sugars in the biomass. In this process ethanol is formed as a waste product, which, from an energy generation point of view, is the main purpose. Biomass that contains sugars, starch or cellulose is suitable for fermentation. Examples are sugar cane, grains, and wood fiber (Hanssen, 2004).

A good example of the applicability of fermentation can be found in Brazil, where large quantities of ethanol have been produced from sugar cane for the past twenty years (Macedo, 1995). Of the 15 million cars in that country, 9 million drive on gasoline which is enriched with about 23% ethanol (Projectbureau Duurzame Energie, 2003).

2.3.4 PHYSICAL-CHEMICAL CONVERSION

Biomass can also be converted into liquid energy carriers by a physical-chemical route. Mechanical pressing or extracting and esterfication are physical-chemical methods by which some biomass types can be converted into vegetable oils or bio-oil. With pressing, the liquid fraction of the biomass is mechanically separated from the solid fraction. Extraction of liquid oil is done by adding a solvent, e.g. hexane. Both pressing and extraction produce a solid rest product which can be used as fodder (Hanssen, 2004). The liquid fraction is not instantly suitable for use as transportation fuel in conventional motors. By esterfication, the characteristics of the bio-fuel can be changed to meet the requirements set for diesel oil. This is done by adding an alcohol (e.g. ethanol, methanol) to the oil, thus producing bio-diesel.

Rapeseed is the biomass most often used for physical-chemical conversion. Esterfication of rapeseed produces RME (Rapeseed Methyl Ester), which can be used in a diesel motor (Daey Ouwens, Kupers, & Lysen, 2002). RME is preferable over fossil diesel on the basis of a sustainable energy production and reduction of the enhanced greenhouse effect. Whether the CO (carbon monoxide) and NO_x emissions are higher for RME than for fossil diesel or the other way round is still a point of discussion. This makes a final conclusion about the desirability of RME impossible for now.

2.4 RELEVANCE OF TECHNOLOGY FOR THIS STUDY

This chapter has shown that bio-energy is a very complex technology. It is not something people will understand automatically. The principle ideas can be communicated without making the message complex, but explaining every aspect is hardly ever possible. This strengthens the need for good communication if the aim is to have the general public form a positive attitude toward bio-energy. The present study looks into one aspect of communication about bio-energy, and that way it tries to contribute to a strategy for successful communication.

As bio-energy in itself is not the main topic of this study, not all aspects of bio-energy will play an important role in this research. With respect to the types of biomass, the emphasis lies on those types that are currently being introduced on a large scale in the Netherlands, i.e. rest materials. Energy crops do not feature in the rest of this study because they require large areas of agricultural land and have too high a cost price to be grown in the Netherlands or to be imported on a large scale today. Bio-energy is a largely unknown topic to the general public, and already complex without going into detail about all the different techniques to convert biomass into bio-energy. Therefore, the conversion methods are left out of consideration in this study.

Now that a rough sketch is given of the technological background of this research, the next chapter will proceed to outline the social psychological background.

3 SOCIAL PSYCHOLOGICAL BACKGROUND

Projectbureau Duurzame Energie's main mission is to promote the awareness and use of renewable energy in the Netherlands. With targeted information on renewable energy it tries to stimulate people to form an opinion about renewable energy on the basis of facts. In the social sciences the term used for an opinion is *attitude*. An attitude can be the result of information processing. The first section of this chapter deals with attitudes and how they are formed. First the concept of attitudes and its characteristics are discussed, followed by a review of two leading theories on information processing. The emphasis lies on the cognitive formation of attitudes. The second section is about communication. This section starts out with identifying the components of communication. Next, the literature on aspects of those components that are of interest for this research is reviewed. The final section of this chapter summarizes and combines the findings that are relevant to the present study.

3.1 ATTITUDES AND ATTITUDE FORMATION

3.1.1 ATTITUDES

There are many definitions of what an attitude consists of. One that captures the essence of most definitions describes attitudes as "tendencies to evaluate an entity with some degree of favor or disfavor, ordinarily expressed in cognitive, affective, and behavioral responses" (Eagly & Chaiken, 1993, p. 155). The entity that is evaluated is called an attitude object and can be virtually anything that is distinguished in a person's mind. From the aforementioned definition it is clear that an attitude has valence, i.e. favorable, unfavorable or neutral, and that its consequences can be cognitive, affective, and behavioral. This tripartite can also be observed in the origin of an attitude, while the antecedents of an attitude can also be any combination of cognitions, affects, and behavior. A person's attitude toward bio-energy can, for instance, be based upon things he reads or hears about biomass. When he adopts those things they become his own beliefs (cognition). It can also be based upon his feelings or emotions associated with the sight of a row of willows, a potential biomass (affect), and upon his work at a bio-energy power plant (behavior). In memory these experiences are all linked with the attitude object. This whole group of beliefs, affects and behaviors related to one attitude object together make up the intra-attitudinal structure of the attitude (Eagly & Kulesa, 1997) (see Figure 3-1).
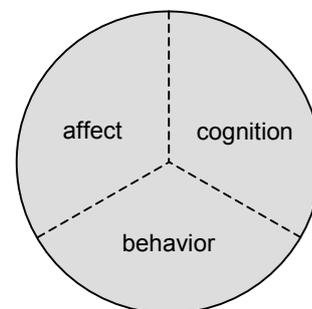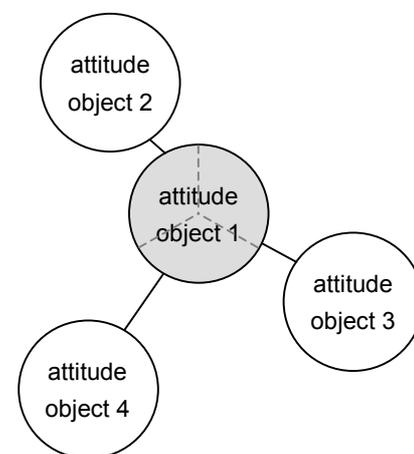

Figure 3-1 *Intra-attitudinal structure.*

Figure 3-2 *Inter-attitudinal structure.*

Besides this attitudinal structure on a micro level there is also a macro level structure, i.e. the inter-attitudinal structure. Inter-attitudinal structure refers to the network of different attitude objects with which the particular attitude object is linked. For the attitude object bio-energy, such an inter-attitudinal structure can consist of links with vegetable, fruit and garden waste, i.e. a potential biomass, a utility company that generates bio-energy, but also with more abstract attitude objects like the enhanced greenhouse effect (see Figure 3-2).

Both the inter- and intra-attitudinal structure can contain many links, i.e. many links may be available in memory. However, because not all available links will be accessible at a certain point in time, an attitude is not necessarily stable but can vary over time.

Besides valence and structure an attitude also has a strength dimension (Eagly & Chaiken, 1998). In general, an attitude is stronger when the attitude object is linked to more beliefs, affects, and behavior and also to more other attitude objects. In other words, an attitude is stronger when it has a more complex structure.

The present research is about communication on bio-energy. Here, written communication is intended to convey information about bio-energy to the general public on which they can base their attitude. Therefore, the focus of this present study lies on the cognitive aspect of attitudes and attitude formation. How information is processed cognitively with regard to attitude formation and attitude change is discussed in the next section.

3.1.2 INFORMATION PROCESSING

The leading view on message-based information processing for attitude formation is that there are two pathways by which people process information. Theories based on this view are called dual-process theories. The Elaboration Likelihood Model by Petty and Cacioppo (1986) and Chaiken's Heuristic Systematic Model (1980) are the two theories that dominate this field.

The Elaboration Likelihood Model (ELM) is based on the assumption that attitude change varies with respect to people's degree of elaborative information processing activity (Petty & Wegener, 1999). It distinguishes between central route processing and peripheral route processing. People are said to use the former when information processing is relatively extensive and effortful, i.e. when they show high elaboration. The information processed in this case is content-relevant information, e.g. the arguments mentioned in a message. The peripheral route on the other hand, usually requires less cognitive effort. There is little elaboration and people use peripheral cues that are not necessarily related to the message content. For example, when applying peripheral route processing, people do not look at the claims made in each argument but only count the number of pro and con arguments. Or they base their evaluation on the picture that is shown next to the message. When it is a positive cue, like a sunny beach, they might evaluate the message more favorably than when it is negative, a traffic jam for instance. Whether central or peripheral processing occurs depends on two conditions, i.e. motivation and ability. In order to process information centrally, people must both have the desire to exert a certain level of mental effort (motivation) and possess the necessary skills and have the opportunity to engage in thought (ability) (Petty & Cacioppo,

1996). When either of these criteria is not met, elaboration is not possible and processing is initially done via the peripheral route. When a peripheral cue increases a person's motivation sufficiently, central processing might still occur (e.g. Pechmann & Esteban, 1993). Attitude change that results from peripheral processing is thought to be weaker than that which results from central processing (Petty & Wegener).

The other prominent dual-process theory is the Heuristic-Systematic Model (HSM; Chen, 1980). The two basic modes by which a person forms his or her attitude according to the HSM are the systematic and the heuristic mode (Chen & Chaiken, 1999). The systematic mode involves the analytic and comprehensive processing of judgment-relevant information. In the heuristic mode decisions are made on the basis of rules and heuristics. These are not applied to the judgment-relevant content of a message, but to more easily processed judgment-relevant cues. For instance, to form an attitude toward the topic of a message, one might use the heuristic that "people generally agree with persons they like". Then, if the source is a likable person and is positive about the topic, this will result in a positive attitude toward it. This kind of processing depends on the availability, accessibility, and applicability of the rules and heuristics. Availability refers to the storage in memory, accessibility to its activation potential, and applicability to the relevance of the rule or heuristic with respect to the task at hand. All three have to be sufficient for a heuristic to be used for a task. For the given example this means that one has to have the likable-source-heuristic in memory (available), think of it at the time of judgment (accessible), and judge it to be relevant to forming an attitude toward the topic of the message (applicable). Overall, the heuristic mode demands less cognitive resources than the systematic mode.

Requirements for the systematic processing mode are sufficient cognitive ability, capacity and motivation. According to the HSM, receivers use a sufficiency principle when processing information because they are limited in their cognitive resources (Chen & Chaiken, 1999). This sufficiency principle maintains that people are motivated to exert cognitive effort as long as their actual confidence is lower than their desired confidence. A prerequisite for this is that people think more systematic processing will lead them to more judgmental confidence. The sufficiency principle has direct consequences for the mode of processing. When people perceive the gap between actual and desired confidence to be low, motivation to process will also be low, and processing will be heuristic. When the gap is big, they will be motivated to exert cognitive ability and capacity, given that they have both. Thus, if motivation is high, and cognitive ability and capacity are also sufficient, systematic processing will occur.

This section has shown that not everybody processes a message the same way, and that processing is not the same at every moment. Whether a person processes the content of a message elaborately or just peripherally is subject to personal, as well as external factors. What the influence of a message is on a person's attitude in turn depends on the processing route the person uses. So the effect of a message is indirectly influenced by personal and external factors. The next section goes into these factors with regard to communication.

3.2 COMMUNICATION

Communication is the process of information exchange. This research looks at the one-way type of communication, at the process of giving information to the general public. In this process several factors can be identified (see Figure 3-3). First, there is a *source*. This source composes a *message*, which is sent to a *receiver*. At the same
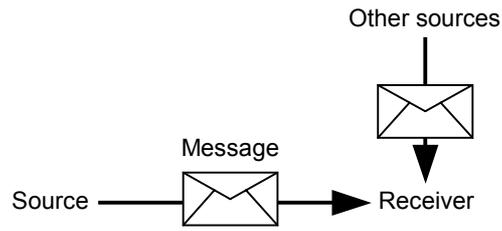
Figure 3-3 *Factors of communication.*

time there might also be *other sources* that send the receiver messages on the same topic, but with opposing content. It is neither useful nor feasible to include the receiver, the message, and the different sources into one study. PDE instigated this research with its question how to communicate to counter the negative messages of other sources. As communication runs via the message the source composes, message-related aspects will be reviewed. PDE's objective is to have the public form a positive attitude toward renewable energy, including bio-energy. Attitudes result from the processing of information about the attitude object. And according to the ELM the level of information processing depends on motivation and ability (Petty & Cacioppo, 1986). Because aspects of the receiver influence motivation and ability, and thus indirectly influence information processes, they are also taken into account. PDE can adjust message-related aspects, and target a message based on receiver-related aspects, which makes these aspects interesting from a practical point of view as well. The primary and other sources on the other hand, are not that interesting. Even though PDE is the primary source, there are not many source-related aspects that can easily be changed. And because PDE has hardly any control over other sources that communicate an opposing view and the messages these sources send, this factor is not interesting from a practical viewpoint either.

This section will now discuss two literature studies, one on message-related aspects of communication, the other on receiver-related aspects. First, message-related aspects that have been researched in previous studies will be discussed. These aspects are complexity of the message, sidedness of the message, and refutation of counterarguments. The second literature study reviews two factors related to the receiver that have been the topic of research in the past. The aspects under review are beliefs about the attitude object and involvement.

3.2.1 MESSAGE-RELATED ASPECTS

► COMPLEXITY

The level of complexity of a message is a very interesting variable for two reasons. First, bio-energy is a complex subject, as is clear from the previous chapter. This does not mean that messages about this technology are necessarily complex as well. Nonetheless, they often are. Second, the complexity of a message is controllable by PDE, and hence research on this aspect has practical use. But complexity is a concept with many dimensions, e.g. linguistic usage and content complexity. One aspect of a message that is easy to vary, and

influences the complexity of a message is message sidedness. The next paragraphs explain what is meant by message sidedness and give an overview of previous research.

► SIDEDNESS & REFUTATION

When composing a message, a source can choose what arguments it uses. The arguments can all support the advocated position, or be both pro and con. The first message type is called one-sided, the latter two-sided (Allen, 1991). When composing a two-sided message there is another option, that is, whether the included counterarguments are refuted or not. In his meta-analysis, Allen (1991) combined a large number of studies and compared the effect that a one-sided, two-sided nonrefutational, and two-sided refutational message had on receiver's attitude toward the message topic. He showed that a two-sided message led to a more positive attitude than a one-sided message, but only when the counterarguments were refuted. A two-sided message without refutation led to a less positive attitude than a one-sided message. However, all the studies used for this meta-analysis only compared a one-sided message with either a two-sided nonrefutational or a two-sided refutational message. No studies were used in which all the three message types were compared with each other. Though Allen looked at the effects of the different message types on people's attitude, he did not look at the underlying reasons for these effects. The three message are expected to have different effects on the perceived clarity, credibility, and persuasiveness of the message, as well as on the cognitive responses a receiver has while reading the message. These effects, for their part, are all thought to have an effect on a person's attitude toward the topic of the message. Opinions differ about what the combined effect on a person's attitude is. Two theories that make predictions about the different effects of one-sided, two-sided nonrefutational, and two-sided refutational messages are McGuire's Inoculation Theory (as cited in Crowley & Hoyer, 1994) and Attribution Theory by Jones and Davis (as cited in Crowley & Hoyer). McGuire compared the effect of a two-sided refutational message with that of inoculation against diseases. Inoculation theory says that by showing people how to refute counterarguments, they learn how to resist future, possibly different, counterarguments, i.e. they are inoculated against future attacks. A two-sided refutational message is expected to lead to more positive cognitive responses that support the advocated position of the message. This is why a two-sided refutational message is expected to lead to a more positive attitude than a one-sided message or a two-sided message without refutation (Crowley & Hoyer, 1994). Of these latter two messages, Inoculation Theory predicts the two-sided one to lead to a more positive attitude, because voluntarily presenting counterarguments is expected to lead to less counterarguing.

Attribution theory predicts that the effect on attitude toward the topic differs between message types because a receiver attributes either internal of external causes to the different message types (Jones & Davis, as cited in Crowley & Hoyer, 1994). The one-sidedness of a message is expected to be attributed to the external cause of trying to sell the advocated position, which objectively might not be the best possible position. Receivers of a two-sided message on the other hand, are expected to attribute the two-sidedness to the internal cause

of the source's honesty, because even though the source advocates a certain position, it still presents arguments against that position. Presenting counterarguments thus enhances the credibility of the message, while a one-sided message is expected to trigger derogation of the source and counterarguing. To a certain extent, the enhanced credibility effect is offset by the content of the counterarguments. The net effect of a two-sided message thus depends on the persuasiveness of the support and counterarguments as well. According to Attribution Theory, adding refutation of counterarguments to a two-sided message reduces the effect including counterarguments has on credibility. At the same time, the impact of the negative content of the counterargument is also diminished. So when the counterargument presented is not too persuasive, Attribution Theory says a two-sided refutational message will lead to a less positive attitude toward the topic than a two-sided message without refutation. This is in conflict with Inoculation Theory, which assumes a two-sided refutational message is better than a two-sided nonrefutational message. This contradiction makes sidedness and refutation an interesting factor from a scientific perspective. From a practical perspective it is also worthwhile to learn more about the effects of these three types of messages, since PDE has total control over the arguments they use in their messages about bio-energy.

Several authors have looked into the effects of message sidedness and refutation, and how it influenced a person's attitude (e.g. Hale, Mongeau, & Thomas, 1991; Kamins & Assael, 1987; Pechmann, 1992). Hale, Mongau and Thomas for instance looked at the effect of message type on the cognitive responses a message incurs. They compared the three message types in one experiment and found that message type did indeed influence the receiver's attitude toward the topic of the message, but indirectly. Message sidedness first generated positive cognitive responses, based on which attitude formation or attitude change occurred. The data showed that more positive cognitive responses were generated in response to the two-sided refutational message compared to the other two message types. The latter two message types were also found to lead to a less positive attitude than the former.

In her advertisement research, Pechmann (1992) also found that a two-sided message enhanced the receiver's attitude toward the message topic indirectly. She however did not look at cognitive responses, but at perceived credibility of the source and the combination of support and counterarguments. In her experiment, she used one-sided messages and two different two-sided nonrefutational messages. In the first two-sided message, the counterargument, i.e. the high number of calories in an ice cream, was perceived to be linked to the support argument, i.e. its richness of taste. The second two-sided message used the same support argument, but here the counterargument, that is, the limited variation in container sizes, seemed to have not connection with it. The experiment showed the source of a two-sided message was perceived as more credible than the source of a one-sided message, but only for the negatively correlated arguments. The same effect was found for the attitude toward the ice cream. This seems to correspond partially with Attribution Theory. However, in the first message, the counterargument was justified by the support argument,

which can be seen as inherent refutation. For the second message, the richness of taste was no justification for offering only a limited number of container sizes, i.e. no refutation was present. When looked at it this way, the experiment is in line with Inoculation Theory, which predicts a more positive attitude in response to a two-sided refutational message than in response to the two-sided nonrefutational or one-sided message. Pechmann also asked subjects to rate the product on the basis of only the support argument. Receivers of the two-sided message with linked arguments gave a significantly more positive rating than did receivers of the corresponding one-sided messages. This was not the case for the two-sided message with independent arguments. Receivers of that message rated the product just as positive as receivers of the corresponding one-sided messages did. Apparently, addition of a counterargument can enhance the impact of the support argument, but only if the counterargument is negatively linked to this argument. It has to be noted however, that the counterargument that was linked to the support argument, i.e. the number of calories, gave information that would otherwise be unknown, while the other counterargument, i.e. available container sizes, provided information that a person would easily find out while shopping. In other words, the information that was provided in the latter message was not as revealing as in the former, which might explain the difference in perceived credibility.

Kamins and Assael (1987) gave subjects a one-sided, two-sided nonrefutational or two-sided refutational message and then measured their positive and negative cognitive responses and attitude toward the topic of the message. With their first experiment the authors showed that the two-sided messages triggered less counterarguing than the one-sided message, which was in line with both Inoculation and Attribution Theory. However, the two-sided messages did not differ in the amount of either support or counterarguing they triggered. In their second experiment, the message, which was an advertisement for a pen, was followed by a five-minute trial of that pen. The trial was manipulated to disconfirm the claims of the advertisement. Attitude toward the pen was measured both before and after the trial. Receivers of the two-sided message showed less attitude change after the trial than receivers of the one-sided message, but again no difference was observed between the two-sided nonrefutational and the two-sided refutational message. The data thus did not provide support for the dominance of either Inoculation or Attribution Theory. The experiments did show two-sided messages led to more positive cognitive responses and less counterarguing, and led to a more stable attitude.

In their model about the influence of two-sidedness on attitude change, Crowley and Hoyer (1994) identified two routes through which two-sidedness positively influences attitude. Both routes result from the fact that people expect a one-sided message. In other words, a two-sided message is not normative. Firstly, the perceived novelty itself makes the attitude toward the message more positive. Secondly, the novelty draws attention, which motivates people to pay attention to the message, i.e. to process the message content. Given that the overall message content is positive, this leads to more positive and less negative cognitive responses. The authors also suggested that an increase in the number of counterarguments

causes an increase in credibility. At the same time however, the negative content of these arguments decreases the overall evaluation. At a certain point, this decrease due to content outweighs the positive influence of the credibility increase. This can be when too many counterarguments are mentioned, or when the counterarguments mentioned are too important. This effect was illustrated in Pechmann's second 1992 study, in which she compared a one-sided message with a two-sided message that contained independent arguments. The latter message led to a less positive attitude than the former, even though its source was perceived to be more credible.

3.2.2 Receiver-related aspects

► Prior beliefs

According to Rogers' (1995) theory on innovativeness, the adoption of an innovation is a gradual process. Some people adopt the innovation early on, others adopt it later. Rogers differentiated between five adopter categories, each of which adopts an innovation at different moments. He called the first category of adopters the innovators. These innovators distinguish themselves from later adopters in that they are more knowledgeable about innovations (Rogers). These first adopters are of great importance in the diffusion process because they launch the new idea into society. For an innovation to be accepted by the general public, innovators have to accept it. This is also true for bio-energy. As knowledge is one of the distinctive characteristics of this group it is important to know what role it plays in the process of attitude formation and attitude change. Several experiments have been reported in which this role was studied (e.g. Ahluwalia, 2002; Johnson, 1994; Wu & Shaffer, 1987).

Ahluwalia (2002) studied the effects of familiarity with the attitude object on the perceived importance of information about this attitude object. The results of her experiment showed negative information was judged more important than equally positive information, i.e. a negativity effect, but only when the product was unknown to subjects. When subjects were given information about the product prior to the experiment, no significant difference was found between subject's rating of negative and positive information. This study showed that whether or not a person has prior beliefs about an attitude object influences the importance the person assigns to negative and positive information about that object. This influences the attitude change that takes place. Thus, in other words, the presence of an inter-attitudinal structure (prior beliefs) influences attitude change.

Wu and Shaffer (1987) studied the effect of how subjects got their beliefs about an attitude object. In their experiments, subjects either just received written information about two brands of peanut butter, or they also tasted both brands. The latter subjects, who based their attitude on both indirect and direct experience, were more resistant to counter-attitudinal persuasion messages, i.e. messages opposite to the subject's attitude, than the subjects who based their attitude only on indirect experience. When the persuasion attempt was pro-attitudinal, direct experience subjects showed a stronger attitude change in the direction of the persuasion

attempt than subjects who only had indirect experience. The explanation the authors gave for these results is that attitudes based on direct experience are stronger and therefore more accessible than attitudes that are based only on indirect beliefs. As a result, arguments that support their attitude are activated faster and this process strengthens resistance to a counter-attitudinal message as well as enhances susceptibility to a pro-attitudinal message. This experiment showed that the influence of existing beliefs, or prior knowledge, is not constant, but depends on the way a person came to hold those beliefs.

In his research, Johnson (1994) looked at the effects of prior beliefs, in the form of knowledge, and outcome-relevant involvement on persuasion. Half the subjects received neutral information about the topic of the message prior to hearing the real message, the other half received no information. Subjects with prior knowledge that were not involved showed significantly more attitude change in response to strong arguments than to weak arguments, indicating use of the central processing route. No such difference was found for subjects who also received prior knowledge but were highly involved. In the groups without prior knowledge the reverse happened; no effect of argument strength was found for low involved subjects, while this effect was significant for subjects with high involvement. The author suggests that the curiosity of involved subjects was satisfied by the prior information. Consequently, these subjects did not pay much attention to the content of the real message, in other words, peripheral processing occurred. At the same time, the prior information roused the curiosity of the uninvolved subjects, thus making them consider the real message carefully; i.e. processing was done via the central route. Like Wu and Shaffer (1987), Johnson showed that the influence of prior knowledge on attitude formation and attitude change is not always the same. In this case, it interacts with the receiver's involvement.

The studies that are mentioned here all demonstrate that prior beliefs play a role in the process and outcome of attitude formation and attitude change. However, most recent studies on public perception of bio-energy show that the public has few beliefs about bio-energy, though it is growing (Rohracher et al., 2003; MM&MO Consultancies, 2003; Magis Marktonderzoek bv, 2002). Consequently, a distinction between people with and without knowledge of bio-energy is hard to make in practice at this moment. In the future, when bio-energy becomes more known, more people will have beliefs about it. Then, differentiation on the basis of people's beliefs will be possible. Currently however, it has little practical value to research the role of this receiver-related aspect. Another aspect that also influences attitude formation and attitude change is involvement, as Johnson's study (1994) already showed. The next part of this section discusses the role this receiver-related aspect plays in the formation and change of attitudes.

► **INVOLVEMENT**

Involvement influences attitude formation and attitude change on a broader level than prior beliefs because it influences how information is processed. When information is highly involving, people are generally more motivated to process it than when it is not (Petty & Cacioppo, 1996). In turn, motivation, together with ability, determines whether information is

processed via the central or the peripheral route (Petty & Wegener, 1999). As was explained in the section 3.1, attitude formation and attitude change are influenced by the route a person uses to process information. In addition, involvement, as a motivator, is one of the characteristics in which earlier adopters differ from later ones is their motivation to learn more about innovations (Rogers, 1995). All this makes involvement worth looking into for the present study.

The literature distinguishes between three types of motivation, i.e. accuracy, defense, and impression motivation (Chen & Chaiken, 1999). The present study only looks at accuracy motivation, which can be characterized as the desire to hold attitudes and beliefs that are objectively valid (Chaiken, Giner-Sorolla, & Chen, 1996). This definition corresponds with PDE's goal, namely to have people form an attitude on the basis of facts.

Several authors (Ahluwalia, 2002; Pechmann & Esteban, 1993; Petty, Cacioppo, & Schumann, 1983) have investigated the effect of involvement on the processing of information. In most cases the processing route was inferred from the effect strong or weak arguments had on subjects' attitude toward the topic of the information. Petty et al. for instance manipulated subjects' involvement with the topic of the information and also varied the strength of the arguments used in the message subjects got to read. In general, strong arguments led to a more positive attitude than weak arguments, but this difference was significantly larger for subjects in the high involvement condition than for those in the low involvement condition. The authors took this as a sign that highly involved people base their attitude more on message content than do low involved people.

Ahluwalia (2002) looked at the influence of type of involvement on the importance people assign to information. She investigated involvement with outcome, with the impression one makes on others, and with the position one has, i.e. prior attitude. A negativity effect could be seen for outcome-relevant involved subjects, that is, negative information was rated significantly more diagnostic than positive information. Impression-involved subjects that did not know the attitude of the others rated positive and negative information equally diagnostic. Subjects that were position involved preferred positive over negative information, i.e. they showed a positivity effect.

In their article, Pechmann and Esteban (1993) hypothesized that level of outcome-involvement, together with whether an ad is comparative or not influences the information-processing route. They manipulated three levels of involvement, i.e. low, moderate and high. As the authors expected, for subjects who were low involved, the final attitude toward the product was not influenced by argument quality. This points to the use of the peripheral route. With highly involved subjects the strong arguments did lead to a significantly more favorable attitude compared to the weak ones. Subjects thoroughly looked at message content, which corroborates with the assumption of the ELM (Petty & Cacioppo, 1986) that when subjects are highly involved they process information via the central route. At these involvement levels it did not matter whether the ad was comparative or not. The most interesting results however, were those for the moderately involved subjects. Their final attitudes resulting from

weak and strong arguments did not differ much when the ad was non-comparative, while strong arguments led to more favorable attitudes when the ad directly compared the target product with a similar product from another brand. Pechmann and Esteban concluded that moderate involvement alone is not enough to make people process information via the central route. For central processing to occur at this involvement level, more is needed, like in this case a comparative ad. In other words: level of involvement may interact with message related factors, like ad type.

Another message related factor that has been suggested to interact with involvement is message sidedness (Hale et al., 1991; Kamins & Assael, 1987). Hale et al. suggest investigation of this interaction because their research indicated that sidedness only operated under central processing. If this is true, the sidedness effect should only be found under high involvement, and not under low involvement, when processing occurs peripherally. Kamins and Assael expected that the implications of Inoculation Theory would apply in the high involvement condition, while Attribution Theory would be most relevant in the low involvement condition. They thus expected different effects on positive and negative cognitive responses as well as on credibility. Hastak and Park (1990) described an experiment in which the expected moderating role of involvement on the effect of message sidedness was tested. They found no significant differences between their experimental conditions. This might be explained by the involvement manipulation, which, according to the manipulation check, did not work. Consequently, the question whether involvement indeed moderates the effect message sidedness and refutation has on a receiver's attitude is still unanswered. The present study will try to finally answer this question.

3.3 SUMMARY: CONCEPTUAL MODEL

This chapter discussed several aspects of communication and attitude formation and change. In short, from the side of the message, type of argument influences the formation of new attitudes and the change of existing ones; a one-sided message has another effect than a two-sided message, and whether a counterargument is refuted or not also matters. From the receiver's side, the route used to process a message plays a role in attitude formation and attitude change. With peripheral processing, the receiver of a message only looks at peripheral cues, while with central processing, he or she elaborates on the message content, i.e. the arguments. When both the message side and the receiver side are taken into account, an interaction is expected. When a person processes a message via the central route, a one-sided message might result in less or more attitude change than a two-sided message, due to the difference in message content. But when a person applies peripheral processing, this difference in message content might go unnoticed or is perceived quite differently, and thus might have a different effect than under central processing. Which of the two processing routes is used depends on motivation, which in turn is influenced by involvement. In other words, via motivation, involvement is expected to have a moderating effect on the influence of message type on attitude formation and attitude change. Of course, the amount of attitude

change due to this interaction also depends on the strength of the initial attitude a person had before receiving the message. Change will be largest for people who had a weak initial attitude. Their attitude structure is still simple, and new information will have more relative weight than for people who already have an attitude that is based on their own cognitions, affects and behaviors. The model described here will be tested in the present study. The objective of the experiment and the hypotheses are discussed in the next chapter.

4 PRESENT RESEARCH

In the last section of the previous chapter a conceptual model was put forward which resulted from the social psychological literature that was reviewed in that chapter. The current chapter starts out with the design of the research that was done to test this model. Next, the hypotheses that were based on the model are reviewed, followed by the objectives of the present study. The chapter is concluded with definitions of the concepts used here.

4.1 RESEARCH DESIGN

The conceptual model that was formulated in the previous chapter is shown in Figure 4-1. The main research question is whether this model is correct. To test whether the model is correct, an experiment is
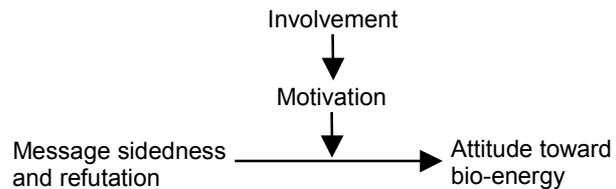
Figure 4-1 *Conceptual model.*

done. The independent variables are involvement (low vs. high) and message type (one-sided vs. two-sided nonrefutational vs. two-sided refutational), which result in a 2 x 3 factorial design (see Figure 4-2). This design is used in a between subject fashion with a questionnaire[1]. To make a distinction between low and high-involved subjects, involvement will be manipulated by an explicit instruction[2].

message ▶ ▼ *receiver*	Message type		
	one-sided	two-sided nonrefutational	two-sided refutational
Low involvement			
High involvement			

Figure 4-2 *Research design.*

4.2 HYPOTHESES

The expected moderating effect of involvement is due to a difference in processing route that is expected to exist between low and high involvement people, i.e. between subjects of the two involvement conditions. Highly involved, and thus motivated, subjects are expected to use central processing, as opposed to the peripheral processing that uninvolved, and thus unmotivated, subjects are thought to use. The advocated position of a one-sided message is

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[1] *Between subject* means each subject only participated in one condition. When, for example, each subject would receive all three the messages, the term *within subject* is used.

[2] A manipulation is preferred over a preselection of two groups with known involvement levels, because these two groups might also differ on factors other than involvement, e.g. the number of beliefs about bio-energy or the level of education. The effect of involvement might then be confounded with the effect of one of these other factors, which compromises the internal validity (Kiesler, Collins, & Millar, 1969). It will not be possible to tell whether differences in the dependent variables between the two groups are due to involvement or to a confounding variable.

clear, while that of the two-sided message is obscured by the presence of both pro and con arguments. Uninvolved subjects who process peripheral cues of the message are expected to judge the former as more persuasive than the latter, and therefore to form a more positive attitude toward the topic based on the one-sided message. On the other hand, when involvement is high and central processing occurs, the one-sided message is also clear, but at the same time is perceived to only show half of the story, whereas the two-sided message does more justice to the truth, because it shows both sides of the story. Thus for involved people, the two-sided message is expected to be judged more persuasive and credible, which results in a more positive attitude toward the topic. In addition, the one-sided message will evoke more counterarguing, for people will imagine what drawbacks might exist that are not mentioned. Given that the message is two-sided, refutation of the counterargument will not reduce credibility, but will increase persuasiveness since the counterargument is discounted. This difference will go unnoticed in the uninvolved condition, but not in the involved condition. These expectations lead to the following hypotheses about the main dependent variable, i.e. attitude toward bio-energy, that also reflect the main research question:

H1: The effect of message sidedness on the receiver's attitude toward bio-energy depends on the receiver's level of involvement.

When involvement is low,
   a. a one-sided message leads to a more positive attitude toward bio-energy than a two-sided message, regardless of whether or not the counterargument is refuted.

When involvement is high,
   b. a two-sided message leads to a more positive attitude toward bio-energy than a one-sided message;
   c. a two-sided refutational message leads to a more positive attitude toward bio-energy than a two-sided nonrefutational message.

Related to these hypotheses about attitude toward bio-energy are the following hypotheses about the perceived clarity, persuasiveness, and credibility of the messages and the attitude toward the message:

H2: A one-sided message is perceived to be clearer than a two-sided message.

H3: The effect of message sidedness on the perceived persuasiveness of the message depends on the receiver's level of involvement.

When involvement is low,
   a. a one-sided message is found to be more persuasive than a two-sided message, regardless of whether or not the counterargument is refuted.

When involvement is high,
   b. a two-sided message is found to be more persuasive than a one-sided message;
   c. a two-sided refutational message is found to be more persuasive than a two-sided nonrefutational message.

H4:   The effect of message sidedness on the perceived credibility of the message depends on the receiver's level of involvement.

   a.   When involvement is low, a one-sided message is judged more credible than a two-sided message;

   b.   When involvement is high, a one-sided message is judged less credible than a two-sided message.

H5:   When involvement is high, a one-sided message leads to a less positive valence of thoughts than a two-sided message.

No assumption is made about the valence of thought in the low involvement condition, because receivers are not expected to take message content into account.

H6:   The effect of message sidedness on the attitude toward the message depends on the receiver's level of involvement.

   When involvement is low,

   a.   people have a more positive attitude toward a one-sided message than toward a two-sided message, regardless of whether or not the counterargument is refuted.

   When involvement is high,

   b.   people have more positive attitude toward a two-sided message than toward a one-sided message;

   c.   people have a more positive attitude toward a two-sided refutational message than toward a two-sided nonrefutational message.

The expected difference in processing between the two involvement conditions that underlies these hypotheses should be visible in subjects in the high involvement condition having a higher number of relevant thoughts than subjects in the low involvement condition. Similarly, highly involved subjects are expected to be more accurate in recognizing the sidedness of the message they read and the arguments that were and were not used in it relative low involved subjects. This translate to the following hypotheses:

H7:   Involved subjects have a higher number of relevant thoughts while reading the message than uninvolved subjects.

H8:   Involved subjects recognize the sidedness of the message they received more accurately than uninvolved subjects.

H9:   Involved subjects recognize arguments more accurately than uninvolved subjects.

Hypothesis 10 expresses the common sense assumption that a more positive attitude toward bio-energy is correlated with less intention to oppose it. The last hypothesis is about attitude strength and involvement, which are assumed to have a relation, based on common sense.

H10: Attitude toward bio-energy is negatively correlated with behavioral intention to oppose realization of bio-energy (a more positive attitude > less intention to oppose).

H11: Attitude strength is higher when involvement is high than when involvement is low.

4.3 OBJECTIVES AND RELEVANCE

This research has two objectives, a practical and a scientific one. The first objective of this research stems from PDE's question that motivated this research. Though this research will not entirely answer this question of how best to communicate about bio-energy, it does aim to further insight into the process of communication. That way, this research can provide a part of the answer to the original question.

The second objective is related to the scientific relevance. By researching the combined effect of message sidedness and receiver's involvement this study aims to further insight into how people process information.

To summarize, the objectives of this research are:

2. To learn more about communication about bio-energy to counter the negative messages of other sources and realize broad public support for this form of renewable energy;

3. To further insight into information processing and the role message sidedness and involvement play in attitude formation and attitude change.

4.4 DEFINITION OF CONCEPTS

This section provides definitions of the concepts that are used in this research. First of all, the messages that are used differ in sidedness and presence of absence of refutation. *A one-sided message* is a message that only presents arguments in favor of a particular proposition. *A two-sided nonrefutational message* on the other hand presents arguments in favor of a proposition but also considers opposing arguments. A message of the latter type is called *two-sided refutational*, when it mentions argument for and against a particular proposition and refutes the counterarguments (Allen, 1991).

Next, the manipulation attempts to influence a subject's level of involvement. *Involvement* is defined here as outcome-relevant or issue involvement, i.e. "the extent to which the attitudinal issue under consideration is of personal importance" (Petty & Cacioppo, 1979, p. 1915). Involvement in turn is supposed to induce a person's motivation to process information, which is just referred to as *motivation* in this report.

Attitude, the main dependent variable, is "the psychological tendency to evaluate an entity with some degree of favor or disfavor, ordinarily expressed in cognitive, affective, and behavioral responses" (Eagly & Chaiken, 1993).

Another concept that the present research is interested in is *attitude strength*. Attitude strength is defined as "the degree to which a person is confident that his or her attitude is correct or valid" (Krosnick, Boninger, Chuang, Berent, & Carnot, 1993, p. 1132).

5 METHODOLOGY

This chapter describes the methodology of the present study. First the type of research and design are reviewed, followed by the population and sample of this study. Next, how subjects were recruited and how the study was conducted are discussed. This chapter concludes with a part by part description of the tools used in this study. This last section also tells who the items were prepared for the analyses.

5.1 TYPE OF RESEARCH AND DESIGN

5.2 POPULATION AND SAMPLE

The population this study aims at is the general public. This is a very heterogeneous group, while for an empirical study the best sample is a homogeneous one, because this eliminates variance due to differences in subject characteristics that go with a heterogeneous group. However, the matter of investigation in this study is a process, i.e. information processing. As this process is thought to be the same for everyone, selecting a homogeneous sample does not inhibit conclusions about the heterogeneous population, i.e. the general public. Therefore, to minimize variance between subjects the sample of this experiment consisted entirely of students of the Fontys Hogeschool in both Tilburg and Eindhoven.

5.3 PROCEDURE

Students were told that a questionnaire was developed as part of a graduation project and they were asked to participate in the project by filling in that questionnaire. They were told it dealt with several topics and would take about fifteen minutes to complete. In Eindhoven, subjects had to go to a nearby classroom where a research assistant handed out the questionnaire. This was done to minimize the chance that subjects' ability would not be sufficient to afford central processing due to external factors. In Tilburg, this was not possible because the room that was made available was too small to accommodate more than four subjects at a time. Therefore, subjects were recruited in quiet places on campus, e.g. study halls, libraries and self-teaching areas, and were asked to fill in the questionnaire on the spot. After subjects completed the questionnaire and handed it in, they received € 2.50, and signed for receipt of the money. After this, they were thanked for participating and received a letter which contained a debriefing about the purpose of the research (see Appendix C.3 for the exact text of the debriefing). To prevent participants from accidentally spoiling other possible participants, they were asked not to discuss the questionnaire with fellow students that day.

5.4 QUESTIONNAIRE

The questionnaire consisted of two parts, the stimulus material and the questions. The exact text of the questionnaire can be found in Appendix C, as well as the English translation.

5.4.1 STIMULUS MATERIALS

The first page of the questionnaire contained some instructions and the involvement manipulation. All subjects were told they would receive written information on three topics, i.e. a system of free-market rents, an EU-directive on software patents, and bio-energy. The first two topics were chosen as dummy topics because they had nothing in common with the real topic, bio-energy. Subjects were asked to read the information on all three the topics since they would be asked questions about each. In the high involvement condition subjects were asked to pay special attention to the information about bio-energy because their opinion about that topic was of special interest to the experimenter. Subjects in the low involvement condition were asked to pay special attention to the information on either the free-market rents or the EU-directive. In a prestudy this involvement manipulation was found to produce two groups that differed significantly in level of involvement and motivation (see Appendix B for a complete account of this prestudy).

After the instruction the information on the three topics was given. First the information on free-market rents, then the information on the EU-directive, and last the information on bio-energy. The information on both dummy topics was two-sided nonrefutational. The information on bio-energy was one-sided, two-sided without refutation, or two-sided with refutation. The selection procedure for the arguments that made up the messages on bio-energy was similar to the one described by Petty and Cacioppo (1986). First, the quality of a large number of arguments was determined empirically. Members of the subject population were asked to rate the arguments on persuasiveness, clarity, newness, and position with regard to bio-energy, i.e. for or against (see Appendix A for a review of this first prestudy). On the basis of the results, three arguments in favor of bio-energy and one counterargument and its refutation were selected. The selected arguments were then combined into the three messages. In all messages, the most persuasive pro bio-energy argument was mentioned first, the least persuasive one last. In the two-sided messages, the counterargument was mentioned before the last pro bio-energy argument. This way, if subjects showed a recency effect, i.e. when the last argument has the most impact, this effect would be the same for all messages. After composing the messages, a second prestudy was done to test the messages as a whole on persuasiveness, clarity, newness, and position, as well as on credibility (see Appendix B for a complete review).

Subjects were randomly assigned to one of the two involvement conditions and one of the three message types. In the low involvement condition, subjects randomly received the focus on the free-market rents or the EU-directive.

5.4.2 MEASURES

Besides a few exceptions, all items had 7-point answer scales. Every answer scale was numbered, from 0 to 6 or from -3 to +3, and all seven answer categories were labeled. Most concepts, like attitude toward bio-energy and involvement, were measured by multiple items. Analysis of this concept is easier when there is one single measure, instead of four items that each assess a part of the concept. The results of the statistical analysis that was done to assess whether a group of items could be combined into a single measure are also described in this section.

► ATTITUDE TOWARD BIO-ENERGY

Attitude toward bio-energy was measured with four semantic differential scales that have been widely used before (e.g. Petty & Cacioppo, 1996). Subjects were asked to indicate what they thought of bio-energy on a 7-point scale with the following opposite extremes: 1) negative – positive, 2) unfavorable – favorable, 3) bad – good, and 4) undesirable – desirable. The good inter-item correlation, Alpha = .83, indicated a high cohesion between the items[3]. No Alpha-if-item-deleted was higher than this total Alpha, which indicates that all items measured the same concept, i.e. attitude toward bio-energy. And thus the unweighted mean score of all four attitude items was used as a single attitude measure.

► ATTITUDE STRENGTH

Attitude strength was measured in terms of attitude certainty, which, according to Lavine, Huff, Wagner, and Sweeney (1998), is one of multiple dimensions of attitude strength. The three items that were used were 1) "To what extent are you convinced about your opinion about bio-energy?"; 2) "To what extent do you doubt your opinion about bio-energy?"; and 3) "To what extent do you trust your opinion about bio-energy?". The second item was recoded to align with the other two; a higher score meant more attitude certainty, i.e. a higher attitude strength. With an Alpha of .75 these items had a sufficient inter-item correlation. Deleting the recoded item meant an increased Alpha of .76. To better assess whether this item should be removed from further analysis, a confirmatory factor analysis was done[4]. Principal axis

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[3] Before a group of items is combined into one measure, an analysis was done to check whether all the items in one group indeed measured the same concept, i.e. whether they correlate. The statistical indicator for this is the inter-item correlation, or Cronbach's Alpha. A low Alpha indicates that not all items in one set measure the same concept. An Alpha higher than .60 is sufficient, higher than .80 is good. A second indicator that is used to assess one item's fit with the rest of the group is the Alpha-if-item-deleted. This is the Alpha the group would have if that one item would be removed. Normally, an Alpha-if-item-deleted that is more than .05 higher than the overall Alpha is reason to remove the item in question because it does not really measure the same concept as the other items. The unweighted mean score of the items that measure the same concept is used as the score for the single measure of that concept. By using the mean score of the original items, the original answer categories are applicable to the new measure. This single measure is then used in the actual analyses.

[4] A factor analysis assesses whether an original set of items can be grouped into a smaller number of factors. Factors are extracted on the basis of their eigenvalue, which have to exceed 1. Here, the factor

factoring showed a one-factor solution with an eigenvalue of 1.54 and an explained variance of 51%[5]. The factor loadings ranged from .56 to .83. Based on this analysis, it was decided to use all three items to calculate the single attitude strength measure.

► **ATTITUDE TOWARD THE MESSAGE**

Attitude toward the message was measured by a single semantic differential scale with bad and good as extremes.

► **MESSAGE CHARACTERISTICS**

The message characteristics persuasiveness, clarity, newness, and credibility were each measured by a single item. The answer scales ranged from 0 (not …) to 6 (very …). After these four items, subjects had to indicate whether they thought the information pleaded for or against bio-energy on a scale from -3 (pleads very much against bio-energy) to +3 (pleads very much for bio-energy).

► **THOUGHT LISTING**

A thought listing task was included in the questionnaire to record the cognitive responses subjects had while reading the message. The reason for including this task was to assess the subjects' level of processing and the valence of their thoughts. Subjects were asked to write down any thoughts they had had while reading the information, regardless of their perceived relevance. These thoughts were categorized by two independent judges, who were blind to the condition subjects were in and to the purpose of the task (see Appendix D for the written instruction the judges received). First, every thought was categorized as either relevant or irrelevant to bio-energy or to the message. Even though the judges agreed in 90% of the 505 thoughts, inter-observer reliability (Kappa) was only .47, which is very low[6]. Those thoughts that were judged relevant were also categorized on valence (negative, neutral, or positive). Given that the judges agreed on relevance, agreement on valence occurred in 80% of the cases. Inter-observer reliability in this case was .70. The majority of the disagreements on both relevance and valence was resolved by discussion. The five thoughts on which no agreement was reached on valence were removed from the dataset.

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analysis is called confirmatory because it is used to assess whether the factors correspond with the theorized concepts. Theory is confirmed if the number of factors is the same as the number of concepts, and if the items that make up a factor are the same as the ones intended to measure a concept.

[5] The explained variance indicates how much percent of the information that is present in the original items is also present in the factor.

[6] There were only two categories, 'relevant' and 'irrelevant'. Even in case of random categorization the expected percentage of agreement was still 50%. The 90% agreement was thus not that high, resulting in a low Kappa. The valence categorization had three categories, i.e. 'negative', 'neutral', and 'positive'. Here, the expected agreement in case of random categorization was 33%. The actual agreement was 80%, which is a lot higher than the random agreement. This is expressed by a higher Kappa.

Per subject, the number of positive and negative thoughts he or she had were used to calculate the relative valence of that subject's thoughts. This was done as followed:

$$\text{relative valence of thoughts} = \frac{\text{\# of positive thoughts} - \text{\# of negative thoughts}}{\text{total \# of relevant thoughts}} \qquad (6.1)$$

Division by the total number of thoughts makes an honest comparison possible between participants who had very few thoughts, and those who had many. This measure or thought valence can range from –1, i.e. only negative thoughts, to +1, only positive thoughts.

► **INVOLVEMENT WITH BIO-ENERGY**

Three concepts; involvement itself, motivation, and other consequences of involvement measured involvement with bio-energy. Involvement itself was measured using four items, which were based on the dimensions of involvement identified by Borgida and Howard-Pitney (1983), i.e. importance of the topic, interest in the topic, care about the topic, and involvement with the topic. Subjects were asked 1) "To what extent is bio-energy a topic that is important to you?"; 2) "To what extent is bio-energy a topic you are interested in?"; 3) "To what extent is bio-energy a topic you care about?"; and 4) "To what extent is bio-energy a topic you feel involved with?". The answers scales ranged from 0 ("not") to 6 ("very much"). Next were four questions rating consequences of involvement: 1) "To what extent is bio-energy a topic you go deep into?"; 2) "To what extent is bio-energy a topic you would like to know more about?"; 3) "How concentrated were you when you read the information about bio-energy?"; and 4) "How much or little attention did you pay to reading the information about bio-energy?". The answer scale of the first three questions ranged from 0 ("not") to 6 ("very much"), that of the last question ranged from -3 ("very little attention") to +3 ("very much attention"). The involvement manipulation check was concluded with five items measuring message relevance, or motivation to process (Laczniak & Muehling, 1993). All questions started with "When you read that bio-energy was one of the topics, did you think the information about it…". The specific questions then read: 1) "…might be important to me"; 2) "…might be useful to me"; 3) "…might be worth paying attention to."; 4) "…might be worth remembering."; and 5) "…is not interesting to me". Answers were given on a scale ranging from –3 ("entirely disagree") to +3 ("entirely agree"). The last motivation item was recoded before further analysis to align with the other motivation items.

A confirmatory factor analysis was used to assess whether the three theorized concepts could be detected in the data[7]. Using Principal axis factoring with Varimax rotation, this factor analysis showed a three-factor solution; all involvement items loaded on the first factor, all motivation items on the second, and two of the four consequence items on a third. The only discrepancy with the theorized concepts were the first two consequence items ("To what extent is bio-energy a topic you go deep into?" and "To what extent is bio-energy a topic you would like to know more about?"). These items did not load onto the third factor but on the

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[7] For sets of items that are meant to measure multiple concepts, a confirmatory factor analysis was done to assess whether the data reflected the concepts.

first factor with all the involvement items. Because these two items did not comply with the theory they were removed from the analysis. A second factor analysis was done without these two items. It revealed the expected distribution of the remaining items over the three factors (see Table 5-1 for the results). Inter-item correlation was calculated for each factor and showed each set of items formed a unidimensional and reliable measure (see Table 5-1). The unweighted mean score of each set of items was used as the score for each corresponding concept.

Table 5-1 *Eigenvalue, percentage of explained variance, and factor loading range per involvement-related factor after rotation and corresponding inter-item correlation.*

	Factor		
	Involvement	Motivation	Consequences
Eigenvalue	2.91	2.70	1.32
Explained variance	26%	25%	12%
Range factor loadings	.75 – .85	.62 – .80	.59 – .88
Cronbach's Alpha	.90	.87	.68

► **INVOLVEMENT WITH THE DUMMY TOPICS**

Involvement with the EU-directive on software patents and with free-market rents were measured with the same four items that were used to measure involvement with bio-energy, and that were described above. The four items measuring involvement with free-market rent showed very good inter-item correlation, Alpha = .96, as did the items measuring involvement with the EU-directive, Alpha = .95. Both Alpha's were higher than any Alpha-if-item-deleted. The unweighted mean score of the involvement with free-market rents items was calculated to make up the single measure for this concept. The same was done for the involvement with the EU-directive items.

► **TRUST IN THE SOURCE**

The idea to measure trust came from the general discussion in an article of Meijnders et al. (2004) about the determinants of trust. The authors suggested the sidedness of a message might be used as an indicator of a source's trustworthiness. To test this suggestion, a trust measure was included in the questionnaire. This multi-item measure was designed by Bondarenko, Meijnders and Midden (O. Bondarenko, personal communication, May 21, 2004). It was intended to measure four concepts, i.e. trust itself and three dimensions of trust, i.e. perceived competence, perceived openness, and perceived care of the source. Each concept was measured using four items, except for the care concept, which was measured by three items.

Trust in the source was measured by the following items: 1) "I feel I can rely on the writer's opinion about bio-energy."; 2) "I feel the writer provides information about bio-energy that I can trust."; 3) "I feel doubtful about the opinion provided by the writer about bio-energy."; and 4) "I feel I can trust this writer's judgment about bio-energy." The answer scales of these

questions ranged from 0 ("not") to 6 ("very strongly"). Next, perceived competence was assessed using the following items: 1) "I think the writer has enough knowledge to make proper judgments about bio-energy."; 2) "I think the writer is experienced enough to write about bio-energy."; 3) "I think the writer knows enough about bio-energy."; and 4) "I think the writer is capable to write about bio-energy.". Here, the answer scales ranged from –3 ("totally disagree") to +3 ("totally agree"). The third trust dimension, perceived openness of the source, was measured with the following items: 1) "I think the writer will be objective in his judgments about bio-energy."; 2) "I think the writer will hide information about bio-energy."; 3) "I think the writer will be honest when writing about bio-energy."; and 4) "I think the writer will truly believe in what he says about bio-energy.". The answer categories for this set of items was the same as the ones used for the perceived competence items. Last, an assessment of perceived care was made using these four items: 1) "I think the writer feels responsible for the opinion he provides about bio-energy."; 2) "I think the writer feels responsible for the readers being informed well."; and 3) "I think the writer cares about the well-being of the readers.". The answer scales again varied from –3 ("totally disagree") to +3 ("totally agree"). Both the third trust item, and the second openness item were recoded because their answer scales were opposite to the answer scales of the other items.

A factor analysis was done to see if the four concepts could be detected in the data. The bend in the scree plot shows a clear one-factor solution (Figure 5-1). However, when all factors whose eigenvalue exceed 1 are extracted, a four-factor solution arises. Because the factor analysis was done as confirmatory analysis for the conceptualized dimensions of trust, the four-factor solution is used to further assess the distribution of items across factors. After Principal axis factoring with Varimax rotation, the four dimensions that are extracted correspond with the four concepts, with the exception of the fourth openness item, which

Figure 5-1 *Scree plot for all trust-related items*

loaded onto the care factor. This item was removed and a second factor analysis was done, using the same extraction and rotation method. This analysis again showed a four-factor solution, this time entirely in line with the four concepts (see Table 5-2 for eigenvalues, percentages of explained variance, and factor loading ranges). Next, the inter-item correlation was calculated for each group of items that corresponded with one concept. All Alpha's were sufficient or good, but deleting the third trust item meant an increase of Alpha with .07. This item also loaded least onto the trust factor, .32. Therefore, the item was removed and a new inter-item correlation was calculated (see Table 5-2).
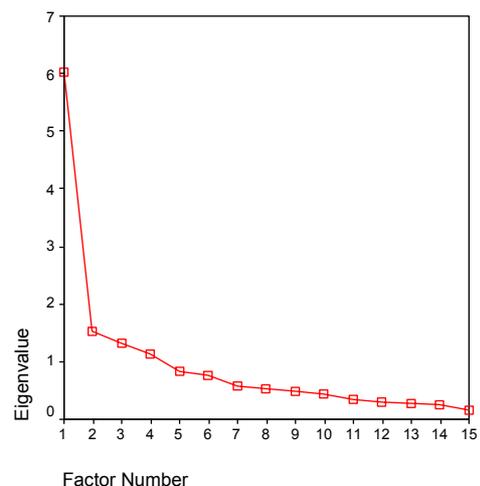
The fact that the data also accommodate a one-factor solution showed in the correlations between each pair of trust concepts, which all exceeded .40.

Table 5-2 *Eigenvalue, percentage of explained variance, and factor loading range after rotation and inter-item correlation per trust-related factor.*

	Factor			
	Trust	Competence	Openness	Care
Eigenvalue	2.34	2.42	1.77	1.43
Explained variance	17%	17%	13%	10%
Range factor loadings	.32 – .89	.66 – .75	.62 – .70	.54 – .63
Cronbach's Alpha	.87	.87	.77	.68

► BEHAVIORAL INTENTION

Behavioral intention was measured to evaluate subjects' intention to oppose to bio-energy: "When a friend of mine wants to buy electricity from biomass, I will try to convince him not to do it". To make the questionnaire balanced, an item assessing pro bio-energy behavioral intention was included as well: "If I could fill up my car with biofuel, a form of bio-energy, I would do so.". In both cases the answer scale ranged from –3 ("entirely disagree") to +3 ("entirely agree"). The inter-item reliability for the two behavioral intention items was very low (-.03) which meant the items could not be combined into a single measure.

► SIDEDNESS RECOGNITION

A method to find out how much attention subjects paid to the message content, i.e. on what level they processed the message, is to ask them whether the message they just read was one-sided or two-sided. The question that was included in the questionnaire was: "What type of arguments does the information on bio-energy contain according to you?". The answer categories were "exclusively arguments in favor of bio-energy", "exclusively arguments against bio-energy", and "both arguments in favor and against bio-energy". The answers were recoded in such a way that the correct answer corresponded with a 1, a wrong answer with a 0. For example, if a receiver of the two-sided refutational message answered "both arguments in favor and against bio-energy" the score for sidedness recognition was 1, whereas both other answers were rewarded a 0.

► ARGUMENT RECOGNITION

Another technique to assess level of processing is to test how well subjects can distinguish arguments that were mentioned in the message from ones that were not. For this purpose, ten arguments about bio-energy were listed and subjects were asked to indicate for each one whether it was mentioned in the information they just read. The answer categories were "yes", "no", and "do not know". All arguments used in the message were given, as well as five arguments that were not used. In total, this task contained five arguments for bio-energy, three against, and two refutations.

Signal theory (Massaro, 1975) distinguishes between four different categories (Figure 5-2). For assessment of the accuracy of argument recognition only correct answers were of interest, i.e. the hits and the correct rejections. Hits are those arguments that were present in the message and that were recognized as such. Correct rejections are those arguments that were not present in the message and were correctly recognized as such. Because the answer "I don't know" was never the correct answer, these cases were recoded as either miss or false alarm.

		Response	
		"yes"	"no"
message	present	Hit	Miss
	not present	False alarm	Correct rejection

Figure 5-2 *Representation of the outcomes of the argument recognition task.*

A measure of accuracy was calculated by adding up the number of hits and correct rejections and dividing the total by the total of arguments used in the questionnaire, i.e. 10. This resulted in a accuracy score ranging from 0 (no correct recognition) to 1 (100% correct recognition). On average, random answering would lead to an accuracy of .50. This accuracy measure was subsequently used in the analysis.

► SELF-ASSESSMENT OF PRIOR KNOWLEDGE

Subjects were asked to estimate their own prior knowledge about bio-energy on a 7-point scale ranging from 0 ("No knowledge") to 6 ("Very much knowledge"). This item was included to compare the knowledge level of the sample with that reported in other studies.

► PERSONAL DETAILS

Subjects were asked about their year of birth, sex, education, membership of environmental organizations, sort of electricity used ("regular", "green", "other, namely…", or "I don't know"), and prior participation in an experiment about bio-energy.

► REMARKS

Subjects were asked to write down any possible questions about the questionnaire or the topic of this research in an open-ended question.

6 RESULTS

This chapter deals with the results of the present study. The first section gives a description of the sample. Next, the hypotheses that were formulated in Section 4.5 are tested, starting with the ones related to the manipulations. The final section of this chapter provides a summary of the analyses described in this chapter.

6.1 SAMPLE DESCRIPTIVES

In total 171 students took part in the experiment. 66% of all subjects was male, 34% was female. The youngest subject was 18, the oldest 35. The mean age was 20.8 years (SD = 2.12 years). 47% of the questionnaires was handed out at the Fontys Hogeschool in Tilburg, the rest at the Eindhoven division of the same school. Age, sex, and prior knowledge of the subjects did not differ significantly between the two locations. These two groups also showed no significant difference in the level of processing, as measured by the thought listing, sidedness recognition, and argument recognition tasks. The two groups were thus merged and treated as one sample.

Subjects were asked to rate their own level of prior knowledge on a scale from 0 to 6. The mean knowledge level was 1.97 (SD = 1.22). This corresponds with the label "little knowledge" and matches the results from previous studies that found knowledge level on bio-energy to be low (e.g. Rohrachter et al., 2003). Figure 6-1 shows the distribution of prior knowledge.

The questionnaire also contained items on membership of an environmental organization and on use of electricity from sustainable energy sources, i.e. "groene stroom". 12% of the sample was member of an environmental organization, and 30% used groene stroom.
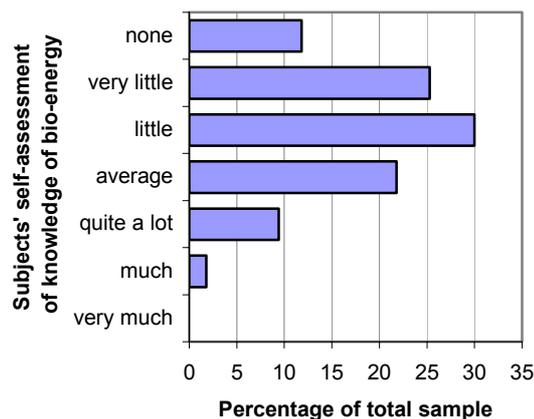
Figure 6-1 *Subjects' self-assessment of prior knowledge of bio-energy.*

6.2 TESTING OF HYPOTHESES

6.2.1 MANIPULATION CHECK

► MESSAGE SIDEDNESS

The one-sided, two-sided nonrefutational and two-sided refutational message only differed in the arguments they contained. A univariate analysis of variance with position as dependent variable and message type as independent variable showed that, while the one-sided message was judged to plead more for bio-energy than the two-sided messages (see Table 6-1), this difference was not significant (F (2, 168) = 1.77, p = .19).

Table 6-1 *Mean position with regard to bio-energy (and standard deviation) per message type.*

one-sided	two-sided	two-sided refutational
1.86	1.63	1.60
(1.21)	(1.14)	(1.09)

► INVOLVEMENT

Within the low involvement condition, half the subjects was asked to pay special attention to the information on free-market rents, the other half was asked to pay special attention to the information on the EU-directive on software patents. As these two low involvement groups do not differ significantly in involvement with bio-energy, motivation to process, and other consequences of involvement they are combined and treated as one low involvement group in the analyses (see Table 6-2 for mean scores and standard deviations).

Table 6-3 shows the distribution of subjects after combining the two low involvement groups into one low involvement manipulation condition.

Table 6-2 *Mean scores (and standard deviation) per variable for the two groups that focused on a dummy topic.*

	Involvement	Motivation	Consequences
Free-market rents	2.38	.614	3.58
	(1.16)	(1.18)	(1.21)
EU-directive	2.38	.610	3.88
	(1.31)	(1.16)	(.900)

Table 6-3 *Number of subjects per dummy topic per message type.*

Involvement manipulation	Message type		
	one-sided	two-sided	two-sided refutational
Low	29	26	30
High	29	29	29

Before testing the hypotheses, the success of the involvement manipulation has to be tested. Taken over the entire sample, mean involvement and consequences of involvement were 2.39 (SD = 1.17), and 3.74 (SD = 1.07) on a scale from 0 to 6, respectively. Mean motivation of the entire sample was .80 (SD = 1.06), on a scale of –3 to +3 (for the mean score and standard deviation per experimental condition, see Appendix G). A multivariate analysis of variance was done with the three involvement-related concepts as dependent variables and involvement and message type as fixed factors. This analysis shows a marginally significant effect of involvement manipulation on the involvement-related concepts (Table 6-4). To distinguish between the three concepts, individual analyses of variance were done for each concept as dependent variable and again the involvement manipulation and the message type as fixed factors. These analyses of variance show that the involvement manipulation only had a significant effect on motivation (Table 6-5). Motivation is significantly higher for subjects in the high involvement manipulation condition (M = .99, SD = .91) than for subjects in the low involvement condition (M = .61, SD = 1.17). The data showed the manipulation had no effect on involvement or consequences of involvement. This is not surprising, given that the manipulation consisted only of a request to pay special attention to one particular topic. Since subjects have already agreed to participate, the request is likely to manipulate motivation, but not necessarily involvement.

Table 6-4 *Multivariate Analysis of Variance for involvement concepts.*

Source	Wilks' Lambda	df	F	p
Involvement manipulation (I)	.96	3, 163	2.30	.08
Message type (M)	.96	6, 326	1.17	.32
I x M	.94	6, 326	1.72	.12

Table 6-5 *Univariate Analysis of Variance for separate involvement concepts.*

		Involvement		Motivation		Consequences	
	df	F	p	F	p	F	p
Involvement manipulation (I)	1	< 1	*ns.*	5.38	.02	< 1	*ns.*
Message type (M)	2	1.30	.28	< 1	*ns.*	< 1	*ns.*
I x M	2	2.43	.09	< 1	*ns.*	1.14	.32
Error	165	(1.36)		(1.11)		(1.14)	

Note. Values enclosed in parentheses represent mean square errors.

The analysis of variance with involvement as dependent variable shows a marginally significant interaction effect of the involvement manipulation and message type[8]. Further

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[8] An interaction effect means that the effect of one independent variable on the dependent variable also depends on the other independent variable. In other words, the joint effect of the two independent variables is different from the sum of the separate effects of each independent variable (Heus, Van der Leeden & Gazendam, 1999).

analyses show that in the high involvement condition involvement does not vary across the message types ($F < 1$). In the low involvement condition however, receivers of the one-sided message are significantly more involved than receivers of a two-sided message ($F(1, 167) = 5.16$, $p = .02$). This effect was not expected. An explanation in line with the Elaboration Likelihood Model (Petty & Cacioppo, 1986) might be that initially, in the low involvement condition, subject's involvement only afforded peripheral processing. However, based on the peripheral cues of the one-sided message, i.e. short and simple, people's involvement might have increased to afford central processing. Another explanation in terms of the Heuristic-Systematic Model (Chen, 1980), is that for receivers of the one-sided message in the low involvement condition, the gap between actual confidence and desired confidence was judged small, which led to an increase in involvement. However, neither explanation makes clear why involvement in the high involvement condition was lower than the involvement of receivers of the one-sided message in the low involvement condition.

As a double check on the effect of the involvement manipulation, an analysis of variance was done using the measured involvement with a dummy topic as dependent variable and involvement with regard to that topic and message type as independent variables. As was the case with involvement with bio-energy, no effect of the manipulation on the measured level of involvement with the two dummy topics was found (see Table 6-6). As motivation with regard to these topics was not measured, nothing can be said about potentially existing differences in motivation.

Table 6-6 *Univariate Analysis of Variance for involvement with dummy topics.*

	df	Involvement with free-market rents		Involvement with EU-directive	
		F	p	F	p
Involvement manipulation (I)	1	< 1	*ns.*	< 1	*ns.*
Message type (M)	2	1.67	.19	< 1	*ns.*
I x M	2	< 1	*ns.*	< 1	*ns.*
Error	165	(2.22)		(2.16)	

Note. Values enclosed in parentheses represent mean square errors.

The conclusion of these analyses is that the manipulation caused subjects in the high involvement condition to be significantly more motivated than those in the low involvement condition. The intended effect of the manipulation on involvement itself was not found. Because the reason for manipulating involvement was to indirectly manipulate motivation, these results still enable testing of the hypotheses.

► LEVEL OF PROCESSING

The questionnaire contained three indirect measures of level of processing, namely the thought listing task, the sidedness recognition question, and the argument recognition task. One hypothesis was formulated about each of these measures. Hypotheses 7, 8, and 9 state that involved subjects have more relevant thoughts while reading the message, and recognize its sidedness and the presented arguments better than uninvolved subjects, respectively. These effects of involvement are expected because of an expected difference in level of processing between the two involvement groups.

The overall mean number of relevant thoughts was 2.69 (SD = 1.43). To test for any difference between conditions, an analysis of variance with involvement and message type as independent variables and number of relevant thoughts as dependent variable was done (see the left part of Table 6-7). This analysis showed no main effect of involvement manipulation on the number of relevant thoughts, nor any other significant effect.

Table 6-7 *Univariate Analysis of Variance for number of relevant thoughts and argument recognition.*

	Relevant thoughts			Argument recognition		
	df	*F*	*p*	*df*	*F*	*p*
Involvement manipulation (I)	1	< 1	*ns.*	1	< 1	*ns.*
Message type (M)	2	< 1	*ns.*	2	3.47	.03
I x M	2	1.54	.22	2	2.43	.09
Error	165	(2.07)		165	(.09)	

Note. Values enclosed in parentheses represent mean square errors.

Overall, 63.7% of all subjects identified the sidedness of the message they had read correctly. Within the low involvement condition this percentage was 66.7%, within the high involvement condition 60.9%. A nonparametric test (Kruskal Wallis) showed the difference in percentage of correct recognition between these two conditions was not significant (χ^2(1) = .61, p = .44). This difference was also not significant when the analysis was done for each message type separately. Another nonparametric test showed that the three message types differed significantly in sidedness recognition (χ^2(2) = 22.57, p = .00). Figure 6-2 clarifies this effect and shows more receivers of the one-sided message recognized the message as one-sided than receivers of either two-sided message recognized their message as two-sided.
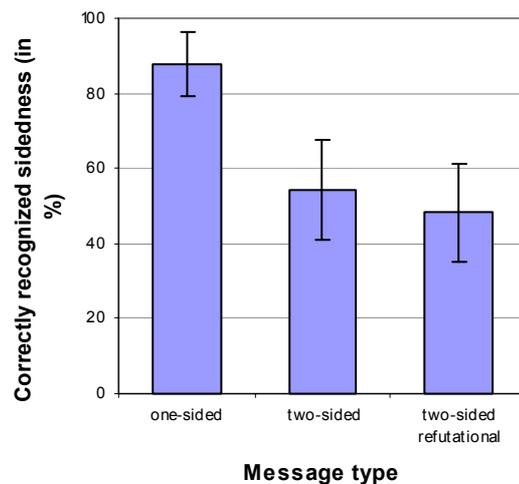

Figure 6-2 *Percentage of subjects who correctly recognized message sidedness.*

Note. The T-shaped lines represent 95% confidence intervals.

The mean accuracy of argument recognition calculated over the entire sample was .74 (*SD* = .21), which is significantly higher than the accuracy of .50 that can be expected with random answering (*t*(170) = 14.6, *p* = .00). Table 6-8 shows the mean accuracy and standard deviation per experimental condition. An analysis of variance with involvement and message type as independent variables and accuracy of argument recognition as dependent variable did not show the expected main effect of involvement manipulation, but did show a significant main effect of message type, and a marginally significant interaction effect (see the right side of Table 6-7). A contrast analysis shows that receivers of the one-sided message are significantly more accurate in argument recognition than receivers of a two-sided message, with or without refutation (*F*(1, 163) = 7.08, *p* = .01). Figure 6-3 shows the interaction effect of involvement manipulation and message type. Contrast analyses of the two involvement conditions within each message type show that involvement has a marginally significant influence on argument recognition for receivers of the two-sided refutational message (*F*(1, 165) = 3.58, *p* = .06) but not for receivers of the other two messages, *F* < 1 for the one-sided and *F*(1, 162) = 1.54, *p* = .22 for the two-sided nonrefutational message. This interaction effect can be explained by a difference in level of processing between the two involvement conditions. The one-sided and the two-sided nonrefutational message contain only a few arguments, i.e. three and four, respectively, and these are all independent of each other. As a result, no elaborate processing is needed to accurately identify these arguments. Peripheral processing might even be enough. The two-sided refutational message contains more arguments, and the refutation is directly related to the counterargument, making the message more complex. For this message, elaboration has to be high, i.e. central processing is needed, to achieve accurate argument recognition, hence the marginally significant difference between the uninvolved and the involved receivers of this message type.
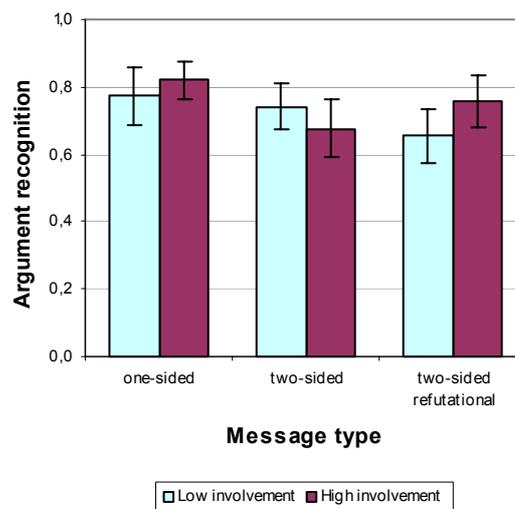
Figure 6-3 *Mean argument recognition per experimental condition.*

Note. The T-shaped lines represent 95% confidence intervals.

The data do not provide support for hypotheses 7, 8, and 9, since no main effect of involvement on the number of relevant thoughts, sidedness recognition or argument recognition was found. On first sight, the data do not provide support for the idea of two different levels of processing either. However, the interaction effect of message type and involvement manipulation on argument recognition does point in the direction of different levels of processing. But given the equal accuracy within the one-sided and two-sided

nonrefutational message, it is more likely that the interaction is due to two different levels of central processing, not to the expected difference between peripheral and central processing[9].

Table 6-8 *Mean argument recognition (and standard deviation) per condition.*

Involvement manipulation	Message type			per involvement condition
	one-sided	two-sided	two-sided refutational	
Low	.77 (.23)	.74 (.18)	.66 (.22)	.72 (.22)
High	.82 (.15)	.68 (.24)	.76 (.21)	.75 (.21)
per message type	.80 (.20)	.71 (.21)	.71 (.22)	.74 (.21)

Note. The answer scale ranged from 0 (total incorrect recognition) to +3 (perfect recognition).

6.2.2 DEPENDENT VARIABLES

► **ATTITUDE TOWARD BIO-ENERGY**

Overall, subjects had a quite positive attitude toward bio-energy after reading a message about it (see Table 6-9). According to hypothesis 1a, in the low-involvement condition, a one-sided message would result in a more positive attitude toward bio-energy than a two-sided message, regardless of whether or not the two-sided message contains refutation of the counterargument. In the high-involvement condition, the two-sided messages was expected to lead to a more positive attitude than the one-sided nonrefutational message (1b), and of the two-sided messages the refutational one was expected result in the most positive attitude toward bio-energy (1c).

If these hypotheses are correct, an analysis of variance with attitude toward bio-energy as dependent variable and involvement and message type as independent variables would find an interaction effect of the two independent variables. Table 6-10 shows the result of this

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[9] Besides the original involvement manipulation, a post hoc method was used to distinguish between high and low motivation, that is, a median split was performed on motivation. The median motivation score was 1.00. All subjects that scored lower than, or equal to 1.00 on this variable were designated low motivated (52,6% of the sample), the rest highly motivated. This new division led to roughly the same number of subjects per experimental condition. The median split does not change the distribution of subjects across message types. Therefore, main effects of message type on any variable are roughly the same for the analysis with median split and the one with the original manipulation.

The median split motivation was used instead of the involvement manipulation to do the same analyses as described in this section. These analyses showed an interaction effect of median split and message type on argument recognition, which was stronger but still only marginally significant (F (2, 165) = 2.80, p = .06). The effects found on the number of relevant thoughts and sidedness recognition were the same as for the original manipulation.

analysis. As the low *F-* and *p*-value in the I x M interaction row show, no significant interaction occurred between the two independent variables. Yet, based on the hypothesis, differences in attitude toward bio-energy were expected between receivers of the different message types within low as well as within high involvement. Therefore, even though the analysis of variance did not show an interaction effect, additional contrast analyses were done to test the three components of hypothesis 1. However, these showed no significant differences between message types in either the low or the high involvement manipulation condition. Figure 6-4 illustrates these results.
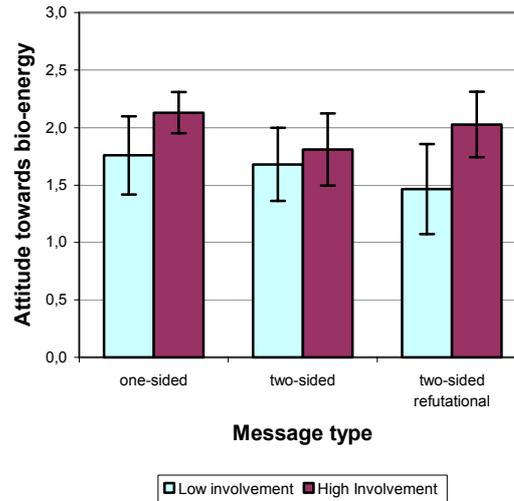
Figure 6-4 *Attitude toward bio-energy and 95% confidence interval per condition.*

Table 6-9 *Mean attitude toward bio-energy (and standard deviation) per condition.*

Involvement manipulation	Message type			per involvement condition
	one-sided	two-sided	two-sided refutational	
Low	1.76 (.94)	1.68 (.81)	1.47 (1.08)	1.63 (.95)
High	2.13 (.49)	1.81 (.86)	2.03 (.77)	1.99 (.73)
per message type	1.94 (.76)	1.75 (.83)	1.74 (.97)	1.81 (.86)

Note. The answer scale ranged from –3 (very negative) to +3 (very positive).

Table 6-10 *Analysis of Variance for attitude toward bio-energy.*

	df	*F*	*p*
Involvement manipulation (I)	1	7.41	.01
Message type (M)	2	1.05	.35
I x M	2	< 1	*ns*
Error	163	(.71)	

Note. Value enclosed in parentheses represents mean square error.

Though the expected effects were not found, the original analysis of variance did show a significant main effect for the involvement manipulation (Table 6-10). Subjects in the high involvement manipulation condition had a significantly more positive attitude toward bio-energy compared to subjects in the low involvement manipulation (see Figure 6-5). While unexpected, this effect is not surprising. According to the ELM (Petty & Cacioppo, 1986), higher motivation leads to more processing. When people have a weak initial attitude, it is not surprising that people who elaborate more on a persuasive message show more attitude change than people who elaborate less. When the message is positive, as in this experiment, the attitude will change in the positive direction. This results in a more positive attitude for motivated people than for unmotivated people.
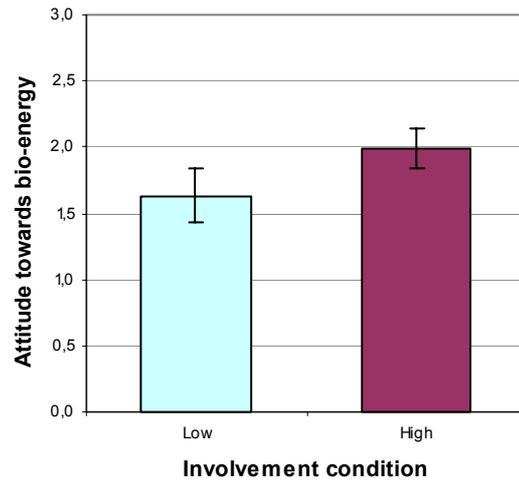
Figure 6-5 *Mean attitude toward bio-energy per involvement condition.*

The data did not provide support for the first hypotheses. People in the high involvement condition, who were more motivated than people in the low involvement condition, were found to have a significantly more positive attitude toward bio-energy than people in the low involvement condition[10].

► **CLARITY OF THE MESSAGE**

According to Hypothesis 2, a one-sided message would be perceived as clearer than a two-sided message because it contains only one type of arguments and is thus less complex. Table 6-12 shows the mean clarity and standard deviation per experimental condition.

Table 6-11 *Analysis of Variance for message clarity.*

	df	F	p
Involvement manipulation (I)	1	< 1	ns
Message type (M)	2	< 1	ns
I x M	2	< 1	ns
Error	165	(1.33)	

Note. Value enclosed in parentheses represents mean square error.

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[10] No main effect of median split motivation on attitude toward bio-energy was found when the same analysis was done with median split motivation as independent variable instead of the original manipulation ($F(1, 163) = 1.21$, $p = .27$). The interaction effect of median split motivation and message type was also not significant, $F(2, 163) = 1.04$ ($p = .36$).

An analysis with involvement and message type as independent variables and clarity as dependent variable showed that the main effect of message sidedness was not significant, nor were the other effects (see Table 6-11). The data thus do not support Hypothesis 2[11].

Table 6-12 *Mean clarity of the message (and standard deviation) per condition.*

Involvement manipulation	Message type			per involvement condition
	one-sided	two-sided	two-sided refutational	
Low	3.69 (1.11)	3.54 (1.45)	3.62 (1.12)	3.62 (1.21)
High	3.69 (.89)	3.31 (1.04)	3.48 (1.27)	3.49 (1.08)
per message type	3.69 (1.00)	3.42 (1.24)	3.55 (1.19)	

Note. The answer scale ranged from 0 (not certain) to 6 (very certain).

► **PERSUASIVENESS OF THE MESSAGE**

Hypothesis 3a said that in the low-involvement condition, a one-sided message would be judged more persuasive than a two-sided message, regardless of whether or not the counterargument is refuted in the latter message. About the high involvement condition, the two-sided messages were hypothesized to be judged more persuasive than the one-sided nonrefutational message (3b), and the refutational message was expected to be judged the most persuasive of the two-sided message (3c).

An analysis of variance with persuasiveness of the message as dependent variable and involvement and message sidedness as independent variables was done to see if the interaction effect, that was expected as a result of the combination of Hypotheses 3, indeed occurred. Table 6-14 shows no significant interaction effect was found, nor was either of the main effects significant. The data thus did not provide support for the hypotheses that were formulated about persuasiveness[12].

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[11] A similar analysis with the original manipulation substituted by median split motivation as independent variable showed a marginally significant effect of median split motivation ($F(1, 167) = 3.85$, $p = .05$). Contrast analyses illustrated that this effect was only significant for the two-sided messages, which unmotivated subjects found significantly less clear than did motivated subjects ($F(1, 167) = 7.87$, $p = .01$).

[12] Running the same analysis with the median split motivation instead of the original manipulation gave the same results, i.e. no significant differences between the experimental conditions were found.

Table 6-13 *Mean persuasiveness of the message (and standard deviation) per condition.*

Involvement manipulation	Message type			per involvement condition
	one-sided	two-sided	two-sided refutational	
Low	3.31 (1.37)	3.31 (1.12)	3.31 (1.14)	3.31 (1.20)
High	3.03 (1.18)	3.00 (1.20)	3.34 (1.05)	3.13 (1.14)
per message type	3.17 (1.27)	3.15 (1.16)	3.33 (1.08)	

Note. The answer scale ranged from 0 (not persuasive) to 6 (very persuasive).

Table 6-14 *Analysis of Variance for persuasiveness of the message.*

	df	F	p
Involvement manipulation (I)	1	1.03	.31
Message type (M)	2	< 1	ns
I x M	2	< 1	ns
Error	165	(1.39)	

Note. Value enclosed in parentheses represents mean square error.

► **CREDIBILITY OF THE MESSAGE**

In the low involvement condition, the one-sided message was expected to be viewed as more credible than its two-sided counterparts (Hypothesis 4a). In the high involvement condition the reverse was expected because the one-sided message only showed one side of the picture, while the two-sided message acknowledged both sides (Hypothesis 4b).

An analysis of variance with involvement and message sidedness as independent variables and credibility as dependent variable was done to test the hypotheses (see Table 6-16). The results showed that while there was no interaction effect of involvement and message sidedness, but that there was a significant main effect of message type. As can be seen in Table 6-15, the mean score in the one-sided message condition was lower than that in the two-sided message conditions for both
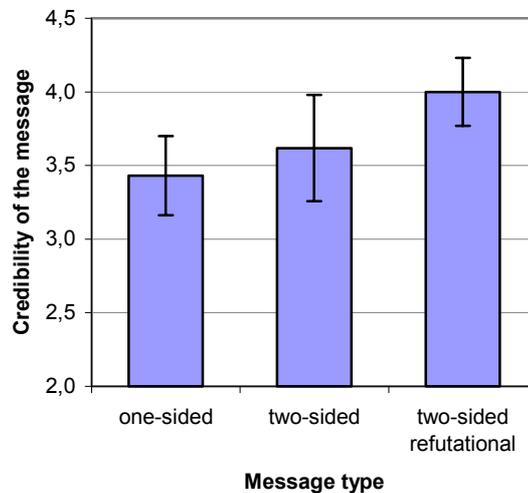

Figure 6-6 *Perceived credibility per message type.*

low and high involvement. Based on this, and on the lack of an interaction effect of involvement manipulation and message type, Hypothesis 4a had to be discarded. To assess what caused the main effect of message type, two additional orthogonal contrast analyses were done. One compared the perceived credibility of the one-sided message with the mean perceived credibility of the two-sided messages. The other compared the two two-sided message with each other with respect to their perceived credibility. The first analysis showed that perceived credibility of the one-sided message differed significantly from that of the two-sided messages, F (1, 164) = 4.46 (p = .04). The second analysis showed that the perceived credibility of the two-sided message were marginally significantly different, F (1, 164) = 3.38 (p = .07). Figure 6-6 illustrates that, of the two-sided messages, the one with refutation is judged to be most credible. A last contrast analysis showed that the difference in perceived credibility between the one-sided and the two-sided nonrefutational message was not significant (F < 1). This suggests that mere addition of a counterargument to a one-sided message is not enough to increase its credibility but that credibility does go up when the counterargument is not merely added, but is refuted as well. This additive effect of refutation was not expected.

Based of the data, Hypothesis 4a about credibility in the low involvement condition could not be confirmed. Support was found for the hypothesis that in the high involvement condition the one-sided message is perceived as less credible than the two-sided message (Hypothesis 4b), a significant difference that occurred not just under high involvement, but regardless of a subject's involvement[13].

Table 6-15 *Mean credibility of the message (and standard deviation) per condition.*

Involvement manipulation	Message type			per involvement condition
	one-sided	two-sided	two-sided refutational	
Low	3.38 (.90)	3.73 (1.31)	3.97 (.91)	3.69 (1.06)
High	3.48 (1.18)	3.52 (1.43)	4.03 (.91)	3.68 (1.21)
per message type	3.43 (1.05)	3.62 (1.37)	4.00 (.90)	

Note. The answer scale ranged from 0 (not credible) to 6 (very credible).

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[13] When the same analyses were done with median split motivation, the results were the same; credibility of the two-sided message was higher than that of the one-sided message, and no main effect of motivation was found. This was expected, because redefining experimental conditions based on the median split of motivation did not change the distribution of subjects over message type.

Table 6-16 *Analysis of Variance for credibility of the message.*

	df	F	p
Involvement manipulation (I)	1	< 1	*ns*
Message type (M)	2	3.84	.02
I x M	2	< 1	*ns*
Error	165	(1.26)	

Note. Value enclosed in parentheses represents mean square error.

► **THOUGHT VALENCE**

The valence of subjects' thoughts in the different conditions is given in Table 6-17. According to hypothesis 5, a one-sided message would result in relatively more negative thoughts than a two-sided message when involvement is high. An analysis of variance was done with thought valence as dependent variable and involvement and message sidedness as independent variables. As expected, the results did not show significant main effects, but did show a significant interaction effect (see left part of Table 6-18). Two orthogonal contrast analyses were done to test the hypothesis within high involvement. The analysis compared the thought valence of receivers of the one-sided message with the mean thought valence of receivers of the two-sided messages within the high involvement condition. The same was done for the low involvement condition to explore the interaction effect. No significant difference was found within the low involvement condition ($F_{(1, 164)} = 1.59$, $p = .21$), but in the high involvement condition the valence of thought elicited by the one-sided message did differ marginally significantly from that elicited by the two-sided messages ($F_{(1, 164)} = 2.81$, $p = .10$). Figure 6-7 shows that in the high involvement condition the expected effect occurred, i.e. people had a less positive valence of thoughts while reading a one-sided message than while reading a two-sided message. The figure shows the opposite trend in the low involvement condition, which explains the interaction effect.
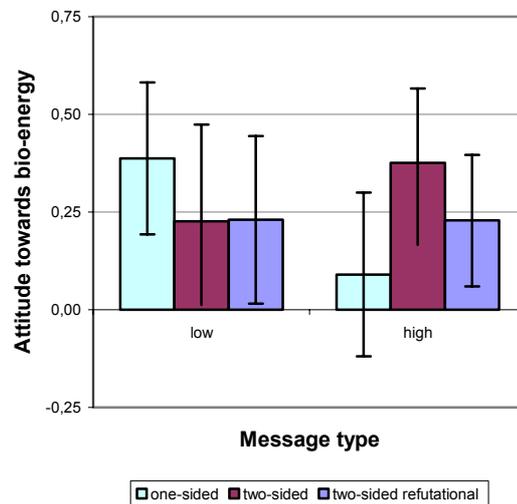

Figure 6-7 *Mean thought valence per message type per involvement condition.*

Table 6-17 *Mean relative valence of thought (and standard deviation) per condition.*

Involvement manipulation	Message type			per involvement condition
	one-sided	two-sided	two-sided refutational	
Low	.39 (.53)	.23 (.64)	.23 (.59	.28 (.59)
High	.09 (.57)	.38 (.52)	.23 (.46)	.23 (.53)
per message type	.24 (.57)	.31 (.58)	.23 (.52)	

Note. The answer scale ranged from -1 (only negative thoughts) to +1 (only positive thoughts).

Table 6-18 *Univariate Analysis of Variance for thought valence and number of negative and positive thoughts..*

	df	Thought valence		Number of negative thoughts		Number of positive thoughts	
		F	p	F	p	F	p
Involvement manipulation (I)	1	< 1	ns	1.31	.25	< 1	ns.
Message type (M)	2	< 1	ns	< 1	ns.	< 1	ns.
I x M	2	2.37	.10	< 1	ns.	2.53	.08
Error	165	(.31)		(.50)		(1.11)	

Note. Values enclosed in parentheses represent mean square errors.

To find out whether the interaction effect on thought valence was due to a change in positive thoughts or in amount of counterarguing, the absolute number of negative and positive thoughts was analyzed. The number of negative thoughts was found not to differ across conditions, but the number of positive thoughts showed a significant interaction effect (see right part of Table 6-18). Inspection of the mean number of positive thoughts per condition showed this interaction effect is identical to the interaction effect on thought valence (see Table 6-19). In other words, the interaction effect of message sidedness and involvement on thought valence was not caused by a change in counterarguing, but by a change in the relative number of positive thoughts a person had about bio-energy.

The valence of a person's thoughts can be seen as an indicator of that person's attitude. From this perspective, the results described here support the hypotheses that were formulated about the influence of message type and involvement on attitude toward bio-energy. Low involved people thought more positively about bio-energy as result of a one-sided message than as result of a two-sided message, while highly involved people showed the reverse effect.

The conclusion of the thought valence data is that hypothesis 5 is confirmed, i.e. in the high involvement condition people think more positively about a two-sided message than about a one-sided message. Additionally, the reverse trend is observed for people in the low involvement condition. At the same time, neither message type nor involvement influences the number of negative thoughts a person has while reading a message[14].

Table 6-19 *Mean number of positive thoughts (and standard deviation) per condition.*

Involvement manipulation	Message type			per involvement condition
	one-sided	two-sided	two-sided refutational	
Low	1.45 (1.02)	1.15 (1.05)	1.00 (.89)	1.16 (1.05)
High	.86 (1.03)	1.24 (1.02)	1.24 (1.27)	1.16 (1.05)
per message type	1.16 (1.06)	1.20 (1.03)	1.12 (1.09)	1.16 (1.05)

Note. The answer scale ranged from -1 (only negative thoughts) to +1 (only positive thoughts).

► **ATTITUDE TOWARD THE MESSAGE**

Attitude toward the message was thought to be influenced by the credibility of it, and thus by message type and receiver involvement. In the low involvement condition, subjects were thought to have a more positive attitude toward the one-sided message than toward the two-sided messages, regardless of whether or not the two-sided message contained refutation of the counterargument (Hypothesis 6a). In the high involvement condition, the reverse was expected (Hypothesis 6b), and the two-sided refutational message was supposed to lead to a more positive attitude toward the message than the two-sided message without refutation (Hypothesis 6c).

These hypotheses were tested with an analysis of variance was done with involvement and message type as independent variables and attitude toward the message as dependent variable. No interaction effect was found between the two independent variables, nor was any individual main effect significant (see Table 6-20). The hypotheses were thus not supported by the data[15].

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[14] Similar analyses with the original manipulation substituted by median split motivation as independent variable showed there was no significant interaction effect of motivation and message type on thought valence ($F < 1$). There was no longer any significant difference in number of positive thoughts between the conditions.

[15] A main effect of median split motivation on attitude toward the message was found ($F(1, 165) = 5.45$, $p = .02$); motivated subjects had a significantly more positive attitude toward the message than unmotivated subjects. Besides this, none of the hypotheses regarding attitude toward the message was supported.

Table 6-20 *Analysis of Variance for attitude toward the message.*

	df	F	p
Involvement manipulation (I)	1	1.01	.32
Message type (M)	2	< 1	*ns*
I x M	2	< 1	*ns*
Error	165	(1.22)	

Note. Value enclosed in parentheses represents mean square error.

Table 6-21 *Mean attitude toward the message (and standard deviation) per condition.*

Involvement manipulation	Message type			per involvement condition
	one-sided	two-sided	two-sided refutational	
Low	1.21 (1.15)	1.08 (1.16)	1.34 (1.11)	1.21 (1.13)
High	1.31 (1.23)	1.41 (.78)	1.41 (1.15)	1.38 (1.06)
per message type	1.26 (1.18)	1.25 (.99)	1.38 (1.12)	1.30 (1.10)

Note. The answer scale ranged from –3 (very negative) to +3 (very positive).

► **BEHAVIORAL INTENTION**

Hypothesis 10 said there would be a negative correlation between the attitude toward bio-energy and the behavioral intention to oppose bio-energy, i.e. a more positive attitude would mean less intention to oppose. Over the entire sample, the Pearson correlation was in the intended direction, but it was only marginally significant. Further analysis showed that this correlation was not at all significant for subjects in the low involvement condition and marginally significant for subjects in the high involvement condition (see Table 6-22).

Figure 6-8 *Mean intention to perform pro bio-energy behavior per involvement condition.*

Note. The scale ranged from –3 (total disagreement) to +3 (total agreement).

Table 6-22 also shows the correlation between attitude toward bio-energy and behavioral intention that is pro bio-energy for the same samples. In line with Hypothesis 10, a positive correlation between these two variables could be expected. However, no such correlation was
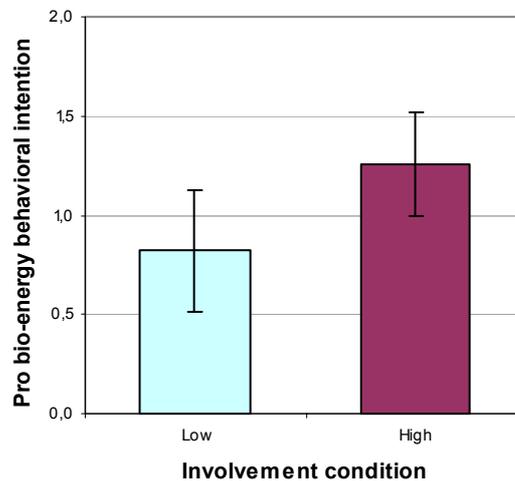
found. An analysis of variance with this variable as dependent variable and involvement and message type as independent ones did show a significant main effect of involvement on pro bio-energy behavioral intention ($F(1, 162) = 4.53$, $p = .04$); involved subjects expressed stronger intention of behavior that was pro bio-energy than uninvolved subjects (see Figure 6-8). The same main effect was found for attitude toward bio-energy, but since no direct link between the two was found, no positive correlation between pro bio-energy intention and attitude toward it can be assumed.

The conclusion of these analyses is that although hypothesis 10 is not entirely supported by the data, the data do point in the expected direction. A more positive attitude toward bio-energy corresponds with a weaker intention to oppose bio-energy, but only for subjects in the high involvement condition. This is in line with the ELM, which says that attitudes that result from central route processing are predictive of behavior while those that result from peripheral processing are not (Petty, Cacioppo, & Schumann, 1983). However, although the involvement manipulation has a significant effect on both behavioral intention and attitude toward bio-energy, no direct correlation between the two was found[16].

Table 6-22 *Pearson correlation between attitude toward bio-energy and behavioral intention to oppose bio-energy for different samples.*

	Negative intention		Positive intention	
Sample	*r*	*p*	*r*	*p*
Low involvement	-.08	.49	.15	.17
High involvement	-.20	.06	-.00	.98
Overall	-.14	.07	.12	.12

► **ATTITUDE STRENGTH**

Attitude strength was hypothesized to be higher for subjects in the high involvement condition than for subjects in the low involvement condition (Hypothesis 11).

An analysis of variance with involvement and message type as independent variables and attitude strength as dependent variable was done to test this hypothesis. Table 6-23 shows the results of this analysis. As the table illustrates, no significant main or interaction effects were found. All subjects were rather certain of their attitude, regardless of the message they received or the manipulation condition they were in (see Table 6-24). The difference in attitude strength between involvement conditions was thought to occur because of a difference in level of processing, and thus in this experiment because of a difference in motivation. So another way to test this hypothesis was by calculating the correlation between

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[16] The Pearson correlation between negative behavioral intention and attitude toward bio-energy for unmotivated and motivated subjects was -.02 ($p = .84$) and -.27 ($p = .02$), respectively. For positive behavioral intention the correlations with attitude toward bio-energy were .27 ($p = .01$) and -.05 ($p = .68$), respectively. These data provide partial support for Hypothesis 10.

involvement and motivation on the one hand and attitude strength on the other. Both correlations were significant, r = .28 (p =.00) for involvement and r = .20 (p =.01) for motivation. The small proportion of common variance, r^2, suggests attitude strength depends on more factors than involvement or motivation alone.

No final conclusion can be drawn with regard to hypothesis 11 about attitude strength on the basis of the results of the questionnaire. Even though no significant effect was found, the pattern found in the correlations points in the expected direction[17].

Table 6-23 *Analysis of Variance for attitude strength.*

	df	F	p
Involvement manipulation (I)	1	< 1	ns
Message type (M)	2	< 1	ns
I x M	2	< 1	ns
Error	165	(.89)	

Note. Value enclosed in parentheses represents mean
square error.

Table 6-24 *Mean attitude strength (and standard deviation) per condition.*

Involvement manipulation	Message type			per involvement condition
	one-sided	two-sided	two-sided refutational	
Low	3.63 (1.03)	3.49 (.78)	3.60 (1.01)	3.58 (.94)
High	3.68 (.86)	3.63 (1.06)	3.79 (.88)	3.70 (.93)
per message type	3.66 (.94)	3.56 (.93)	3.70 (.94)	3.64 (.93)

Note. The answer scale ranged from 0 (not certain) to 6 (very certain).

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[17] When the median split motivation was used as independent variable, Hypothesis 11 was confirmed, i.e. attitude strength was higher for motivated than for unmotivated subjects (F (1, 165) = 4.55, p = .03). The analysis of variance in this case also showed a significant interaction effect of median split motivation and message type (F (2, 165) = 4.95, p = .01). Contrast analyses showed that this was due to a significantly higher attitude strength for motivated receivers of the two-sided refutational message than for unmotivated receivers of that message (F (1, 165) = 14.51, p = .00). A possible explanation lies in the belief structure that results from the messages. The two-sided refutational message contains the most information, and can thus result in the most beliefs. In addition, due to the refutation, this message type is clear with respect to the advocated position, resulting in high attitude strength for those who elaborate on the message content, i.e. motivated subjects. The two-sided non-refutational message does not show this difference because of its two-sidedness, which does not enhance a person's attitude certainty. The one-sided message has less beliefs to strengthen an attitude. There was no significant difference between motivated and unmotivated receivers of the other two messages.

► TRUST IN THE SOURCE

The trust items were added to the questionnaire because trust was expected to depend on message type. However, no formal hypotheses were formulated about the outcome. The only expectation was that trust would be related to the credibility of the message, which proved to be the case (see Table 6-25).

Table 6-25 *Correlation between credibility and trust related concepts.*

Concept	*r*	*p*
Trust	.50	.00
Competence	.32	.00
Honesty	.29	.00
Care	.34	.00

To see if the involvement manipulation and message type had any effect on trust and the dimensions of trust, a multivariate analysis of variance was done with the trust concepts as dependent variables and involvement manipulation and message type as independent variables. As Table 6-26 below shows, no overall effects were found. Inspection of the effects on each individual concept, by means of univariate analyses of variance with the same independent variables, showed message type had a significant effect on trust and a marginally significant effect on competence (Table 6-27). Additional contrast analyses showed this effect was due to a significant difference in perception between receivers of the two-sided refutational message and receivers of the one-sided message. From the mean scores it is clear that the former subjects trust the source of the information more than latter ones, $F(1, 112) = 7.47$ ($p = .01$), and that they also judge the source to be more competent $F(1, 112) = 5.03$ ($p = .03$)[18]. The mean scores and standard deviations per experimental condition of each trust concept are given in Appendix G.

Table 6-26 *Multivariate Analysis of Variance for trust-related concepts.*

Source	Wilks' Lambda	*df*	*F*	*p*
Involvement manipulation (I)	.98	4, 162	< 1	*ns.*
Message type (M)	.94	8, 324	1.28	.25
I x M	.99	8, 324	< 1	*ns.*

---

[18] A similar multivariate analysis with median split motivation instead of involvement showed a marginally significant main effect for motivation (Wilks' Lambda (4, 162) = .95, $p = .07$), which univariate analyses of variance for each separate trust concept proved to be caused by a marginally significant main effect on openness and a significant main effect on care ($F(1, 165) = 3.35$ ($p = .07$) and 6.86 ($p = .01$), respectively). For both variables, the mean scores were higher for motivated subjects compared to unmotivated subjects. The message sidedness effect of course was the same as with the original involvement manipulation.

Table 6-27 *Univariate Analysis of Variance for separate trust concepts.*

Effect	df	Trust F	p	Competence F	p	Openness F	p	Care F	p
Involvement manipulation (I)	1	1.47	.23	1.95	.16	< 1	ns	2.03	.16
Message type (M)	2	3.21	.04	2.52	.08	1.29	.28	< 1	ns
I x M	2	< 1	ns	< 1	ns	< 1	ns	< 1	ns
Error	165	(1.11)		(1.06)		(1.53)		(1.10)	

Note. Values enclosed in parentheses represent mean square errors.

6.3 SUMMARY

In this section the results discussed in this chapter are summarized. The table below shows every hypothesis and whether it was confirmed or not. Noteworthy results that were not hypothesized are given after the table.

Table 6-28 *Correspondence of the data with the hypotheses*[19].

Hypothesis		Supported	Not supported
H1	The effect of message sidedness on the receiver's attitude toward bio-energy depends on the receiver's level of involvement.		
	When involvement is low, a. a one-sided message leads to a more positive attitude toward bio-energy than a two-sided message;		X
	When involvement is high, b. a two-sided message leads to a more positive attitude toward bio-energy than a one-sided message;		X
	c. a two-sided refutational message leads to a more positive attitude toward bio-energy than a two-sided nonrefutational message.		X
H2	A one-sided message is perceived to be clearer than a two-sided message.		X
H3	The effect of message sidedness on the perceived persuasiveness of the message depends on the receiver's level of involvement.		
	When involvement is low, a. a one-sided message is found to be more persuasive than a two-sided message;		X

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[19] The results of the analyses with median split motivation did not always have the same results as the original manipulation. A closer look at mean motivation scores and standard deviations of the two median split based groups showed that the distinction unmotivated – motivated was not entirely correct. The group with a motivation score higher than the median was a narrow group (M = 1.65, SD = .39), but the other group was broader and also contained motivated subjects (M = .05, SD = .88). In other words, the so-called unmotivated groups was not homogeneous with respect to motivation. A potentially better distinction between motivated and unmotivated subjects can be made by splitting the sample into three groups based on their motivation (e.g. –3 to –1, +1 to +3, and in between), and then comparing the two extreme groups. However, for the present study this procedure would mean discarding more than one third of the sample, greatly reducing the power of the analyses.

Table 6-28 *Correspondence of data with the hypotheses (continued).*

Hypothesis		Supported	Not supported
	When involvement is high,		
	b. a two-sided message is found to be more persuasive than a one-sided message;		X
	c. a two-sided refutational message is found to be more persuasive than a two-sided nonrefutational message.		X
H4	The effect of message sidedness on the perceived credibility of the message depends on the receiver's level of involvement.		
	a. When involvement is low, a one-sided message is judged more credible than a two-sided message;		X (reverse)
	b. When involvement is high, a one-sided message is judged less credible than a two-sided message.	V	
H5	When involvement is high, a one-sided message will result in a more negative valence of thought than a two-sided message.	V	
H6	The effect of message sidedness on the attitude toward the message depends on the receiver's level of involvement.		
	When involvement is low,		
	a. people have a more positive attitude toward a one-sided message than toward a two-sided message;		X
	When involvement is high,		
	b. people have more positive attitude toward a two-sided message than toward a one-sided message;		X
	c. people have a more positive attitude toward a two-sided refutational message than toward a two-sided nonrefutational message.		X
H7	Involved subjects have a higher number of relevant thoughts while reading the message than uninvolved subjects.		X
H8	Involved subjects recognize the sidedness of the message they received more accurately than uninvolved subjects.		X
H9	Involved subjects recognize arguments more accurately than uninvolved subjects.	½	½
H10	Attitude toward bio-energy is negatively correlated with behavioral intention to oppose realization of bio-energy (a more positive attitude > less intention to oppose).	½	½
H11	Attitude strength is higher when involvement is high than when involvement is low.	½	½

There are some other results worth noting. First of all, the two groups that resulted from the involvement manipulation did not differ on their level of involvement. They did differ significantly on their level of motivation. Subjects in the low involvement condition were more motivated than subjects in the low involvement condition were. Second, attitude toward bio-energy was significantly more positive for subjects in the high involvement condition compared to subjects in the low involvement condition. Third, a two-sided refutational message was judged significantly more credible than a one-sided message. The two-sided refutational message was also judged marginally more credible the two-sided message without refutation. Last, people trusted the source of a two-sided refutational message significantly more, and judged the source marginally significantly more competent, than the source of a one-sided message.

7 CONCLUSIONS, DISCUSSION AND RECOMMENDATIONS

The present research was conducted to test the effect of message sidedness and possible refutation on one's attitude regarding bio-energy and to test to what extent involvement moderates this effect. The first section of this chapter gives an overview of the conclusions that can be drawn based on the results of this research. After this overview, the second section first provides a discussion of both the results and the methodology, followed by the practical implications of the results.

7.1 CONCLUSIONS

Overall, subjects judged the messages about bio-energy to be persuasive, credible, and clear, and to plead for bio-energy. After reading any one of the messages, subjects had a positive attitude toward bio-energy, and were rather certain about their attitude.

On the basis of the Elaboration Likelihood Model (Petty & Cacioppo, 1986), the effects of a one-sided, two-sided nonrefutational, and two-sided refutational message were expected to be different under high involvement than under low involvement. This was expected because the different levels of involvement were expected to lead to different levels of motivation and thus to different levels of processing, i.e. central for involved and peripheral for uninvolved people (see Figure 7-1). However, the involvement manipulation did not result in two significantly different levels of involvement. What did differ significantly between the two manipulation groups, was the level of motivation, which was higher for subjects in the high involvement condition than for those in the low involvement condition. Consequently, the conceptual model, as shown in Figure 7-1, could only be tested from motivation and down, i.e. the black arrows and words in the figure. All main effects of the manipulation could thus only be attributed to a difference in motivation, not to a difference in involvement. With regard to the expected difference in level of processing between the two manipulation groups, only one of the three measures showed an indication of this effect of motivation; highly motivated receivers of the two-sided refutational message were significantly more accurate in recognizing arguments than were low motivated receivers of that message.
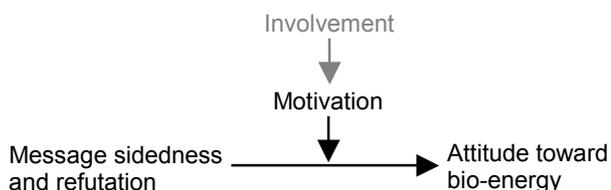
Involvement

↓

Motivation

↓

Message sidedness and refutation ——————→ Attitude toward bio-energy

Figure 7-1 *Conceptual model.*

The main hypothesis said uninvolved subjects would have a more positive attitude toward bio-energy when receiving a one-sided message than when receiving a two-sided message, with or without refutation. For involved subjects, the one-sided message was expected to lead to the least positive attitude, and the two-sided refutational message to the most positive. However, the data provided no support for this hypothesis, since there were no significant differences between the experimental conditions.

The one-sided message was expected to be judged clearer than the two-sided messages, since all arguments in the one-sided message advocate the same position, while they point in opposite directions in the two-sided message. The data showed no difference in perceived clarity between the message types, and the hypothesis about clarity was thus not supported.

The hypotheses regarding the perceived persuasiveness of the message and the attitude toward the message were also not supported by the data, because again no differences between conditions were found.

What the data did show was that the two-sided refutational message was perceived to be more credible than the one-sided message, regardless of the receiver's level of involvement. This sidedness effect was expected in the high involvement condition, but not in the low.

The involvement manipulation, and thus motivation, and message type had an interaction effect on the valence of subject's thoughts while reading a message. The thought valence of motivated receivers of the two-sided messages was more positive than that of motivated receivers of the one-sided message. When the subjects were unmotivated, the effect was the other way around. This interaction effect was due to the number of positive thoughts subjects had, which varied as a result of involvement in combination with message type.

Another hypothesis that was tested predicted that a person's attitude toward bio-energy correlated negatively to his or her intention to oppose the realization of bio-energy. Over the entire sample, a marginally significant negative correlation was found. The data do suggest that this correlation might only exist for motivated people however, since for subjects in the high involvement conditions the correlation was marginally significant, while for those in the low involvement conditions it was nearly nonexistent. This is in line with the predictions of ELM, according to which attitudes are predictive of behavior when processing is done centrally but not when it is done peripherally (Petty, Cacioppo, & Schumann, 1983).

A person's attitude certainty was expected to be correlated to his or her involvement. Though no main effect of the involvement manipulation was found, the data point in the expected direction since the correlation between attitude strength and both involvement and motivation was significant.

Besides the variables related to the hypotheses, the questionnaire also contained items about trust. Subjects were asked about their trust in the source, and how they perceived the source's competence, openness, and care. No effect on the latter two concepts was found, but trust in the source and the rating of the source's competence were both higher when the message was two-sided and contained refutation than when it was only one-sided.

Another effect that was not hypothesized was that of motivation on attitude. The hypotheses mostly concerned effects of message type within the two motivational conditions, and not between them. However, the data showed motivated subjects had a more positive attitude towards bio-energy than unmotivated people.

7.2 DISCUSSION AND RECOMMENDATIONS

7.2.1 SCIENTIFIC

► RESULTS

The two manipulated levels involvement were expected to result in different levels of motivation, and thus of processing. The thought listing data nor the sidedness recognition data showed any sign of this difference. The argument recognition data did show a difference between the two involvement conditions, but only when subjects received a two-sided refutational message. This effect implies a difference in level of processing, but whether this is a difference between peripheral and central processing, or between two different levels of central processing is unclear. On first sight, the high argument recognition accuracy (M = .74 (SD = .21)) points in the direction of two levels of central processing. However, peripheral processing of the one-sided and two-sided nonrefutational message can also have resulted in this high accuracy, for these messages contained only a few arguments that were uncorrelated, which could thus be easily identified, or guessed. The idea that all subjects processed the information centrally is countered by the significant difference in attitude toward bio-energy between the motivated and the unmotivated group. Though this effect was not hypothesized, it is not surprising. According to the ELM (Petty & Cacioppo, 1986), people that are motivated process a message thoroughly, while people that are not motivated process peripherally. When people hardly have an attitude toward an attitude object, it is not surprising that people who elaborate on a persuasive message show more attitude change than people who process peripherally. When the message is positive, as in this experiment, the attitude will change in the positive direction. This results in a more positive attitude for motivated people than for unmotivated people. Similar results have been obtained for different attitude objects in other studies (e.g. Hastak & Park, 1990[20]).

No effect of message type on attitude was found. Message type did have an effect on perceived credibility of the message and on trust in, and perceived competence of its source, which were all higher for the two-sided refutational message than for the one-sided message. According to Attribution Theory, perceived credibility influences a person's attitude toward the topic of the message, but this effect is decreased by the content of the presented counterarguments (Crowley & Hoyer, 1994). This is a possible reason for the absence of an

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[20] Their initial manipulation check showed no difference in involvement between the manipulation conditions. When a post hoc distinction between involved and uninvolved subjects was made by means of a median split on the involvement measure, the former group had a significantly more positive attitude toward the attitude object than the latter group.

effect of message type on attitude toward bio-energy; the content of the counterargument used in this experiment might have entirely countered the impact of the increased credibility of the two-sided refutational message in comparison to the one-sided message. To be able to control for this possibility, future research should use several messages that differ in the counterarguments they contain. These counterarguments should for their part differ in perceived persuasiveness, which should be tested in a prestudy.

► **METHODOLOGY**

In this section the methodology that was used to collect the data is discussed. The manipulation is reviewed first, followed by the procedure, the material and the measures, respectively.

This research focused on involvement for two reasons. The first reason was that attitude change is thought to depend on the whether a message is processed centrally or peripherally. Which route is used is supposed to depend on the level of motivation a person has. A person's motivation in turn is influenced by that person's involvement. Thus, involvement is expected to influence, i.e. moderate, the effect message characteristics have on a person's attitude. This made it an interesting concept to research. The second reason was more practical, namely that involvement is a characteristic on which different groups can be selected, thus enabling more specific communication with groups differing in involvement. However, the data showed that the manipulation did not influence involvement but that it influenced motivation directly, resulting in two groups with significantly different levels of motivation. When the manipulation was tested in Prestudy 2, it did have a highly significant main effect on involvement, and a marginally significant effect on motivation. A reason for this incongruity might be found in the order of the questions. In Prestudy 2, involvement was measured directly after the messages, while in the experiment the involvement items were preceded by the main dependent measures. The presence of the dependent measures might have sent subjects the signal that the true topic of the research was bio-energy. This knowledge, in combination with a subject's willingness to do what they think the researcher wants, could lead to an upward adjustment of subject's involvement and motivation in the experiment. However, because the wording of the motivation items explicitly linked it to before the experiment ("When I read that bio-energy was one of the topics, I thought the information about it…"), this upward adjustment did not occur for the motivation measures. This might be what caused the difference in involvement level between the two conditions that was visible in Prestudy 2 to disappear in the experiment, while the difference in level of motivation remained. This explanation is supported by the mean involvement and motivation scores in the Prestudy and the experiment[21].

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[21] Two-tailed independent samples t-tests were done to test for differences in mean scores between Prestudy 2 and the experiment. Mean motivation in the low involvement condition was $M = .20$ ($SD = 1.46$) in Prestudy 2 and $M = .61$ ($SD = 1.17$) in the experiment, respectively. This was not significantly different, $t(102) = -1.35$, $p = .18$. The same was true for motivation in the high involvement condition (t

In hindsight, that the manipulation influenced motivation but not involvement is not so surprising. Kiesler, Collins and Miller (1969) already said that when people have promised to participate in an experiment, in general, they are motivated to follow the instructions. Thus, when the instructions tell them to pay special attention to one particular topic, motivation to read about that topic will increase. This was also the reason for using this manipulation; It was expected that subjects' involvement, and thus motivation to process the bio-energy message, would decrease when they were instructed to pay special attention to one of the dummy topics, thus resulting in a bigger contrast in involvement between the two conditions. Though the two groups did differ significantly in motivation, both still had a mean motivation higher than zero on a scale of –3 to +3, i.e. decreasing motivation was not successful.

The procedure that was used to find participants for the experiment was not the same for the two locations that were visited. While in Eindhoven external factors were largely controlled because subjects had to fill in the questionnaire in a quiet classroom, this was not the case in Tilburg, where subjects were asked to fill in the questionnaire on the spot. Thus in the latter location there was less control over subjects' ability to process the message, which might not always have afforded central processing. Preferably, all questionnaires are filled in in a controlled environment. Then, if external factors do limit ability, this will be so for all subjects, or at least it is known for whom this is so. This knowledge can then be taken into account in the analyses. A possibility is to run the experiment on the computer, instead of on paper. This method also affords more control over the entire procedure, e.g. leafing back to the message while answering the questions can be prevented.

The experiment used five arguments about bio-energy, i.e. three pro bio-energy arguments, one con, and one refutation of the con argument. Use of other arguments might have led to different results. A more persuasive counterargument would only influence message characteristics of the two-sided message but not of the one-sided message, thus changing the effect of message sidedness. At the same time, this influence is not expected to be the same for all message characteristics. For instance, the overall persuasiveness of the two-sided message would probably decrease, while its credibility would probably be unchanged, given that it is expected to stem from presentation of a counterargument and not from its content. Thus, caution is needed with regard to generalization of the results of this present study. Further tests are needed to find out whether other arguments would also result in a different pattern of results.

The order in which the arguments were presented in the messages was done in such a way to minimize the differences between the messages. In the two-sided messages, the

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(109) = -.82, p = .41), in which the means were M = .83 (SD = .66) and M = .99 (SD = .91), respectively. Involvement did differ significantly between the two studies, but only in the two low involvement condition, t (102) = -2.19, p = .03. Subjects in the Prestudy were less involved than subjects in the experiment (M = 1.74 (SD = .93) and M = 2.38 (SD = 1.23), respectively). In the high involvement condition, mean involvement was M = 2.66 (SD = 1.17) in Prestudy 2 and M = 2.39 (SD = 1.13) in the experiment, which is not significantly different, t (109) = 1.00, p = .32.

counterargument was mentioned before the last pro bio-energy argument, which was the least persuasive of the three support arguments. This way, if subjects showed a recency effect, i.e. when the last argument had the most impact, this effect would involve the same argument for all messages. Igou and Bless (2003) found that people do show a recency effect, but only when they receive a two-sided message, because then they expect the most important argument to be mentioned last. When receiving a one-sided message though, they expect the most important argument to be mentioned first, and consequently show a primacy effect. Summarizing, the effect of message type seems to be moderated by the order of the arguments presented. If this is true, and a two-sided message ends with its least persuasive argument, the receiver might infer the entire message is not persuasive because he or she expects the last argument to be the most persuasive. This might have happened with the two-sided messages in this study, for the arguments were ordered from most to least persuasive in every message. At the same time, the one-sided message might have been judged more persuasive because of a recency effect. The present experiment was not designed no test for recency or primacy effects. A suggestion for future research to test this moderating role of argument order is to make several one- and two-sided messages which differ in the order of the arguments. The two-sided messages should vary not only whether the most persuasive argument is presented first or last, but also which argument type is presented first, i.e. pro or con. The different messages within each message type can then be compared with each other to test for primacy and recency effects. The corresponding one- and two-sided messages can also be compared to test which message type has the most positive effect on a person's attitude toward the topic of the message. If argument order is a moderator of the effect message type has on a person's attitude toward the message topic, this has practical implications; a source should then not only be careful what message type to use, but also in which order to present the arguments.

7.2.2 PRACTICAL

The present research was done to find out what type of message can best be used to make people form a positive attitude toward bio-energy. This preferred message type was expected to be different for uninvolved than for involved people, because they would differ in motivation, and thus in method of information processing. However, most hypotheses about the effects of message type, moderated by motivation, were not supported by the data. Therefore, the results of the experiment do not provide many suggestions as to which message type leads to a more positive attitude under high or low involvement or motivation. However, when motivation to process is high, either because of involvement or for other reasons, a two-sided refutational message is preferable over other messages because it is judged more credible, and the source is trusted more and judged more competent. A two-sided refutational message also leads to more positive thoughts that are relevant to the message or the topic when motivation is high. Yet when motivation is low, no one message is preferred on the basis of all measures. For while a two-sided refutational message scores better on message credibility, and trust in and competence of the source, it induces less

positive relevant thoughts than a one-sided message. So while no suggestions can be made with regard to the effect on attitude, when increasing trust is the objective, a two-sided refutational message is favored over a one-sided message and.

Beside the main target of this study, the data indicate that for motivated people, a more positive attitude toward bio-energy goes with less strong behavioral intention to oppose to bio-energy. This result supports PDE's aim to promote the awareness of bio-energy and to have the general public form a positive attitude toward bio-energy.

In addition, some indications have been found that people are more certain about their attitude after reading a message when they are more motivated to process that message. Thus, to have people form an enduring and stable attitude, they should be motivated to process the information on which they base that attitude.

The results of this study are found with a specific set of arguments about bio-energy. Other arguments will be perceived differently by people, which will lead to different attitude. Further tests are needed to find out whether this would also change the pattern of the results.

In the end, the answer to the question "to refute or not to refute" seems clear. Whether it does something to people's attitude and how motivation fits in the process, that still is the question.

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INDEX OF APPENDICES

APPENDIX A PRESTUDY 1

The selection of arguments for the messages was done with a prestudy. Before running this prestudy a list of arguments concerning bio-energy was compiled using a variety of sources: newspaper articles, websites, scientific publications, college books, results of consumer research done at the research group of Human Technology Interaction and interviews with experts both at the university and at PDE. The arguments were then categorized according to their principal idea, e.g. "good for the environment" or "better than fossil fuels". This list of arguments can be obtained from the author (in Dutch only). After categorizing the arguments those that were not suitable for any of the three messages were removed, i.e. all counterarguments that had no proper refutation, and arguments about those aspects of bio-energy that are not relevant for the present study (see Section 2.4). The final list of arguments contained twenty pro bio-energy arguments, ten counterarguments and their refutation (see Appendix E for the entire list). In this prestudy these arguments were tested on position regarding bio-energy, persuasiveness, clarity, and newness.

A.1 METHODOLOGY

Subjects were recruited in the canteen the Fontys Hogeschool in Eindhoven and the Eindhoven University of Technology. They were asked for fifteen minutes of their time to fill in a questionnaire about their evaluation of several statements about bio-energy. This could be done on the spot. Subjects received no compensation.

This prestudy consisted of two questionnaires, each of which contained ten pro bio-energy arguments, five counterarguments and five counterarguments with refutation, which were called statements. The order of the statements was chosen randomly. The list of arguments was divided in two in order to keep the time to fill in the questionnaire acceptable, which meant each subject rated half of the statements.

For each statement the procedure was the same. First subjects were presented with an argument. The argument was followed by four questions about the quality of that argument. The first question was "Do you find this statement to plead for or against bio-energy?". The 7-point answer scale ranged from –3 (pleads very much against bio-energy) to +3 (pleads very much for bio-energy). They then had to rate the statement on persuasiveness, clarity and newness ("To what extent do you find this statement about bio-energy persuasive/clear/new?"). The answering scales for these questions ranged from 0 (not …) to 6 (very …). All intermediate points were labeled as well for all four questions.

After the twenty statements, the questionnaire was concluded with questions about age, sex, education, prior knowledge about bio-energy and membership of environmental organizations.

An example of the lay-out of the questionnaire is given in Appendix F.

A.2 RESULTS

A.2.1 SAMPLE DESCRIPTIVES

In total 48 non-technical students participated. They were evenly distributed among the two questionnaires. 56% of the sample was male and 44% was female. The youngest participant was 18, the oldest 26. The mean age of the sample was 21.3 years old (SD = 2.3 year). Sex nor university had any significant effect on the evaluation of the arguments that were ultimately chosen for use in the experiment.

Four subjects were removed from the dataset on the basis of their prior knowledge about bio-energy, which they rated to be "above average" (higher than 3 on a scale of 0 to 6)[22]. Of the remaining 44 subjects, four were member of an environmental organization. Their evaluation of the arguments did not differ from the rest of the sample and therefore they were not removed from the dataset.

Due to the ambiguous wording of one pro bio-energy statement ("Most types of biomass are waste products that have no further function. Because of this, most of the time the fuel for bio-energy is cheap."), it could be seen as either one or two arguments. For scientific reasons it is important to know how many arguments the message contained. As the data do not show whether subjects viewed it as one argument or as two, this statement was removed from the analysis.

A.2.2 PRO ARGUMENTS

The criterion for further consideration of a pro bio-energy argument was that it scored higher than the midpoint of the scale on position, persuasiveness and clarity (> 3, "rather …"). For the position of the argument this meant the score had to be rated higher than 1.5 for the arguments in favor of bio-energy, since that is the midpoint of the pro bio-energy part of the scale. Six of the twenty pro bio-energy arguments met all these criteria. A seventh was added on the basis of its high clarity rating (M = 4.35, SD = 1.04). These arguments are given in table A-2 on the next page. The left column shows the category the argument was assigned to, based on the principle idea behind the argument. Examples of categories are "good for the environment", and "useful application of rest products" (category 1 and 2, respectively). The columns on the right of the table show the average scores and standard deviation (between parentheses) for the dimensions position, persuasiveness, and clarity.

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[22] Using the entire sample changes the mean ratings of the arguments, but not to such extent that the arguments selected would not meet the criteria set for selection.

Table A-1 *Mean ratings (standard deviation) of pro bio-energy arguments.*

Category	Argument (translation from Dutch)	Position	Persuasiveness	Clarity
2	Bio-energy from waste kills two birds with one stone; the waste problem is solved and energy is generated.	2.20[a] (.95)	4.05[b] (1.36)	4.05[b] (1.15)
3	If bio-energy is used to replace fossil fuels this will mean a reduction of harmful emissions.	2.00[a] (.98)	3.64 (2.06)	4.05[b] (1.46)
1	With the generation of bio-energy from biomass carbon dioxide (CO_2) is emitted. This is a less harmful greenhouse gas than methane (CH_4) that is produced when the same biomass is biologically degraded.	1.74 (.96)	3.30 (1.80)	3.17 (1.78)
2	The use of manure for the generation of bio-energy helps the reduction of the manure surplus.	1.73 (.71)	3.45 (1.37)	4.09[b] (1.11)
8	As bio-energy can be generated continuously, it can provide the base load in a future, 100% sustainable energy society.	1.63 (1.10)	3.21 (1.82)	3.21 (1.91)
3	Biomass, the energy source for bio-energy, grows quick. Generation of fossil fuels like oil, natural gas and coal takes many millions of years.	1.70 (1.26)	3.65 (1.47)	3.78[b] (1.68)
4	As biomass can be converted in bio-diesel, a form of bio-energy, it can also be used in transportation. For energy from wind and solar this is not possible.	1.43 (1.21)	3.25 (1.77)	4.35[b] (1.04)

[a] = position significantly higher than the midpoint of the positive side of the scale, 1.5 ($p < .05$).

[b] = mean score significantly higher than the midpoint of the scale, 3.0 ($p < .05$).

A.2.3 COUNTERARGUMENTS AND REFUTATION

None of the counterarguments, with or without refutation, met all the criteria that were used for selection of the pro bio-energy arguments (the position criterion for counterarguments was a rating lower than –1.5). Therefore, the difference between the position of the counterargument and that of the counterargument in combination with its refutation was used for a first selection. The results showed that addition of the refutation had a neutralizing effect on the perceived position of every counterargument. While a counterargument by itself scored negatively on position, i.e. was perceived to plead against bio-energy, that same argument in combination with its refutation scored close to neutral. This effect was significant for four of the ten counterarguments with refutation ($p < .05$). The counterargument for which this effect was largest also met the criteria clarity and persuasiveness, though in combination with its refutation persuasiveness was rated below the midpoint of the scale (see Table A-2). On the basis of these ratings this argument was selected as counterargument for the two-sided messages.

Table A-2 *Mean ratings (standard deviation) of counterargument and refutation.*

Category	Argument (translation from Dutch)	Position	Persuasiveness	Clarity
1	*Counterargument:* Bio-energy is not sustainable because the amount of biomass that grows in a period does not equal the amount that is used.	-1.45 (1.57)	3.14 (1.58)	3.36 (1.76)
	Counterargument in combination with refutation: Bio-energy is not sustainable because the amount of biomass that grows in a period does not equal the amount that is used. If fast growing wood types like willow and poplar, are planted, more biomass will grow and it will grow faster thereby making bio-energy sustainable.	.25 (1.62)	2.35 (1.46)	3.15 (1.42)

A.3 SELECTION OF ARGUMENTS

When two arguments in one message originate from the same principal idea, this combination is probably not as persuasive as two equally strong arguments that are based on different principal ideas. Therefore, only arguments that are categorized differently could be selected. As the best counterargument was categorized as "good/bad for the environment" (category 1), and so was the pro bio-energy argument about the harmfulness of carbon dioxide versus methane, the latter argument cannot be used. The two pro bio-energy arguments that were rated best were classified as category 2 and 3, respectively. Selecting these arguments meant two other arguments could not be used because they were also categorized 2 or 3 (see Table A-1 above). Of the two remaining arguments the last one was rated significantly better on two dimensions, clarity and newness (both *p* < .01) and was therefore selected as third and final pro bio-energy argument. Another content-related reason for selecting this argument was that it is linked to transportation, something most people come in contact with every day. This argument is therefore more tangible for the general public than the argument about the generation time of fossil fuels and biomass.

To summarize, the following arguments were selected on the basis of this prestudy:

Pro arguments
- Bio-energy from waste kills two birds with one stone; the waste problem is solved and energy is generated.
- If bio-energy is used to replace fossil fuels this will mean a reduction of harmful emissions.
- As biomass can be converted in bio-diesel, a form of bio-energy, it can also be used in transportation. For energy from wind and solar this is not possible.

Counterargument
- Bio-energy is not sustainable because the amount of biomass that grows in a period does not equal the amount that is used.

Refutation of counterargument
- If fast growing wood types like willow and poplar, are planted, more biomass will grow and it will grow faster thereby making bio-energy sustainable.

APPENDIX B PRESTUDY 2

The second prestudy was designed to test the persuasiveness, credibility, clarity, newness, and position of the three messages. The involvement manipulation was also tested in this prestudy. After the selection of the arguments the messages themselves were written. They were kept as bare and simple as possible to minimize potential differences between the messages other than the number of arguments and arguments themselves.

B.1 METHODOLOGY

B.1.1 SAMPLE AND PROCEDURE

Subjects were recruited in two instruction classes and in the library of the department of Technology Management at the Eindhoven University of Technology. They were asked to fill in a questionnaire about several topics. For compensation of the ten to fifteen minutes it took they received two treacle waffles ("stroopwafels"). The questionnaire was written in Dutch.

B.1.2 MATERIALS

► STIMULUS MATERIAL

The first page of the questionnaire contained the instructions and the involvement manipulation. All subjects were told they would get information on three topics, free-market rents, an EU-directive on software patents, and bio-energy. Free-market rents and the EU-directive were chosen as dummy topics because they had nothing in common with the real topic, bio-energy. Subjects were asked to read the information on all three topics since they would be asked questions about each. In the high involvement manipulation subjects were then asked to pay special attention to the information about bio-energy because that was of special interest to the me. In the low involvement manipulation subjects were asked to pay special attention to the information on either of the dummy topics. Half the subjects in this condition got the free-market rents as their focus topic, the other half got the EU-directive.

After the instruction the information on free-market rents, the EU-directive on software patents, and bio-energy was provided. In each involvement condition, one third of the subjects received the one-sided bio-energy message, one third received the two-sided bio-energy message and the last third received the two-sided refutational bio-energy message. The information on the two dummy topics was two-sided nonrefutational.

► MEASURES AND PREPARATION OF VARIABLES

INVOLVEMENT. Involvement with the three topics was measured using four items that were based on the four dimensions of involvement identified by Borgida and Howard-Pitney (1983). Subjects were asked 1) "To what extent is bio-energy a topic that is important to you?"; 2) "To what extent is bio-energy a topic you are interested in?"; 3) "To what extent is bio-energy a topic you care about?"; and 4) "To what extent is bio-energy a topic you feel involved with?". The answer scales ranged from 0 ("not") to 6 ("very much").

Next were four items about consequences of involvement with bio-energy: 1) "To what extent is bio-energy a topic you go deep into?"; 2) "To what extent is bio-energy a topic you would like to know more about?"; 3) "How concentrated were you when you read the information about bio-energy?"; and 4) "How much or little attention did you pay to reading the information about bio-energy?". The answer scale of the first three questions ranged from 0 ("not") to 6 ("very much"), that of the last question ranged from -3 ("very little attention") to +3 ("very much attention").

The involvement manipulation check was concluded with five items measuring message relevance, or motivation to process the bio-energy information (Laczniak & Muehling, 1993). All questions started with "When I read that bio-energy was one of the topics, did you think the information about it…". The specific questions then read: 1) "…might be important to me"; 2) "…might be useful to me"; 3) "…might be worth paying attention to."; 4) "…might be worth remembering."; and 5) "…is not interesting to me". Answers were given on a 7-point scale, ranging from –3 ("entirely disagree") to +3 ("entirely agree").

All items related to involvement with bio-energy were grouped and one inter-item correlation was calculated, Alpha = .92. No item could be deleted to increase Alpha. Subsequently, a factor analysis was performed to check whether the three theorized concepts were detected in the data. Principal axis factoring with Varimax rotation showed a three-factor solution that explained 65% of the variance. These three factors corresponded with the three concepts, except for two of the consequences items ("To what extent is bio-energy a topic you go deep into?" and "To what extent is bio-energy a topic you would like to know more about?"), which primarily loaded onto the motivation and involvement factor, respectively. After removal of these item because they did not fit the theorized concept, a second factor analysis was done. The extracted factors entirely corresponded with the theorized concepts. The items within each concept also had a good inter-item correlation, as Table B-1 shows, together with the eigenvalues and percentage of explained variance after rotation. The unweighted mean of all items related to one concept was used as aggregate measure for that concept.

The inter-item correlation for the items measuring involvement with each dummy topic was good (.89 for free-market rents, and .91 for the EU-directive).

Table B-1 *Eigenvalues and percentage of explained variance after rotation and inter-item correlation per involvement-related factor.*

	Factor		
	Involvement	Motivation	Consequences
Eigenvalue	2.82	3.42	1.34
Explained variance	26%	31%	12%
Range factor loadings	.71 – .83	.60 – .86	.52 – .93
Cronbach's Alpha	.90	.89	.72

MESSAGE CHARACTERISTICS. Next, subjects were asked to read the bio-energy information again. The information was given on the same page so subjects did not have to leaf through the questionnaire. They were then asked to rate the entire message on the same characteristics as in Prestudy 1. A question about credibility was added. The first question was "Do you find this information to plead for or against bio-energy?". The 7-point answer scale ranged from –3 (pleads very much against bio-energy) to +3 (pleads very much for bio-energy). They then had to rate the argument on persuasiveness, clarity, credibility, and newness ("To what extent do you find this information on bio-energy persuasive/clear/credible/new?"). The answering scales for these questions ranged from 0 ("not …") to 6 ("very …"). All intermediate points were labeled as well for all four questions.

PERCEIVED MESSAGE SIDEDNESS. Perceived message sidedness was measured by asking subjects "What type of arguments does the information on bio-energy contain according to you?". The answer categories were "exclusively arguments in favor of bio-energy", "exclusively arguments against bio-energy", and "both arguments in favor and against bio-energy".

ATTITUDE TOWARD BIO-ENERGY. Attitude toward bio-energy was measured with four semantic differential scales. Subjects were asked to indicate what they thought of bio-energy on a 7-point scale with the following opposite extremes: 1) negative – positive, 2) unfavorable – favorable, 3) bad – good, and 4) undesirable – desirable.

Inter-item correlation for the four attitude items was good, Alpha = .83. No Alpha-if-item-deleted was higher .80, and thus an unweighted mean of all items was calculated as aggregate measure of attitude toward bio-energy.

PERSONAL DETAILS. The questionnaire ended with questions about age, sex, education, prior knowledge about bio-energy and membership of environmental organization. A question was added to find out whether subjects had participated in an experiment about bio-energy before.

The lay-out of this questionnaire is the same as the one used for Prestudy 2 and the actual experiment. See Appendix F, which is an excerpt of the questionnaire used in the experiment.

B.2 RESULTS

B.2.1 SAMPLE DESCRIPTIVES

In total 44 non-technical students participated in the second prestudy. 80% of the sample was male, 20% was female. The mean age of the sample was 20.8 years old (*SD* = 2.33), the youngest participants being 19, the oldest 27.

On average, subjects had little to average knowledge of bio-energy prior to the prestudy, *M* = 2.68 (*SD* = 1.27). Five subjects were member of an environmental organization, nine out of the 44 used sustainable electricity ("groene stroom") at home. Both members of environmental organizations and users of sustainable electricity were evenly distributed over the two involvement conditions.

B.2.2 INVOLVEMENT MANIPULATION

The aggregate measures for involvement, motivation to process and consequences of involvement were used to evaluate the effect of the involvement manipulation (see Table B-2 for mean scores). Analyses of variance with involvement manipulation as independent factor and one of the three involvement-related concepts as dependent measure showed the effect of the manipulation was significant for both involvement itself and consequences of involvement. The difference in motivation was marginally significant (Table B-3).

As a double check a comparison of the involvement scores was made between subjects who were asked to pay special attention to one of the dummy-topics and those who were asked to pay special attention to the other two topics. A t-test showed no significant effect for either of the two dummy topics ($t(42) = .78$ for the free-market rents and $t(42) = .35$ for the EU-directive).

Table B-2 *Mean ratings (and standard deviation) per involvement concept.*

		Involvement-related concept		
Manipulation condition	*n*	Involvement [0 ; 6]	Motivation [-3 ; +3]	Consequences [0 ; 6]
Low involvement	20	1.74 (.93)	.20 (1.46)	1.53 (1.07)
High involvement	24	2.66 (1.17)	.83 (.66)	2.48 (.634)

Table B-3 *Univariate Analysis of Variance for separate involvement concepts.*

		Involvement		Motivation		Consequences	
	df	*F*	*p*	*F*	*p*	*F*	*p*
Involvement manipulation	1	8.09	.01	3.53	.07	13.47	.00
Error	42	(1.14)		(1.21)		(.74)	

Note. Values enclosed in parentheses represent mean square errors.

B.2.3 MESSAGE TYPES

The mean message quality ratings are shown in Table B-4. This table shows the three messages scored well on all but newness, which was far below the midpoint of the answer scale for each message (the criterion set for the individual arguments in Prestudy 1). An analysis of variance with message type as independent variable and message position as dependent variable showed a marginally significant main effect ($F(2, 41) = 5.04$, $p = .01$); the one-sided message was rated to plead more in favor of bio-energy than either two-sided message. Similar analyses for the other message dimensions showed no main effect of message type ($F < 1$ for all dimensions).

The last question that was asked about the message was what kind of arguments it contained. The subjects who read the one-sided message all correctly answered "exclusively arguments in favor of bio-energy". For the two-sided messages the correct answer was "both arguments in favor of and against bio-energy". 62% of the receivers of the two-sided nonrefutational gave the correct answer, for the two-sided refutational message this

percentage was 81%. Subjects who did not give the correct answer all said the message contained only arguments in favor of bio-energy. Nonparametric Kruskal-Wallis analyses showed the sidedness of the one-sided message was correctly recognized significantly more often than both other messages were recognized as two-sided (χ^2(1) = 12.46, p = .00 for the nonrefutational, and χ^2(1) = 20.31, p = .00 for the refutational message).

Table B-4 *Mean rating per dimension per message type.*

	Message type		
	one-sided	two-sided	two-sided refutational
Dimension [scale]	*n* = 15	*n* = 13	*n* = 16
Position [-3 ; +3]	2.27 (.59)	1.15 (1.14)	1.56 (1.03)
Persuasiveness [0 ; 6]	3.20 (1.15)	2.92 (1.19)	2.81 (.83)
Clarity [0 ; 6]	3.47 (1.25)	3.62 (.96)	3.56 (.73)
Credibility [0 ; 6]	3.13 (1.41)	3.31 (1.18)	3.25 (.86)
Newness [0 ; 6]	1.87 (1.13)	1.62 (1.66)	1.88 (1.26)

B.3 CONCLUSIONS

The goal of this Prestudy was to test whether the involvement manipulation was successful in creating two distinct levels of involvement with bio-energy. The data showed that asking subjects to pay special attention to the information on bio-energy resulted in a significantly higher level of involvement and consequences of involvement than asking them to pay special attention to information on one of the dummy topics. The difference in motivation was marginally significant.

Though neither of the three messages met the criterion set for each characteristic, they were rated well on all characteristics, except newness. In other words, the messages were thought to plead in favor of bio-energy, and to be persuasive, clear, and credible. The overall conclusion is that the messages are good enough to be used in the experiment.

APPENDIX C QUESTIONNAIRE

This appendix contains the original text of the questionnaire that was used to gather the data. The left column contains the original Dutch text, in the right column, the English translation is given. The headings shown here were not present in the original questionnaire. In the measure section, when a group of items has the same answer categories, these are given per group, not per item individually

As example of the lay-out used for the questionnaire an excerpt of the original questionnaire is given in Appendix F).

C.1 INTRODUCTION

Welkom bij dit onderzoek.

Welcome to this research.

Voor de afronding van mijn studie Techniek en Maatschappij aan de Technische Universiteit Eindhoven ben ik bezig met een afstudeeronderzoek. Het doel van dit onderzoek is om te weten te komen wat de meningen van mensen zijn over verschillende onderwerpen.

As part of my study Technology and Society at the Eindhoven University of Technology, I am working on a graduation research. The aim of this research is to find out what the opinion of people is on several topics.

Voor dit onderzoek gelden de volgende zaken:
- *Vertrouwelijk*

Je antwoorden zullen strikt vertrouwelijk behandeld worden. Ze zullen anoniem verwerkt worden; je hoeft je naam nergens op te schrijven.
- *Niet vooruit- of terugbladeren*

Beantwoorde de vragen alsjeblieft in de volgorde waarin ze in deze vragenlijst staan.
- *Geen goede of foute antwoorden*

Bijna alle vragen gaan over je mening of je beleving. Dat wil zeggen dat er geen sprake is van goede of foute antwoorden. Het is geen test!

The following things apply for this research
- *Confidential*

Your answers will be treated strictly confidential. They will be processed anonymously; you don't have to fill in your name anywhere.
- *Do not leaf forward or backward*

Please answer the questions in the order given by the questionnaire.
- *No right or wrong answers*

Almost all the questions deal with your opinion of perception. That means there are no right or wrong answers. It is not a test!

C.2 STIMULUS MATERIAL

Je krijgt zo meteen informatie over drie verschillende onderwerpen. Dit zijn achtereenvolgens: marktconforme huurprijzen, een EU-richtlijn voor softwarepatenten en bio-energie. Voorkennis over deze onderwerpen is niet nodig. Na alle informatie krijg je over elk onderwerp een stel vragen.

You will receive information about three different topics. These topics will be free-market rents, an EU-directive on software patents, and bio-energy, in that order. Prior knowledge about these topics is not necessary. After all the information you will be asked a few questions about each topic.

*<bold, red>*Lees alsjeblieft de informatie over alle drie de onderwerpen, maar ik wil je vragen vooral te letten op de informatie over bio-energie (marktconforme huurprijzen / EU-richtlijn) omdat ik met name hierover wil weten wat je mening is.*<end bold, red>*

Onderwerp 1 – marktconforme huurprijzen

Nederland kent voor huurwoningen een huurprijzensysteem dat gebaseerd is op sociale huur. Dat wil zeggen dat iedereen een voor hem of haar betaalbare huur moet krijgen. Een alternatief hiervoor is het systeem van marktconforme huurprijzen waarbij de hoogte van de huur wordt overgelaten aan de marktwerking.

Marktconforme huurprijzen leveren extra inkomsten voor woningcorporaties die kunnen worden ingezet voor nieuwbouw en woningverbetering. Het invoeren van marktconforme huurprijzen betekent wel een stijging van de huursubsidie-uitgaven van het rijk doordat de huren omhoog gaan. Ook kan het zijn dat direct na de overgang op dit nieuwe systeem de doorstroming van goedkopere naar duurdere huurhuizen stagneert. Dit omdat de oude huur gehandhaafd wordt zolang mensen niet verhuizen terwijl bij verhuizing de huur in één keer drastisch omhoog gaat. Daar staat tegenover dat marktconforme huurprijzen de doorstroming van huren naar kopen juist wel bevorderen doordat het verschil in de kosten van huren en kopen kleiner wordt. Hierdoor komen er weer sneller woningen vrij voor starters.

Onderwerp 2 – EU-richtlijn voor software patenten

In de Europese Unie wordt een ontwerp-richtlijn besproken voor softwarepatenten. Deze patenten zijn bedoeld om de rechten te beschermen van de uitvinders van software applicaties.

Deze richtlijn maakt het ondernemingen mogelijk hun R&D-investeringen en

*<bold, red>*Please read the information on all three the topics, but I want to ask you to pay special attention to the information on bio-energy (free-market rents / EU-directive) because I especially want to know what your opinion on that topic.<end *bold, red>*

Topic 1 – free-market rents

The Netherlands has a rent system for public housing that is based on social rents. That means that everyone must be able to get a rent that that he or she can afford. An alternative for this is the system of free-market rents where the height of the rent is left to the market processes.

Free-market rents provide extra income for housing corporations, that can be used for new development and house improvement. Introducing free-market rents will mean a rise in rent subsidy spending for the state because the rents will go up. It might also be so that right after the introduction of the new system the move up the housing ladder from within public housing will stagnate. The reason for this is that the old rents will be maintained as long as people do not move, while in case of a move, the rent will go up drastically. On the other hand, the move from public housing to privately owned houses will be promoted because the difference in costs between renting and owning a house will decrease. Because of this, more public housing will come available for starters.

Topic 2 – EU-directive on software patents

The European Union is discussing a draft directive on software patents. These patents are meant to protect the rights of the designers of software applications.

This directive makes it possible to protect their R&D-investments and designs in the field of information and communication technology with

uitvindingen op het gebied van informatie- en communicatietechnologie goed te beschermen met behulp van octrooien. Daarnaast sluit de richtlijn aan bij wereldwijde verdragen op het gebied van intellectueel eigendom. Wel maakt de richtlijn het mogelijk om triviale ideeën te patenteren, zoals het idee van een webshop. Door de licentiekosten die voortkomen uit patenten wordt het voor kleine ondernemers onmogelijk om dergelijke ideeën te gebruiken. De richtlijn waarborgt wel het beginsel van interoperabiliteit. Hiermee wordt het principe bedoeld dat men software mag bestuderen om zo nieuwe software ermee te kunnen laten samenwerken.

the help of patents. Besides, the directive fits the worldwide treaties in the sphere of intellectual property. The directive does also enable the patenting of trivial ideas, like the idea of a webshop. The license fees that result from these patents make it impossible for small entrepreneurs to use such ideas. The directive guarantees the principle of interoperability. This means that one can study software to design new software that can operate with the existing software.

Onderwerp 3 – bio-energie

Bio-energie is energie die verkregen wordt door verbranding, vergassing of vergisting van biomassa. Biomassa is een verzamelnaam voor organische stoffen die in een cyclus van enkele jaren steeds weer worden aangemaakt en gebruikt.

Als bio-energie wordt ingezet ter vervanging van fossiele brandstoffen betekent dit een vermindering van de schadelijke uitstoot. Daar komt bij dat met bio-energie uit afvalstromen twee vliegen in één klap worden geslagen: het afvalprobleem wordt opgelost en er wordt energie geproduceerd. Wel is het zo dat bio-energie niet duurzaam is wanneer de hoeveelheid biomassa die in een periode aangroeit niet zo groot is als de hoeveelheid die verbruikt wordt. *Als echter snelgroeiende houtsoorten, zoals wilgen en populieren, aangeplant worden groeit er meer biomassa en groeit het sneller aan. Op deze manier is bio-energie toch duurzaam.* Verder is biomassa om te zetten in biodiesel, een vorm van bio-energie, en kan het dus ook gebruikt worden in het verkeer. Bij wind- en zonne-energie is dit niet mogelijk.

Topic 3 – bio-energy

Bio-energy is energy generated by combustion, gasification, or digestion of biomass. Biomass is an umbrella term for organic material that is generated an used within a cycle of a few years.

If bio-energy is used to replace fossil fuels this will mean a reduction of harmful emissions. In addition, bio-energy from waste kills two birds with one stone; the waste problem is solved and energy is generated. On the other hand, it is so that bio-energy is not sustainable if the amount of biomass that grows in a period does not equal the amount that is used. *However, if fast growing wood types like willow and poplar, are planted, more biomass will grow and it will grow faster thereby making bio-energy sustainable. This way, bio-energy is sustainable.* Additionally, biomass can be converted in bio-diesel, a form of bio-energy, thus enabling use in transportation. For energy from wind and sun this is not possible.

Note. Underlined text = counterargument / *Italic* text = refutation

In the questionnaire this text had the same font as the rest of the text.

C.3 MEASURES

Nu volgt een aantal vragen over de drie onderwerpen waar je over gelezen hebt. We beginnen steeds met het laatste onderwerp, bio-energie.

Now follow a few questions on the three topics you just read about. Each time we'll start with the last topic, bio-energy.

C.3.1 ATTITUDE TOWARD BIO-ENERGY

Deze vragen betreffen je mening over bio-energie.

These questions are about your opinion on bio-energy.

Wat vind je van bio-energie?

What do you think of bio-energy?

1) Negatief – Positief
2) Ongunstig – Gunstig
3) Slecht – Goed
4) Onwenselijk – Wenselijk

1) Negative – Positive
2) Unfavorable – Favorable
3) Bad – Good
4) Undesirable - Desirable

-3	Heel erg (negatief)
-2	Behoorlijk (negatief)
-1	Beetje (negatief)
0	Er tussenin
1	Beetje (positief)
2	Behoorlijk (positief)
3	Heel erg (positief)

-3	Very (negative)
-2	Quite (negative)
-1	A little (negative)
0	In between
1	A little (positive)
2	Quite (positive)
3	Very (positive)

C.3.2 ATTITUDE STRENGTH

Over sommige onderwerpen zul je een meer uitgesproken mening hebben dan over andere onderwerpen. We willen graag weten hoe uitgesproken je mening over bio-energie is.

You will have a stronger opinion on some topics than on others. We would like to know how strong your opinion on bio-energy is.

5) In hoeverre ben je overtuigd van je mening over bio-energie?
6) In hoeverre twijfel je aan je mening over bio-energie?
7) In hoeverre vertrouw je op je mening over bio-energie?

5) To what extent are you convinced about your opinion on bio-energy?
6) To what extent do you doubt your opinion on bio-energy?
7) To what extent do you trust your opinion on bio-energy?

0	Niet
1	Klein beetje
2	Beetje
3	Nogal
4	Behoorlijk
5	Erg
6	Heel erg

0	Not
1	Very little
2	A little
3	Rather
4	Quite a lot
5	A lot
6	Very much

C.3.3 ATTITUDE TOWARD THE MESSAGE

Wat vind je van de informatie over bio-energie die je net gelezen hebt?

8) Slecht – Goed

- -3 Heel erg (slecht)
- -2 Behoorlijk (slecht)
- -1 Beetje (slecht)
- 0 Er tussenin
- 1 Beetje (goed)
- 2 Behoorlijk (goed)
- 3 Heel erg (goed)

What do you think of the information on bio-energy you just read?

8) Bad – Good

- -3 Very (bad)
- -2 Quite (bad)
- -1 A little bit (bad)
- 0 In between
- 1 A little bit (good)
- 2 Quite (good)
- 3 Very (good)

C.3.4 PERCEPTION OF THE INFORMATION

In hoeverre vind je deze informatie over bio-energie…

9) …overtuigend?

10) …duidelijk?

11) …nieuw?

12) …geloofwaardig?

- 0 Niet
- 1 Klein beetje
- 2 Beetje
- 3 Nogal
- 4 Behoorlijk
- 5 Erg
- 6 Heel erg

To what extent do you find this information on bio-energy…

9) …persuasive?

10) …clear?

11) …new?

12) …credible?

- 0 Not
- 1 Very little
- 2 A little bit
- 3 Rather
- 4 Quite a lot
- 5 A lot
- 6 Very much

Vind je deze informatie voor of tegen bio-energie pleiten?

13) Pleit tegen bio-energie – pleit voor bio-energie

- -3 Heel erg
- -2 Behoorlijk
- -1 Beetje
- 0 Er tussenin
- 1 Beetje
- 2 Behoorlijk
- 3 Heel erg (goed)

Do you find this information to plead for or against bio-energy?

13) Pleads against bio-energy – pleads for bio-energy

- -3 Very
- -2 Quite
- -1 A little bit
- 0 In between
- 1 A little bit
- 2 Quite
- 3 Very

C.3.5 THOUGHT LISTING

Wij zijn nu geïnteresseerd in de gedachten die je had tijdens het lezen van de informatie over bio-energie. Het kan zijn dat deze ideeën positief zijn, ze kunnen negatief zijn of naar jouw idee irrelevant. Elk van deze ideeën is prima, schrijf eenvoudigweg op waar je aan dacht tijdens het lezen van de informatie over bio-energie. Probeer hierbij alleen de gedachten op te schrijven die je had toen je de informatie over bio-energie las.

14) Welke gedachten had je tijdens het lezen van de informatie over bio-energie?

We are now interested in the thoughts you had while reading the information on bio-energy. It might be that these ideas are positive, they might be negative, or you might think they're irrelevant. Each of these ideas is fine, just write down what you thought about while reading the information on bio-energy. Try to write down only those thoughts you had when you read the information on bio-energy.

14) What thoughts did you have while reading the information on bio-energy?

C.3.6 INVOLVEMENT WITH BIO-ENERGY

Nu volgt een aantal vragen over je betrokkenheid bij de drie onderwerpen waar je over gelezen hebt.

Here are some questions about your inv with the three topics you read about.

► INVOLVEMENT

De volgende vragen gaan over je gevoel van betrokkenheid bij het onderwerp 'bio-energie'.
In hoeverre is bio-energie…

15) …een belangrijk onderwerp voor je?
16) …een onderwerp waarin je geïnteresseerd bent?
17) …een onderwerp waar je om geeft?
18) …een onderwerp waarbij je je betrokken voelt?

0 Niet
1 Klein beetje
2 Beetje
3 Nogal
4 Behoorlijk
5 Erg
6 Heel erg

The next questions are about your sense of involvement with the topic 'bio-energy'.
To what extent is bio-energy…

15) …an important topic for you?
16) …a topic you are interested in?
17) …a topic you care about?
18) …a topic you feel involved with?

0 Not
1 Very little
2 A little bit
3 Rather
4 Quite a lot
5 A lot
6 Very much

► CONSEQUENCES OF INVOLVEMENT

In hoeverre is bio-energie…
19) …een onderwerp waarin je je verdiept?
20) …een onderwerp waar je graag meer over zou willen weten?

To what extent is bio-energy…
19) …a topic you go deep into?
20) …a topic you would like to know more about?

0	Niet		0	Not
1	Klein beetje		1	Very little
2	Beetje		2	A little bit
3	Nogal		3	Rather
4	Behoorlijk		4	Quite a lot
5	Erg		5	A lot
6	Heel erg		6	Very much

21) Hoe geconcentreerd was je toen je de informatie over bio-energie las?

21) How concentrated were you when you read the information about bio-energy?

0	Niet		0	Not
1	Klein beetje		1	Very little
2	Beetje		2	A little bit
3	Nogal		3	Rather
4	Behoorlijk		4	Quite a lot
5	Erg		5	A lot
6	Heel erg		6	Very much

22) Hoe veel of weinig aandacht heb je besteed aan het lezen van de informatie over bio-energie?

Weinig aandacht – Veel aandacht

22) How much or little attention did you pay to reading the information about bio-energy?

Little attention – much attention

-3	Heel erg		-3	Very
-2	Behoorlijk		-2	Quite
-1	Beetje		-1	A little
0	Er tussenin		0	In between
1	Beetje		1	A little
2	Behoorlijk		2	Quite
3	Heel erg		3	Very

► **MOTIVATION**

De volgende vragen gaan over je interesse in bio-energie voorafgaand aan dit onderzoek.
Ben je het eens of oneens met de volgende stellingen?
Toen ik las dat bio-energie een van de onderwerpen was, dacht ik dat de informatie hierover…

The next questions are about your interest in bio-energy prior to this research.
Do you agree or disagree with the following statements?
When I read that bio-energy was one of the topics, I thought the information about it…

23) …wellicht belangrijk voor me was.

24) …wellicht nuttig voor me was.

25) …wellicht de moeite waard was om aandacht aan te besteden.

26) …wellicht de moeite waard was om te onthouden.

23) …might be important to me.

24) …might be useful for me.

25) …might be worth paying attention to.

26) …might be worth remembering.

27) …niet interessant voor me was.

   -3 Geheel oneens

   -2 Oneens

   -1 Beetje oneens

   0 Neutraal

   1 Beetje eens

   2 Eens

   3 Geheel eens

27) …was not interesting for me.

   -3 Disagree entirely

   -2 Disagree

   -1 Disagree a little

   0 Neutral

   1 Agree a little

   2 Agree

   3 Agree entirely

C.3.7 INVOLVEMENT WITH THE EU-DIRECTIVE ON SOFTWARE PATENTS

De volgende vragen gaan over je gevoel van betrokkenheid bij het onderwerp 'EU-richtlijn voor softwarepatenten'.

In hoeverre is een EU-richtlijn voor softwarepatenten…

28) …een belangrijk onderwerp voor je?

29) …een onderwerp waarin je geïnteresseerd bent?

30) …een onderwerp waar je om geeft?

31) …een onderwerp waarbij je je betrokken voelt?

   0 Niet

   1 Klein beetje

   2 Beetje

   3 Nogal

   4 Behoorlijk

   5 Erg

   6 Heel erg

The next questions are about your sense of involvement with the topic 'EU-directive on software patents'.

To what extent is a EU-directive on software patents…

28) …an important topic for you?

29) …a topic you are interested in?

30) …a topic you care about?

31) …a topic you feel involved with?

   0 Not

   1 Very little

   2 A little

   3 Rather

   4 Quite a lot

   5 A lot

   6 Very much

C.3.8 INVOLVEMENT WITH FREE-MARKET RENTS

De volgende vragen gaan over je gevoel van betrokkenheid bij het onderwerp 'marktconforme huurprijzen'.

In hoeverre zijn marktconforme huurprijzen…

32) …een belangrijk onderwerp voor je?

33) …een onderwerp waarin je geïnteresseerd bent?

34) …een onderwerp waar je om geeft?

35) …een onderwerp waarbij je je betrokken voelt?

   0 Niet

   1 Klein beetje

   2 Beetje

The next questions are about your sense of involvement with the topic 'free-market rents'.

To what extent are free-market rents…

32) …an important topic for you?

33) …a topic you are interested in?

34) …a topic you care about?

35) …a topic you feel involved with?

   0 Not

   1 Very little

   2 A little

3	Nogal		3	Rather
4	Behoorlijk		4	Quite a lot
5	Erg		5	A lot
6	Heel erg		6	Very much

C.3.9 TRUST IN THE SOURCE

De informatie over bio-energie is door iemand geschreven. Wij zijn nu geïnteresseerd in jouw mening over de schrijver van deze informatie. Hier gaan de volgende vragen over.

The information about bee is written by someone. We are now interested in your opinion about the writer of this information. This is what the following questions are about.

► TRUST

De volgende vragen gaan over je vertrouwen in de schrijver van de informatie over bio-energie.
Ben je het eens of oneens met de volgende stellingen over je gevoelens?

The next questions are about your trust in the writer of the information on bio-energy.
Do you agree or disagree with the following statements about your feelings?

36) Ik heb het gevoel dat ik de mening van de schrijver over bio-energie kan vertrouwen?

37) Ik heb het gevoel dat de informatie van de schrijver over bio-energie betrouwbaar is?

38) Ik heb het gevoel te twijfelen aan de mening van de schrijver over bio-energie.

39) Ik heb het gevoel dat ik af kan gaan op het oordeel van de schrijver over bio-energie.

36) I feel I can rely on the writer's opinion about bio-energy.

37) I feel the writer provides information about bio-energy that I can trust.

38) I feel doubtful about the opinion provided by the writer about bio-energy.

39) I feel I can trust this writer's judgment about bio-energy.

0	Niet		0	Not
1	Klein beetje		1	Very little
2	Beetje		2	A little
3	Nogal sterk		3	Rather
4	Behoorlijk sterk		4	Quite a lot
5	Erg sterk		5	A lot
6	Heel erg sterk		6	Very much

► COMPETENCE

De volgende vragen gaan over je mening over de competentie van de schrijver van de informatie over bio-energie.
In hoeverre ben je het oneens of eens met de volgende stellingen?

The next questions are about your opinion on the competence of the writer of the information on bio-energy.
To what extent do you disagree or agree with the following statements?

40) Ik denk dat de schrijver over voldoende kennis beschikt om een oordeel over bio-energie te geven.

40) I think the writer has enough knowledge to make proper judgments about bio-energy.

41) Ik denk dat de schrijver over voldoende ervaring beschikt om over bio-energie te schrijven.

42) Ik denk dat de schrijver genoeg weet over bio-energie.

43) Ik denk dat de schrijver kundig genoeg is om over bio-energie te schrijven.

-3   Geheel oneens

-2   Oneens

-1   Beetje oneens

0   Neutraal

1   Beetje eens

2   Eens

3   Geheel eens

41) I think the writer is experienced enough to write about bio-energy.

42) I think the writer knows enough about bio-energy.

43) I think the writer is capable to write about bio-energy.

-3   Disagree entirely

-2   Disagree

-1   Disagree a little

0   Neutral

1   Agree a little

2   Agree

3   Agree entirely

► HONESTY

De volgende vragen gaan over je mening over de eerlijkheid van de schrijver van de informatie over bio-energie.

In hoeverre ben je het oneens of eens met de volgende stellingen?

44) Ik denk dat de schrijver een objectief oordeel over bio-energie zal geven.

45) Ik denk dat de schrijver informatie over bio-energie zal achterhouden.

46) Ik denk dat de schrijver eerlijk zal schrijven over bio-energie.

47) Ik denk dat de schrijver zelf zal geloven wat hij zegt over bio-energie.

-3   Geheel oneens

-2   Oneens

-1   Beetje oneens

0   Neutraal

1   Beetje eens

2   Eens

3   Geheel eens

The next questions are about your opinion on the honesty of the writer of the information on bio-energy.

To what extent do you disagree or agree with the following statements?

44) I think the writer will be objective in his judgments about bio-energy.

45) I think the writer will hide information about bio-energy.

46) I think the writer will be honest when writing about bio-energy.

47) I think the writer will truly believe in what he says about bio-energy.

-3   Disagree entirely

-2   Disagree

-1   Disagree a little

0   Neutral

1   Agree a little

2   Agree

3   Agree entirely

► CARE

De volgende vragen gaan over je mening over het verantwoordelijkheidsgevoel van de schrijver van de informatie over bio-energie.

In hoeverre ben je het oneens of eens met de volgende stellingen?

The next questions are about your opinion on the sense of responsibility of the writer of the information on bio-energy.

To what extent do you disagree or agree with the following statements?

48) Ik denk dat de schrijver zich verantwoordelijk voelt over de mening die hij geeft over bio-energie.

49) Ik denk dat de schrijver zich ervoor verantwoordelijk voelt dat zijn lezers goed geïnformeerd worden.

50) Ik denk dat de schrijver geeft om het welzijn van zijn lezers.
    - -3 Geheel oneens
    - -2 Oneens
    - -1 Beetje oneens
    - 0   Neutraal
    - 1   Beetje eens
    - 2   Eens
    - 3   Geheel eens

48) I think the writer feels responsible for the opinion he provides about bio-energy.

49) I think the writer feels responsible for the readers being informed well.

50) I think the writer cares about the well-being of the readers.
    - -3 Disagree entirely
    - -2 Disagree
    - -1 Disagree a little
    - 0   Neutral
    - 1   Agree a little
    - 2   Agree
    - 3   Agree entirely

C.3.10 BEHAVIORAL INTENTION

Geef aan in hoeverre je het met de volgende stellingen eens of oneens bent.

51) Als een vriend van mij elektriciteit uit biomassa wil kopen, zal ik proberen hem te overtuigen om het niet te doen.

52) Als ik biodiesel, een vorm van bio-energie, zou kunnen tanken zou ik dat doen.
    - -3 Geheel oneens
    - -2 Oneens
    - -1 Beetje oneens
    - 0   Neutraal
    - 1   Beetje eens
    - 2   Eens
    - 3   Geheel eens

Indicate to what extent you agree or disagree with the following statements.

51) When a friend of mine wants to buy electricity from biomass, I will try to convince him not to do it.

52) If I could fill up my car with biofuel, a form of bio-energy, I would do so.
    - -3 Disagree entirely
    - -2 Disagree
    - -1 Disagree a little
    - 0   Neutral
    - 1   Agree a little
    - 2   Agree
    - 3   Agree entirely

C.3.11 PERCEIVED MESSAGE SIDEDNESS

53) Wat voor type argumenten bevat de informatie over bio-energie volgens jou?

    - O Uitsluitend argumenten voor bio-energie.
    - O Uitsluitend argumenten tegen bio-energie.
    - O Zowel argumenten voor als tegen bio-energie.

53) What type of arguments does the information on bio-energy contain according to you?

    - O Exclusively arguments in favor of bio-energy.
    - O Exclusively arguments against bio-energy.
    - O Both arguments in favor and against bio-energy.

C.3.12 ARGUMENT RECOGNITION

Voor de volgende vraag is het belangrijk dat je niet terugbladert naar de informatie over bio-energie.

Geef van elk van de volgende argumenten aan of ze wel of niet in de informatie over bio-energie stonden die je zojuist gelezen hebt.

54) Bij de opwekking van bio-energie uit biomassa ontstaat kooldioxide (CO_2). Dit is een minder schadelijk broeikasgas dan methaan (CH_4) dat vrijkomt bij de natuurlijke afbraak van diezelfde biomassa.

55) Bio-energie is niet duurzaam omdat de hoeveelheid biomassa die in een periode aangroeit nooit zo groot is als de hoeveelheid die verbruikt wordt.

56) Het opwekken van bio-energie door biomassa mee te stoken in bestaande kolencentrales houdt het gebruik van kolen in stand.

57) Als snelgroeiende houtsoorten, zoals wilgen en populieren, aangeplant worden groeit er meer biomassa en groeit het sneller bij waardoor bio-energie duurzaam is.

58) Als bio-energie ingezet wordt ter vervanging van fossiele brandstoffen betekent dit een vermindering van de schadelijke uitstoot.

59) Bij de opwekking van bio-energie komen lokaal nog steeds schadelijke stoffen vrij zoals fijne stofdeeltjes.

60) Met bio-energie uit afvalstromen worden twee vliegen in één klap geslagen; het afvalprobleem wordt opgelost en er wordt energie geproduceerd.

61) De meeste biomassa is een reststof die geen functie meer heeft. Hierdoor is de brandstof voor bio-energie veelal goedkoop.

For the following question it is important that you do not look back to the information on bio-energy.

For each of the following arguments, indicate if the were or were not mentioned in the information about bio-energy that you just read.

54) With the generation of bio-energy carbon dioxide (CO_2) is produced. This is a less harmful greenhouse gas than methane (CH_4) which is produced during the natural degradation of that same biomass.

55) Bio-energy is not sustainable because the amount of biomass that grows in a period does not equal the amount that is used.

56) Generating bio-energy by co-combustion of biomass in existing coal-fired power plants maintains the use of coal.

57) If fast growing wood types like willow and poplar, are planted, more biomass will grow and it will grow faster thereby making bio-energy sustainable.

58) If bio-energy is used to replace fossil fuels this will mean a reduction of harmful emissions.

59) Generation of bio-energy still produces harmful emissions locally, like small dust particles.

60) Bio-energy from waste kills two birds with one stone; the waste problem is solved and energy is generated.

61) Most types of biomass are waste products that have no further function. Because of this, most of the time the fuel for bio-energy is cheap.

62) Schadelijke uitstoot kan verminderd worden door aan de filtering van bio-energie centrales dezelfde strenge eisen te stellen als aan afvalverbrandingsinstallaties.

63) Doordat biomassa is om te zetten in biodiesel, een vorm van bio-energie, kan het ook gebruikt worden in het verkeer. Dit is bij wind- en zonne-energie niet mogelijk.

   O Wel
   O Niet
   O Weet niet

62) Harmful emissions can be reduced by making the same high demand upon the filtering of bio-energy plants as on waste incineration plants.

63) As biomass can be converted in bio-diesel, a form of bio-energy, it can also be used in transportation. For energy from wind and sun this is not possible.

   O Was mentioned
   O Was not mentioned
   O Don't know

C.3.13 PRIOR KNOWLEDGE

Sommige mensen wisten al wat over bio-energie voordat ze meededen aan dit onderzoek, anderen nog niets. Ik wil graag weten hoeveel jij al wist over bio-energie voordat je deze vragenlijst invulde.

64) Hoe schat je jouw kennis over bio-energie in? Ik heb…

   0 Geen kennis
   1 Zeer weinig kennis
   2 Weinig kennis
   3 Gemiddelde kennis
   4 Nogal wat kennis
   5 Veel kennis
   6 Zeer veel kennis.

Some people already knew something about bio-energy before they participated in this research, others didn't. I would like to know how much you knew about bio-energy before you filled in this questionnaire.

64) How do you estimate your knowledge about bio-energy? I have…

   0 No knowledge
   1 Very little knowledge
   2 Little knowledge
   3 Average knowledge
   4 Rather some knowledge
   5 Much knowledge
   6 Very much knowledge

C.3.14 PERSONAL DETAILS

De volgende vragen gaan over jezelf en je persoonlijke situatie. Ik stel deze vragen om een beeld te krijgen van de groep mensen die aan dit onderzoek meewerkt.

65) Wat is je geboortejaar?
   19 . .

66) Ben je vrouw of man?
   O Vrouw
   O Man

The following questions are about yourself and your personal situation. I ask these questions to form a picture of the group of people that participated in this research.

65) What is your year of birth?
   19 . .

66) Are you female or male?
   O Female
   O Male

67) Wat voor opleiding volg je momenteel en hoe heet de studie?

- O MBO, namelijk…
- O HBO, namelijk…
- O WO, namelijk…
- O Anders, namelijk…

67) What kind of education do your currently receive and what is the study called?

- O Lower professional education, namely…
- O Higher professional education (undergraduate), namely…
- O University, namely…
- O other, namely…

68) Ben je lid van een natuur- of milieuvereniging?

- O Nee
- O Ja, namelijk van…

68) Are you a member of an environmental organization?

- O No
- O Yes, namely of…

69) Wat voor stroom gebruik je thuis?

- O Gewone stroom
- O Groene stroom
- O Anders, namelijk…
- O Ik weet het niet

69) What kind of electricity do you use at home?

- O Regular electricity
- O Sustainable electricity
- O Other, namely…
- O I don't know

70) Heb je al een keer eerder meegedaan aan een onderzoek over bio-energie?

- O Nee
- O Ja

70) Did you participate in a research on bio-energy before?

- O No
- O Yes

C.3.15 REMARKS

65) Als je nog opmerkingen over deze vragenlijst of over het onderwerp van dit onderzoek hebt kun je deze hieronder kwijt.

65) If you have any comments on this questionnaire or on the topic of this research you can write them down here.

Heel hartelijk bedankt voor het invullen van deze vragenlijst. Je hebt ons daarmee een grote dienst bewezen.

Thank you very much for filling in this questionnaire. You've helped us a lot with it

C.4 DEBRIEFING

Bedankt voor je deelname aan dit onderzoek.

Je hebt zojuist meegedaan aan een sociaal psychologisch onderzoek. Bij dit soort onderzoek is het vaak niet mogelijk om van tevoren te vertellen waar het onderzoek precies over gaan. Dit was bij dit onderzoek ook het geval.

Ik doe dit onderzoek om na te gaan hoe informatie verwerkt wordt en wat de invloed van betrokkenheid bij het onderwerp is. Het onderwerp van dit onderzoek was bio-energie, vandaar ook het grote aantal vragen hierover. Om de invloed van betrokkenheid bij bio-energie te bekijken zijn er verschillende versies van deze vragenlijst. Sommige mensen wordt gevraagd vooral op de informatie over bio-energie te letten. Anderen wordt indirect gevraagd om dat juist niet te doen, namelijk door ze te vragen te letten op de informatie over marktconforme huurprijzen of de EU-richtlijn voor softwarepatenten.

Ik voer dit onderzoek uit als deel van mijn afstuderen. Dit afstuderen doe ik deels bij de capaciteitsgroep Mens-Techniek Interactie van mijn studie Techniek en Maatschappij aan de Technische Universiteit Eindhoven en deels bij Projectbureau Duurzame Energie in Arnhem.

Nogmaals bedankt voor het invullen van de vragenlijst.

Peter van der Heijden

Thank you for your participation in this research.

You just participated in a social psychological study. In this kind of research it is often not possible to tell beforehand what the research is about. This was also the case with this research.

I do this research to find out how information is processed and what the influence of involvement with the topic is. The topic of this research was bio-energy, hence the large number of questions about it. To investigate the influence of involvement with bio-energy, several versions of this questionnaire were made. Some people are asked to pay special attention to the information about bio-energy. Others are indirectly asked not to do so, that is, by asking them to pay special attention to the information about the free-market rents or the EU-directive on software patents.

I conduct this research as part of my graduation. My graduation is partly done at the Human-Technology Interaction group of my study Technology and Society at the Eindhoven University of Technology, and partly at Projectbureau Duurzame Energie in Arnhem.

Thanks again for filling in the questionnaire.

Peter van der Heijden

APPENDIX D INSTRUCTION THOUGHT LISTING JUDGES

Hier zijn de uitkomsten van de thought listing taak uit mijn experiment.

Proefpersonen kregen eerst een tekst te lezen over bio-energie (zie kader onderaan deze pagina). Vervolgens kregen zij hier een aantal vragen over. Eén hiervan was de vraag om op te schrijven welke gedachten men had tijdens het lezen van de informatie over bio-energie. Men werd gevraagd om per regel één gedachte op te schrijven.

Het is nu de bedoeling dat jij deze gedachten van de proefpersonen categoriseert. **Geef per gedachte aan:**

> hoe relevant de gedachte volgens jou is:

  0 = irrelevant: de gedachte heeft niets met bio-energie noch met de tekst te maken;

  1 = relevant: de gedachte heeft wel met bio-energie noch met de tekst te maken.

> indien het volgens jou een relevante gedachte is, geef dan ook de valentie (evaluatieve richting) van de gedachte aan:

  -1 = negatief: de gedachte drukt een negatieve evaluatie van bio-energie en/of de tekst zelf uit;

  0 = neutraal: de gedachte drukt noch een negatieve noch een positieve evaluatie van bio-energie en/of de tekst zelf uit;

  +1 = positief: de gedachte drukt een positieve evaluatie van bio-energie en/of de tekst zelf uit.

De proefpersonen kregen de volgende tekst te lezen:

> *Hier stond de tekst van het tweezijdige bericht met weerlegging.*

Here are the results of the thought listing task from my experiment.

Subjects first received a text about bio-energy (see box at bottom of this page). Next, they received a number of questions about this text. One of these was the question to write down what thoughts they'd had while reading the information on bio-energy. They were asked to write down one thought per line.

The purpose of your job is to categorize the subjects' thoughts. **Per thought, indicate:**

> how relevant the thought was according to you:

  0 = irrelevant: the thought has nothing to do with either bio-energy or the test;

  1 = relevant: the thought has something to with either bio-energy or the test.

> In case you judge the thought to be relevant, also indicate the valence (evaluative direction) of the thought:

  -1 = negative: the thought expresses a negative evaluation of bio-energy and/or the text itself;

  0 = neutral: the thought expresses neither a negative nor a positive evaluation of bio-energy and/or the text itself;

  +1 = positive: the thought expresses a positive evaluation of bio-energy and/or the text itself.

Subjects got to read the following text:

> *Here stood the text of the two-sided refutational message.*

APPENDIX E ARGUMENTS TESTED IN PRESTUDY 1

This appendix contains two tables with arguments that were tested in Prestudy 1. The arguments in favor of bio-energy are given in the first table, the counterarguments, with their refutation, are given in the second. column contains the original Dutch argument, the English translation is given in the second column. The last column indicates the category the argument was assigned to. The categories are:

1 = Good for the environment

2 = Useful application of rest products

3 = Better than fossil energy

4 = Better than other forms of sustainable energy

5 = Economically sensible

6 = Easily applicable

7 = Risk and/or nuisance

8 = Step in the direction of sustainable supply of energy

Table E-1 *Pro bio-energy arguments tested in Prestudy 1.*

Argument in Dutch	English translation	Category
Bij de opwekking van bio-energie uit biomassa ontstaat kooldioxide (CO_2). Dit is een minder schadelijk broeikasgas dan methaan (CH_4) dat vrijkomt bij de natuurlijke afbraak van diezelfde biomassa.	With the generation of bio-energy carbon dioxide (CO_2) is produced. This is a less harmful greenhouse gas than methane (CH_4) which is produced during the natural degradation of that same biomass.	1
Bio-energie draagt niet bij aan het broeikaseffect omdat het CO_2-neutraal is. Daarmee wordt bedoeld dat er bij de productie van bio-energie niet meer kooldioxide (CO_2) vrijkomt dan er tijdens het ontstaan van de biomassa is opgenomen.	Bio-energy does not enhance the greenhouse effect because it is CO_2-neutral. This means that no more carbon dioxide (CO_2) is produced with the generation of bio-energy than is taken in during the formation of the biomass.	1
Met bio-energie uit afvalstromen worden twee vliegen in één klap geslagen; het afvalprobleem wordt opgelost en er wordt energie geproduceerd.	Bio-energy from waste kills two birds with one stone; the waste problem is solved and energy is generated.	2
Het gebruik van mest voor opwekking van bio-energie draagt bij aan het terugdringen van het mestoverschot.	The use of manure for the generation of bio-energy helps the reduction of the manure surplus.	2
Als bio-energie ingezet wordt ter vervanging van fossiele brandstoffen betekent dit een vermindering van de schadelijke uitstoot.	If bio-energy is used to replace fossil fuels this will mean a reduction of harmful emissions.	3
Biomassa, de brandstof voor bio-energie, groeit weer snel aan. Vorming van de fossiele brandstoffen aardolie, aardgas en kolen duurt vele miljoenen jaren.	Biomass, the energy source for bio-energy, grows quick. Generation of fossil fuels like oil, natural gas and coal takes many millions of years.	3
Biomassa, de brandstof voor bio-energie, is altijd aanwezig. Windenergie is er alleen als het waait en zonne-energie alleen als de zon schijnt.	Biomass, the fuel for bio-energy, is always present. Windenergy can only be generated when the wind blows, and solar energy when the sun shines.	4
Doordat biomassa is om te zetten in biodiesel, een vorm van bio-energie, kan het ook gebruikt worden in het verkeer. Dit is bij wind- en zonne-energie niet mogelijk.	As biomass can be converted in bio-diesel, a form of bio-energy, it can also be used in transportation. For energy from wind and sun this is not possible.	4

Table E-1 *Pro bio-energy arguments tested in Prestudy 1. (continued)*

Argument in Dutch	English translation	Category
Op het moment dat bestaande restmaterialen en infrastructuur gebruikt worden is bio-energie goedkoper dan andere vormen van duurzame energie.	If existing residues and infra structure are used, bio-energy will be cheaper than other forms of sustainable energy.	4
Gebruik van mest voor de productie van bio-energie draagt bij aan het toekomstperspectief van het platteland.	Use of manure for the generation of bio-energy supports the perspective of the countryside.	5
De meeste biomassa is een reststof die geen functie meer heeft. Hierdoor is de brandstof voor bio-energie veelal goedkoop.	Most types of biomass are waste products that have no further function. Because of this, most of the time the fuel for bio-energy is cheap.	5
Als bio-energie ingezet wordt ter vervanging van fossiele brandstoffen betekent dit een vermindering van de afhankelijkheid van olieproducerende landen.	When bio-energy are used to replace fossil fuels this will mean a reduction of the dependency on oil producing countries.	5
Het speciaal telen van biomassa voor bio-energie, energieteelt, is een positieve stimulans voor de landbouw.	Special growing of biomass for bio-energy, i.e. energy crops, is a positive stimulus for the agriculture.	5
Bio-energie sluit aan bij de huidige energie-infrastructuur en is dus nu al goed toe te passen.	Bio-energy fits the current energy infrastructure and can does already be utilized easily.	6
Bio-energie kan op korte termijn substantieel bijdragen aan de energiedoelstelling van Kyoto.	Bio-energy can contribute to the energy goals of Kyoto in the near future.	8
Doordat bio-energie continu gegenereerd kan worden, kan het in een toekomstige, 100% duurzame energiehuishouding zorgen voor de basislast.	As bio-energy can be generated continuously, it can provide the base load in a future, 100% sustainable energy society.	8
Bio-energie is een goede ontwikkeling in afwachting van goedkopere en efficiëntere wind- en zonne-energie.	Bio-energy is a good development in anticipation of cheaper and more efficient wind and solar energy.	8
Bio-energie kan kernenergie vervangen. Hierdoor is er geen probleem meer met radioactief afval.	Bio-energy can replace nuclear energy. That way, there is no longer a nuclear waste problem.	-
Er is een grote verscheidenheid aan soorten bio-energie; elektriciteit, warmte en biobrandstoffen. Hierdoor is bio-energie bruikbaar voor veel verschillende doeleinden.	There is a large diversity of form of bio-energy; electricity, heat, and Biofuels. This makes bio-energy applicable for many purposes.	-

Table E-2 *Counterarguments (and refutation) tested in Prestudy 1.*

Argument in Dutch (refutation)	English translation	Category
Door bio-energie uit pluimveemest op te wekken wordt stikstof (N), een belangrijke meststof, uitgestoten in de lucht en dus onttrokken aan de grond.	By generating bio-energy from poultry manure nitrogen (N), an important fertilizer, is emitted to the air and thus withdrawn from the soil.	1
(In Nederland wordt pluimveemest niet gebruikt als mest. Gebruik ervan voor opwekking van bio-energie gaat dus niet ten koste van bemesting)	(Poultry manure is being not used as fertilizer in the Netherlands. Therefore, use for the generation of bio-energy does not go at the expense of fertilizing.)	

Table E-2 *Counterarguments (and refutation) tested in Prestudy 1. (continued)*

Argument in Dutch (refutation)	English translation	Category
Bij de opwekking van bio-energie komen lokaal nog steeds schadelijke stoffen vrij zoals kooldioxide (CO_2) en fijne stofdeeltjes. (Deze uitstoot kan grotendeels voorkomen worden door strenge eisen aan de filtering te stellen.)	Generation of bio-energy still yields local harmful emissions like carbon dioxide (CO_2) and fine particles. (This emission can largely be prevented by putting high demands on the filtering.)	1
Er is in Nederland nooit genoeg biomassa om op grote schaal bio-energie te produceren en dus moet biomassa geïmporteerd worden uit het buitenland. Importeren kost energie en dus is bio-energie uit geïmporteerde biomassa niet CO_2-neutraal. (De netto CO_2-uitstoot bij geïmporteerde biomassa is minder dan bij fossiele brandstoffen die ook geïmporteerd worden.)	There is never enough biomass in the Netherlands to generate bio-energy on a large scale, and therefore biomass has to be imported from abroad. Import costs energy, and thus bio-energy from imported biomass is not CO_2-neutral. (The net CO_2 emission from imported biomass is less than from fossil fuels which are imported as well.)	1
Bij verbranding van sloophout en rioolslib komen zware metalen vrij die schadelijk zijn voor de gezondheid. (Deze uitstoot kan verminderd worden door aan de filtering dezelfde strenge eisen te stellen als aan afvalverbrandingsinstallaties.)	With the combustion of wood and sewage sludge, heavy metals are emitted that are harmful for your health. (Harmful emissions can be reduced by making the same high demand upon the filtering of bio-energy plants as on waste incineration plants.)	1
Bio-energie is niet duurzaam omdat de hoeveelheid biomassa die in een periode aangroeit nooit zo groot is als de hoeveelheid die verbruikt wordt. (Dit is niet waar als snelgroeiende houtsoorten, zoals wilgen en populieren, aangeplant worden. Er groeit dan meer biomassa, en het groeit sneller bij. Bio-energie is dan wel duurzaam.)	Bio-energy is not sustainable because the amount of biomass that grows in a period does not equal the amount that is used. (If fast growing wood types like willow and poplar, are planted, more biomass will grow and it will grow faster thereby making bio-energy sustainable.)	1
Door resthout te gebruiken als brandstof voor bio-energie, kan het niet meer hergebruikt worden als materiaal voor een hoogwaardigere toepassing zoals bijvoorbeeld spaanplaat. (Dit is niet waar als het houtaanbod vergroot wordt door meer productiehout aan te planten.)	By using restwood as a fuel for bio-energy, it can no longer be used as material for a higher order purpose like chipboard. (This is no true when the wood supply is increased by planting more production forests.)	2
Bij de productie van wind- en zonne-energie komt geen kooldioxide (CO_2) vrij. Bij de productie van bio-energie wel. (Het maken van zonnepanelen en windmolens gaat wel gepaard met CO_2-productie.)	Generation of wind and solar energy does not produce carbon dioxide (CO_2), while generation of bio-energy does. (CO_2 is still produced during the manufacturing of solar panels and wind turbines.)	4
Transport van biomassa kan geurhinder opleveren. (Geurhinder bij transport kan voorkomen worden; vleeswagens veroorzaken bijvoorbeeld ook geen geurhinder.)	Transport of biomass can cause odor nuisance. (Odor nuisance in transportation can be prevented; meat trucks, for instance, doe not cause odor nuisance.)	7

Table E-2 *Counterarguments (and refutation) tested in Prestudy 1. (continued)*

Argument in Dutch (refutation)	English translation	Category
Het opwekken van bio-energie door biomassa mee te stoken in bestaande kolencentrales houdt het gebruik van kolen in stand. (Het is nu nog niet mogelijk om alle kolen te vervangen door biomassa. Door biomassa mee te stoken worden minder kolen verbruikt, en dus wordt de netto CO_2-uitstoot verminderd.)	Generating bio-energy by co-combustion of biomass in existing coal-fired power plants maintains the use of coal. (It is not yet possible to replace all coals by biomass. By co-combusting biomass less coals are used, and thus less CO_2 is emitted).	8
Door pluimveemest te gebruiken als brandstof voor bio-energie wordt de bio-industrie in stand gehouden. (Dit kan voorkomen worden door niet meer pluimveemest te gebruiken voor bio-energie dan de grootte van het mestoverschot. Zodoende wordt er geen extra vraag naar mest gecreëerd en wordt de bio-industrie niet bevorderd.)	By using poultry manure as fuel for bio-energy the bio-industry is maintained. (This can be prevented by not using more manure for bio-energy than the size of the manure surplus. That way no extra demand is created and thus the bio-industry is not supported.)	-

APPENDIX F QUESTIONNAIRE LAY-OUT

Wat vind je van de informatie over bio-energie die je net gelezen hebt?
Kruis een hokje aan.

		Heel erg ▼	Behoorlijk ▼	Beetje ▼	Er tussenin ▼	Beetje ▼	Behoorlijk ▼	Heel erg ▼	
8	Slecht	-3	-2	-1	0	1	2	3	Goed

In hoeverre vind je deze informatie over bio-energie…
Kruis op elke regel een hokje aan.

		Niet ▼	Klein beetje ▼	Beetje ▼	Nogal ▼	Behoorlijk ▼	Erg ▼	Heel erg ▼
9	…overtuigend?	0	1	2	3	4	5	6
10	…duidelijk?	0	1	2	3	4	5	6
11	…nieuw?	0	1	2	3	4	5	6
12	…geloofwaardig?	0	1	2	3	4	5	6

Vind je deze informatie voor of tegen bio-energie pleiten?
Kruis een hokje aan.

		Heel erg ▼	Behoorlijk ▼	Beetje ▼	Er tussenin ▼	Beetje ▼	Behoorlijk ▼	Heel erg ▼	
13	Pleit tegen bio-energie	-3	-2	-1	0	1	2	3	Pleit voor bio-energie

APPENDIX G MEAN INVOLVEMENT AND TRUST SCORES

G.1 INVOLVEMENT CONCEPTS

Table G-1 *Mean involvement with bio-energy (and standard deviation) per condition.*

Involvement manipulation	Message type			per involvement condition
	one-sided	two-sided	two-sided refutational	
Low	2.76 (1.18)	1.95 (1.07)	2.36 (1.30)	2.38 (1.23)
High	2.28 (1.03)	2.41 (1.25)	2.48 (1.14)	2.39 (1.13)
per message type	2.53 (1.12)	2.20 (1.18)	2.42 (1.21)	2.39 (1.17)

Note. The answer scale ranged from 0 (not involved) to 6 (very involved).

Table G-2 *Mean motivation to process (and standard deviation) per condition.*

Involvement manipulation	Message type			per involvement condition
	one-sided	two-sided	two-sided refutational	
Low	.64 (1.15)	.78 (1.26)	.43 (1.10)	.61 (1.17)
High	.94 (.94)	.99 (.85)	1.05 (.97)	.99 (.91)
per message type	.79 (1.05)	.89 (1.06)	.74 (1.07)	.80 (1.06)

Note. The answer scale ranged from -3 (not motivated) to +3 (very motivated).

Table G-3 *Mean consequences of involvement (and standard deviation) per condition.*

Involvement manipulation	Message type			per involvement condition
	one-sided	two-sided	two-sided refutational	
Low	3.90 (1.17)	3.71 (1.05)	3.57 (1.02)	3.73 (1.08)
High	3.85 (.82)	3.48 (1.33)	3.93 (.95)	3.75 (1.06)
per message type	3.87 (1.00)	3.59 (1.20)	3.75 (.99)	3.74 (1.07)

Note. The answer scale ranged from 0 (not involved) to 6 (very involved).

G.2 TRUST CONCEPTS

Table G-4 *Mean trust in the source (and standard deviation) per condition.*

Involvement manipulation	Message type			per involvement condition
	one-sided	two-sided	two-sided refutational	
Low	2.55 (1.09)	2.90 (1.21)	3.05 (.95)	2.83 (1.09)
High	2.83 (.95)	2.93 (1.20)	3.32 (.89)	3.03 (1.03)
per message type	2.69 (1.02)	2.92 (1.19)	3.18 (.93)	2.93 (1.06)

Note. The answer scale ranged from 0 (not certain) to 6 (very certain).

Table G-5 *Mean competence of the source (and standard deviation) per condition.*

Involvement manipulation	Message type			per involvement condition
	one-sided	two-sided	two-sided refutational	
Low	.473 (1.12)	.95 (.95)	.92 (.92)	.78 (1.02)
High	.85 (1.07)	.92 (1.15)	1.24 (.92)	1.00 (1.05)
per message type	.66 (1.10)	.94 (1.05)	1.08 (.93)	.89 (1.04)

Note. The answer scale ranged from 0 (not certain) to 6 (very certain).

Table G-6 *Mean openness of the source (and standard deviation) per condition.*

Involvement manipulation	Message type			per involvement condition
	one-sided	two-sided	two-sided refutational	
Low	-.30 (1.53)	.31 (1.22)	.10 (1.05)	.03 (1.29)
High	.09 (1.24)	.22 (1.20)	.17 (1.12)	.16 (1.18)
per message type	-.10 (1.39)	.26 (1.20)	.14 (1.08)	.10 (1.23)

Note. The answer scale ranged from 0 (not certain) to 6 (very certain).

Table G-7 *Mean care of the source (and standard deviation) per condition.*

Involvement manipulation	Message type			per involvement condition
	one-sided	two-sided	two-sided refutational	
Low	.52 (.92)	.69 (1.19)	.74 (.91)	.65 (1.00)
High	.85 (1.07)	.87 (1.14)	.91 (1.06)	.88 (1.08)
per message type	.68 (1.00)	.79 (1.16)	.82 (.98)	.76 (1.04)

Note. The answer scale ranged from 0 (not certain) to 6 (very certain).