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ORIGINAL PAPER

Decision-Making Strategies for the Choice of Energy-friendly Products

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Abstract Although energy efficiency of many products has been improving constantly, residential energy consumption is not decreasing as much as desired. Therefore, the goal of the European Union (EU) and many other countries is to promote energy-friendly product choices (i.e., choice of products with low energy consumption). In a purchase situation, consumers are confronted with a wide range of energy-related information that can influence the decision-making process. Understanding how consumers reach a decision based on the information provided and identifying decision-making strategies that are beneficial or destructive in terms of energy friendliness is crucial for the improvement of existing energy-policy measures and, consequently, for the successful achievement of target energy saving goals. This paper provides insights from an exploratory eye-tracking study ($N = 59$) investigating consumers' decision-making process. Participants were required to identify the most energy-friendly television (i.e., the television with lowest energy consumption). Cluster analysis revealed three consumer segments with different decision-making strategies: the energy-directed lexicographic, unsystematic lexicographic, and unsystematic exhaustive strategies. The energy-directed lexicographic strategy resulted in 60% optimal choices in terms of energy friendliness, unsystematic lexicographic in 33%, and unsystematic exhaustive in 38%. No decision-making strategy resulted in 100% optimal choices in terms of energy friendliness. Findings emphasize that lexicographic strategies can successfully identify energy-friendly products when the correct information (i.e., actual energy consumption) is used. However, a lexicographic strategy can be very misleading and result in non-optimal choices in terms of energy friendliness when it is based on ambiguous information (i.e., energy efficiency information) that does not enable a conclusive decision. Further, this paper discusses implications for policy-makers and marketers for the promotion of energy-friendly consumer behaviour.

Keywords Consumer decision-making · Energy efficiency · Eye tracking · Household energy use · Heuristic

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Governments and non-governmental organizations (NGOs) spend a vast amount of money, time, and research to succeed in the reduction of energy consumption. Many countries, including Switzerland and several member states of the European Union (EU), announced their pursuance of this goal (e.g., Bundesrat 2013b; Directive 2012; OECD/IEA 2013). The main strategy to reduce energy consumption is by increasing energy efficiency. For example, the EU set minimal energy efficiency standards for household appliances and consumer electronics and implemented the inclusion of an energy label on every product that provides information about a products' energy friendliness (Directive 2012). In Switzerland, the sale of inefficient products has been restricted and it is mandatory for new products to fulfil the required energy-efficient standards (Bundesrat 2013a). These regulations have been successful, as the energy efficiency of electronic products is constantly increasing (Molenbroek et al. 2014). However, the enhancement of energy efficiency is not sufficient for attaining the targeted energy-saving goals. One reason for this development is the increase of energy consumption at the household level, with a total increase of 26% since 1990 (Eurostat 2014). Residential energy consumption accounts for approximately 30% of the final energy consumption (Eurostat 2014; Prognos 2014). Most energy is used for heating; however, a substantial share (i.e., approximately 13%) of the household energy demand is for household appliances and consumer electronics, like televisions (IEA 2003; Prognos 2014). The increase in energy consumption in the residential sector is partially due to population growth and enhanced material wealth (OECD/IEA 2013). As a consequence, also the number of energy-related durables in household has increased (Prognos 2014). However, part of the increase in energy consumption is related to the fact that products are getting bigger and bigger. For example, an analysis of televisions' screen size showed an increase of 20% from 2007 to 2013 (Michel et al. 2014). Despite the technological development (e.g., replacement of cathode ray tube televisions by more efficient LED televisions), the energy consumption of televisions has only slightly decreased (FIMRT 2012; Prognos 2012). Televisions have changed from being single-purpose products to products that provide a multitude of different functions (e.g., internet, game stations, etc.) (FIMRT 2012). This development is one reason for the increase in energy consumption at household levels, despite technological progress (e.g., LCD televisions) and enhanced energy efficiency (Michel et al. 2014; Prognos 2012). Given that despite energy-friendly technological innovations, energy consumption at the household level is still increasing, the question arises whether the implemented policy tools to promote energy savings in households, such as the energy label for electrical appliances, are not as successful as they need to be in order to achieve a decrease in final consumption.

In summary, the aim of this study is to investigate which decision-making strategies consumers apply when purchasing electric goods and identify which of these strategies are expedient in terms of energy friendliness. Furthermore, we aim to understand the role of personal characteristics, such as age, gender, and attitude towards energy conservation, because understanding the role of these attributes is important for developing policy measures that are specifically targeted at consumer segments. Investigating consumers' judgment and decision-making behaviour when it comes to energy-related purchase decisions will enable us to detect barriers and drivers for the choice and use of energy-friendly products. Based on these insights, tools such as the energy label can be developed and improved to enable and promote effective energy-saving purchase behaviour.

The EU Energy Label and the Promotion of Energy Efficiency

The EU energy label is a mandatory label for various household appliances (e.g., freezers, refrigerators, and washing machines) and consumer electronics (e.g., televisions). An energy efficiency rating is depicted on the energy label that indicates how efficiently the product uses the energy. Originally, the rating scale ranged from A to G, with A assigned for the most efficient products and G for the least efficient products. The rapid development of more efficient products required the introduction of additional ratings to differentiate between the most efficient products. These new categories are marked with a plus (e.g., A^+). This development occurred at a different speed in various product categories and, consequently, the energy efficiency rating scale now differs between product types.

A crucial characteristic of the depicted energy efficiency rating is that it is relative to the size of the products. This implies that products can be very energy-efficient and be assigned a good energy efficiency rating but still consume a considerable amount of energy due to their size. For example, a television with a screen size of 60 inches (in.) consuming 101 kWh/year is assigned an A^{++} rating, whereas a television with a screen size of 32 in. consuming 50 kWh/year is assigned an A rating (Energie Agentur Elektrogeräte 2015). Therefore, this rating system can be misleading, because the best energy-efficient product is not automatically the most energy-friendly choice. Hence, in order to determine the most energy-friendly product from among numerous products, consumers should study the information on the actual energy consumption displayed on the energy label in kilowatt-hours per year (i.e., XY kWh/annum), because this information is depicted in absolute terms. Nevertheless, understanding this information might be challenging, as it requires at least some technological knowledge or a strong interest in the topic. Otherwise, it is difficult to judge whether a certain amount of kWh/year is high or low. Research has shown that this task is difficult to achieve for consumers (Attari et al. 2010).

Energy-efficiency information is depicted prominently and saliently on the energy label due to the colour code and letter rating. On the other hand, information about absolute energy consumption is only numerically depicted without any visual facilitator, such as a reference value or a colour code for high and low consumption. To increase the evaluability of information about annual consumption, in the USA, for example, the energy guide for energy-related durables shows the estimated yearly operating costs in US dollars in addition to the annual energy consumption in kWh/year. Without any additional facilitator, the crucial information about annual energy consumption (kWh/year) is less likely to be considered in the decision-making process. In line with this reasoning, recent research has shown that consumers tend to judge a product's energy friendliness based on its energy efficiency rating neglecting information about its actual energy consumption and, consequently, overestimate the energy friendliness of products with good energy-efficiency ratings (Waechter et al. 2015b). This focus on energy-efficiency information can even shift the perception of entire product categories that are usually associated with high energy consumption, such as freezers. This energy efficiency fallacy might partially explain why consumers choose bigger products, because they merely rely on energy-efficiency information. This is particularly problematic, because the percentage of products with the best energy-efficiency rating is higher for bigger products than for smaller products (VZBV 2015). This could further contribute to the explanation of the appearance of an energy-efficiency gap. The energy-efficiency gap refers to a discrepancy between the potential of energy saving (e.g., due to technology) and the actual market situation (Allcott and Greenstone 2013; Jaffe and Stavins 1994).

The extent of this gap is part of an on-going discussion between experts, as the calculation of the potential and actual savings are rather complex. However, Gillingham and Palmer (2014) stated that behavioural aspects, like consumers' purchase decisions, are a major reason why the estimated energy savings have not been achieved yet. As mentioned earlier, consumers' tendency to overestimate the relevance of energy efficiency information when judging the energy friendliness of products is one possible reason for the aforementioned trend towards bigger products, thereby boosting final energy consumption. Furthermore, apart from the fact that the size of products available on the market is increasing, the number of televisions and other consumer electronics per household is also rising (Molenbroek et al. 2014; Prognos 2012). This trend could be due to the fact that consumers might feel compelled to purchase more products as long as they are assigned an excellent energy-efficiency rating. More precisely, consumers might assume that the energy consumption of products with excellent efficiency ratings is no longer problematic. In economics, this effect is known as the "rebound effect" and it constitutes a major part of the explanation of the energy-efficiency gap (Gillingham and Palmer 2014). In general, these backfiring effects are also referred to as "negative spillover effects" and are not restricted to behaviours related to energy efficiency (for a review, see Truelove et al. 2014). Studying consumers' decision-making strategies is essential to prevent such undesired behavioural effects. We need to understand how consumers process and interpret the energy-related information provided, which pieces of information they integrate, and how this ultimately affects their decision-making process and product choice. In this context, understanding how the energy label and the different formats of energy information presentation influence consumers' decision-making is especially important to further improve the EU energy label which other countries, such as China, also use as a model for their own energy labels (Zeng et al. 2014). Moreover, for the further development of the most suitable policy tools to facilitate the choice of energy-friendly products and to forecast the feasibility of the energy goals, modelling the consumers' decision-making process is important.

Decision-Making Strategies

Decisions are part of the people's daily life. Many of these daily decisions are made fast and without much cognitive effort, while others require more substantial considerations. What all decisions do have in common is that they rely on some sort of a strategy. The strategies can vary from being very rudimental to highly elaborated depending on the person, the context, and many other factors including the motivation, the provided options, and the type of product (Bettman et al. 1991). This is also true for the decision-making processes related to the purchase of electric goods.

Decision-making strategies can be allocated to two frameworks, namely, compensatory and non-compensatory strategies (Schulte-Mecklenbeck et al. 2013; Weber and Johnson 2009). Compensatory strategies assume that attributes can compensate each other; for example, a popular brand compensates for a higher price. Non-compensatory strategies, on the other hand, assume that people apply simple heuristics and decide solely based on the price, for example. One typical compensative strategy is the weighted additive strategy (WADD). It assumes that people assign a weight to each attribute, sum them up, and choose the product with the highest sum (i.e., highest value to person). One very unattractive attribute can thereby be compensated by other attractive attributes. A typical non-compensative strategy is the lexicographic strategy (LEX). The lexicographic strategy assumes that one attribute is the most important one and the comparison proceeds along this criterion. If one option performs best in terms of this attribute, this option will be chosen. If two options perform equally well, the comparison continues along the second most important attribute. Unattractive attributes can thereby not be compensated.

Weighted additive strategies are particularly dominant in economic and marketing research and assume that humans evaluate and integrate all information provided and choose the option with the highest value (for a critical review, see Camerer and Loewenstein 2004; Stüttgen et al. 2012). Although the theory of bounded rationality (Tversky and Kahneman 1974) has become more relevant in the mentioned fields, acknowledging that the assumption of a purely rational, utility-maximizing decision-making behaviour might be inaccurate (Kahneman 2011), many classical approaches to studying decision-making (e.g., conjoint-analysis) often still assume a weighted additive decision-making process (Netzer et al. 2008). Moreover, these studies usually provide estimates of the revealed importance of different attributes, but they miss monitoring the process prior to the final decision, including the dynamic component (e.g., direction of search) of the decision-making process (e.g., Heinzle and Wüstenhagen 2012; Yamamoto et al. 2008). This is of special concern, because research on decision-making has shown that people often do not integrate all information provided into the decision but often make choices based on a few attributes. Much well-known work regarding such decision-making behaviour has been conducted by Gigerenzer and colleagues (Gigerenzer and Gaissmaier 2011). Like many other researchers (Chase 1978; Schwartz et al. 2002; Simon 1955), they underscore that humans often make fast and frugal decisions without considering all the information. The use of such fast and frugal decision heuristics can result in high-quality decisions and can be helpful in many daily situations (Goldstein and Gigerenzer 2009). However, it has been shown that the use of such heuristics can also potentially lead to biased decisions, because what all heuristics do have in common is that they ignore part of the information (Gigerenzer and Gaissmaier 2011). For example, how information is framed (e.g., positive vs. negative) strongly influences people's choices (Kahneman and Tversky 1979). Furthermore, certain aspects of the information format, such as the evaluability and saliency of the information, are crucial to whether a certain piece of information is integrated (Hsee 1996; Slovic et al. 2007; Sütterlin and Siegrist 2014). The opposition between the two frameworks has nourished the development of different decision-making strategies as well as the research on decision-making in past years, including studies on decision-process tracing by means of eye tracking (Stüttgen et al. 2012). Research suggests that not one framework (weighted additive vs. lexicographic) alone can explain it all, but that decision-making strategies are task-dependent and adaptable to the environment (Bettman et al. 1991). One person might use different strategies in comparable situations and others might use the same strategy in very different situations (Shi et al. 2013; Söllner et al. 2014).

A lot of research has been conducted to investigate consumers' decision-making strategies regarding food choices (e.g., Scheibehenne et al. 2007; Schulte-Mecklenbeck et al. 2013) or decision-making strategies under uncertainty (e.g., Fiedler and Glöckner 2012; Kahneman and Tversky 1979; Pachur et al. 2013; Tversky and Kahneman 1974). However, little is known about the decision-making strategies for the purchase of energy-consuming durables. Moreover, research on the relevance of different consumer characteristics and attitudes for energy-friendly choices does not provide a clear picture of how these variables influence energy-friendly consumer behaviour (Kastner and Stern 2015). Some studies indicate that a pro-environmental attitude is a positive predictor for the consideration of ecolabels (Thøgersen 2000), while other researchers found no clear connection between pro-environmental attitudes and energy-friendly behaviour (Gaspar and Antunes 2011). Nevertheless, attitude towards energy conservation might play a role when it comes to making an energy-friendly choice.

Consumers' choice of electric goods is of interest to policy-makers and marketers, as consumer goods are responsible for a substantial amount of overall energy consumption (IEA 2009). Therefore, it is of special interest to identify decision-making strategies that are beneficial or destructive in terms of energy friendliness (i.e., choosing products with low energy consumption). However, thus far, little is known about this field of consumer decision-making. This study aimed to extend the knowledge of energy-friendly decision making by identifying and describing the different strategies that consumers apply when choosing an electric good (i.e., a television). Consumers' age, gender, and attitudes towards energy conservation were taken into account as well as the existing policy tools that aim to enhance energy-friendly consumer behaviour (i.e., the EU energy label).

Methods

This study provided a segmentation of the energy-friendly decision-making strategies employed by consumers when purchasing a television by combining an experimental approach with eye-tracking measures. Based on the knowledge and insights gained about how consumers use and apply the energy-related information provided, existing energy policy measurements, such as the EU energy label, can be improved and adapted in order to enable consumers to identify the most energy-friendly products and to make informed purchasing decisions. Eye-tracking research has been applied in various consumer studies, including studies of how consumers process labels (e.g., Siegrist et al. 2015) and how they make decisions (e.g., Stüttgen et al. 2012). It is especially suitable to investigate these types of research because it provides an objective measure of consumer behaviour (for an overview, see Orquin and Mueller Loose 2013).

Stimuli Material

The material for the eye tracking study consisted of the descriptions of four different television models as usually provided in online stores (e.g., price, picture, and technical information) (Fig. 1). The four televisions were all available on the market at the time that the study was conducted. We chose televisions because they are a product that most consumers are familiar with and which play an important role in the increase in the final electricity demand in the residential sector. A big television consumes more energy than a small television does; therefore, a decision based solely on energy efficiency is not sufficient to identify the product with the lowest energy consumption. For the experiment, televisions were chosen in a manner such that the most efficient television was not automatically the most energy-friendly choice (i.e., not the television with the lowest energy consumption). This means that the stimuli material consisted of televisions with good energy efficiency ratings, but with high energy consumption (i.e., the bigger televisions), and of a television with a lower efficiency rating, but with a lower absolute energy consumption (i.e., the smallest television and the most energy-friendly choice).

Participants were shown four televisions, including their pictures and additional information such as technical features and price, on the screen and were asked to indicate which one they would recommend to a person who wants to use a television with the least possible

Television PF	Price: 1'199.-
Screen Size	47 in (120 cm)
Display	LCD
Display Resolution	Full HD (1920 x 1080)
Automatic Energysa-vings	Light sensor, Auto switch-off timer
On/Off Power Switch	Yes
Image Display	3D / 2D
Features	PayTV, Memory Card, 3 HDMI-Connections
Energy Efficiency Ra-ting	A+
Annual Energy Consumption	95 kWh
Power	69 Watt

Television UE	Price: 799.-
Screen Size	40 Zoll (102 cm)
Display	LCD
Display Resolution	Full HD (1920 x 1080)
Automatic Energysa-vings	Automatische Helligkeitsregulierung, Abschaltautomatik
On/Off Power Switch	Nein
Image Display	3D / 2D
Features	4 HDMI-Anschlüsse
Energy Efficiency Ra-ting	A
Annual Energy Consumption	89 kWh
Power	61 Watt

Television ME	Price: 2'259.-
Screen Size	60 in (153 cm)
Display	LCD
Display Resolution	Full HD (1920 x 1080)
Automatic Energysa-vings	Light sensor, Auto switch-off timer
On/Off Power Switch	No
Image Display	3D / 2D
Features	3 HDMI-Connections
Energy Efficiency Ra-ting	A+
Annual Energy Consumption	145 kWh
Power	99 Watt

Television LS	Price: 2'850.-
Screen Size	70 Zoll (178 cm)
Display	LCD
Display Resolution	Full HD (1920 x 1080)
Automatic Energysa-vings	Automatische Helligkeitsregulierung, Abschaltautomatik
On/Off Power Switch	Nein
Image Display	3D / 2D
Features	BlueRay-Player, Speicherkarte
Energy Efficiency Ra-ting	A+
Annual Energy Consumption	197 kWh
Power	135 Watt

Fig. 1 Televisions with information and pictures. The participants were asked to identify the most energy-friendly product

amount of energy consumption. The instruction that participants received is presented in Table 1. We opted against a personal choice, because the focus was to understand energy-friendly decision-making strategies. Personal choices would be strongly affected by personal preferences, such as the size of the television, which would impede the assessment of the decision-making strategy related to the purchase of energy-friendly appliances. By instructing the participants to identify the most energy-friendly product, we were able to control for the effect of personal preferences.

The energy label plays a crucial role in energy policies and should empower consumers to identify energy-friendly products. In order to ascertain the influence of energy labels on the decision-making process, half of the participants were provided with television descriptions as presented in Figure 1 and the other half (i.e., label condition) received the energy labels of the televisions as additional information (Fig. 2). Participants were randomly assigned to either the condition with or without energy labels.

Procedure

The data for this study were collected using the iViewx RED500 eye tracker manufactured by SMI, Germany. This system provides a binocular sampling rate of 50 Hz and an accuracy of

Table 1 Task instructions

Instructions
Please imagine that a person wants to buy a television that consumes the least possible amount of energy. The choice has to be made from among four televisions, and the person asks for your advice. The next page presents the four televisions, out of which you have to choose one. Look at the pictures and the information as you would at home on your computer screen. Please decide which television you would recommend to the person. Tell the examiner the name of the chosen product. The name is displayed on the top left corner of each product and consists of two characters (e.g., SZ). Take as much time as you need. Please look at the screen the entire time and attempt to sit very still.
If you have any questions regarding the task, please ask the examiner.
If you do not have further questions, inform the examiner that you have understood the task and he/she will activate the next page.

0.4° of visual angle. The eye tracker uses an infrared-sensitive video camera placed below the computer monitor to observe the participants' eye movements. Software provided by SMI generates x- and y-coordinates for the gaze points on the monitor screen, and the default classification algorithm was employed to define fixations. The experiment was designed and run by Experiment Centre 3.3 (SMI, Germany).

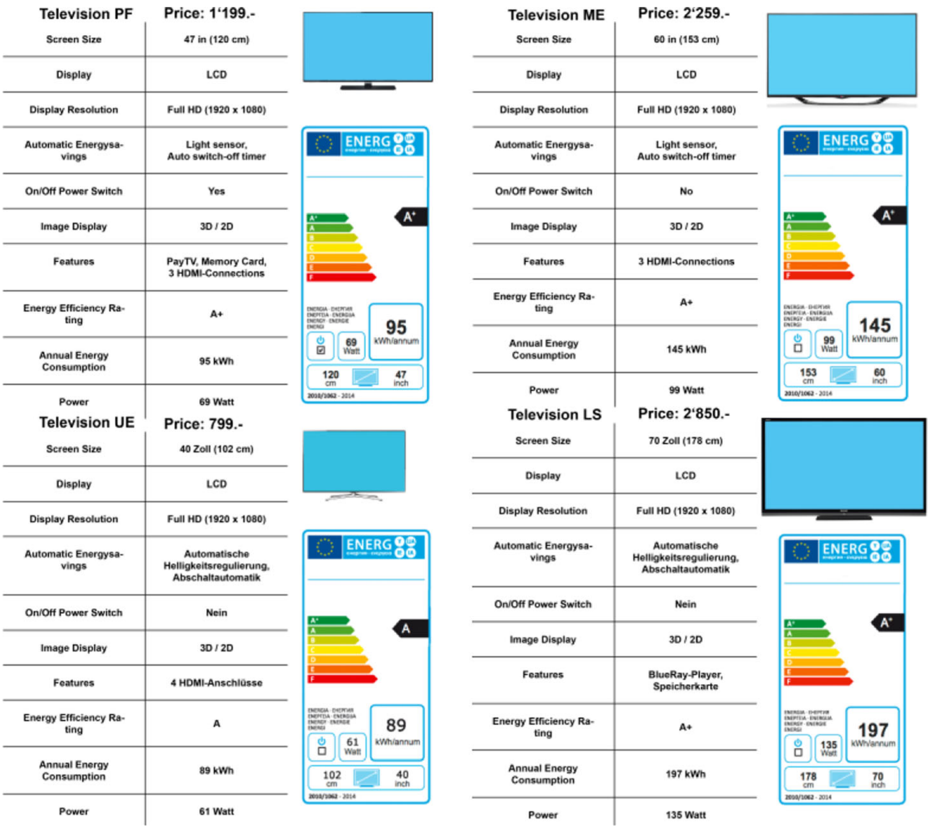

Fig. 2 Televisions with information, pictures, and corresponding energy labels. The participants were asked to identify the most energy-friendly product

Before the actual experiment began, all participants read and signed a consent form. With their signature, the participants acknowledged that their gaze behaviour would be recorded, that the data would be treated anonymously, and that they could quit the experiment at any time without providing a reason. Participants were then asked to sit in front of the eye tracker at a distance of approximately 70 cm with a visual angle of approximately 2°. The master computer on which the experiment was run was placed on a second desk at a distance of approximately 1.5 m from the eye tracker. The examiner explained the device and the procedure and started the calibration. After a successful calibration, the instruction for the first task was shown on the screen. The examiner activated the next page when the participants confirmed that they had read and understood the instruction. When the participants articulated their choice (by saying the name of the selected television), the examiner immediately pressed the space button and a blank page appeared. This procedure enabled the calculation of the time each participant needed for making the decision. After the task on the eye tracker, the examiner asked some qualitative questions regarding the decision-making process. Finally, the participants were asked to fill in a paper-and-pencil questionnaire.

Participants

A random sample of 500 households in the German-speaking part of Switzerland was drawn from the electronic telephone directory; the households were advised via an invitation letter about the study's objectives and procedure. After a few days, the households were contacted by phone and asked about their willingness to participate in the study. In addition, a free advert in a newsletter also provided information about the study and included the option of signing up for it. The exclusion criteria for participation consisted of wearing eyeglasses or hard contact lenses or suffering from eye diseases, because these factors can pose a problem for the eye tracker (e.g., due to reflections on the eyeglasses). Additionally, participants were required to be in the age group of between 20 and 65 years. The maximum age limit was set at 65 years because aging tends to cause drooping eyelids, which can lead to calibration problems. The experiment was conducted alongside a second unrelated study. It took participants less than 1 h to complete the two studies and they received CHF 40 (≈USD 42) as an incentive.

In total, 62 people from the population of the German-speaking part of Switzerland participated in the experiment. Three participants were excluded from the final sample due to calibration problems on the eye tracker. Thus, the final sample comprised 33 women and 26 men ($N = 59$) and the mean age was 37 years ($SD = 11$). The education level was high, with 28.8% of the participants having a university degree and 52.5% having finished high school or similar. The majority of the participants were tenants (86.4%), and the number of people living in a household was 2.3 people, on average. All participants had normal or corrected-to-normal eye vision.

Segmentation Variables

Parameters of Decision-Making Strategies

When using eye-tracking data, two parameters are of interest: saccades and fixations (Just and Carpenter 1976). A fixation is detected when the eye remains on an area for a certain amount of time (i.e., a minimal duration of 80 ms). Saccades are the movements of the eye between two fixations. The eye-mind hypothesis states that where people look is also where they pay attention to (Just and Carpenter 1976). Based on this assumption, research on decision-making has relied on eye-tracking measures to understand which pieces of information people process (Jones and Richardson 2007; Siegrist et al. 2015), in which order they process the information (Keller et al. 2014; Stüttgen et al. 2012), and how difficult certain information is to process (Duchowski 2007; Glöckner and Herbold 2011). The assessment of these parameters allows the researcher to model judgment and decision-making behaviour (Gidlof et al. 2013; Glöckner and Herbold 2011; Horstmann et al. 2009; Orquin and Mueller Loose 2013).

Direction of Information Search It is assumed that search strategies differ in their proportion of within- versus between-options information processing (Payne et al. 1988; Schulte-Mecklenbeck et al. 2013). For this analysis, each information cue (e.g., annual consumption) for each option was defined as an area of interest (AOI). If two subsequent fixations were on two AOIs belonging to the same option, the transition was classified as a within-option. If two subsequent fixations were on two AOIs belonging to different options but containing the same information, the transition was classified as between-option. These transitions were the basis for the calculation of a ratio of within- versus between-option transitions to determine the search direction. The determination of the search direction was based on the search metric (SM) index (Böckenholt and Hynan 1994; Schulte-Mecklenbeck et al. 2013):

$$\mathrm{SM}_i = \frac{\sqrt{N_i}\left(\left(\frac{A*O}{N_i}\right)(\mathrm{WO}_i-\mathrm{BO}_i)-(O-A)\right)}{\sqrt{A^2(O-1)+O^2(A-1)}}$$

In the above equation, N represents the total number of transitions, A the number of attributes, and O the number of options. WO denotes within-option transitions and BO between-option transitions. An SM value above 0 indicates a within-option information search and a value below 0 indicates a between-option information search. In this study, the mean of the SM-index was rather high (M [SD] = 12.26 [5.39]), thereby indicating the participants' tendency to use a predominantly within-option acquisition pattern.

Importance of Attributes Decision-making strategies differ in terms of how the attention is distributed over the attributes, that is, how much weight (i.e., importance) is assigned to the attributes. The importance—that is, the weight of an attribute—was assessed by how often the AOIs corresponding to this attribute were acquired across the various choice options in relation to the total number of transitions (Gidlof et al. 2013; Schulte-Mecklenbeck et al. 2013). This procedure yielded the weight of each attribute. Subsequently, the coefficient of variation (CV) for the estimated attributes' weights was calculated:

$$\mathrm{CV}_i = \frac{\sigma_i}{\mu_i}$$

In the equation above, μ denotes the mean of the weights of all attributes and σ denotes the standard deviation of these weights. A value below 1 is considered low in variance, that is, all attributes are of similar importance. A value above 1 is considered high in variance, that is, some attributes are more important than others (Schulte-Mecklenbeck et al. 2013). The mean of the CV was M (SD) = 0.84 (0.47).

Incompleteness of Information Search A third classifier for the decision-making strategy was the incompleteness of information search. This value was calculated by counting the AOIs that were not acquired. A lower number of not-acquired AOIs indicated a more complete information search, whereas a higher number of not-acquired AOIs indicated a more limited information search. For the analysis, the ratio of the not-acquired AOIs was used. The mean was M (SD) = 0.35 (0.21).

Decision Time The last indicator for the decision-making strategy used was the total time in milliseconds (ms) that each participant took to reach the decision. On average, participants took 67,652.05 ms (SD = 43,569.64) for the decision.

Attention to Energy-Related Information In order to identify the most energy-friendly product, the participants need to inspect energy-related information. Therefore, we calculated the proportion of time spent on energy-related information relative to the time spent on all information by dividing the gaze times on all energy-related AOIs by the decision time. This procedure provided the Energy-Gaze-Proportion (EGP) with values between 0 and 1 (Ashby et al. 2012, 2015). Higher values indicate stronger attention to energy-related information. On average, participants spent 29% (SD = 12) of their decision time on energy-related information.

Descriptive Variables

Choice The participants were instructed to choose the most energy-friendly product out of the four provided televisions (see Fig. 1 or Fig. 2, respectively). The television with the lowest annual consumption (i.e., television UE, see Fig. 1 or Fig. 2, respectively) was coded as the most energy-friendly choice (i.e., the “correct” choice), and all other televisions were coded as choices that were not energy-friendly. Accordingly, the participants’ choices were classified as either energy-friendly or energy-unfriendly. In total, 40.7% of the participants chose the product with the lowest consumption, which is higher than expected by chance.

Energy-Efficiency Information As indicated in the previous section, energy-efficiency information can be imprecise in terms of energy friendliness. Therefore, reliance on this information could lead to non-optimal decisions in terms of absolute energy consumption, because a big television can be very efficient but still consume a considerable amount of energy. To generate a measure of the proportion of participants’ attention toward energy-efficiency information, the fixations on all AOIs containing energy-efficiency information were summed up and divided by the number of all fixations during the task.

Actual Energy Consumption In order to objectively identify the optimal product in terms of absolute energy consumption, the participants should rely on information on actual energy consumption (i.e., XY kWh/year). The same procedure as that for energy-efficiency information was applied to generate a measure of the participants’ attention on the crucial information related to annual consumption. That is, all fixations on AOIs containing information on actual energy consumption were counted and divided by the number of all fixations during the task.

Energy Label The energy label causes consumers to focus more on energy-efficiency information (Waechter et al. 2015a, b) and might therefore influence the participants’ decision-making strategies. To test for a potential impact of the energy label on decision-making, the participants were either assigned to a condition with the corresponding EU energy labels presented next to the four televisions or a condition without the energy labels (see Figs. 1 and 2).

Attitude Towards Energy Conservation Research on the relation between environmental behaviour and environmental attitude is often ambiguous (for an overview, see Steg and Vlek 2009). The goal of integrating an attitudinal measure was to add more facets to the description of the consumers' segments applying different decision-making strategies. Attitude towards saving electricity was assessed using 12 statements (Table 2). The participants were requested to indicate their agreement with each item on a six-point scale ranging from 1 (do not agree at all) to 6 (absolutely agree). The reliability of the scale was good with Cronbach's alpha of .78.

Objective Numeracy Numeracy is defined as the ability to understand and interpret probabilities, fractions, and ratios (Fagerlin et al. 2007). The interpretation of energy-related information, particularly annual-consumption information, might pose a problem to people with lower numeracy skills. A study by Attari et al. (2010) has found that participants with higher numeracy scores were better in estimating the energy consumption of different products. However, to the best of our knowledge, no study investigating the relation of numeracy and energy literacy has been conducted thus far. Furthermore, several studies have shown that the choice of decision-making strategy and selection of attributes for the decision are correlated with numeracy (Keller et al. 2014; Peters et al. 2006). In this study, the objective numeracy

Table 2 Items used to measure attitude towards saving electricity

Items	M	SD
When purchasing electrical appliances, I pay attention to whether or not such appliances have low energy consumption levels.	3.54	1.26
The increasing shortage of energy sources is a serious problem for our society.	3.90	1.34
The electricity consumption in Switzerland can be significantly reduced by using energy-efficient appliances.	4.17	1.01
The increasing electricity demand can become a problem.	3.75	1.38
For me, the energy label is an important source of information when purchasing new electrical appliances.	3.48	1.48
There would be severe consequences if the electricity supply was no longer guaranteed.	4.40	1.08
I think that by purchasing energy-efficient appliances, I can make a difference in the reduction of the electricity demand.	3.92	1.04
I think that the difference between appliances with efficiency rating "A" and appliances with efficiency rating "B" is negligibly small.[+]	3.27	1.27
For electrical appliances that I rarely use, it is not worth it to consider the energy label.[+]	3.02	1.50
I think that energy-efficient appliances can contribute very little to the reduction of electricity consumption in Switzerland.	3.59	1.33
Considering the short operating life of appliances, it is not worth it to pay attention to the energy label.[+]	3.98	1.24
Nowadays, electrical appliances are already very low in consumption and thus it is not necessary to consider the energy label.[a]	3.80	1.11
Cronbach's $\alpha = .78$		

Participants indicated their agreement with each item on a six-point scale ranging from 1 (do not agree at all) to 6 (absolutely agree)

[a] Items reversed

measurement by Weller et al. (2013) was used, because it provides a short and reliable assessment of the participants' numeracy skills. This Rasch-based questionnaire comprises eight mathematical problems of increasing difficulty. The participants' answers were subsequently coded as correct (1) or incorrect (0). The reliability of the scale was satisfying (Cronbach's alpha = .63).

Results

Correlation of Decision-Making Parameters

All four decision-making parameters were highly correlated ($p < .01$). The SM index correlated positively with the decision time ($r = .75$) and negatively with CV ($r = -.77$) and the incompleteness of information search ($r = -82$). This implies that an increase in the SM index (i.e., stronger within-option search) is more time-consuming, leads to a more equal importance distribution, and increases the amount of acquired information. CV positively correlates with the incompleteness of information search ($r = .75$) and negatively with the decision time ($r = -.54$). That is, a higher preference for certain attributes goes along with a limited information search and faster decision. Furthermore, the decision time is negatively correlated with the incompleteness of information search ($r = -.89$), thereby indicating that the acquisition of more information needs more time.

Identification of Consumers with Different Decision-Making Strategies

A cluster analysis was conducted to identify groups of people with different information-search and decision-making behaviours. The cluster analysis was conducted with the pooled sample because the number of participants in each label condition (i.e., condition with and condition without energy labels) was too small to perform two independent cluster analyses. Clusters were identified based on the following decision-making variables: SM index, CV, incompleteness of information search, and decision time. Attention to energy-related information was also included in the cluster analysis, because the consideration of energy-related information constitutes the base for an energy-friendly decision-making strategy. Before conducting the cluster analysis, the variables were transformed to diminish the influence of outliers. For the variables SM index, decision time, and attention to energy-related information, the square root was extracted and CV was log transformed. Subsequently, all variables were z-standardized to ensure equal weight of all segmentation variables (Aldenderfer and Blashfield 1984). Ward's method was applied and the squared Euclidean distance was used as the proximity measure for the cluster analysis. Thereafter, the range of possible cluster solutions was determined on the basis of the agglomeration schedule. The elbow plot suggested a two-, three-, or four-cluster solution. The two-cluster solution was rejected, because too much variance of the clustering variables was lost. In the four-cluster solution, the means of the clustering variables within the clusters provided an undifferentiated picture. The three-cluster solution provided a meaningful differentiation regarding the clustering variables used, as was expected based on the decision-making theory. A subsequently conducted ANOVA with the three clusters supported the solution, thereby revealing significant differences between the clusters for all clustering variables (Table 3). To further validate the cluster solution, we tested for significant differences between the clusters with the descriptive variables. The results were significant for all descriptive variables, except for the attitude towards energy conservation (Tables 3 and 4).

We identified three consumer segments with different decision-making strategies: consumers with an *energy-directed lexicographic* strategy (16.9%), an *unsystematic-lexicographic* strategy (15.3%), and an *unsystematic-exhaustive* strategy (67.8%). The three groups were tested for homogeneity by calculating the F-values for all clustering variables for each group (Aldenderfer and Blashfield 1984; Backhaus et al. 2003). The F-value is the quotient of the variance of a variable within a group and the variance of the variable in the survey population. A cluster is considered completely homogeneous if all F-values are smaller than one. The unsystematic lexicographic and unsystematic exhaustive groups were completely homogenous. The energy-directed lexicographic group was almost homogenous with one F-value

Table 3 Characterization of consumers applying various decision-making strategies with regard to the clustering and descriptive variables

	Energy-directed lexicographic ($n = 10$)	Unsystematic lexicographic ($n = 9$)	Unsystematic exhaustive ($n = 40$)
Clustering variables			
SM Index**[a]	5.89 (4.64)a	9.16 (2.33)a	14.55 (4.36)b
CV**[b]	1.49 (0.76)a	1.01 (0.27)a	0.63 (0.14)b
Completeness**[c]	0.65 (0.13)a	0.54 (0.11)a	0.24 (0.12)b
Decision time (ms)**	26144.30 (9757.68)a	37668.78 (25197.14)a	84775.22 (41484.65)b
EGP**[d]	0.45 (0.09)a	0.14 (0.07)b	0.29 (0.08)c
Descriptive variables			
Correct choice (%)	60a	33a	38a
Energy efficiency*[e]	0.21 (0.08)a	0.10 (0.12)b	0.11 (0.06)b
Annual consumption**[e]	0.27 (0.09)a	0.06 (0.04)b	0.14 (0.05)c
Energy label (%)+[f]	80a	33b	45b
Numeracy+	5.40 (1.17)a	4.00 (1.94)b	4.12 (1.74)b
Attitude energy	3.77 (0.55)a	3.28 (0.90)a	3.83 (0.67)a

Characterization of consumers applying various decision-making strategies with regard to the clustering and descriptive variables. Untransformed means and standard deviations (in brackets) are depicted. Analysis of variance (ANOVA) revealed a significant effect of all clustering variables and three of the descriptive variables. Different letters indicate significant differences between the groups ($p < .05$) using the Games-Howell post hoc test

*$p < .05$; **$p < .01$ (significant effects); + $p < .10$ (marginally significant effects)

[a] Lower values indicate a tendency toward between-option search and higher values a tendency toward within-option search

[b] Values below 1 indicate no preferences (i.e., equal importance distribution) and values over 1 indicate preferences for selected attributes

[c] The ratio of not acquired attributes. Higher numbers represent a more directed information search (i.e., less complete information search)

[d] The ratio of time spent on energy-related information

[e] The ratio of fixations spent on energy efficiency and annual consumption, respectively

[f] Percentage of participants in the condition with the energy labels

Table 4 Characterization of consumers applying the different decision-making strategies with regard to socio-demographic variables

	Energy-directed lexicographic ($n = 10$)	Unsystematic-lexicographic ($n = 9$)	Unsystematic-exhaustive ($n = 40$)
Age (years)	40.60a	46.22a	33.90b
Female (%)**	50b	0a	70b
Tenants (%)	80a	89a	88a
High educational level (%)[a]	60a	33a	48a

ANOVA revealed a significant effect of age. Chi square tests of independence were conducted to test for significant dependences for the categorical variables. Different letters indicate significant differences between the groups ($p < .05$) using the Hochberg's GT2 post hoc test

*$p < .05$; **$p < .01$ (Significant effects)

[a] Primary school, high school, and vocational school were coded as low educational level. Grammar school and technical college were coded as intermediate educational level. University was coded as high educational level.

greater than one. In the next section, the three groups are described with regard to both the clustering and descriptive variables.

Characterization of the Different Decision-Making Strategies

The Energy-Directed Lexicographic Strategy Participants relying on this strategy had a tendency towards a between-options search, and they had a clear preference for energy-related attributes (Table 3). They spent almost half of their decision time on energy-related information, ignored a big portion of the irrelevant (i.e., not energy-related) information, and reached the decision quickly. The analysis of the choice showed that this strategy resulted in 60% of the cases in optimal choices in terms of energy friendliness. Participants applying this strategy had a higher numeracy and 60% of them had a higher education. Further, females and males were equally likely to apply this strategy (Table 4). The analysis of the attention distribution on energy efficiency and annual consumption showed that the participants who employed this strategy focused significantly more on the latter information—that is, the essential, actually relevant, information—to determine the most energy-friendly product (Table 3). This strategy was more often used in the condition with the energy label (Table 3). This indicates that the energy label can be useful for energy-literate people to quickly grasp the energy-related information. To summarize, the energy-directed lexicographic strategy can be described as a fast and frugal decision-making strategy (Gigerenzer and Gaissmaier 2011), because it ignores part of the (irrelevant) information and the direction of the search is towards important attribute between-options. It is an expedient heuristic, because the focus is mostly on energy-related attributes with a peak at the most important attribute. However, a pre-condition to make this energy-directed lexicographic strategy successful is the comprehension of the meaning of the provided information. One needs the knowledge on which information needs to be considered, as this was the case for the majority of the group. Applying this strategy without a focus on annual consumption but by first comparing energy efficiency information does not lead to the optimal product choice. In 40% of the cases, the participants with this strategy did not choose the product with the least consumption. They overlooked the product with the lowest actual consumption, because its energy efficiency rating is lower than that of the other three products.

The Unsystematic Lexicographic Strategy This strategy involves a tendency toward a between-options search with clear preferences for some attributes. However, the preference was less pronounced compared with the energy-directed lexicographic strategy (Table 3). Similar to this strategy, participants using the unsystematic lexicographic strategy reached the decision quickly and ignored a large portion of the information. The analysis of the choices revealed that only 33% of the choices could be classified as optimal when using this strategy. This low rate of optimal choices can be explained with the importance distribution of participants relying on this strategy. First, they spent significantly less time of their decision-making time on energy-related information—that is, only 14%. Second, they spent more time on information on energy efficiency than on actual energy consumption (Table 3). This behaviour cannot result in a high number of optimal choices, because the strategy is biased towards ambiguous information (i.e., energy efficiency) that does not permit a conclusive decision in terms of energy friendliness. Further analysis revealed that only male participants with low numeracy skills and a low level of education applied this strategy (see Table 2 for numeracy and Table 3 for gender and education). Contrary to our expectations, this strategy was more frequently applied in the condition without the energy label (Table 3). Consequently, energy-efficiency information seems to be generally more easily accessible for individuals relying on this strategy than information on actual energy consumption. This result indicates that the concept of energy efficiency is strongly anchored in consumers' mindsets. Overall, the unsystematic lexicographic strategy can be defined as a fast heuristic, but with limited success due to generally little consideration of energy-related information and the tendency, once energy-related information is considered, to focus on the less relevant one—that is, the energy efficiency rating.

The Unsystematic Exhaustive Strategy The third decision-making strategy is an additive strategy with a clear within-option search (Table 3). Participants relying on this strategy did not have a clear preference for certain attributes and evaluated almost all information. The decision time with this strategy is rather long, with only 29% of the time spent on energy-related information. This strategy resulted in 38% of the cases in the optimal decision. The choice result was not affected by whether participants were presented the energy labels. Participants using this strategy showed a levelled attention distribution on energy efficiency and annual consumption without a preference for one of the two information types (Table 3). Younger participants were more likely to use this strategy compared to the other two strategies. Furthermore, they had a lower numeracy level than participants using an energy-directed lexicographic strategy. Females applied this strategy more often than males did. Summing up, the unsystematic exhaustive decision-making strategy contrasts with the two other strategies, as it cannot be classified as a fast and frugal decision heuristic. The participants' attention (i.e., importance) was equally distributed over the attributes, thereby failing to assign more weight to the relevant information. This resulted in the high number of non-optimal choices. The lower numeracy suggests that this strategy was applied by participants who were somewhat overstrained by the technical and numerical information.

Discussion

Consumers make purchase decisions every day. Understanding how beneficial and destructive decision-making strategies look like in terms of energy-friendly product choices enables the development and adjustment of policy tools to support and sustain energy-friendly consumer behaviour. The results of this study suggest that consumers rely on different decision-making strategies when attempting to make an energy-friendly choice. In this study, we identified three consumer types who apply different decision-making strategies to determine the most energy-friendly television. The results revealed that people applying a lexicographic strategy with a directed focus on energy-related information were most likely to choose the most energy-friendly product, since they considered the relevant information—that is, the products' annual energy consumption. For this consumer segment, the energy label seemed to be a helpful tool. However, even with this strategy, not all participants made the optimal choice. Relying on a lexicographic strategy without a directed focus on energy-related information (i.e., unsystematic lexicographic strategy) or on an additive strategy without a preference for the critical information (i.e., unsystematic exhaustive strategy) was barely successful, because only a few participants chose the product with the least consumption. Further analysis revealed that when consumers applied these unsystematic strategies, the relevant information (i.e., annual consumption) did not receive sufficient attention and consequently could not influence the final decision. Participants over-weighted energy efficiency information when applying the unsystematic lexicographic strategy. This finding is consistent with the results of other studies showing consumers' tendency to rely on energy-efficiency information when estimating the energy friendliness of products (Waechter et al. 2015a, b). The lower numeracy level in this group could be one explanation for this so-called energy-efficiency fallacy, as low numerates tend to prefer graphical icons (e.g., energy efficiency letter rating) over numerical information (Keller et al. 2014). Participants applying the unsystematic exhaustive strategy did study the relevant information. However, they assigned equal weight to the relevant information on annual consumption and to the energy efficiency information and they, in general, weighted all provided information equally, even the information that was not related to energy consumption.

Thus, the information processing patterns of the unsystematic lexicographic and the unsystematic exhaustive strategies suggest that participants using these strategies might have struggled with the interpretation of the information provided and were unable to correctly integrate it in the decision-making process. This finding is in line with other research suggesting that many people have a low energy literacy level (Brounen et al. 2013). For these consumer segments, the energy labels did not facilitate the interpretation and integration of the energy-related information. This is problematic because the energy label should empower consumers to make an informed decision regarding a product's energy consumption thereby fostering the purchase of low-consuming products (European Commission 2015). Women were more likely to apply the unsystematic exhaustive strategy compared to the unsystematic lexicographic strategy. This may be because women are more risk-averse (Byrnes et al. 1999) and tend to strive to complete tasks as diligently and carefully as possible (Masson et al. 2004). For the other measured variables, such as attitude towards energy conservation and other socio-demographic information, no differences were found for the three strategies.

Summing up, a lexicographic strategy that focuses on energy-related information can be very effective if the emphasis is placed on the relevant information (i.e., information on annual consumption). On the other hand, even an exhaustive and thorough strategy can be very ineffective if the consumer struggles to understand or adequately classify (i.e., weight) the information provided. Furthermore, lexicographic strategies that rely on ambiguous information—in this case, information on energy efficiency that is not suitable for identifying the product with the lowest actual consumption (i.e., the most energy-friendly product)—are rarely effective.

Implications

The different information presentation formats affect and shape decision-making strategies and the resultant choices, respectively. Research on decision-making suggests that information on energy efficiency is more likely to be evaluated due to its salient and easily accessible format compared to the technical and more complex information on actual energy consumption (Waechter et al. 2015a, b; Weber and Johnson 2009). For consumers, this information seems to be more top of mind and, as a result, exerts a stronger influence on decision-making when it comes to assessing a product's energy friendliness. This study has demonstrated that decision-making strategies relying on this piece of information are less successful for energy-friendly decisions. One way to overcome this issue is to facilitate the correct interpretation of energy-related information, particularly information on annual consumption. This could help consumers to identify the most energy-friendly product when confronted with different products. Results suggest that people with lower numeracy skills and a lower educational level, in particular, are susceptible to such misleading strategies as the energy-efficiency fallacy. This raises concern for the prominent and salient presentation of energy efficiency on the energy label as well as the prevalent promotion of energy efficiency on a political level. Furthermore, there is a growing body of opinion that enhancing energy efficiency is not enough for reducing energy consumption (IEA 2009; Molenbroek et al. 2013; Otto et al. 2014). Therefore, it seems that it is important to communicate the relevance of actual energy consumption for the energy friendliness of electric goods, for example, by enhancing the accessibility and saliency of annual consumption on the energy label. With the last revision, energy consumption is now depicted as annual consumption, but it remained purely numerical information (Directive 2010). To further enable consumers to access this crucial information, the energy label could be amended as an additional graphical cue indicating whether a given absolute consumption is high or low. Research has shown that the use of traffic lights can enhance the effectiveness of labels, because this information presentation format is easy to interpret and consumer friendly (Siegrist et al. 2015; Thøgersen and Nielsen 2016). Furthermore, the focus on energy-efficiency information is problematic because the scale only provides relative information about a product's energy consumption. An absolute energy-efficiency rating on the energy label would allow consumers to directly infer a product's consumption and to compare products independent of their size. This method to change the environment/context in order to implicitly modify behaviour is also known as nudging, and it has the potential to be a powerful intervention tool (Keller et al. 2015; Ölander and Thøgersen 2014). The benefit of this method is that it does not forbid any options (e.g., products with high energy consumptions) or amend financial incentives, but it can alter a behaviour by changing the "choice architecture," that is, how choices are presented (Thaler and Sunstein 2008). A change of the presentation format of annual consumption on the energy label—for example, by providing a reference point—could therefore work as a "nudge." Consequently, information on annual consumption could become more influential in the decision-making process, particularly when applying a lexicographic strategy (Slovic et al. 2007).

The attitude towards energy conservation and socio-demographic factors did not differ between the selected consumer groups applying different decision-making strategies. This is good news for the promotion of energy-friendly purchase decisions, because the impact of an intervention is not limited to only a certain consumer segment. For example, clarifying the meaning of energy efficiency could improve the decision-making strategy for all the described consumer segments and, consequently, increase the number of optimal decisions in terms of energy friendliness. The results of this study have shown that the mere motivation to make an energy-friendly choice is not sufficient to actually make one when the energy-related information is incorrectly understood.

Limitations and Further Research

In this study, we did not investigate personal choices of consumers; instead, participants were asked to make an energy-friendly choice. The idea underlying this approach was to specifically investigate decision-making strategies for energy-friendly decisions to detect potential drivers and barriers for energy-friendly consumer choices. This idea is in line with the increasing recognition that a more substantial change in consumer behaviour is required to successfully reach the targeted energy goals (Otto et al. 2014; Steg and Vlek 2009; Stern 2000). By assessing the decision-making behaviour via eye tracking, thereby relying on an objective behavioural measurement, the results of this study are less susceptible to potentially influential factors such as the social desirability response bias—the tendency to answer in a manner that one assumes is socially desirable (Randall and Fernandes 1991). Therefore, the observed behaviour is closer to the "real behaviour" when it comes to energy-friendly product choices. Nevertheless, decision-making strategies in a real purchase situation might differ from the strategies found in this study. Research, for example, suggests that for many consumers, consideration of energy-related information is not a high priority (Sovacool and Blyth 2015; Yamamoto et al. 2008). Based on the present study, only limited conclusions can be drawn about decision-making strategies of consumer who do not care at all about a product's energy consumption.

Furthermore, the nature of this study was rather explorative as it relied on a small sample. We accepted this limitation in favour of conducting an experimental study by means of eye tracking. The three clusters have shown to be relatively homogeneous, although they differed significantly on the segmentation variables, and the results were in line with other studies on decision-making. In order to ensure the validity of the clusters, we included several external variables to describe the clusters (Aldenderfer and Blashfield 1984). Nevertheless, it seems likely that this study is not exhaustive with regard to the identified strategies. Studies conducted in other fields suggest that consumers rely on a variety of decision-making strategies (Schulte-Mecklenbeck et al. 2013; Stüttgen et al. 2012); however, these studies did not assess energy-friendly decision-making strategies. Therefore, future studies should investigate the strategies applied in energy-related judgment and decision-making situations with a bigger and more representative sample. Moreover, studies with different products and in a non-laboratory setting could further help to understand how consumers make energy-friendly choices.

Finally, the data for this study was collected by means of eye tracking. Eye tracking data has been proven to be reliable and valid (Holmqvist et al. 2011); however, there are some limitations of this method that should be addressed. First, the interpretation of the eye-tracking parameters (e.g., fixation count) might vary between researchers (Holmqvist et al. 2011; Orquin and Mueller Loose 2013). For example, the fixation count can reflect semantic importance (e.g., Poole et al. 2005) or difficulty related to the fixated information (Goldberg and Kotval 1999). Second, eye-tracking data can be susceptible to potentially influential factors—such as motivation, fatigue, or interest—that could not be controlled for and might have affected the results. Third, the parameters used, such as total decision time, might have been affected by the operational procedures; for example, the time to verbalize the choice and the time required for the examiner to react. Finally, the design of the stimuli material has to fulfil the requirements of the eye-tracker. In our case, all information had to fit on one page and it had to be readable from a distance of approximately 70 cm. The format and the design used in this study were similar to the design of online shops in order to create a realistic situation; however, the chosen design might have affected the decision-making parameters, such as the SM index, leading to a stronger within-option search strategy. A different design might have revealed slightly different results.

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