

# COMPUTER-BASED SURVEYING AND INTERVIEW QUESTIONS TO IDENTIFY DECISION MAKING STRATEGIES

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## Abstract

*Most research on consumer choice modelling has assessed the choices made when respondents are faced with different types of products, but less is known about the strategies individuals actually use when making these decisions. There are two classes of theories offering explanations on how consumers make decisions: neoclassical decision making theories and theories of bounded rationality. The former propose optimising strategies that use complete search for information that is weighted, integrated and compensatory. The latter suggest non-optimising, simplified and non-compensatory strategies. The present research used a computerised choice modelling survey coupled with face-to-face interview questioning to assess the decision processes participants used when making choices regarding potatoes with different attributes. The computer-based choice survey was administered to a convenience sample of students at Lincoln University. The survey required the participants to choose from different types of potatoes with different attributes. The computerised choice survey captured the order in which respondents sought new information about their choice options, providing one source of information on their decision processes. Respondents were also questioned about their decision strategies, which provided a second source of such information. This information was analysed to determine the decision processes that respondents used and how those processes related to theorised decision strategies. The results indicated that participants' decision processes may not be consistent with neoclassical decision making theories and may fit more closely with theories of bounded rationality.*

## Introduction

Making decisions is a basic economic activity. Individuals must make a choice of employment, housing, food, entertainment, and more. The way that people arrive at their decisions has long been studied by economists and psychologists, but as yet there is still disagreement about decision making behaviours. Two elements that are contested are the amount of information that individuals use in making decisions, and how they integrate the available information to make a choice. Most of the research on consumer choice modelling has assessed the choices consumers make when faced with different alternatives but researchers only have a limited understanding of the strategies consumers employ when making these decisions.

There are two classes of decision making theories, neoclassical decision making theories and theories of bounded rationality, that provide an insight into the strategies individuals may use when making decisions. However, there is a lack of agreement on which class of decision making theories best describe how people make decisions. The aim of this paper is to gain an understanding of the processes individuals apply when making consumer decisions and to what extent the two classes of theories are able to explain these decision processes.

## Decision making research

The effectiveness and application of the decision strategies proposed by the two classes of decision making theories, neoclassical decision making theories and theories of bounded rationality, have been

investigated in previous research. This section first provides an outline of neoclassical decision making theories, and then describes theories of bounded rationality and previous research assessing these theories. The last part of this section presents an overview of consumer choice modelling surveying.

### *Neoclassical decision making theories*

Neoclassical decision theories are based on the vision of unbounded rationality where the decision choice is dictated by an explicit rule which always results in an optimal outcome. In neoclassical decision making theory, the decision maker considers all possible alternatives; identifies the complete set of attributes that could impact on the success of choosing any of the available alternatives; assigns a relative importance to each attribute; computes an overall value for each alternative based on the impact of attribute and relative weight; and selects the alternative with the best value (e.g. Kreps 1990; von Winterfield & Edwards, 1986). It is also often assumed that decisions are compensatory, that is, negative attributes can be compensated for by equal or higher value positive attributes. Examples of neoclassical decision theories are probability theories such as Bayesian theory, and utility theories such as Expected Utility and Multi-Attribute Utility theory where all attributes are weighted (Beach & Lipshitz, 1993).

The theories are primarily concerned with the internal logical coherence of decisions and judgements rather than how useful they might be in helping humans to make useful decisions in real-world environments (Todd & Gigerenzer, 2000). Kahneman and Tversky (1979) suggest that people rarely follow the explicit rules and that decision behaviours do not appear to conform to logic. Beach and Lipshitz (1993) further argue that the neoclassical decision theories are unrealistic as they require humans to have unlimited time, knowledge and computational capacities. Another criticism of the neoclassical theories is that people are unable to integrate information as fully as some of these theories demand (Schoemaker, 1982). According to psychologists, people do not make decisions as though they are fully integrating available information and then finding the global maximum (Plott, 1987; Slovic, 2000). Fullbrook (2004) provides further criticism of the neoclassical theories and points out that they focus on individual decision-making and do not take into account the social context in which individuals exist. Neoclassical theory says nothing about how individuals learn about the world and where their judgements originate (Bettman, Luce & Payne, 1998). There is therefore no place for learning or for preference formation (Earl, 1986; Earl & Potts, 2004).

These criticisms of the neoclassical theories apply to choice experiments. It is true that choice experiment theory does recognise that one of the factors affecting choice is the process by which decisions are made

(Ben-Akiva, McFadden, Train, Walker, et al., 2001; McFadden, 2001a). However, it does not claim to analyse the choice process (Crouch & Louviere, 2001), but instead assumes that choice proceeds by integrating available information and maximising utility given stable individual preferences (McFadden, 1986, 2001a). Considering the criticism of the neoclassical decision making theories, it may be useful to look outside these theories in order to understand consumer decision making processes.

### *Theories of bounded rationality*

Simon (1956) recognised the criticism of neoclassical theories and suggested models of bounded rationality, where simplified decision strategies with non-optimising rules are applied. That is, the decision making processes need to satisfice rather than optimise. A typical bounded rationality theory suggests that decision makers do not collect all the relevant information about possible alternatives and their attributes, fail to assign the relative importance to various attributes, and often use non-compensatory strategies where the benefits of some attributes are not traded off against the deficits of others (e.g. Chase, Hertwig & Gigerenzer, 1998; Todd & Gigerenzer, 2000). There are many different bounded rationality decision making theories but the most recognised theory is Decision Making Heuristics. Another less recognised theory is the Differentiation and Consolidation Theory. Both these theories are discussed below.

*Decision making heuristics.* One type of bounded rationality decision making theory is heuristics, simple rules for making decisions using realistic mental resources (Gigerenzer & Todd, 1999). After 1970, heuristics were regarded as a limited decision making model that people often misapplied to situations where neoclassical theories should be used. It was argued that heuristics would produce systematic flaws in the internal relationship among judgements and result in systematic errors and biases. Hence, heuristics were often invoked as the explanation when errors were found in human reasoning (Cohen, 1993). In contrast, Gigerenzer and Todd (1999) suggest that the heuristic-bias approach does not consider the fit between the environment and cognitive mechanisms, which enables the human mind to take advantage of the structure of information in the environment to make accurate judgements. Hence, neoclassical models fail because the models themselves do not capture the adaptive characteristics in real-world environments in the same way as heuristics do.

There are three core principles that function as the building blocks of a heuristic: principles for guiding search, principles for stopping search and principles for decision making. Principles for guiding search suggest that an active search based on the information between alternatives must take place. The search is simple and

does not require extensive knowledge or computation. Principles for stopping search are used to terminate the search when a limited number of appropriate alternatives have been found. Simple stopping rules are used rather than cost-benefit analysis (Anderson & Milson, 1989).

Saad and Russo (1996) investigated individuals' stopping strategies in a sequential search task. Subjects were asked to make choices between pairs of apartments that were to be rented. First, participants were presented with a list of 25 apartment attributes and were asked to rate the relative importance of them. Second, subjects made choices between given pairs of apartments that varied in the level of each attribute, by requesting one attribute of information at a time. It was predicted that the participants would use the "Core Attribute" stopping rule, which suggests that participants would stop acquiring information and commit to the leading alternative once the last set of the most important attributes had been acquired. The results supported the hypothesis as a majority of the participants applied the Core Attribute stopping rule and the remaining participants used the Core Attribute stopping rule together with another stopping rule. These results suggest that simple stopping rules are used when searching for cues.

Once the stopping rule has been applied, the final set of heuristic principles is employed to make the decision based on the results of the search. The building blocks can be joined in various ways and therefore produce an array of heuristics (Todd & Gigerenzer, 2000). There are many different types of decision making heuristics that are suitable for different situations, environments and individuals. Thus, the same heuristics may not work in two different environments or two different individuals may employ different heuristics in the same environment (Todd & Gigerenzer, 2000). Gigerenzer and Todd (1999) have proposed many different types of heuristics and three of them are discussed below: one-reason heuristics, elimination heuristics and satisficing heuristics.

One-reason heuristics are used when multiple attributes are available for a decision. A stopping rule is applied that ends the search when a single attribute is found that enables a choice to be made between two alternatives. A decision rule is applied that selects the alternative to which the one attribute points. The search rule used depends how the attribute values are sought out, which varies between types of one-reason heuristics (Gigerenzer & Goldstein, 1999). For example, the "Take the Best" heuristic searches for cues in the order of their validity, that is, how often the attribute has indicated correct judgements (Gigerenzer & Goldstein, 1999). A few studies have been undertaken to assess the performance of Take the Best compared to neoclassical decision models and these studies show that the Take the Best heuristic is faster than the neoclassical decision making strategies as it looks up less attributes, yet draws as many correct inferences as any of the competing models (Chater, Oaksford, Nakisa & Redington, 2003; Czerlinski,

Gigerenzer & Goldstein, 1999; Gigerenzer & Goldstein, 1996). Research has also been undertaken to assess whether decision makers actually employ the Take the Best decision strategy and the results of these studies show mixed results. That is, some of the participants in these studies made choices consistent with Take the Best some of the time and a large proportion of participants adopted strategies that are only partially consistent with Take the Best or used completely different decision making strategies (e.g. Bröder, 2000; Bröder & Schiffrs, 2003; Lee & Cummins, 2004; Newell & Shanks, 2003; Newell, Weston & Shanks 2003).

Research indicates that many individuals are reluctant to make a decision based on one piece of discriminatory information (one valid attribute) and tend to seek additional evidence to increase their confidence in their decision choice, which is a phenomenon called "accumulation of evidence strategy" (Lee & Cummins, 2004; Svenson, 1996). Hence, there is a tendency for individuals to consider more than one reason when making a decision.

Another type of heuristics is the elimination heuristics. The elimination heuristics are non-compensatory decision making strategies suitable in situations where an individual must choose between several alternatives and when a single attribute will be unable to distinguish between alternatives. These heuristics use successive attributes to eliminate more and more alternatives and thereby reduce the set of remaining alternatives, until one single option can be determined (Todd and Gigerenzer, 2000). "Categorisation by Elimination" is an elimination heuristic that is closely related to Tversky's (1972) probabilistic Elimination by Aspects Model. It is applied when the task is to choose the one category, from several possible, that a given alternative falls into. The heuristic uses successive attributes to reduce the set of possible categories, until only one single category remains. It is a non-compensatory strategy as it uses attributes in a particular order and categorisation decisions made by earlier cues cannot be altered by later attributes (Berretty, Todd & Martignon, 1999). Blythe, Todd and Miller (1999) found in their study that the Categorisation by Elimination strategy performed as well as three competing neoclassical decision strategies but considered less of the available information, which suggests that this heuristic is an effective decision making strategy. However, the authors have not identified any research investigating whether individuals apply the Categorisation by Elimination decision making strategy.

Satisficing heuristics (Simon, 1982; Todd & Miller, 1999) are a third type of decision making heuristics that are applied in situations where all possible alternatives are not readily available to the decision maker and may appear sequentially over a period of time. An aspiration level is set for the selection criterion being used and the search for alternatives stops as soon as the aspiration level is met. For instance, when searching for a flatmate an aspiration

level in the desired characteristics in a flatmate is set and one keeps on searching for potential flatmates until a person that meets the set aspiration levels is encountered. The satisficing heuristics are consistent with Simon's (1955) notion of aspiration based satisficing search. The problem with employing satisficing heuristics is how to establish the stopping rule. Neoclassical search theory suggests that one should stop searching for alternatives when the costs of further search outweigh the benefits of additional searching (Anderson & Milson, 1989). In practice however, this rational cost-benefit analysis is time consuming and cognitively demanding. For this reason, another search theory was developed which is based on statistics, the "37% rule". This rule proposes that the searcher should sample the first 37 per cent of alternatives encountered and then select the first alternative thereafter that is better than all previous alternatives (Ferguson, 1989). Todd & Miller (1999) suggest that one can achieve satisficing outcomes by sampling a much smaller number of alternatives than proposed in the 37% rule and select the best alternative encountered so far. Although the chance of finding the highest value alternative is reduced, there is an increased chance of selecting an alternative with higher expected value and the cost associated with the search is reduced. Despite the lack of clarity in how the stopping rule is established, research shows that humans apply decision strategies consistent with satisficing heuristics (e.g. Chen and Sun, 2003; Seale and Rapoport, 1997 cited in Todd & Gigerenzer, 2003).

There is some applied research indicating that humans are actually employing heuristic decision making strategies. For example, Murdach (1995) conducted a survey on staff members on a psychiatric ward to investigate if clinical practitioners employ heuristics to perform their duties. Unstructured interviews combined with indirect observation of staff interaction and retrospective analysis were employed to explore the staff's employment of heuristics. The results demonstrated that heuristics consistent with the Take the Best was commonly used to ensure effective operation of the clinic. Furthermore, Krabuanrat and Phelps (1998) demonstrated in their study through in-depth interviews that heuristics such as Take the Best and Satisficing were employed in strategic decision making.

Whilst the above research provides some support for the application of heuristics, Harries and Dhami (2000) argue that heuristics are only valid descriptions of decision making behaviour, but this descriptive success of heuristics does not imply that individuals are actually employing decision making heuristics. That is, individuals' descriptions of their decision making strategies do not necessarily imply that these strategies are in fact employed. Hence, it is important to validate descriptive self-report data with quantitative experimental data.

*Differentiation and Consolidation Theory.* The Differentiation and Consolidation theory is another theory of bounded rationality that was proposed by

Svenson (1992; cited in Svenson 1996). This decision strategy involves both a pre-decisional stage and a post-decisional stage. In the pre-decisional stage, an alternative is tentatively chosen using a differentiation process. The differentiation process separates available alternatives until one alternative reaches a degree of differentiation from the others which is acceptable to the decision maker and fit with aspiration levels. A non-compensatory rule is often applied in the beginning of the differentiation process whilst a compensatory rule is more likely to be utilised in the final stages of the differential phase when only limited alternatives remain (Svenson 1979; cited in Svenson 1996).

In the post-decision stage, various consolidation processes are applied to protect the chosen alternative and to justify that this alternative was the most suitable (Svenson, 1996). The notion that decision makers apply a consolidation strategy is consistent with the confirmation bias concept. Confirmation bias is the tendency to search for or interpret new information in a way that confirms one's preconceptions and avoid information and interpretations which contradict prior beliefs (Festinger, 1957). Hence, the confirmation bias is a type of consolidation process.

#### *Consumer choice modelling surveying*

Choice modelling surveys are a common tool in when determining the choices consumer make when faced with a product that is available in different varieties with different attributes. They are based on Lancaster's (1966) conception of consumption, in which products are treated as baskets or collections of attributes. Consumers are interested in consuming these attributes, and modify their choices of products in order to optimise their consumption of attributes.

Choice modelling surveys similarly focus on choice attributes. A survey presents participants with a series of choice questions or choice sets. Each question presents several alternatives that are different configurations of the available product attributes. For each choice set, the respondent is asked to review the attributes for each product alternative and select one alternative that is preferred over the other alternatives in the choice set. Because the participants have indicated that the chosen alternative is preferred, it is assumed to provide the highest utility (McFadden, 2001). In choice modelling surveys, the attributes of the products are systematically varied to examine the impact of changes in attribute values on choices of products.

The surveys are appealing because they highlight the trade-offs that consumers might face between different product attributes, such as between taste and price. A primary theoretical advantage of choice modelling is that it generates data consistent with the economic theory of utility maximisation (Louviere, Hensher &

Swait, 2000). For discussions of attribute-based stated choice methods, see Bateman, Carson, Haneman, Hanley, Hett, et al. (2002), Bennett & Blamey (2001), and Hensher, Rose, & Greene (2005).

## Method

### *Survey Design*

The computer-based consumer choice modelling survey contained four sections: initial questions, choice set questions, follow-up questions, and demographic questions. In the initial questions section, the respondents were asked to rank the importance of six different potato attributes (Texture, Price, Colour, Production Practices, Nutrition, Country of Origin) on a scale one to six. In the choice set questions section, the participants were presented with 10 choice sets. Each choice set required the participants to select one out of three potato options with six different attributes (the same attributes the participants were required to rank in the first section) with different values or levels. The value of each attribute was "hidden" under a blue card. The screen contained rows and columns; each column represented a different potato and each row represented a different attribute. The order in which the attributes were presented was randomised for each participant. The participants were required to click on the blue card to reveal the value of each attribute. They could click on as many attributes they wanted and the cards would remain open once they had been clicked. The participants then had to select one of the potatoes by clicking on an option button at the bottom of the column for the potato they wanted to choose, and then click on submit to move on to the next choice set. The choice sets were designed to allow participants to skip questions. In the follow-up questions section, the participants were asked a number of questions about their beliefs and attitudes. The last section asked demographic questions including gender, age, income and educational attainment. The survey included instructions on how to complete the survey. The participants were also provided with a handout with descriptions and definitions of the six different attributes and their values.

The computer-based consumer choice modelling software was developed using HTML, JavaScript and PHP. There were two parts to the software, one that dealt with follow-up and demographic questions and one that handled the display and recording of choice sets, which was controlled by a configuration and a data file that specified the titles, attributes and values on display. By using the information in the configuration and data files, a display generator created web pages to show a choice set in a web browser. As the participants clicked on different cards in the set, the time at which each card was clicked and the information revealed was recorded. When the participant made the final selection from the three potato options, the data was sent to a data recorder

which stored it on a server and called the display generator to present the next page of choices.

Following the computer-based survey, some of the respondents were also interviewed. The interview questions were semi-structured and queried how the participants went about completing the choice set questions. The questions investigated the decision strategy the participants used by asking questions about the process they went through to make the decisions and about the attributes they considered. Participants were also asked if their strategy changed over time, if the method they used was compensatory or non-compensatory, and if they felt they had to justify their decisions to themselves or someone else.

### *Survey Administration*

The respondents were told that the purpose of the study was to trial software for consumer surveys and the software being tested investigates purchase decisions regarding potatoes. The survey administrator provided the participant with the handout with the descriptions and definition of the different attributes and values, and explained that they could refer to this handout as needed. All the participants worked through the computer-based survey at their own pace using the instructions provided on the screen, but an administrator was always available to answer any questions. Once the computer-based survey was completed, some of the participants were asked to participate in a short face-to-face interview with one of the authors.

### *Participants*

Ninety-two students and staff members and Lincoln University in New Zealand took part in this study. All participants completed a computer-based survey and 26 of the participants were also interviewed. The data for five of the participants were incomplete or poorly recorded, and their results were therefore excluded from the study. As a consequence, the study includes computer-based survey results from 87 participants and interview results from 24 participants.

Forty-seven per cent of the participants were females and 53 per cent were males. The median category age range was 31-35 years, and 69 per cent of the participants earned less than \$15,000 per year. Over 60 per cent of the participants had either an undergraduate or post graduate degree or diploma. The demographic characteristics of the individuals who participated in the interview were similar to the demographics presented above.

## Results

### *Computer-based survey data*

The data from the computer-based consumer choice modelling were analysed to establish to what extent the respondents revealed the attribute value information available for the three different potatoes in the 10 choice sets. That is, the data were analysed to determine whether respondents had opened the blue cards and acquired the information “underneath”. The results showed that 78.5 per cent of all the blue cards were opened (21.5 per cent not opened). For the potatoes, 56.6 per cent had all their cards opened (43.4 per cent not opened) and 60.3 per cent of the chosen potatoes had all their cards opened (39.7 per cent not opened). Thus, more attributes were revealed for a chosen potato than for a potato that was not chosen. For the choice sets, each with three potatoes, 52 per cent had all the cards opened (48 per cent of choice sets had at least one card not opened). Finally, 43.7 per cent of the participants opened all the cards in all choice sets (56.3 per cent of participants left at least one card unopened).

The graph on the next page displays the average number of cards not opened per potato for each choice set (across all participants) and the time (seconds) it took for participants to select one of the potato options. The graph shows that in the first choice set, the participants opened more cards than in any of the other choice sets and used more time. The average number of cards not opened per potato slightly increased until choice set 10 (apart from a slight decrease in choice set seven), where the number of cards not opened decreased. The time used to select a potato decreased slightly in choice set two to nine but increased again in the last choice set. These results show that the participants were faster and opened fewer cards as they completed more choice sets. For the final choice set, however, they opened more cards and spent more time.

### *Interview data*

The information gathered in the interviews about the strategies respondents used when completing the choice set questions showed a clear and consistent decision making process pattern. The participants reported that they used the following process:

1. They looked at the most important attributes first and the number of attributes considered important varied from two to four. Most participants outlined the order of importance for each attribute but commented that this order did not necessarily correspond to the importance ranking given in the initial question section where the participants were asked to rank the importance of the six different potato attributes. The participants mentioned they were not fully aware of the

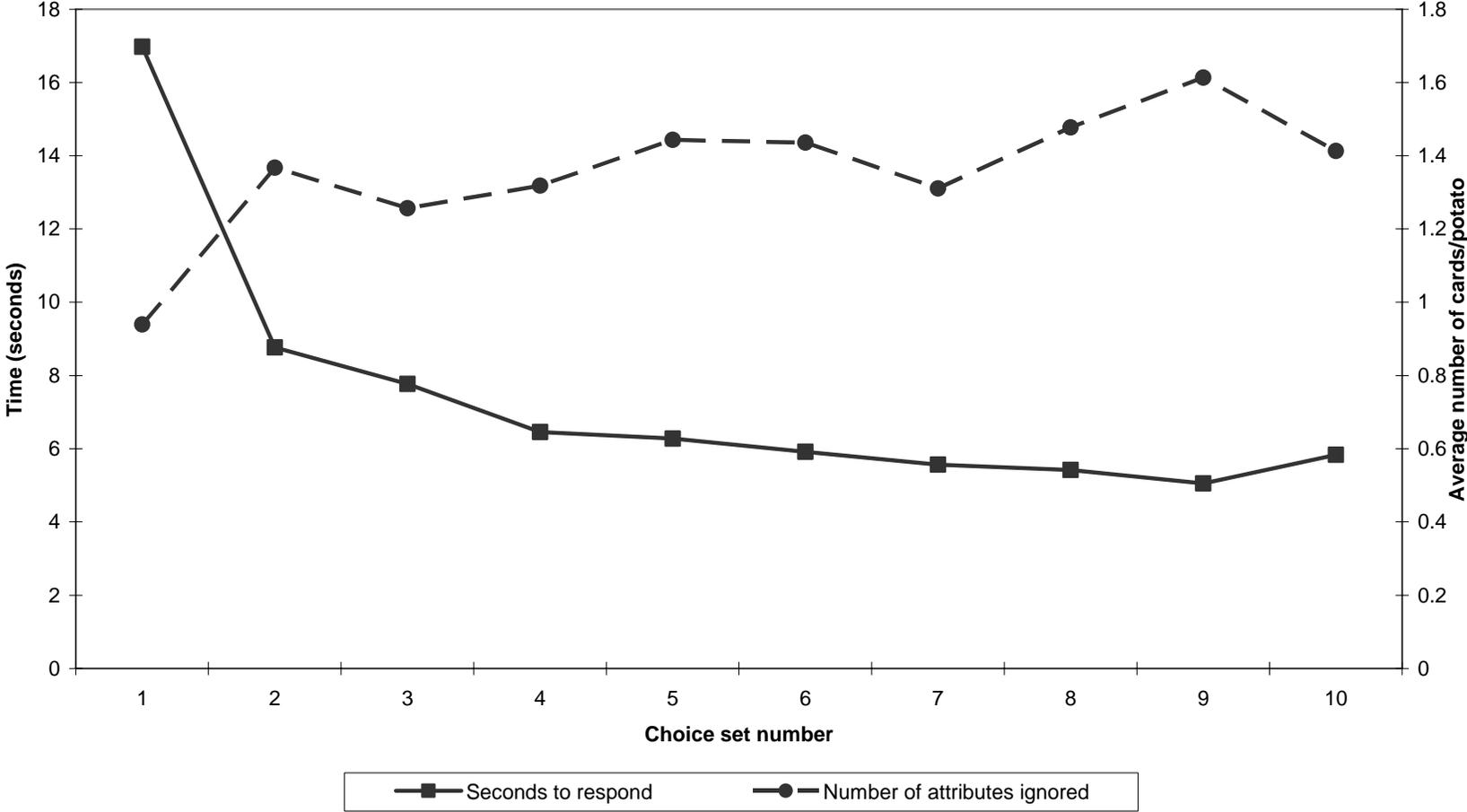
definition of each attribute because they did not refer to the handout containing this information. Some of the participants mentioned that the order they considered the important attributes sometimes differed across the choice sets.

2. The participants looked for the potato with the most favourable values on the important attributes. For example, if price was important to them, they looked for the cheapest potato.
3. Respondents stopped looking at attributes as soon as they had investigated the three potato options on the most important attributes and found a potato that was satisfactory, or found one alternative that differentiated from the others and was acceptable to the respondent. If they did not find a potato that was satisfactory or differentiated after considering the most important attributes, they would then continue the search and open the cards for the less important attributes.
4. Many of the participants reported that they looked up additional attributes that were not of importance after they had found a potato option that was satisfactory because of curiosity and to ensure their decision was the most appropriate. Some of the participants mentioned that they looked up the extra information just because it was readily available. The participants estimated that they had looked 3-5 attributes in each choice set, but as mentioned above, only considered two to four of them important.

It is important to note that over half of the participants (13 of 24) reported they opened all the cards. Ten of these participants explained that they opened all the cards first and then followed the same process described above. The remaining three participants reported they opened and considered all cards because all attributes were of importance to them and needed to be considered in order to make a decision. However, these participants clarified they considered the attributes in order of importance and made their decisions in the same manner as the other participants. That is, they considered all the attributes and looked for the potato with the most favourable values on the most important attributes.

The participants’ self-reports on the process they employed to select one of the potatoes in the choice set questions were compared to the computer-based survey data. Table 1 outlines the outcome of the comparison. The three participants who had reported they considered all cards had opened all the cards. The ten participants who had reported opening all the cards but claimed they only considered some of the attributes had actually opened all the cards. However, whether they only considered some of the attributes cannot be

Figure 1: Average number of cards not opened per potato and selection time per choice set



determined as all the cards had been opened. Five participants provided a consistent description but the order they opened the cards did not correspond to the order they reported looking at the attributes. An additional five participants provided a consistent description but the order they opened the cards did not correspond to the order they reported looking at the attributes and they also reported one additional inconsistent piece of information. For example, the survey data showed they did not open the cards for an attribute they reported they had considered, or they did not report that they had looked at an attribute when the data showed they had opened the cards for this attribute. One of the respondent's self-report was strongly inconsistent with the survey data.

**Table 1: Level of comparison consistency between computer-based survey data and participants' self-reports**

<b>Comparison consistency</b>	<b>Number of participants</b>
Opened all cards and reported considering all cards	3
Opened all cards and reported only considering some cards (cannot determine consistency)	10
Consistent description Reported order of attribute consideration $\neq$ card opening order	5
Consistent description Reported order of attribute consideration $\neq$ card opening order + one other inconsistency	5
Inconsistent description	1
Total	24

The respondents who were interviewed were also asked to report whether they felt that they had to justify why they had selected a particular potato, either to themselves or someone else, when completing the choice set questions. Twenty-five percent of the participants (six out of 24) reported they felt they had to justify their decisions. The participants were also

asked whether they used a compensatory or non-compensatory strategy (whether a negative value on an attributes can be compensated for by equal or higher value positive attributes). All participants reported that some attributes could compensate for a negative value in other attributes but clarified that not all attributes were compensatory.

## Discussion

The information collected through the surveys and interviews provided two different sets of data on respondent behaviours when making decisions in a choice modelling survey. The simplest result to draw from these results is that respondents did not make their decisions with the full set of information available to them. Collectively, they left over one-fifth of the cards unopened, so could not have known what information they did not have. Ignoring some of the information was widespread: about one-half of all respondents did not bother with some of the available information. Combining these numerical findings with the self-reports suggests that the assumption of full information that is part of neoclassical decision theory may not hold.

The participants' self-reports suggests they used a search rule, stopping rule and a decision rule, which is consistent with decision making heuristics (Gigerenzer & Todd, 1999). As a search rule, the participants considered the most important attribute first, but the order they considered these important attributes varied. It is important to note that three of the respondents who were interviewed considered all the six attributes important and therefore looked up all the attributes for all the potato options, which is a behaviour that shows a greater consistency with neoclassical theories than theories of bounded rationality.

As a stopping rule, the participants reported that they stopped looking for attributes as soon they had investigated the potato options on the most important attributes. This stopping rule is consistent with the Core Attribute stopping rule found in Saad and Russo's (1996) study. The Core Attribute stopping rule suggests decision makers stop acquiring information and commit to the leading alternative once the last set of the most important attributes had been considered. However, the respondents also reported they continued the search and looked up less important attributes if they could not find a potato that satisfied their preferences. Hence, the participants were required to consider less important attributes to make their decisions in some of the choice sets. The applied stopping rule appears to be inconsistent with neoclassical decision theories that expect participants to look up alternatives and their attributes until perceived marginal benefit equals perceived marginal cost (Anderson & Milson, 1989).

The decision rule applied by respondents was to select the potato that was most satisfactory in its attributes,

namely, the potato with the most desirable or least undesirable attributes. The participants explained that they went through a process of differentiation that is consistent with the Differentiation and Consolidation Theory (Svenson, 1996). This bounded rationality decision theory suggests decision makers employ a differentiation process that separates available alternatives until one alternative reaches a degree of differentiation from the others which is acceptable to the decision maker and fits with aspiration levels. The decision rule applied by the participants is also consistent with the Elimination heuristic decision strategy which uses successive attributes to eliminate more and more alternatives until one single option can be determined (Todd & Gigerenzer, 2000). Furthermore, the decision rule is consistent with the Satisficing heuristic strategy which proposes that decision makers set an aspiration level that is satisfactory and search for alternatives until the aspiration level is met (Todd & Miller, 1999).

It is interesting to note that most of the participants reported they also considered attributes they did not consider important in some of the choice sets in order to ensure they made the most appropriate decision or because of curiosity. This behaviour is not consistent with theories of bounded rationality but is consistent with the “accumulation of evidence strategy”, which proposes that decision makers tend to seek additional evidence to increase their confidence in their decision choice (Lee & Cummins, 2004; Svenson, 1996). The tendency to look up extra information is also consistent with the Differentiation and Consolidation theory. This theory suggest that decision makers go through a consolidation process after making a decision to protect the chosen alternative and to justify that the alternative was the most suitable (Svenson, 1996). The data from the computer-based choice survey showed that more cards were opened for the chosen potato alternatives than for the non-chosen potato alternatives. In addition, a quarter of the participants reported they were justifying their decisions to themselves or the survey administrator. These results provide further support for the accumulation of evidence strategy and the Differentiation and Consolidation theory.

Neoclassical decision making theories assume decision makers employ compensatory strategies where a negative attribute can be compensated for by equal or higher value positive attributes, whilst theories of bounded rationality assume non-compensatory strategies are utilised (Todd & Gigerenzer, 2000). The respondents indicated that some, but not all, attributes could compensate for negative values in other attributes. Hence, the respondents’ compensatory strategy is not perfectly consistent with either of the decision making theories. However, it is somewhat consistent with the Differentiation and Consolidation theory which points out that both non-compensatory and compensatory rules can be applied in a decision making process, and suggests that the non-compensatory rule is often applied in the beginning of the differentiation process whilst a compensatory rule is more likely to be utilised in the final stages of the

differential phase (Svenson 1979; cited in Svenson, 1996). In this study, the participants were more concerned about whether they were willing to let one particular attribute compensate for another, than whether they were in the beginning or the end of the decision process.

It is important to note that most of the participants reported a similar decision making strategy but there were some differences amongst participants. As mentioned before, three of the respondents reported they looked up all the attributes as they were all considered important, whilst the other participants stated they only considered some of the attributes important and mainly focussed on them. Many, but not all, respondents considered non-important attributes, and some participants went through a decision justification process. Theories of bounded rationality argue that different individuals may employ different strategies in the same environment or situation (Todd & Gigerenzer, 2000). It is also worth noting that the decision strategy self-reports obtained from the interviews were fairly consistent with the data obtained from the computer-based survey but some inconsistencies were identified. This is consistent with Newell et al.’s (2003) study that stated self-reports generally matched actual behaviour but some inconsistencies were found.

The reason for some of the inconsistencies in our study may be that the participants found it difficult to describe the decision strategy they employed in the choice set questions. It is important to note that assessing the consistency between the interview and computer-based survey data was problematic because it was not clear whether all the cards that had been opened had actually been considered by the participant. For example, many participants reported they opened all card in a choice set but did not consider the content of all of them when making their decision. This is a limitation of the methodology used in this study which could be addressed in future studies. An additional limitation is the unrepresentative convenience sample of university students and staff participating in the survey. A convenience sample was used because one of the aims of the study was to test the computer-based survey.

Our interpretation of the respondents’ behaviour is that they did not open all the cards in order to simplify their decision making. An alternative explanation, consistent with neoclassical theory, is that participants did not seek information about less-important attributes when the possibility that they could compensate for more-important attributes was zero. That is, respondents knew the utility weighting of the attributes and the range of potential values. If the ‘best’ level of an attribute would not alter the choice, then obtaining the information from the less-important attributes would not be worthwhile. Further analysis may be able to answer the validity of this interpretation.

In conclusion, the results from this research indicate that survey respondents did not make their decisions with the full set of information available to them. This appears to be inconsistent with theories of neoclassical decision making which assume that respondents use all the information available to them in a holistic, integrative, and compensatory fashion in order to choose the optimal alternative. Behavioural theories of respondents' choice may therefore warrant further attention, especially theories that are based on simple rules and that recognise cognitive constraints.

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### **JEL Classification**

B49 Economic Methodology - Other

C25 Discrete Regression and Qualitative Choice Models

C42 Survey Methods

### **Key Words**

Consumer Choice Modelling, Bounded Rationality, Decision Making Strategies, Computer-Aided Surveying, Biotechnology