Asking about and Predicting Consumer Preference: Implications for New Product Development

by

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Rotman School of Management
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Abstract

Designers do not merely develop concepts; they are increasingly involved in testing product concepts and learning consumer preference. However, designers’ decision making processes in these tasks have been little studied. In the two essays, I apply decision making frameworks to concept testing and preference learning to study consumer’s and designer’s biases.

In my first essay, I study consumer bias in concept testing. When consumers test new products, they are often asked to choose which product they prefer. However, a choice question can elicit biased preference because consumers simply choose the product that is superior on the attribute serving their purchase purpose. My studies show that when consumers are asked to predict which product they will enjoy more, they are more likely to prefer the product that actually reflects their consumption utility. These findings suggest that making trade-offs is avoided in the choice question, but is encouraged in the enjoyment prediction question. Thus, a simple change of question format, in otherwise identical product comparisons, elicits different answers. This holds true when product attributes are easy to evaluate; when product attributes are hard to evaluate, changing question format does not affect consumer choice.
My second essay examines designer bias in preference learning. When designers predict consumer preference for a product, they often base their predictions on consumer preference for similar products. However, this categorization-based strategy can result in biased predictions because categorical similarity is not diagnostic for preference prediction. I conducted two studies by applying a Multiple Cue Probability Learning experiment to a designer’s prediction task. I found that when subjects used a sequential learning strategy, making a sequence of predictions and receiving feedback, they increased prediction accuracy by 14% on average. When they made predictions with multiple sets, with a break between each set during which they reflected on what they had learned, their prediction accuracy further improved by 7% on average.

In sum, I demonstrate bias and propose approaches to avoid them in two design tasks. My two essays show that the decision making frameworks are crucial in understanding and improving the successful outcome of the design process.
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Chapter 1

Design is the professional service of creating and developing concepts and specifications that optimize the function, value, and appearance of products and systems for the mutual benefit of both consumer and manufacturer (Industrial Designers Society of America). Design has attracted increasing attention for its commercial value since the early 1990s. For instance, Roy and Potter (1993) analyzed 220 design projects in UK companies and identified the long-term commercial benefits of investment in design. Gemser and Leenders (2001) studied 147 Dutch companies and also established that design investment pays off. Design Council (2004) reported that the stock prices of 63 UK companies that had earned design awards outperformed the FTSE 100 index. Petersen (2008) showed that the stock prices of award winning products outperformed S&P 500 by 6.5%. Hertenstein et al. (2005) found that even when expenditure on design is controlled, the companies with effective design programs have higher returns on sales, higher net incomes, and higher stock market performance.

Now, managers attempt to broadly apply the insights from design to their businesses. Some researchers argue that implementing design programs in a company can help the company achieve its objectives (Borja de Mozota 2003), and others propose that managers should think and work like designers to identify market opportunities (Brown 2008; Martin 1995). Design is considered as “innovative thinking, strategy, and planning that IDEO, Jump, Design Continuum, and Ziba do and Patrick Whitney at the Illinois Institute of Design and David Kelley at Stanford teach” (Nussbaum 2009).

In my dissertation, design is broadly defined as an activity to benefit consumers by either educating them if their preference is not developed (e.g., Allessi, Bang & Olufsen, and designers in the fashion, paintings, and music industries) or serving them if their preference is well established (e.g., US design firms such as P&G, OXO, Target, and IDEO). According to this view, new product development is a sub-area of design (Hauser et al. 2006), including other areas such as engineering design (Howard et al. 2008) and business design (Fraser 2007). Therefore, not only physical attributes of a product but also non-observable or non-verifiable
physical attributes (e.g., thread count of sheets or shape of product), nonphysical attributes (e.g., warranty duration), and even non-attributes (e.g., benefits) can be design elements.

As design has expanded its boundaries in the business area, designers have started undertaking tasks well beyond their traditional boundaries. Perks et al. (2005) investigated design tasks in 18 UK consumer goods manufacturers and found that designers not merely developed product concepts but they also participated in market research and business analysis. Increasingly, designers are required to support the entire product development effort by linking consumer needs with form and function to create something attractive as an innovation (Turner 2003). As harsh competition emphasizes innovative differentiation, they are often asked to undertake a leadership role in the product development process (von Stamm 2004).

As designers are increasingly performing tasks that have traditionally been outside their purview and are involved in data collection, analysis, and application, the decisions that consumers and designers make while they participate in design tasks are being documented in case studies. For example, when designers for Doblin developed a new furniture system with Herman Miller, potential users were asked to provide their preference for its prototypes (Deasy et al. 2001). In another example, when designers for Ziba developed a desktop computer with Lenovo, they surveyed computer users’ preferences for a large variety of products to choose the most preferred material and color for the computer (Business Week 2005). Interestingly however, designers applied the research findings selectively; Doblin designers ignored a significant portion of the data collected from the prototype testing and did not change their pre-consultation product concept and Ziba designers inferred consumer preferences regarding computers by relying on consumer preferences only for consumer electronics, choosing to ignore consumer data for all other product categories.

These two examples raise questions such as whether consumers’ decisions indicate their preferences accurately and whether designers’ decisions apply research findings accurately. Although such decisions determine design outcomes significantly, the decisions made by consumers and designers have not been studied in research papers but mostly described in case studies. The lack of academic study of design decisions can be attributed to design researchers emphasizing practice over academic study. Design researchers have long suggested that design is concerned with how things ought to be but science is about how things are (Gregory 1966;
Simon 1969). For example, Archer (1979) and Cross (1982) compared, so called, the “designerly way of knowing” (Cross 1982) to the scientific way of knowing and claimed that design is a collective body of practical knowledge based upon invention and implementation, whereas science is a collective body of theoretical knowledge based upon measurement and hypothesis testing. This tradition continues until this day; contemporary design researchers tend to consider developing a design project as a form of task-specific research and, therefore, a large number of design papers published in design journals are case studies without insights transferrable to other design research (Buchanan 2001; Franz 1998; Friedman 2000; Margolin 1999; Owen 2000).

In my dissertation, I study decisions in the design process by drawing on decision-making literature. This literature will provide a useful framework because it studies decision bias, which is the human tendency to make systematic errors resulting from information-processing shortcuts. Therefore, decision-making research is well positioned to study the systematic errors that consumers and designers make.

My dissertation discusses two biases in two design tasks. One is consumer bias that occurs when consumers indicate their preferences. If consumers provide biased preferences, designers can collect biased data. Another is designer bias that arises when designers use the collected data. If designers apply the findings of the collected data in a biased way, they can result in biased predictions even when the collected data are not biased. I study these two biases in two tasks of design process: concept testing and preference learning. In practice, there are many design processes that contain somewhat different tasks. As a result, these two tasks correspond to somewhat different tasks in each of these processes. Firstly, concept testing is concerned with assessing consumers’ responses to product concepts. This task corresponds to new product evaluation in product development (Hauser et al. 2006), concept evaluation in product design (Luchs and Swan 2010), screening and evaluation in engineering design (Howard et al. 2008), and user evaluation in business design (Fraser 2007). Secondly, preference learning is concerned with predicting consumers’ preference using available market data. Designers perform the preference learning task in the various stages of the design process: fuzzy front end in product development, idea generation in product design, conceptual design in engineering design, and opportunity identification in business design.
In sum, I draw on the decision-making frameworks to study the relatively little-discussed topic of decision-making in the design process. In particular, I study two different biases, consumer bias and designer bias, in two design tasks, concept testing and preference learning. Therefore, my dissertation consists of two essays: consumer bias in concept testing is discussed in the first essay and designer bias in preference learning is discussed in the second essay. The two essays are briefly summarized below.

In the first essay, I study consumer bias that occurs when consumers evaluate product concepts. When designers test product concepts, they often ask consumers to indicate which product they prefer between two products. Sawtooth Software, for example, reported that the proportion of their clients who use the choice-based conjoint analysis increased from 50% in 2003 to 87% in 2009. Choice is also a dominant question format in my review of the conjoint research papers published after 1985 (55%). Although majority of academic support and practical research applications are in favor of the choice-based approach, having consumers make choices is not the best way to elicit their “true” preference. Decision-making literature on the topic of preference construction suggests that a choice question can elicit biased preference because consumers simply choose the product that is superior on the most important attribute (Fischer and Hawkins 1993; Tversky et al. 1988). Similarly, Huber (1997) noted in his review of conjoint studies that conjoint respondents spent significantly less time and produced less reliable outcomes when they were asked to choose a product than when they were asked to rate a product, concluding that choice tasks tend to oversimplify consumers’ decision-making process.

I propose that modifying the format of the question helps consumers to make trade-offs and provide the preferences that reflect their consumption utility (Hsee et al. 2003; Shiv and Huber 2000). My three studies show that when consumers are asked to predict which product they will enjoy more, they tend to choose the product that is less likely to serve their immediate purchase purpose, which can differ from how the product will be used in the long term. For example, a performance attribute tends to serve an immediate purchase purpose while an aesthetic attribute would be more related to long-term enjoyment. When consumers are asked to predict enjoyment, the likelihood of choosing a product superior on the performance attribute over a product superior on the aesthetic attribute decreases compared to when they are asked to choose. These findings suggest that making trade-offs is avoided in the choice question condition, but is encouraged in the enjoyment prediction question condition. Thus, a simple change of question
format, in otherwise identical product comparisons, can elicit preference reversals. I also found that this holds true only when product attributes are easy to evaluate; when product attributes are hard to evaluate, changing the question format does not affect consumer choice.

The second essay examines designer bias in preference learning. When designers predict consumer preference using market information, they often base their predictions on consumer preferences for similar products. As introduced previously, when Ziba designers developed a new computer in China with Lenovo, they selected the material and the color of the new computer similar to those that Chinese computer users like for consumer electronics (Business Week 2005). Although designers often base their predictions on categorization, this categorization-based strategy can result in biased predictions. Decision-making research on the topic of diagnosticity suggests that people often make biased predictions because they ignore meaningful data or consider meaningless data important (Doherty et al. 1979) and that similar products are not liked equally by an individual consumer, suggesting that categorization is not necessarily meaningful for preference (Elrod 1988).

I propose that designers should not use a categorization-based strategy but should use a sequential learning strategy – making a sequence of predictions and receiving feedback for each prediction – and, for further improvement in prediction accuracy, they should make predictions with multiple data sets (Brunswik and Herma 1951). I applied a typical Multiple Cue Probability Learning experiment to a designer’s preference learning task and conducted two studies to test whether prediction accuracy is a function of prediction strategy and the number of data sets. I found that when subjects used a sequential learning strategy, they increased prediction accuracy by 14% on average. Subjects further improved their prediction accuracy by 7% on average when they made predictions in multiple sets, with a break between each set during which they reflected on what they had learned.

In sum, in two essays, I demonstrate biases and propose approaches to avoid them in two design tasks. Since Tversky and Kahneman (1974) claimed that people rely on a limited number of heuristic principles that result in systematic errors, decision-making researchers have identified biases in a wide variety of contexts and tried to help people make better decisions or predictions (Blattberg and Hoch 1990; Gourville and Soman 1998; Hoch and Loewenstein 1991; Hoch and Schkade 1996; Huber et al. 1982). My work adds to this body of knowledge by studying design
through the lens of decision-making, suggesting that the decision-making framework itself can be crucial in understanding and improving the successful outcome of the design process.
Chapter 2

1 Introduction

Imagine that a company develops two new stereo systems which are subsequently tested with a group of consumers. One option provides greater power and the other provides richer sound. If consumers have a well-defined preference, their indicated preference will not depend on the methods to assess preference. They will choose the same option regardless of whether they are asked to make a choice or they are asked to predict which option they would enjoy more. However, Hsee et al. (2003) showed in his study that preference depends on questions being asked; preference for the rich sounding option was not consistent between when subjects were asked to choose and when they were asked to predict which option they would enjoy more.

Such preference reversals have attracted considerable attention among decision researchers as they violate procedure invariance assumption. However, prior research on this topic focuses on response mode and compares the preference based on a comparative response with preference based on a non-comparative response. Studies have shown that people choose one option when two options are presented together, but they bid, judge, or evaluate another option more highly when each option is evaluated separately (Fischer and Hawkins 1993; Lichtenstein and Slovic 1971; Nowlis and Simonson 1997; Tversky et al. 1988). Recently, some studies have shown that preference in the comparative response mode changes when consumers are asked different questions (Hsee et al. 2003; Hsee et al. 2009; Shiv and Huber 2000). Note that, however, a comprehensive understanding of why question type influences preference has not been reached yet.

This article investigates the effect of two different question types, choice and enjoyment prediction, on the preference in a comparative response mode, called question mode effect. It aims to demonstrate the effect, identify one of its underlying mechanisms, and test one of its boundary conditions. In particular, I propose that different questions evoke different decision strategies, which in turn lead to different preferences; predict enjoyment questions compared to choice questions encourage consumers to make a trade-off, which increases preference for an option superior on the attributes that serve the purchase purpose to a lesser extent. Going beyond
demonstrating the effect, I explore whether the question mode effect is moderated by attribute evaluability.

The present work contributes to the decision-making literature by adding question mode as a determinant of decision strategy selection (Bettman et al. 1998; Payne et al. 1993). Research on this topic has devoted considerable attention to characterize different decision strategies, identify variables evoking different strategies, and encourage people to make decisions in a compensatory way. A significant body of research formulates descriptive models of different decision strategies (e.g., elimination-by-aspects in Tversky 1972) and finds evidence of the utilization of non-compensatory decision strategies (Payne et al. 1993). Research indicates that people utilize non-compensatory decision strategies when they find it difficult to make a trade-off cognitively or emotionally, such as, when a decision is complex (Bettman et al. 1998) or when anticipated negative emotion is considerable (Luce 1998). Because non-compensatory decision strategies are generally assumed to lead to less normatively accurate choices\(^1\), attempt has been made to encourage people to make decisions in a compensatory fashion. It has been found that compensatory decision strategies are utilized when incentives are provided with feedback over repeated choices (Cox and Grether 1996) or when people are under cognitive load so that they do not avoid trade-off (Drolet and Luce 2004).

The present work also provides implications for choice-based conjoint analysis by advising how to decrease consumers’ tendency to simplify task. Conjoint analysis is a statistical technique to elicit part-worth utilities for attributes from respondents (Green and Srinivasan 1978, 1990). Its older systems involve rating or ranking profiles. However, marketers found that respondents’ choices in the lab match their in-market behavior and individual level utilities can be estimated by choice data (Louviere Woodworth 1983). Therefore, asking respondents to choose among multiple profiles has become popular (e.g., 50% in 2003, 70% in 2005, 78% in 2007, and 87% in 2009 in Sawtooth Software) and the majority of recent academic support and practical research applications are in favor of choice-based approaches. Although choice questions are widely

\(^1\) When selecting noncompensatory decision strategies, people focus on a limited number of attributes and choose or eliminate options depending on the values of those attributes. However, compensatory decision strategies consist of considering one option at a time, examining each of the attributes for that option, multiplying each attribute’s subjective value times its importance weight, summing these products across all the attributes to obtain an overall value for each option, and choosing the option with the highest value.
applied, marketers are aware that respondents appear to simplify their task before giving a single answer for each choice set; they spend relatively less amount of time and produce relatively unreliable outcomes. For example, choice reflects 20%-30% greater emphasis on the most important attribute and therefore marketers adjust their weights after collecting data (Huber 1997)

1.1 Current practice of concept testing

Before the effect of question mode on preference is examined, a current practice of conjoint analysis is assessed. A preliminary study was conducted by reviewing published conjoint studies in order to find relationships among questions, responses, and outcomes of conjoint analysis.

In total, 107 peer-reviewed papers published after the year of 1985 were collected by entering conjoint analysis as an author provided keyword in the Business Source Premier database. Twenty six papers were eliminated due to missing empirical studies or failing to specify questions or responses, leaving 81 papers to be analyzed. Each conjoint study was coded according to question mode (choice vs. enjoyment prediction), response mode (comparative vs. non-comparative), and conjoint outcome (product/service vs. policy/program), and their relationships were tested.

Two findings were obtained. Firstly, a significant interaction between question mode and response mode was found. When marketers asked choice questions, they preferred comparative responses than non-comparative responses (comparative = 100% vs. non-comparative = 83%). However, when they asked enjoyment prediction questions, only non-comparative responses were selected (comparative = 0% vs. non-comparative = 17%, \(X^2(1) = 6.49, p < .05\)). This suggests that choice questions tended to be answered in a comparative way, whereas enjoyment prediction questions were answered in a non-comparative way. This suggests that some questions (e.g., enjoyment prediction questions) may share properties with some responses (e.g., non-comparative responses). A related and more developed discussion follows in the section of question mode effect.
Secondly, a significant interaction between conjoint outcome and response mode was found. When marketers studied products or services, they tended to use comparative rather than non-comparative responses (comparative = 58% vs. non-comparative = 42%). However, when they studied policies or programs, they preferred non-comparative over comparative responses (comparative = 32% vs. non-comparative = 68%, $X^2(1) = 3.90, p < .05$). This finding is in line with the characteristics products/services and policies/programs. In general, products and services can be compared with other options. However, policies and programs are often evaluated separately.
Two findings generally suggest that questions, responses, and outcomes appear to be associated. When marketers study something which needs to be compared with other options, they ask choice questions and employ comparative responses. However, when conjoint analysis is conducted for something that is not often compared with other options, marketers can ask enjoyment prediction questions and use non-comparative responses. In other words, choice questions and comparative responses are preferred for comparing multiple options, whereas enjoyment prediction questions and non-comparative responses are suitable for evaluating a single option.

The rest of the article is organized as follows. Firstly, prior literature on preference reversals due to preference elicitation method is reviewed under the title of response mode effect. Secondly, I hypothesize question mode effect by extending the underlying mechanism of the response mode effect. Thirdly, a boundary condition of the hypothesized question mode effect is proposed on attribute evaluability. Then, the four studies testing the question mode effect and its boundary condition are presented. Previewed briefly, findings suggest that (1) the likelihood of preferring a
product superior on less instrumental attributes is greater when consumers are asked to predict enjoyment than when asked to make choices and (2) the proposed question mode effect disappears when attributes are hard to evaluate. Finally, I conclude with discussing implications of the findings for product development.

2 Conceptual background

2.1 Response mode effect

The classical theory of preference assumes that each individual has a well-defined preference and it does not depend on preference elicitation method. However, the growing belief among decision researchers is that people may construct preferences on the spot when needed, such as when they make a choice (Bettman et al. 1998; Payne et al. 1993). In particular, studies have shown that preferences depend on the methods used to assess, violating the assumption of procedure invariance (Lichtenstein and Slovic 1971; Fischer and Hawkins 1993; Nowlis and Simonson 1997; Tversky et al. 1988).

Early work in this topic area contrasted choice with bidding or matching. In Lichtenstein and Slovic’s (1971) original demonstration, for instance, subjects were asked to indicate their preferences between two risky options: two bets of almost equal expected value. One (P bet) has a higher probability of winning a modest amount and the other ($ bet) has a smaller probability of winning a large amount. When asked to choose between two bets presented together, more subjects chose the P bet. However, when asked to bid two bets presented separately, the $ bet received a higher bid amount. Similar findings were obtained in subsequent studies in which preferences for two riskless options were compared between in a comparative response (e.g., choice) and in a non-comparative response (e.g., matching or evaluation) (Fischer and Hawkins 1993; Nowlis and Simonson 1997; Tversky et al. 1988).

Such response-based preference reversals are attributed to the difference of the way people make decisions. According to Lichtenstein and Slovic (1971), choices are influenced by probabilities while bids are primarily determined by winning amount because subjects in the choice task make decisions in a non-compensatory way (compared each attribute of one bet directly with the same attribute of the other bet), whereas subjects in the bidding task make decisions in a compensatory way (had a starting point, amount to win, and then adjusted accordingly with probability to win).
Extending this argument to the riskless condition, Tversky et al. (1988) proposed prominence effect. According to this argument, people tend to resolve the close choice with a non-compensatory strategy in choice tasks, that is, by choosing an option that is superior on the most important (prominent) attribute. By contrast, matching tasks typically evoke a compensatory process in which differences on the prominent attribute are traded off against differences on other attributes. Later, Fischer and Hawkins (1993) generalized the prominence effect from choice versus matching to strategy-compatibility hypothesis regarding any comparison of a qualitative and quantitative response mode. They proposed that people seek out compatibility between the meta-property of response mode (qualitative vs. quantitative) and the meta-property of decision strategy (ordering of attribute importance vs. making a trade-off). They showed that a qualitative response mode (choice) was more likely than a quantitative mode (rating or pricing) to evoke preferences for the option that is superior on the most important attribute (e.g., price).

A compensatory strategy is one in which a good value on one attribute can compensate for a poor value on another. For instance, deciding how much one is willing to sacrifice color for very good rather than average battery life of a mobile phone involves making an explicit trade-off between color and battery life. An example of the compensatory decision strategies is the weighted adding strategy (Bettman et al. 1998). It is based on the assumption that a consumer can assess the importance of each attribute and assign a subjective value to each possible attribute level. Consumers using the weighted adding strategy consider one option at a time, examine each of the attributes for that option, multiplying each attribute’s subjective value times its importance weight (e.g., multiplying the subjective value of a given color of a mobile phone times the importance of a mobile phone’s color), sum these products across all the attributes to obtain an overall value for each option, and finally choose the option with the highest value. In contrast, consumers can use non-compensatory strategies in which a good value on one attribute does not make up for a poor value on another (e.g., lexicographic in Tversky 1972). For example, if a consumer decides to choose a mobile phone with the most preferred color, then the mobile phone with the highest rating on color is preferred regardless of its high price or the high rating on the battery life of another option. The compensatory strategy is often considered to be more normatively accurate than the non-compensatory strategies though it potentially places great demands on consumers’ working memory and computational capabilities (Frisch and Clemen 1994).
Going beyond inferring strategies from expressed preferences, some empirical studies have process evidence that choice leads to compensatory decision strategy. Hawkins (1994) tested the prominence effect using the Mouselab computer process tracing system and demonstrated that the response time for choice is smaller than for matching and that the relative attention (fixation time) devoted to the prominent attribute compared to non-prominent attribute is greater in choice than in matching. Similarly, Schkade and Johnson (1989) also reported that the pricing judgment for gambles takes significantly longer than the choice.

In sum, preferences for the option superior on the most important attribute can be shaped by responses; they are greater when people choose between two options presented together than when they evaluate each option presented separately, because the former response mode evokes non-compensatory strategies whereas the latter evokes compensatory strategies.

2.2 Question mode effect

Extending the literature on response mode effect, I propose different questions also can evoke different strategies, which results in preference reversals. Firstly, drawing on the literature on imagery processing, I propose that enjoyment prediction questions evoke compensatory decision strategies. Secondly, drawing on the literature on consumption goal, I propose that compensatory decision strategies increase preferences for the option superior on less instrumental attributes. Two arguments are elaborated and then combined in the following three sections.

2.2.1 Decision strategy

Different responses evoke different strategies primarily because options are presented differently; two options are presented together in a comparative response and only one option is presented in a non-comparative response. Although the way options are physically presented is governed by response mode, question mode can influence how consumers present them “mentally.” If a question encourages consumers to focus on one option, they will be more likely to utilize compensatory strategies.

I propose that enjoyment prediction questions evoke compensatory strategies because they induce imagery processing, a conceptually distinct way of representing information that is “very like picturing and very unlike describing” (Fodor 1981, p. 76). Imagery processing appeared in the problem solving literature that people can visually imagine a product in use and use that
evoked scenario as a basis for subsequent problem solving activities (Simon and Hayes 1976). It refers to imagining the actual experience with an alternative and assessing the desirability of the alternative according to the affective response to this imagined experience (McGill and Anand-Keller 1989).

There are two related reasons that imagery processing leads to compensatory strategies. Firstly, it is characterized as “within-option processing strategies as opposed to across-option strategies” (MacInnis and Price 1987, p. 479). Therefore, people who process information in an imagery way, compared to those who process information verbally or non-imaginary fashion, are more likely to consider the attributes of each option more carefully. Prior studies have demonstrated that when options are presented in a visual form compared to a verbal form, people are more likely to enter attribute interactions of each option into their evaluation (Holbrook and Moore 1981) and less likely to lend itself to attribute-by-attribute comparisons between options (Park and Mittal 1985). Furthermore, imagining future consumption experiences requires limited processing resources. When people process information about two options, resources available for processing information about one option are reduced and, therefore, people may end up with processing information about only one option (McInnis and Price 1987; McGill and Anand-Keller 1989).

According to Kahneman and Snell (1990, 1992), discrepancies between decision and experience results from one of two reasons; consumers either fail to predict accurately how much they will enjoy the consumption of the consequences of a chosen option in the future or predict their enjoyment relatively accurately but fail to choose based on the prediction. The former reason is established by several bodies of psychological work on affective forecasting that people tend to over-predict how much a future event will influence them emotionally (Gilbert et al. 2002; Wilson and Gilbert 2003). The latter reason is well documented by the work on rule-following decisions suggesting that people tend to discount their predicted enjoyment as they make a decision following rules (Prelec and Herrnstein 1991). For instance, people show status-quo bias when following the rule of “if it ain't broke, don't fix it” (Baron 1994), they continue an endeavor once an investment is made when following the “don’t waste” rule (Arkes and Ayton 1999), or they refuse to pay for delays even when the delays are beneficial when following the “don’t pay for delay” rule (Amir and Ariely 2007). In the present work, I do not investigate the former instance that people do not predict their enjoyments accurately. Rather, I examine the latter
instance that enjoyment prediction is relatively accurate but it is not considered when people make a decision. This suggests that I assume that enjoyment prediction question results in accurate prediction.

### 2.2.2 Instrumental attribute

Prior research on response mode effect demonstrates that non-compensatory decision strategies favor the most important attribute (Tversky et al. 1988) or price (Fischer and Hawkins 1993; Luce et al. 1999). This argument can be generalized that non-compensatory decision strategies increase the weight of an attribute that serve the consumers’ purchase purpose.

In the present work, *attribute instrumentality* is defined as the degree to which an attribute serves the consumers’ purchase purpose (Batra and Ahtola 1990; Ratneshwar et al. 2000). Research on consumer attitude suggests that product evaluation is often made based on instrumental reasons. Furthermore, research on consumption goal suggests that when an attribute appears to serve the purchase purpose, consumers tend to consider it importantly. For instance, when consumers look for a desk that fits into a small space, they consider size of desk. When seeking a good looking desk, however, they consider whether a desk is mass produced or not (Ratneshwar et al. 2000). Similarly, when consumers intend to gather information from a website, they concentrate on what will remain as the residue after the reading. However, when they approach a website to be entertained, they enjoy of rhythms and metaphors of the text (Schlosser 2003).

Attribute instrumentality does not always depend on attribute characteristics (e.g., performance or aesthetic appeal). Rather, it can be determined by contextual variables which activate a specific purchase purpose, such as product type or consumer trait. For instance, when a product is an aesthetic product and consumed primarily for its own sake, as a product in itself, apart from any utilitarian functions performed or tangible benefits gained through product use, its aesthetic attribute will be more instrumental than its performance attribute. Alternatively, for consumers

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2 Aesthetic experience takes place when a product is viewed without attention to practical or utilitarian consideration (Bullough 1912). Therefore, “nothing is truly beautiful except that which can serve for nothing; whatever is useful is ugly” (Osborne 1968, p. 20), and that a product supposed to provide sensory pleasure serves any functional purpose is considered as a “serious defect” (Davies et al. 1999, p. 128).
who generally pursue sensory pleasure more strongly than practical benefits will consider aesthetic attributes are more instrumental than performance attributes.  

Consider two attributes, the number of translated languages and color, of digital dictionary. When a consumer buys a digital dictionary to translate multiple languages, the former attribute is more instrumental than the latter attribute. However, when the aesthetic purpose dominates the performance purpose in the purchase condition (e.g., a consumer purchases a dictionary to show it off to friends or one generally considers aesthetic appeal importantly), color is a more instrumental attribute than the number of translated languages. This example illustrates that aesthetic appeal often belongs to a less instrumental attribute because it does not enhance performance, but it is highly instrumental when consumers make purchase decisions for sensory pleasure.

2.2.3 Question, decision strategy, and instrumental attribute

Two arguments elaborated in the previous sections lead me to hypothesize question mode effect; preferences for the option superior on less instrumental attributes are greater when consumers are asked to predict enjoyment than when asked to make choices.

Choice questions will lead consumers to avoid making trade-offs and such avoidance can be accomplished by using non-compensatory strategies. These strategies minimize confronting the possibility that one attribute must be sacrificed to gain on another, and place heavy weight on highly instrumental attributes and ignore less instrumental attributes. In the present work, these strategies are called score-based decision strategies to represent consumers’ tendency to construct preferences in order to maximize purchase purpose. By contrast, enjoyment prediction questions will lead consumers to make a trade-off by utilizing compensatory strategies. These strategies assure that less instrumental attributes receive some weight. In the present work, these strategies are called usage-based decision strategies to represent consumers’ tendency to construct preferences based on their imagined usage of an option.

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3 Research on consumption goals indicates that life themes and values guide consumers to seek which types of benefits. Studies show that consumers evaluate fashion design differently depending on their gender and their tendency to visualize and verbalize (Holbrook 1986), and consumers have different levels of significance that visual aesthetics hold in their relationships with products (Bloch et al. 2003).
The proposed question mode effect is supported by some recent studies (Hsee et al. 2003; Hsee et al. 2009; Shiv and Huber 2000). For example, Hsee et al. (2003) in a study compared purchase decision (choice) and enjoyment prediction between a pair of TVs; one has a significantly better sound quality and the other has a marginally better picture quality. When asked to predict which option they would enjoy more when using it, 76% of the participants chose the TV with much better sound quality. However, it was preferred by 55% when subjects were asked to make a choice as participants placed greater weight on picture quality (as opposed to making trade-offs between sound quality and picture quality) under the condition of choice. Hsee et al. (2009) also found in a study that preferences for the mobile phone with a more vivid screen are greater when asked to indicate how much they like than when asked to choose. Shiv and Huber (2000) obtained a similar finding from a study comparing choice with anticipated satisfaction between a pair of computers; one is cheaper and the other has a built-in power protection feature. When asked to make a choice, only 50% of the subjects chose the computer with the power protection feature. However, when subjects were asked to choose an option after anticipating satisfaction, the percentage of those who selected the same option went up to 80%. All of these findings share with my proposition a focus on the effect of questions on preferences in the comparative response mode; choice questions increase preferences for the option superior on an attribute that serves the purchase purpose to a greater extent (e.g., picture quality of TV, screen size of mobile phone, and price of computer), whereas enjoyment prediction questions (e.g., liking or anticipating satisfaction) increase preferences for an option superior on an attribute that serves a purchase purpose to a little extent (e.g., sound quality of TV, screen vividness of mobile phone, and power protection of computer). We add to their findings by identifying decision strategy as an underlying mechanism and specifying that attributes weighted in different strategies. Formally speaking,

Hypothesis 1: Likelihood of preferring a product superior on a less instrumental attribute is greater when consumers are asked to predict enjoyment than when asked to make choices.

2.3 Attribute evaluability

Making a trade-off requires calculating an exchange rate between attribute values. When the exchange rate is difficult to calculate, consumers avoid making a trade-off, leading to non-compensatory decision strategies (Dick et al. 1990; Jacoby et al. 1994; Johnson and Meyer 1984;
Olshavsky 1979; Payne et al. 1988; Simonson and Tversky 1992). I propose that attribute evaluability can determine the ease of calculating the exchange rate.

Attribute Evaluability refers to the degree to which one’s subjective evaluation is responsive to objective variations in value of an attribute (Hsee 1996). While evaluability depends on numerous factors including evaluation mode and attribute knowledge (Hsee and Zhang 2010), two aspects of attribute nature are discussed in the present work: measurability and objectivity. Measurability is the degree to which consumers assign a quantitative value to a given value of an attribute easily. The more difficult it is to assign a score, the less measurable (and less evaluable) the attribute is. Objectivity is the degree to which consumers interpret a given value of an attribute unambiguously. If consumers perceive there is a lot of variance across consumers in interpreting a given value, the less objective (and less evaluable) the attribute is. Note that measurability has to do with attribute value and objectivity has to do with attribute nature; any value of any attribute can be quantified but some attributes are by nature more objective than others. In general, performance features (e.g., memory size, waterproof, or display size) are more objective than aesthetic appeal (e.g., color, shape, or resolution). For those less objective attributes, even if scores are assigned to their values, they are likely to be less objective unless a standard measurement scale is developed by experts and widely used (Hsee and Tsai 2009).

Consider, again, the number of translated languages and color of digital dictionary. The number of translated languages is a quantified and unambiguous attribute. However, consumers have difficulty in assigning a score to a given color and they may have different preferences for the same color, suggesting that the number of translated languages is easier to evaluate than color.

Prior studies have shown that people tend to evaluate an option superior on easy-to-evaluate attributes more highly than an option superior on hard-to-evaluate attributes (Bazerman et al. 1999; Hsee 1996; Hsee and Zhang 2010). Findings are generally interpreted that attribute evaluability determines how much people place weight on an attribute while they evaluate multiple options; the easier an attribute is to be evaluated, the more heavily it is weighted. This implies that easy-to-evaluate attributes are entered into exchange-rate calculation, whereas hard-to-evaluate attributes are not. Therefore, when attributes are hard to evaluate, consumers avoid making a trade-off and are more likely to utilize non-compensatory strategies than when attributes are easy to evaluate. Formally speaking,
Hypothesis 2a: When attributes are easy to evaluate, likelihood of preferring a product superior on a less instrumental attribute is greater when consumers are asked to predict enjoyment than when asked to make choices.

Hypothesis 2b: When attributes are hard to evaluate, likelihood of preferring a product superior on a less instrumental attribute is same when consumers are asked to predict enjoyment as when asked to make choices.

In sum, I propose that different questions evoke different decision strategies, which in turn results in different preferences. When asked to predict which option they will enjoy, consumers utilize compensatory decision strategies, which in turn prefer an option superior on less instrumental attributes. However, this question mode effect will disappear when attributes are hard to evaluate. In the next section, I present four studies testing two hypotheses.

Figure 3 RESEARCH FRAMEWORK
3 Empirical test

I present four studies that tested my hypotheses. The first three studies tested hypothesis 1 by measuring or manipulating different constructs which affect attribute instrumentality: product type in study 1, consumer trait in study 2, and purchase purpose in study 3. The last study tested hypothesis 2. In all the studies, the respondents were asked to indicate their preferences between a pair of options which involve a trade-off between two attributes. Preferences for the option superior on a less instrumental attribute were compared between two questions: choice and enjoyment prediction. These studies tapped different products and attributes. Table 4 summarizes them.

<table>
<thead>
<tr>
<th>Study</th>
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<th>Attribute 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Smart phones</td>
<td>Memory size (16GB vs. 8GB)</td>
<td>Color (Black vs. Silver)</td>
</tr>
<tr>
<td></td>
<td>Mouse pads</td>
<td>Adhesive on the back (Yes vs. No)</td>
<td>Drawing on the front (Yes vs. No)</td>
</tr>
<tr>
<td>2</td>
<td>Digital dictionaries</td>
<td>Number of translated languages (5 vs. 2)</td>
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</tr>
<tr>
<td>3</td>
<td>Digital cameras</td>
<td>Waterproof (Yes vs. No)</td>
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<td>4</td>
<td>E-book readers</td>
<td>Display size (9.7 vs. 6 inch diagonal)</td>
<td>Display resolution (960x640 vs. 480x320 pixels)</td>
</tr>
</tbody>
</table>

Table 1 OVERVIEW OF STUDIES

3.1 Study 1: Smart phones and mouse pads

3.1.1 Objectives

Study 1 was designed to test hypothesis 1 using two products. One is a product often serves consumers’ performance purpose and the other is a product providing sensory pleasure.
3.1.2 Stimuli and procedure

A smart phone and a mouse pad were selected for two products. An intuition is that consumers tend to consider performance features importantly for a smart phone, such as memory size, because they generally want to download, store, and run various applications. However, for a mouse pad, consumers usually place it on a desk (like hanging a picture on a wall) and therefore consider its aesthetic appeal importantly. This suggests that performance attributes are more likely to be highly instrumental for the former product but they can be less instrumental for the latter product.

For a smart phone, memory size (16GB vs. 8GB) was chosen for a performance attribute and color (black vs. silver) for an aesthetic attribute. A performance attribute of a mouse pad was repositionable adhesive on the back (yes vs. no) and an aesthetic attribute was drawing on the front (yes vs. no). Therefore, two options of a smart phone are equipped with the same processor and the same camera, and priced similar, but one is black with an 8GB memory and the other is silver with a 16 GB memory. Similarly, two options of a mouse pad have an identical size and are priced similar, but one has a drawing on the front without an adhesive on the back and the other has an adhesive on the back without a drawing on the front.

A pre-test was conducted to test the type of the two products and to find the relative value of the aesthetic attributes: color for a smart phone and a drawing for a mouse pad. Twenty four undergraduate students were asked to indicate, firstly, how much they agree with the two sentences borrowed from the prior literature on product aesthetics (Davies et al. 1999; Bloch et al. 2003) on a 7 point Likert-scale (1 = not at all vs. 7 = very much); (1) Smart phones (mouse pads) are supposed to provide sensory pleasure and, when they serve any performance purposes, they are serious defects and (2) a design of the smart phones (mouse pads) is a source of pleasure. Secondly, they indicated how much each option appeals aesthetically on a 7 point Likert-scale (1 = not at all vs. 7 = very much). Data show that they agreed with the first sentence more strongly when the products are mouse pads (5.96) than smart phones (4.83, t(23) = 3.15, p < .01) and that they also showed greater agreement with the second sentence for mouse pads (4.88) than for smart phones (3.71, t(23) = 2.53, p < .05), indicating that mouse pads are more likely to be aesthetic products than smart phones. Findings suggest that adhesive on the back (performance attribute) is less instrumental than drawing on the front (aesthetic attribute) for mouse pads,
whereas color (aesthetic attribute) is less instrumental than memory size (performance attribute) for smart phones. Furthermore, they indicated that the black smart phone (4.83) appealed more than the silver smart phone (3.71, paired sample t-test = 1.62, t(23) = 1.96, p < .10) and the mouse pad with a drawing on the front (5.96) appealed more than the mouse pad without a drawing (3.63, paired sample t-test = 2.33, t(23) = 8.14, p < .01).

Figure 4 STIMULI FOR STUDY 1: A PAIR OF SMART PHONES AND A PAIR OF MOUSE PADS

3.1.3 Design

Subjects were randomly assigned to one of four conditions that constituted a 2 (question type: choice vs. enjoyment prediction) x 2 (product type: performance vs. aesthetic) between-subjects design. In the choice condition, they were asked which option they would choose. In the enjoyment prediction condition, they were asked which option they would enjoy more when using it. Half of the subjects responded to performance product (smart phone) and the other half responded to aesthetic product (mouse pad).

3.1.4 Data collection and data analysis

In total, 109 participants were recruited from University of Toronto and half of them were asked to indicate preferences for the two options of a smart phone and the other half for the two options of a mouse pad. They were asked to indicate binary preferences (circle one option between A and B) and scaled preferences (circle a number on a 7 point Likert-scale with 1 indicating “definitely B” (an option superior on a performance attribute) and 7 indicating “definitely A” (an
option superior on an aesthetic attribute). Binary preferences were analyzed using Chi-square test
and scaled preferences were analyzed using Analysis of Variance (ANOVA).

3.1.5 Results

My pre-test results suggest that color is less instrumental than memory size for smart phones and
adhesive on the back is less instrumental than drawing on the front for mouse pads. According to
the proposed question mode effect, I expected that the smart phone superior on the color attribute
(black smart phone) is preferred more strongly in the enjoyment prediction question condition
than in the choice condition, whereas the mouse pad with the drawing on the front is less
preferred in the enjoyment prediction question condition than in the choice question condition.

For the performance product, 52% of the subjects who were asked to make a choice preferred the
option superior on an aesthetic attribute (e.g., black smart phone). However, it was preferred by
81% of the subjects who were asked to predict enjoyment ($X^2(1) = 5.33, p < .05$). The opposite
pattern was found for the aesthetic product; the option superior on an aesthetic attribute (e.g.,
mouse pad with a drawing on the front) was preferred by 70% in choice condition but only 29%
in enjoyment prediction condition ($X^2(1) = 9.61, p < .01$).

Scaled preference was consistent with binary preference. For the performance product,
preference score was greater when asked to predict enjoyment than when asked to make a choice
(choice = 4.30 vs. enjoyment prediction = 5.59, $t(52) = 2.43, p < .05$). It was reversed for the
aesthetic product; preference score in the enjoyment prediction condition was lower than that in
choice condition (choice = 5.07 vs. enjoyment prediction = 3.14, $t(53) = 3.57, p < .01$).
Figure 5 PREFERENCE AS A FUNCTION OF QUESTION MODE AND PRODUCT TYPE

3.1.6 Discussion

Findings indicate that when product types differ, enjoyment prediction questions will lead consumers to prefer different options. Data show that they increased preference for the option superior on an aesthetic attribute when a product is for performance (e.g., a black mobile phone) and they increased preference for the option superior on a performance attribute when a product is for aesthetics (e.g., a mouse pad with an adhesive on the back). Findings generally indicate what happens to smart phone buyers and mouse pad buyers in real life. Smart phone buyers are aware of the aesthetic value. However, when they make a choice, they ignore aesthetic attributes and pursue an option performing better. By contrast, mouse pad buyers are aware of the utility of adhesiveness but they ignore it when making a choice. To summarize, study 1 supports hypothesis 1 that enjoyment prediction questions increase preferences for the option superior on less instrumental attributes.
3.2 Study 2: Digital dictionaries

3.2.1 Objectives

In study 1, I tested hypothesis 1 using two products assuming that the type of one product differs from the type of the other. Study 2 aims to test the same hypothesis using one product. Inspired by the idea that attribute instrumentality is determined by not only product type but also consumer trait, I investigated whether consumers who pursue performance goals and those who pursue aesthetic goals consider the same attribute differently in terms of their instrumentality, which will dictate which option is more preferred when enjoyment prediction questions are asked than when choice questions are asked.

3.2.2 Stimuli and procedure

A digital dictionary was selected for a stimulus, and the number of translated languages (5 vs. 2) was selected for a performance attribute and color (white vs. grey) for an aesthetic attribute for digital dictionary. Two options of a digital dictionary are equipped with the same CPU and priced similar. However, one digital dictionary is white and translates between only 2 languages (English and French), and the other is grey and translates among 5 languages (English, French, German, Spanish, and Italian).

A pre-test was conducted to find whether white scores higher than grey. One hundred two undergraduate students were asked to indicate how much each option appeals aesthetically on a 7 point Likert-scale (1 = not at all vs. 7 = very much). They responded that the white digital dictionary (5.30) appealed more than the grey one aesthetically (3.25, paired sample t-test = 2.05, t(101) = 7.29, p < .01).
3.2.3 Design

Subjects were randomly assigned to one of two conditions that constituted a 2 (question type: choice vs. enjoyment prediction) between-subjects design. Same as study 1, half of the subjects were asked which option they would choose (choice) and the other half were asked which option they would enjoy more when using it (enjoyment prediction).

Before indicating their preferences between two options, subjects were asked to write down as many reasons that they purchase a digital dictionary as they could. This instruction would reveal the purchase purpose each subject emphasizes and helped me identify one pursues performance goals or aesthetic goals. Note that while this instruction appears to increase subjects’ need for justification, I do not expect that it changes weighting on attributes systematically. For instance, Simonson and Nowlis (2000) demonstrated that consumers justify their choices differently depending on their level of Need For Uniqueness (NFU); subjects scoring low NFU chose conventional reasons whereas those who scored high NFU selected unconventional reasons. Similarly, subjects who pursued performance goals would reveal their performance goals whereas those pursuing aesthetic goals would reveal aesthetic goals.
3.2.4 Data collection and data analysis

In total, 94 participants were approached in a café and asked to indicate preferences between two options of a digital dictionary. Same as study 1, binary preferences were collected and analyzed using Chi-square test, and scaled preference was collected and analyzed using ANOVA.

Each reason that subjects reported was coded and analyzed in order to identify how much one pursues the performance goal. It was coded +1 for a performance purpose and -1 for a non-performance (e.g., aesthetic) purpose. The higher score one obtains, the more likely she pursues a performance goal.

3.2.5 Results

The average score of the collected reasons is 3.55 in total. Forty seven subjects participating in the choice condition were split into two groups, high and low performance reason. Twenty four subjects in high performance reason group scored 5.04 in average, whereas 23 subjects in low performance reasons group scored 1.57 in average \((F(1,45) = 77.32, p < .01)\). Subjects in the enjoyment prediction condition \((N = 47)\) were also split into two groups. Twenty three subjects who belonged to high performance reason group \((6.17)\) scored higher than 24 subjects who belonged to low performance reason group \((1.42, (F(1,45) = 233.89, p < .01))\).

The results are summarized in figure 7. Binary preferences were determined by question mode and the group of performance reasons. For subjects who belonged to high performance reason group, preferences for the better colored option were greater when asked to predict enjoyment \((43\%)\) than when asked to make a choice \((17\%, X^2(1) =4.04, p < .05)\). An opposite pattern was obtained for those who belonged to low performance reason group; their preferences for the better colored option were smaller in the enjoyment prediction condition \((38\%)\) than in the choice condition \((57\%, X^2(1) = 1.71, p = .16)\). Similarly, scaled preference showed that preference is the function of question mode and the group of performance reasons. For those who were in the high performance reason group, preference was greater in the enjoyment prediction condition \((3.61)\) than in the choice condition \((2.83)\). However, it was smaller in the enjoyment prediction condition than in the choice condition for those in the low performance reason group \((choice = 4.48 \text{ vs.} \text{ enjoyment prediction condition} = 3.58, \text{ interaction, } F(1,90) = 4.23, p < .01)\).
Note that the enjoyment prediction question plays a role in reducing biases in reporting preferences. When the choice question was asked, subjects in the high performance reason group (17%) reported significantly lower preference for the better colored option than those in the low performance reason group (57%, $X^2(1) = 8.10, p < .01$). When subjects were asked to predict their enjoyment, however, preference did not differ between two groups (high performance reason group = 43% vs. low performance reason group = 38%, $X^2(1) = 0.17, p > .01$). These findings are in line with the findings reported in a study by Hsee et al. (2009). In their study, subjects were asked to indicate their preference between two cellular phone options in two different preference measurements, choice and liking, and found that liking was more consistent than choice.

![Figure 7 PREFERENCE AS A FUNCTION OF CONSUMER TRAIT AND QUESTION MODE](image)

3.2.6 Discussion

I replicated the basic question mode effect using only one product. Findings suggest that people pursue different purposes and they consider different attributes as highly instrumental or less instrumental attributes. Therefore, enjoyment prediction questions increased preferences for the
better colored digital dictionary among those who strongly pursue performance purposes, whereas the same question decreased its preferences for those who do not.

3.3 Study 3: Digital cameras

3.3.1 Objectives

In two previous studies, hypothesis 1 was tested using different products or measuring consumer traits. In the present study, the same hypothesis was tested by manipulating consumers’ purchase purposes directly. Therefore, I investigated whether different purchase purposes led subjects to judge attribute instrumentality differently, which results in preference reversals between two different questions.

3.3.2 Stimuli and procedure

A digital camera was selected for stimulus, and waterproof (no vs. yes) was selected for a performance attribute and shape (squared vs. rounded) was selected for an aesthetic attribute. Two options of a digital camera are equipped with the same lens, provide the same level of zoom, and are priced similar. However, one option is not waterproof but squared whereas the other is waterproof and rounded.

A pre-test was conducted to find whether a squared shape scores higher than a round shape. Twenty five undergraduate students were asked to indicate how much each option appeals aesthetically on a seven point Likert-scale (1 = not at all vs. 7 = very much). They indicated that the squared option (4.96) appealed aesthetically more than the round option (3.96, paired sample t-test = 1.00, t(24) = 1.83, p < .10).
3.3.3 Design

Subjects were randomly assigned to one of four conditions that constituted a 2 (question type: choice vs. enjoyment prediction) x 2 (purchase purpose: performance vs. aesthetic) between-subjects design. Question type was manipulated as in the previous studies; subjects in the choice condition chose one option and subjects in the enjoyment prediction condition predicted which option they would enjoy more when using it. Purchase purpose was manipulated by using two different scenarios. Subjects in the performance purchase purpose condition were instructed that they would consider purchasing a digital camera for vacation sports, whereas subjects in the aesthetic purchase purpose condition were instructed that they would consider purchasing a digital camera to take pictures of their partners (boyfriends or girlfriends). An intuition behind the aesthetic purchase purpose manipulation is that when taking pictures of partners, people want their partners to think they have good taste. Prior research suggests that when the product is seen as symbolic of identity, consumers tend to avoid options preferred by majorities and purchase an option that signals their taste, such as aesthetic taste (Berger and Heath 2007).
3.3.4 Data collection and data analysis

In total, 121 participants were recruited from University of Toronto and instructed to assume that an electronic company recruits them to test digital camera. Two dependent variables and their analyses are identical with those in previous studies. Binary preferences were collected and analyzed using Chi-square test, and scaled preferences were collected and analyzed using ANOVA. In order to check purchase purpose manipulation, subjects were asked to indicate the degree to which each attribute, waterproof and shape, serves their purchase purposes on a seven point Likert-scale (1 = not at all, 7 = very much).

3.3.5 Results

Purchase purpose was manipulated successfully. Subjects in the performance purchase purpose condition indicated that waterproof served their purpose more strongly than shape (waterproof = 5.58 vs. shape = 3.77, paired-samples T-test = 1.82, t(59) = 9.10, p < .01). By contrast, subjects in the aesthetic purchase purpose condition considered shape more instrumental for their purpose than waterproof (waterproof = 3.95 vs. shape = 4.72, paired-samples T-test = 0.77, t(60) = 3.14, p < .01).

The results are summarized in figure 9. Supporting hypothesis 1 and replicating previous studies, binary preferences were determined by question mode and purchase purpose. When considering purchasing a digital camera for vacation sports (performance), preferences for the better shaped option were greater when asked to predict enjoyment (53%) than when asked to make a choice (13%, $X^2(1) = 10.80, p < .01$). However, when considering purchasing a digital camera for partners (aesthetic), preferences for the better shaped option were smaller in the enjoyment prediction condition (60%) than in the choice condition (71%, $X^2(1) = 0.82, p > .10$). Scaled preference is in line with binary preferences. When the purchase purpose was performance, preference was greater in the enjoyment prediction condition (4.27) than in the choice condition (1.93). However, it was smaller in the enjoyment prediction condition than in the choice condition when the aesthetic purpose was activated (choice = 4.61 vs. enjoyment prediction condition = 4.17, interaction, $F(1,117) = 15.15, p < .01$). In sum, enjoyment prediction questions increased preferences for the option superior on a less instrumental attribute; a better shaped option in the performance purpose condition and a waterproof option in the aesthetic purpose condition.
Similar to the findings in study 2, purchase purpose affects preference based on choice but not preference based on enjoyment prediction. When subjects were asked to choose between two digital cameras, the better shaped option was more likely to be chosen when an aesthetic purchase purpose was considered (71%) than when a performance purchase purpose was considered (13%, $X^2(1) = 20.71, p < .01$). However, when subjects were asked to predict their enjoyment, their preference was not influenced by purchase purpose (performance purchase purpose = 53% vs. performance purchase purpose = 60%, $X^2(1) = 0.27, p > .01$).

![Preference as a Function of Question Mode and Purchase Purpose](image)

**Figure 9** PREFERENCE AS A FUNCTION OF QUESTION MODE AND PURCHASE PURPOSE

### 3.3.6 Discussion

In this study, I replicated the basic question mode effect by manipulating purchase purpose directly, suggesting that manipulated attribute instrumentality leads to the question mode effect.
3.4 Study 4: E-book readers

3.4.1 Objectives

Previous studies demonstrated question mode effect employing several different ways. This study was designed to test whether this effect is moderated by the degree to which attributes are evaluable.

3.4.2 Stimuli and procedure

An e-book reader is selected for stimulus. Two attributes of e-book reader, display size (9.7 vs. 6 inch diagonal) and display resolution (960 x 640 vs. 480 x 320 pixels), were selected for testing attributes because they are generally difficult to evaluate by themselves. Therefore, two options have identical features except screen resolution and screen size. One option has a relatively big (9.7 inch diagonal) display with poor resolution (480 x 320 pixels) and the other option has a smaller (6 inch diagonal) but better (960 x 640 pixels) display.

3.4.3 Design

Subjects were asked to imagine that they were recruited by an electronic company for testing two options of an E-book reader. This study has a 2 (question mode: choice vs. enjoyment prediction) x 2 (attribute evaluability: easy-to-evaluate vs. hard-to-evaluate) between-subjects design.

Question mode was manipulated in the same way as in the previous studies. Half of the subjects were asked to choose between two options and the other half were asked to predict which option they would enjoy the more when using it.

Attribute evaluability was manipulated by varying the range of the attribute values. When attribute values have a narrow range, they become easier to evaluate. Therefore, a narrow range of the attribute values was provided for the easy-to-evaluate condition and a wide range was provided for the hard-to-evaluate condition. In particular, subjects in the easy-to-evaluate condition were informed that display size for e-book readers available in the market varies between 6 and 10 inch diagonal and their display resolution varies between 480 x 256 and 1024 x 640 pixels. For the hard-to-evaluate condition, subjects were informed that e-book readers can have a display between 4 and 15 inch diagonal and its resolution can vary from 240 x 124 to 2048 x 960 pixels.
3.4.4 Data collection and data analysis

This study was conducted at an electronic shop in South Korea. In order to eliminate a chance that participants indicated their preferences with informed knowledge about attributes, shop visitors who have no interest in purchasing an e-book reader were only approached. In total, 73 visitors participated in this study.

Two dependent variables and their analyses were identical with those in previous studies. Binary preferences were collected and analyzed using Chi-square test, and scaled preferences were collected and analyzed using ANOVA.

In order to assess whether attribute evaluability depends on the range of attribute values, subjects were asked the following two questions after they indicated preferences (Hsee 1996): one is “Do you have any idea how good a display size of 9.7 inch diagonal (6 inch diagonal) is?” and the other is “Do you have any idea how good a display resolution with 960 x 640 pixels (480 x 320 pixels) is?” To answer each question, subjects would choose among seven options ranging from 1 (I have no idea) to 7 (I have a clear idea).

3.4.5 Results

Attribute evaluability was manipulated successfully. Subjects answered that when the range of display size is narrow (5.32), it is easier to evaluate than when its range is wide (3.56, t(71) = 5.32, p < .01). Besides, when the range of display resolution is narrow (4.65), subjects considered it easier to evaluate than when the range is wide (3.36, t(71) = 3.91, p < .01). In sum, the average evaluability of the two attributes in the narrow range condition (4.99) was greater than in the wide range condition (3.46, t(71) = 6.65, p < .01).

The results are summarized in figure 10. They supported the second hypothesis that attribute evaluability moderates the question mode effect. When two attributes were easy to evaluate, preference reversals between two questions were replicated; more subjects preferred the option superior on display resolution when asked to predict enjoyment (68%) than when asked to choose (22%, \(X^2(1) = 7.94, p > .01\)). However, when attributes are hard to evaluate, the question mode effect disappeared; preferences for the option superior on display resolution did not differ between two questions (choice = 29% vs. enjoyment prediction = 37%, \(X^2(1) = 0.22, p > .10\)). Scaled preferences produced a significant interaction between question mode and attribute
evaluability \((F(1, 69) = 9.66, p < .01)\), supporting the pattern obtained from binary preferences. When attributes were easy to evaluate, preference score was significantly greater in the enjoyment prediction condition (4.90) than in the choice condition (2.67). However, when attributes were hard to evaluate, it was not different between the choice condition and the enjoyment prediction condition (choice = 3.24 vs. enjoyment prediction = 2.90).

![Figure 10 PREFERENCE AS A FUNCTION OF QUESTION MODE AND ATTRIBUTE EVALUABILITY](image)

**3.4.6 Discussion**

This study produced two key findings. First, I replicated the basic question effect in the condition which attributes are easy to evaluate. Second, I demonstrated that attribute evaluability moderated the question mode effect; enjoyment prediction questions failed to increase preferences for the option superior on a less instrumental attribute when attributes are hard-to-evaluate. Findings support the hypothesis that attribute evaluability determines consumers’ decision strategy selection in the enjoyment prediction condition, eliminating the proposed question mode effect.
4 General discussion

Four studies tested question mode effect and its boundary condition. The first three studies demonstrated that asking enjoyment prediction questions increase preferences for the option superior on a less instrumental attribute, an attribute inconsistent with product type (study 1), an attribute inconsistent with consumer trait (study 2), or an attribute inconsistent with purchase purpose (study 3). The last study showed that question mode effect disappears when attributes are hard to evaluate. Findings contribute to decision strategy selection and conjoint analysis.

4.1 Contributions to decision strategy selection

Firstly, the present work adds to the literature on discrepancies between choice and various types of preference. Prior work suggests that choice leads people to rationalize their decision and choose an option superior on easy-to-justify attributes. It results in biased choices when people do not carefully analyze attributes of an option (Shafir et al. 1993) or the chosen option does not maximize their own interests (Amir and Ariely 2008). This work shows that choice decreases people’s tendency to make trade-offs, increasing the weight of a purpose-serving attribute, suggesting that decision strategy selection is an underlying mechanism of discrepancies between choice and preference.

Secondly, it adds to the literature on decision strategy selection. A significant body of research finds evidence of the utilization of non-compensatory decision strategies (Payne et al. 1993), examines when simpler decision heuristics are utilized (Simonson and Tversky 1992; Luce et al. 1999), and investigates how compensatory decision strategies are encouraged (Drolet and Luce 2004; Cox and Grether 1996). In particular, as the number of options being offered increases and Web-based search tools are available, consumers often sort products on key attributes and screen them for inclusion in their consideration sets. As a result, firms want to know when and how consumers use a non-compensatory decision strategy to screen products. For instance, about 300 make-model combinations of automobiles are available and 62% of automobile purchasers search online (J.D. Power 2002), General Motors considers its greatest design challenge in the 2000s to be the ability to design products that customers will consider (Urban and Hauser 2004). While there has been extensive consumer research (Bettman et al. 1998) and econometric research on decision strategy (Gilbride and Allenby 2004), only recently have researchers begun to study the impact of non-compensatory decision strategies as they relate to the identification of
opportunities in product development. This work clarifies must-have attributes, identifies why they get a product into consumers’ consideration set, and how to help them make decisions in a compensatory fashion.

4.2 Contributions to conjoint analysis

Firstly, the present work adds to the consumer research on conjoint analysis. Because marketers often use conjoint analysis to test products for successful product development, consumer researchers study contextual variables which can influence the reported part-worth utilities of product attributes. Examples include response mode and profile presentation (Green and Srinivasan 1978, 1990). Studies have found that, for example, when responses are measured by a comparative choice scale, price is weighted more heavily than other attributes than when responses are measured by a non-comparative likelihood-of-purchase scale. It has been also found that consumers place more weight on “stylistic” attributes or attribute interactions when profiles are presented in pictorial or three-dimensional model forms than when they are presented verbally (Holbrook and Moore 1981). Adding to this line of research, I show that what questions being asked has a considerable effect in identifying part-worth utilities of product attributes. More importantly, it is in line with the prescriptive approach toward product test (Hoeffler 2003; Luo et al. 2008). Hoeffler (2003), for instance, suggested that marketers would predict consumers’ preferences for really new products more accurately by incorporating mental simulations and analogies and decreasing consumers’ uncertainty between attributes and their benefit. Luo et al. (2008) claimed that product designers would obtain more accurate predictions of consumers’ preferences when consumer’s perceptions of the subjective characteristics (e.g., ease of use of power tool) are included in attribute-based product test.

Secondly, more broadly speaking, the present work has implications for market research. While market research is an essential stage in developing products (Hauser et al. 2006; Wind and Mahajan 1997), the validity of market research is often called into question. Some researchers claim that technological push matters more than market pull or customer insight (Hamel and Prahalad 1994) and marketers often develop products without conducting market research. For instance, designers at Bang and Olufsen, Herman Miller, and Allessi either avoid market research or ignore market research data, following their own way in finding new product ideas (Verganti 2006). Findings from the present work are in line with this argument that when asked
to make a choice, consumers emphasize the attributes that serve their purchase purpose, which in turn results in biased data.

### 4.3 Limitations and future research

Although the present work contributes to the decision-making research and provides practical implications for conjoint analysis, it certainly has several limitations that need to be further examined.

Firstly, the proposed question mode effect appears only when highly instrumental attributes are not aligned with the predictors of enjoyment. When highly instrumental attributes are important in predicting enjoyment, changing the choice question with the enjoyment prediction question may not result in preference reversals. Imagine that there are two financial advisors; one produces a better performance but has less time with clients and the other produces worse performance but less busy (more time with client). In this case, performance is not only more instrumental but also predicts enjoyment better than time with client. Therefore, consumers will be more likely to choose and, at the same time, predict greater enjoyment from the better performing, busier financial advisor than the other. In the future research, alignment between attribute instrumentality and enjoyment prediction should be further examined in order to specify a boundary condition of the question mode effect.

Secondly, findings from the four studies do not clarify the underlying mechanism of the question mode effect. Although selecting different decision strategies in different questions are proposed to affect preference, preference can be determined by changing of attribute weighting in different questions; consumers may place greater (less) weight on highly (less) instrumental attributes in the choice question than in the enjoyment prediction question (see other attribute weighting accounts in Hsee et al. 2003; Shiv and Huber 2000). In the future research, the decision strategy account needs to be further tested by employing the experimental methods such as protocol, response time, direct test, or cognitive load. Firstly, consumers’ descriptions of the processes by which they develop the preferences and their perceptions of these processes can provide insights into the selection of decision strategy (Coupey et al. 1994). Secondly, consumers’ response time indirectly supports the decision strategy account (Hawkins 1994; Schkade and Johnson 1989). For example, Schkade and Johnson (1989) reported that pricing judgments take significantly longer than choices for gambles and Hawkins (1994) showed that the response time for matching
is greater than for choice. Thirdly, a carefully designed study directly tests whether consumers actually make a trade-off when responding to a choice question. For example, in a study conducted by Luce (1999), each subject makes a series of choices, assessing relative preference for the high quality alternative at a variety of prices for that alternative. These prices are determined by the subject’s previous trade-off for that task. This prior trade-off price is assigned to price level 3; level 1 and 2 are less than the trade-off value and level 4 and 5 are greater than it. Thus, for level 1, 2, 4, and 5, she predicted the choice that each subject would make if he or she recalculated the trade-off during choice exactly as he or she did during matching. Finally, a study employing cognitive load tests whether consumers are less likely to make a trade-off when they are under cognitive load even when the prediction question encourages them to do so.

The present work provides practical implications for concept testing by offering an economical and easy way to improve conjoint analysis: changing the question. In the future research, it needs to be tested whether changing the question is more effective than employing other methods such as using the non-comparative response mode or changing the context of conjoint studies. Furthermore, whether the enjoyment prediction question always captures consumer preference better than other questions needs to be examined because my findings cannot speak to the situations in which consumers judge future consumption experience poorly (Kahneman and Snell 1992; Wilson and Gilbert 2003).
Chapter 3

5 Introduction

Imagine that marketers try to identify which color consumers prefer for a newly developed computer. Suppose that marketers are not aware of consumers’ color preferences for the computer but they know that consumers prefer silver for digital electronics but they prefer black for home accessories. Which color do marketers choose for the computer? In other words, how do marketers use information to make a prediction?

Such a question has been much discussed in decision-making literature. Research generally indicates that even when information is not biased, people often make biased predictions because the way they make predictions is biased. For instance, they sometimes discount or ignore highly diagnostic information such as base rate (Kahneman and Tversky 1973) or false alarm rate (Doherty et al. 1979). Alternatively, they sometimes place too much weight on less diagnostic information (Klayman and Brown 1993; Shah and Oppenheimer 2007) or even non-diagnostic information (Meyvis and Janiszewski 2002; Simonson et al. 1994; Zukier and Jennings 1983).

The present work applies a framework of literature from decision making to a market research context, to investigate the effect of marketers’ prediction strategy on their prediction accuracy. In particular, I build on categorization research and argue that their conventional prediction strategy results in biased predictions. I build on Multiple Cue Probability Learning (MCPL) research and propose that marketers adopt an alternative prediction strategy in order to increase their prediction accuracy. This is because the alternative prediction strategy enables marketers to find

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4 Information diagnosticity refers to how useful information is for a task. While it can be understood in many ways (e.g., reduction in uncertainty or improvement in probability of making a correct decision), a widely used conceptualization of diagnosticity is Weight Of Evidence (WOE) suggested by Good (1950, 1975, 1983). According to this approach, information increases its diagnosticity when it supports a focal hypothesis or negating an alternative hypothesis. Thus, diagnosticity is often measured by the likelihood ratio between hit rate and false-alarm rate. Since Good’s WOE is theoretically defensible and experimentally testable, subsequent work adopting WOE can test whether people identify and use diagnostic information normatively when making predictions (Doherty et al. 1996; Fischoff and Beyth-Marom 1983; Slowiazek et al. 1992).
and use diagnostic information regardless of whether two rules—an implicit rule of categorization (perceived diagnosticity of consumer preference data inferring from categorical similarity) and a target rule of data (actual diagnosticity of consumer preference data)—are congruent or not. Going beyond comparing two prediction strategies, I explore whether marketers utilizing the alternative prediction strategy can further increase their prediction accuracy when information has multiple sets rather than a single set.

The present work contributes to MCPL and market research. Firstly, it tests sequential learning strategy in a new context and suggests that breaking down information into multiple sets improves learning. A significant body of research on MCPL examines whether and when sequential learning strategy (making predictions multiple times and receiving feedback for each prediction) leads to accurate predictions. Numerous studies have shown that sequential learning strategy can increase prediction accuracy (Meyer 1987; West et al. 1996) but its effect depends on contextual variables such as noise in environment, relationships among cues, number of predictions, type and timeliness of feedback, and world knowledge prompted by cue labels, to name a few (Adelman 1981; Aniezek 1986; Hogarth et al. 1991; Karelaia and Hogarth 2008; Klayman 1984, 1988; Stewart and Rusk 1994).

Secondly, the present work provides implications for market research by demonstrating that marketers often make inaccurate predictions and can increase prediction accuracy by selecting an alternative prediction strategy. On the topic of market research, considerable attention has been paid to develop new methods (Arnould and Wallendorf 1994; Griffin and Hauser 1993; Urban and Hauser 2004; Zaltman 1997). However, little is known about whether marketers make accurate predictions and what other prediction strategies are available for them. Such discussions have been made in the engineering context (House of Quality in Hauser and Clausing 1988) and in the management context (Decision Support Systems in Hoch and Schkade 1996) but not in the market research context.

5.1 Current practice of preference learning

Marketers often collect consumers’ preference information for multiple products in order to predict their preferences for a target product. For instance, when Lenovo developed a desktop computer for Chinese consumers, Ziba designers surveyed the color preference of Chinese computer users for various products including digital electronics and home accessories (Business
When Mayo Clinic attempted to improve its services, IDEO designers observed not only patients in the hospital but also people in public spaces such as subway stations, theaters, and shopping malls (Kelley 2001). When Harley-Davidson aimed to serve its rider communities better, designers from Jump Associates studied communities of similar firms such as Disney as well as its own communities (Patnaik and Mortensteim 2009).

Although it has not been studied yet, marketers appear to consider information more importantly when the information is categorically similar with the prediction target. For instance, Ziba designers found that Chinese computer users like silver for digital electronics and they selected silver for their new computer (Business Week 2005). While it is not clarified, patients in the hospital might have been considered more importantly than people in the public spaces, and communities of Harley-Davidson might have studied more carefully than communities of Disney.

The rest of the article is organized as follows. Firstly, literature on categorization and literature on Multiple Cue Probability Learning (MCPL) are reviewed to offer the first hypothesis. Secondly, in the literature on inference type, evidence are collected to propose that information broken down into multiple sets benefit learning compared to information with a single set. Next, two empirical studies testing two hypotheses are reported. Previewed briefly, studies are demonstrating that, firstly, prediction accuracy of the sequential learning strategy is greater than that of categorization-based strategy and that, secondly, prediction accuracy of the sequential learning strategy is greater when information has multiple sets than when it has a single set. Implications of the findings for MCPL and market research are discussed in the final section.

6 Conceptual background

6.1 Categorization-based strategy

Psychologists have long suggested that categorization shapes the way people make predictions using information, suggesting that marketers utilize categorization-based prediction strategy and tend to judge diagnosticity based on categorical similarity. Studies have shown that when people make an educated guess in the face of limited knowledge, they tend to use categorical similarity as a vehicle to transfer information between information and a prediction target (Aaker and Keller 1990; Medin et al. 1993; Osherson et al. 1990). For instance, Rips (1975) demonstrated in a classic study that when subjects were informed about an unknown disease in rabbits, they
predicted that the same disease would be more likely to be found in dogs than in bears. Similarly, when consumers evaluate a newly extended brand, they draw on their own evaluations of the original brand only when the extended brand is categorically similar with the original brand (Aaker and Keller 1990). Emphasizing categorical similarity as a fundamental prediction strategy, some researchers even argued that people tend to make similarity claims vaguely (e.g., X and Y are similar) rather than specifically (e.g., X and Y are similar in terms of A, B, and C) because they expect to find undiscovered information common between them (Medin and Ortony 1989).

Although marketers make predictions based on categorization, consumer research suggests that it is risky to assume that preferences are consistent with overall categorical similarity (Shocker et al. 1990). For instance, consumers’ toy preferences are not related with the way they categorize toys. Their soft drink preferences also differ from how, they believe, the soft drink market is categorized (Shocker et al. 1990). Findings imply that when marketers utilize the categorization-based strategy, their prediction accuracy will depend on the consistency between two rules, an implicit rule of categorization (perceived diagnosticity of consumer preferences inferring from categorical similarity) and a target rule of data (actual diagnosticity of consumer preferences). When the two rules are consistent, predictions are accurate. However, when the two rules are inconsistent, predictions are biased (Hogarth 1981).

Premise: Prediction accuracy of the categorization-based strategy is greater when the two rules—an implicit rule of categorization and a target rule of data—are congruent than when not.

6.2 Sequential learning strategy

Multiple Cue Probability Learning (MCPL) is a research paradigm about whether and how people learn identifying and using multiple cues with probabilistic relationships as they utilize sequential learning strategy (i.e., make predictions and receive feedback) (Goldstein 2004). It is based on Brunswik’s Lens Model (1955) that people’s prediction and the target being predicted are two separate functions of cues available in the environment, and the accuracy of people’s prediction depends on the extent to which the function describing the people’s prediction matches its environmental counterpart or ecology (Stewart and Lusk 1994). A significant body of studies has shown that when doctors diagnose diseases, interviewers assess job candidates, or consumers evaluate multi-attribute products, sequential learning strategy leads to accurate
predictions because it enables people to identify and use diagnostic cues (Klayman 1984; Meyer 1987; West et al. 1996). These findings suggest that marketers can make predictions more accurately when they utilize the *sequential learning strategy* rather than the categorization-based strategy.

In particular, the sequential learning strategy will benefit marketers when the two rules, an implicit rule of categorization and a target rule of data, are not congruent. This argument is supported by the findings that the prediction accuracy based on the sequential learning strategy is not influenced by cue labels (Adelman 1981; Sniezek 1986) or preference similarity between agent and target (West 1996). For instance, Adelman (1981) tested whether subjects predicted GPA scores more accurately when the scores are positively related with academic achievement than when negatively related. Later, Sniezek (1986) tested whether subjects predicted college math GPA scores more accurate when the scores are positively related with high school math GPA scores than when positively related with high school English GPA scores. Two studies commonly showed that prediction accuracy is not influenced by cue labels. When the world knowledge prompted by cue labels accounted for the data (e.g., positive relationship between GPA scores and academic achievement or positive relationships between college math GPA scores and high school math GPA scores), subjects made predictions accurately from the initial prediction trials. However, when the world knowledge prompted by cue labels is not consistent with the data, subjects reinterpreted cue labels to agree with the data and increase their prediction accuracy (“if what makes sense does not work, make sense out of what does work” in Sniezek 1986). Similarly, West (1996) demonstrated that subjects initially predicted others’ preferences by projecting their own preferences. Therefore, subjects who had similar preferences with the target showed greater prediction accuracy than those who did not. However, when they were provided with feedback, preference similarity between agents and targets showed no effect on prediction accuracy. These findings suggest that when two rules—an implicit rule of categorization (the world knowledge prompted by cue labels) and a target rule of data—are inconsistent, the sequential learning strategy eliminates the effect of rule congruency on prediction accuracy by enabling marketers to discard the incorrect implicit rule and learn the correct target rule.

This argument is illustrated by an example that compares categorization-based strategy and sequential learning strategy. Suppose, again, that marketers predict consumers’ color preferences
for a computer and they are informed that consumers prefer silver for digital electronics and black for home accessories. When marketers employ the categorization-based strategy, they will choose silver for the computer, the color that consumers prefer for digital electronics because the computer is categorically similar with digital electronics. In this case, their prediction accuracy depends on whether consumers’ color preference is consistent with categorical similarity. Alternatively, when marketers utilize the sequential learning strategy, they will choose a color for the computer based on diagnosticity. They will choose silver if preferences for digital electronics are more diagnostic than those for home accessories, but they choose black if the relative diagnosticity is opposite. Formally speaking,

*Hypothesis 1:* Prediction accuracy is greater when the sequential learning strategy is utilized than when the categorization-based strategy is utilized.

*Hypothesis 1a:* When the two rules— an implicit rule of categorization and a target rule of data—are incongruent, prediction accuracy is greater when the sequential learning strategy is utilized than when the categorization-based strategy is utilized.

*Hypothesis 1b:* When the two rules— an implicit rule of categorization and a target rule of data—are congruent, prediction accuracy is same when the sequential learning strategy is utilized as when the categorization-based strategy is utilized.

### 6.3 Data presentation

Research on MCPL indicates that the effect of sequential learning strategy on prediction accuracy depends on various contextual variables such as noise in environment, relationships among cues, number of predictions, type and timeliness of feedback, and clarity of rewards, to name a few (Karelaia and Hogarth 2008; Klayman 1988; Stewart and Rusk 1994). In the present work, I propose that when information is provided in different ways, the effectiveness of sequential learning strategy differs. In particular, when the information has multiple sets, marketers utilizing the sequential learning strategy can make predictions more accurately than when the information has a single set.

This is supported by the research comparing two types of learning, classification learning and inference learning, about coherent and abstract categories (Erickson et al. 2005; Rehder and Ross
According to this research framework, in the classification learning, people are provided with items and asked to classify them, whereas in the inference learning, people are provided with pre-classified items and asked to infer each category. Then, whether and how they form coherent (i.e., making sense in light of prior knowledge) and abstract (i.e., being independent of any fixed set of features or stimulus dimensions) categories successfully. Studies have found that people engaged in classification learning often do not understand the underlying coherence or fundamental similarity between items through which people induce abstract categories. However, people engaged in inference learning usually achieve this outcome. Researchers attribute these findings to learning about different information; classifying acquires between-category information, whereas inference obtains within-category information (Markman and Ross 2003; Yamauchi and Markman 1998).

For example, different instances of stealing have different observable features, and yet the relationship among these features remains the same within each instance of the concept—a thief takes some type of property from some property owners. When people are provided with a single set of data, they try to classify items, leading them to focus on differences among instances (e.g., the thief and property owner can be any different individuals or groups, and the property can be a diamond ring, a book, or an animal). However, when items are provided in pre-classified multiple sets, people try to infer each category, leading them to focus on relationships among items and obtain better understanding about each category.

As people understand the underlying coherences of categories better when engaged in inference learning than when engaged in categorization learning, marketers learn the relationships between consumers’ preferences for one product with for other products better when the information is provided as multiple, pre-classified sets than when it is provided as a single set. Note that marketers often collect large amount of data and categorize them into several groups according to, for instance, product category (e.g., whether consumer preferences are about digital electronics or home accessories), consumer trait (e.g., whether consumers are male or female), or research tool (e.g., whether consumer preferences are collected by interview or observation). Then, they analyze each group of data separately to find an underlying mechanism of preferences for each category. When designers analyze market research data, they often break down a large amount of data into several groups. For instance, when they analyze qualitative data such as consumer needs written on the sticky notes, video-taped behavior, or audio-taped interview
materials, they tend to use the divide-and-conquer strategy in order to identify “insights” or deep-rooted causes for unarticulated consumer needs or consumers’ habitual behavior. Therefore, they often categorize the collected data into several groups according to, for instance, product category (e.g., whether consumer preferences are about digital electronics or home accessories), consumer trait (e.g., whether consumers are male or female), or research tool (e.g., whether consumer preferences are collected by interview or observation). Then, they analyze each group of data rather separately to find an underlying mechanism of preferences for each category. Although the current practice of the way designers analyze data may improve the performance of their learning of the consumer preference, it has been little studied in the context of MCPL. Formally speaking,

*Hypothesis 2: Prediction accuracy based on the sequential learning strategy is greater when the information has multiple sets than when it has a single set.*

In sum, when marketers predict consumers’ preferences for a target product, they often use the categorization-based strategy; they consider preferences based on categorical similarity with the target product. It can result in biased predictions when two rules—an implicit rule of categorization and a target rule of data—are inconsistent. When marketers utilize the sequential learning strategy and make prediction trials and receive feedback, they will make predictions more accurately because the effect of rule congruency on prediction accuracy is eliminated. Besides, marketers utilizing the sequential learning strategy can further increase their prediction accuracy when consumers’ preferences are presented in multiple sets; they learn the relationships of the consumer preferences between products. I now turn to the two studies in which an MCPL experiment was applied to a typical market research.
7 Empirical test

7.1 Study 1

7.1.1 Objectives

Study 1 aims to test hypothesis 1, 1a and 1b. I compared prediction accuracy between two prediction strategies. For the sequential learning strategy, prediction accuracy was collected from the subjects who participated in an MCPL-type market research task. For the categorization-based strategy, prediction accuracy was collected by simulation.

7.1.2 Stimuli and procedure

In this study, subjects were instructed to envision themselves as marketers who predict consumers’ preferences and they went through a sequence of prediction trials and feedbacks. In
order to employ the sequential learning strategy, I applied a typical MCPL study to a market research task. In total, they made prediction trials about 69 hypothetical consumers. In each prediction trial, they went through three stages; they (1) were provided with a preference profile indicating which color a consumer prefers for the three electronic products and the three home accessories, (2) predicted which color the consumer prefers for a digital photo frame, and finally (3) received feedback about which color the consumer actually prefers for a digital photo frame.

Preference profiles about the 69 hypothetical consumers were simulated. Firstly, I distributed two colors, silver and black, randomly to six products to create a 64 preference profiles \(2^6=64\). Next, I randomized the order of the 64 preference profiles. Finally, I repeated the initial 5 preference profiles at the end of the 64 preference profiles, having a set of 69 preference profiles. Each profile indicates the color preferences for six products about one consumer and it was reproduced as a graphic image of six sticky notes.

Three points are worth mentioning in this study. Firstly, digital photo frame was selected for the target product because it can be either an electronic product or a home accessory. The ambiguity of the category of the digital photo frame allowed me to manipulate the way consumers categorize it and test the effect of an implicit rule of categorization (combined with a target rule of data) on prediction accuracy. Secondly, the binary response (black vs. silver) was employed to simplify the study. Two most popular colors for both electronic products and home accessories were selected in order to avoid the effect of color preference. Finally, three products were selected for each product category because odd cues were needed for each product category to simulate predictions based on the categorization-based strategy (See Data Collection for more detailed discussion). I conducted a series of pilot tests to have six products which are unambiguously categorized into two categories; MP3 player, mobile phone, and digital camera for electronic products and magazine rack, vase, and wall mirror for home accessories. While testing products, TV, candle holder, and table lamp were eliminated.
7.1.3 Design

The study consisted of a 2 (category of the target product: electronic vs. home) x 2 (target rule of data: electronic vs. home) between-subjects design.

Firstly, the category of a target product was manipulated by emphasizing different attributes of digital photo frame. This is inspired by the previous studies demonstrating that people tend to categorize an identical product differently depending on which attributes are emphasized (MacInnis et al. 1992; Medin et al. 1993; Medin et al. 1997; Murphy and Ross 1999). Subjects in the electronic category condition read the electronic attributes of digital photo frame (“digital photo frames support JPEG and BMP photo formats, are manufactured by companies such as Polaroid and Kodak, and attract attentions with slide show features”). In the home category condition, subjects read the home decoration attributes of digital photo frame (“digital photo frames are placed on a table top or hung on a wall, are available in shops such as Pottery Barn, and attract attentions by filling up empty space with photos”).

**Figure 12 SCREEN SHOT**
A pilot study was conducted in order to check category manipulations. In total, 48 undergraduate students read one of the two descriptions about digital photo frames and indicated how similar a digital photo frame is with the six products including three electronic products and three home accessories on a 7-point Likert scale. Subjects who read the description about electronic attributes of the digital photo frame indicated that it is more similar with three electronic products (4.40) than the three home accessories (2.70, \( F(1,45) = 22.23, p < .01 \)). Subjects who read the other description indicated that the digital photo frame is more similar with the home accessories (4.69) than with the electronic products (2.63, \( F(1,45) = 26.01, p < .01 \)), suggesting that manipulation was successful.

Next, the target rule of data was manipulated by developing two different data sets. In order to explain the relationships between an individual’s color preference for a digital photo frame \( y_i \) and the individual’s color preferences for six products (MP3 player \( D_a \), digital camera \( D_b \), mobile phone \( D_c \), magazine rack \( H_a \), vase \( H_b \), and wall mirror \( H_c \)), a simple additive linear regression model was developed \( y_i = A(D_a + D_b + D_c) + B(H_a + H_b + H_c) + C\varepsilon \), where \( D \) and \( H = +1 \) for silver and \(-1\) for black, and \( \varepsilon \sim N(0,1) \). I placed different amount of weights on two groups of products \((A \text{ and } B)\) to create two different data sets. When the target rule of data is electronic, preferences for electronic products (0.44) were more important than those for home accessories (0.19). Therefore, the function says, \( y_i = 0.44(D_a + D_b + D_c) + 0.19(H_a + H_b + H_c) + 0.19\varepsilon \). For the home target rule, a greater score was assigned to the home accessories than the electronic products. Its function says, \( y_i = 0.19(D_a + D_b + D_c) + 0.44(H_a + H_b + H_c) + 0.19\varepsilon \).

An example is illustrated about one hypothetical consumer (numbered as 29) in order to clarify how to manipulate the target rule of data and develop two different data sets (Figure 9). According to the random distribution of the two colors for six products, the consumers prefers silver (+1) for magazine rack \( H_a \), digital camera \( D_b \), and vase \( H_b \), whereas he prefers black (-1) for MP3 player \( D_a \), mobile phone \( D_c \), and wall mirror \( H_c \). If he is a consumer who follows the electronic target rule of data, he prefers black for the digital photo frame as her preference score is negative. Alternatively, if he is a consumer who follows the home target rule of data, he prefers silver for the digital photo frame.
y = 0.44*(-1+1-1)+0.19*(1+1-1)+0.19*(-0.91) = -0.42 < 0

“He prefers a BLACK digital photo frame”

y = 0.19*(-1+1-1)+0.44*(1+1-1)+0.19*(-0.91) = 0.08 > 0

“He prefers a SILVER digital photo frame”

---

**Figure 13 EXAMPLE OF PREFERENCE PROFILE AND FEEDBACK**

### 7.1.4 Data collection and data analysis

Fifty-eight undergraduate students at the University of Toronto were recruited through a research participation pool. Thirty eight females and twenty males participated and they were rewarded by one-hour course credit.

#### 7.1.4.1 Prediction accuracy

In total, 69 predictions were collected from the subjects who utilized the sequential learning strategy. In order to test hypotheses, I simulated 69 predictions based on the categorization-based strategy. I considered that subjects who utilized the categorization-based strategy would consider the products categorically similar with the target product exclusively and ignore the remaining three products. For instance, when subjects categorized a digital photo frame as an electronic product, they would base predictions on the color preferences for MP3 player, mobile phone, and
digital camera and choose one dominantly preferred color. By contrast, when a digital photo frame is categorized as a home accessory, they would base predictions on the color preferences for magazine rack, vase, and wall mirror.

Next, in order to compare the average prediction accuracy between two prediction strategies, I “collected” prediction data from each subject for the sequential learning strategy and “simulated” prediction data for the categorization-based strategy. For the sequential learning strategy, prediction accuracy for each prediction was derived by comparing the obtained prediction with the prediction based on the target rules, prediction accuracy for each subject was measured by the percentage of the predictions correctly made out of the 69 predictions, and finally prediction accuracy for each condition is derived by averaging prediction accuracy for each subject. For the categorization-based strategy, prediction accuracy for each prediction was derived by comparing the simulated prediction with the prediction based on the target rules and then prediction accuracy for each condition is directly derived by the percentage of the predictions correctly simulated out of the 69 predictions.

Firstly, I compared prediction accuracy about the 64 prediction trials between two prediction strategies. Next, I compared prediction accuracy about randomly selected prediction trials (e.g., 8, 16, 24, 32, and 40 predictions) between two prediction strategies. Finally, I compared prediction accuracy about the initial 8 trials between two prediction strategies in order to control the sequence effect and the ordering effect.

In order to understand the effect of the sequential learning strategy on prediction accuracy clearly, its prediction accuracy about the final 5 prediction trials was compared with the prediction accuracy about the initial 5 prediction trials. Note that both 5 prediction trials are identical. I conducted a repeated-measure analysis of variance (ANOVA) on the average prediction accuracy about the 5 prediction trials with category of the target product (electronic vs. home) and the target rule of data (electronic vs. home) as between-subjects factors and time (initial vs. final) as a within-subject factor.

7.1.4.2 Diagnosticity

I measured diagnosticity of each color preference for six products by asking subjects to respond to (1) “how relevant the color preference for this product is to the color preference for a digital camera...
photo frame?” and (2) “how useful the color preference for this product is for them to predict the color preference for a digital photo frame?” on a 7-point Likert scale (Pham and Avnet 2004). A relative diagnosticity was developed by subtracting the average diagnosticity score about the three home accessories from the average diagnosticity score about the three electronic products.

In order to test whether subjects learn diagnosticity, I asked subjects the identical questions before and after their prediction trials. I conducted a repeated-measure ANOVA on relative diagnosticity with category of the target product (electronic vs. home) and the target rule of data (electronic vs. home) as between-subjects factors and time (before vs. after) as a within-subject factor.

7.1.5 Results

7.1.5.1 Prediction accuracy

Prediction accuracy of the two strategies is summarized in table 5. A few findings are worth to be noted. Firstly, rule congruency affected the categorization-based strategy significantly but it did not influence the sequential learning strategy much. The simulated prediction accuracy varied between 38% and 100% while the collected prediction accuracy moves between 65% and 81%. Secondly, two strategies appear to have their own strengths in different conditions.

<table>
<thead>
<tr>
<th>Category of the target product</th>
<th>Congruent rules</th>
<th>Incongruent rules</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target rule of data</td>
<td>ELECTRONIC</td>
<td>HOME</td>
</tr>
<tr>
<td>64 trials</td>
<td>80.25 (90.63)</td>
<td>81.35 (90.63)</td>
</tr>
<tr>
<td>Random 40 trials</td>
<td>79.82 (90.00)</td>
<td>81.33 (92.50)</td>
</tr>
<tr>
<td>Random 32 trials</td>
<td>75.89 (84.38)</td>
<td>77.08 (90.63)</td>
</tr>
<tr>
<td>Random 24 trials</td>
<td>77.08 (87.50)</td>
<td>78.61 (79.17)</td>
</tr>
<tr>
<td>Random 16 trials</td>
<td>83.48 (93.75)</td>
<td>75.83 (87.50)</td>
</tr>
<tr>
<td>Random 8 trials</td>
<td>78.57 (87.50)</td>
<td>74.17 (75.00)</td>
</tr>
<tr>
<td>Initial 8 trials</td>
<td>75.89 (100)</td>
<td>79.17 (100)</td>
</tr>
</tbody>
</table>

* Scores indicate the percentage of the correct predictions. In each condition, a score not in the parenthesis represents the prediction accuracy of the sequential learning strategy and a score in the parentheses represents the prediction accuracy of the categorization-based strategy.

Table 2 PREDICTION ACCURACY
Going beyond describing differences between two strategies, I obtained evidence that the sequential learning strategy is the better option than the categorization-based strategy. Consider prediction accuracy about the random 8 trials (Table 5). When the two rules are congruent, the sequential learning strategy performed poorly compared to the categorization-based strategy (electronic category + electronic target rule: sequential learning = 78.57% vs. categorization-based = 87.50%, $t(13) = 2.69, p < .05$; home category + home target rule: sequential learning = 74.17% vs. categorization-based = 75.00%, $t(14) = 0.29, p > .05$). However, the sequential learning strategy dominated the categorization-based strategy when the two rules are incongruent (electronic category + home target rule: sequential learning = 74.11% vs. categorization-based = 50.00%, $t(13) = 6.74, p < .01$; home category + electronic target rule: sequential learning = 79.17% vs. categorization-based = 37.50%, $t(14) = 12.34, p < .01$). This suggests that marketers increase their prediction accuracy by 14% in average by changing their prediction strategy from categorization-based to sequential learning strategy ({$(78.57-87.50) + (74.17-75.00) + (74.11-50.00) + (79.17-37.50)$}/4). Similar findings were reported about 64 trials and other randomly selected trials, supporting hypothesis 1.

![Figure 14 PREDICTION ACCURACY ABOUT RANDOM 8 TRIALS AS A FUNCTION OF CATEGORY, TARGET RULE, AND PREDICTION STRATEGY](image-url)
However, about the initial 8 trials, the sequential learning strategy did not benefit subjects. Data suggest that marketers lose their prediction accuracy by 8% when switching from the categorization-based strategy to the sequential learning strategy ($(75.89-100) + (79.17-100) + (70.54-62.50) + (65.83-62.50))/4). This is because the categorization-based strategy performs well, but the sequential learning strategy performs poorly.

![Prediction Accuracy Graph](image)

**Figure 15 PREDICTION ACCURACY ABOUT INITIAL 8 TRIALS AS A FUNCTION OF CATEGORY, TARGET RULE, AND PREDICTION STRATEGY**

Prediction accuracy of the sequential learning strategy suggests that subjects learn how to use information as they make prediction trials and receive feedback, in particular when the two rules are incongruent. When category and target rule are congruent, prediction accuracy about the final 5 prediction trials is not different from prediction accuracy about the initial 5 prediction trials (electronic category + electronic target rule: initial = 78.57% vs. final = 72.86%; home category + home target rule: initial = 86.67% vs. final = 80.00%). However, when the two rules are incongruent, they made predictions more accurately after the 64 prediction trials than before the 64 prediction trials (electronic category + home target rule: initial = 71.43% vs. final = 81.43%,...
$t(13) = 1.53, p = .15$; home category + electronic target rule: initial = 58.67% vs. final = 84.00%, $t(14) = 4.75, p < .01$). A clearer picture was obtained after analyzing the initial 5 prediction trials and the final 5 prediction trials separately. For the initial 5 prediction trials, prediction accuracy was greater when the two rules are congruent than when they are incongruent (category x target rule interaction, $F(1,54) = 14.86, p < .01$). Using a simple main effects analysis, I confirmed that how subjects categorize the target product influenced their prediction accuracy both when the target rule of data is electronic ($F(1,54) = 9.53, p < .01$) and when it is home ($F(1,54) = 5.59, p < .05$). This suggests that rule congruency influenced prediction accuracy for the initial 5 prediction trials. For the final 5 prediction trials, however, rule congruency had no impact on prediction accuracy (electronic category + electronic target rule = 73%, home category + home target rule = 80%, electronic category + home target rule = 81%, home category + electronic target rule = 84%). A significant three-way interaction effect (category of target product x target rule of data x time, $F(1,54) = 19.65, p < .01$) can be interpreted that the sequential learning strategy led subjects to increase prediction accuracy.

![Prediction accuracy graph](image-url)
7.1.5.2 Diagnosticity

Diagnosticity scores suggest that subjects modified diagnosticity only when category of the target product and the target rule of data are not congruent. The relative diagnosticity scores prior to prediction trials were positive for subjects who categorized the target product as an electronic product (1.36) and negative for those who categorized it as a home accessory (-0.76, F(1,54) = 13.90, p < .01). This suggests that before making prediction trials, subjects judged diagnosticity based on how they categorize the digital photo frame. However, they either maintained or modified diagnosticity depending on whether the target rule of data is congruent or not with the way they categorize the digital photo frame. When it is congruent, they did not modify the relative diagnosticity (electronic category + electronic target rule: before = 1.33 vs. after = 1.73; home category + home target rule: before = -0.57 vs. after = -1.37). When the two rules are incongruent, however, they modified diagnosticity (electronic category + home target rule: before = 1.39 vs. after = -0.55, t(13) = 3.02, p < .01; home category + electronic target rule: before = -0.94 vs. after = 0.33, t(14) = 2.13, p = .05). Two significant two-way interactions about relative diagnosticity (category x time, F(1,54) = 3.07, p < .10; target rule x time, F(1,54) = 14.55, p < .01) suggest that subjects judged diagnosticity based on the implicit rule of categorization at first and then after making prediction trials and receiving feedback, they judged diagnosticity based on the target rule of data.
7.1.6 Discussion

In this study, hypothesis 1, 1a, and 1b are tested. Data show that the sequential learning strategy outperformed the categorization-based strategy when the two rules—an implicit rule of categorization and the target rule of data—are not congruent. Additional analysis of diagnosticity suggests that the sequential learning strategy benefited subjects as they modified diagnosticity judgment. In sum, the sequential learning strategy increases prediction accuracy by eliminating the effect of rule congruency on prediction accuracy.

7.2 Study 2

7.2.1 Objectives

The objective of study 2 is to test hypothesis 2 that whether marketers make predictions more accurately when consumer preference data are broken down into multiple sets. In order to test
this hypothesis, we compared prediction accuracy based on the sequential learning strategy between two data sets: a single set and multiple sets.

7.2.2 Stimuli and procedure

I used the identical stimuli and procedures employed in study 1. Similar with the previous study, subjects were provided consumers’ color preferences for six products and asked to predict their color preferences for a digital photo frame. They made prediction trials and received feedback for each consumer. Differently from the previous study, subjects made 32 prediction trials, the half of the full profiles using in study 1.

As this study tested whether data presentation moderates the performance of the sequential learning strategy, I provided the identical preference profiles about 32 hypothetical consumers to two randomly assigned subjects in two different formats. In the single set condition, a set of 32 preference profiles were provided and subjects were asked to complete the 32 prediction trials. In the multiple sets condition, 4 sets of 32 preference profiles (8 preference profiles for each set) were provided and subjects were forced to stop making predictions every 8th prediction trial and, in the three breaks, they were asked to answer what they had learned in order for them to resume making predictions. Although subjects were informed that they might encounter several breaks while they performed prediction trials, they were not informed about when and how many breaks stopped their prediction trials and what they should do to resume their predictions. Subjects in the multiple sets condition were allowed to spend as long as they wanted in each of the three breaks.

7.2.3 Design

This study consisted of a 2 (rule congruency: congruent vs. incongruent) x 2 (number of data sets: single vs. multiple) between-subjects design. Different from study 1, the category of digital photo frame is not manipulated in this study. Instead, subjects were provided with its electronic

5 In this study, I developed a survey program using Java's Swing, an Application Programming Interface, to generate the graphical components of the survey program and using the Eclipse IDE to build and compile our code throughout the entire development process. Then, I used JExcelApi, an Application Programming Interface to read, write, and modify Excel spreadsheets for retrieving and storing data generated during the program's execution.
attributes to encourage them to categorize it as an electronic product. Note that prior research indicates that people are more likely to categorize products based on their features rather than usages (MacInnis et al. 1992).

Firstly, rule congruency was manipulated by providing the data sets based on different target rules. In the congruent rule condition, subjects were provided with a data set based on the electronic target rule. Data show that the color preference for the digital photo frame is more closely related with the color preferences for the electronic products than those for home accessories \( y_i = 0.44(D_a + D_b + D_c) + 0.19(H_a + H_b + H_c) + 0.19\varepsilon \). In the incongruent condition, subjects were provided with a data set based on the home target rule \( y_i = 0.19(D_a + D_b + D_c) + 0.44(H_a + H_b + H_c) + 0.19\varepsilon \).

Secondly, number of data sets was manipulated by whether the data set was provided as a one set of data or it was provided as four sets of data. Subjects in the single data set condition were asked to complete 32 prediction trials without having a break. By contrast, subjects in the multiple data set condition were forced to stop making predictions after every 8th prediction trials. Then, a blank page appeared and subjects were asked to answer in an open-ended box what they have learned so far in order to continue making predictions.

7.2.4 Data collection and data analysis

In total, 158 undergraduate students at the University of Toronto were recruited through a research participation pool. They were rewarded by one-hour course credit. Same as study 1, each subject’s predictions about 32 profiles were collected and compared with the modeled predictions, obtaining prediction accuracy. Firstly, it was tested whether rule congruency and the number of data sets influence the accuracy of their predictions. Secondly, whether rule congruency and the number of data sets influence the accuracy of the predictions about the initial 8 prediction trials and the last 8 prediction trials.

7.2.5 Results

Firstly, I conducted an ANOVA on the accuracy of the whole predictions with rule congruency and the number of data sets as between-subjects factors. When data have multiple sets, subjects made predictions more accurately than when data have a single set (single set = 59% vs. multiple
sets = 69%, $F(1,154) = 20.12, p < .01$). This effect was observed regardless of whether the two rules are congruent (single set = 65% vs. multiple sets = 78%) or they are incongruent (single set = 54% vs. multiple sets = 59%).

**Figure 18 PREDICTION ACCURACY ABOUT 32 PREDICTION TRIALS AS A FUNCTION OF RULE CONGRUENCY AND NUMBER OF DATA SETS**

The number of data sets, however, benefited prediction accuracy only after subjects made prediction trials and received feedback. Accuracy about the initial 8 prediction trials were not influenced by the number of data sets (single set = 61% vs. multiple sets = 64%, $F(1,154) = 1.40, p > .10$) but only determined by whether the two rules are congruent (68%) or incongruent (57%, $F(1,154) = 20.75, p < .01$). Accuracy about the last 8 prediction trials were influenced by both the number of data sets (single set = 65% vs. multiple sets = 77%, $F(1,154) = 15.58, p < .01$) and rule congruency (congruent = 76% vs. incongruent = 65%, $F(1,154) = 14.04, p < .01$).
7.2.6 Discussion

Study 2 tested hypothesis 2; whether the number of data sets moderates the effect of sequential learning strategy on prediction accuracy. Data suggests that this strategy can increase prediction accuracy. An analysis of prediction accuracy between the initial 8 prediction trials and the last 8 prediction trials suggests that people can learn diagnosticity more accurately when they are provided with multiple data sets than a single set. Although subjects did not make predictions as accurately when the two rules are incongruent as when they are congruent probably because 32 prediction trials are not long enough for them to identify and use diagnostic information correctly, I replicated in this study that the sequential learning strategy increases prediction accuracy regardless of rule congruency.

8 General Discussion

Two studies tested sequential learning strategy in the context of market research. Study 1 demonstrated that prediction accuracy based on the sequential learning strategy was greater than the categorization-based strategy because the former strategy enabled subjects to identify and use diagnostic information. Study 2 showed that prediction accuracy based on the sequential learning strategy can increases when the data set is broken down into multiple sets. Findings contribute to MCPL and market research.

8.1 Contributions to MCPL research

Firstly, the present work adds to the literature in decision-making by demonstrating that the sequential learning strategy introduced by MCPL helps people make unbiased predictions. Decision-making studies provide abundant evidence that people often make predictions intuitively, which results in biased predictions. They often judge diagnosticity based on the characteristics of data (Klayman and Brown 1993; Shah and Oppenheimer 2007; York et al. 1987). For instance, when people predict a plant’s growth based on two factors (e.g., the amount of moisture and fertilizer), they do not consider the diagnostic factor but consider the factor that has a small random error (York et al. 1987). Medical students also learn diseases not based on diagnostic symptoms but based on typical symptoms (Klayman and Brown 1993). People also often judge diagnosticity relying on the fluency of data such as how clearly they are written, whether they are in focus, or how easy they are pronounced (Shah and Oppenheimer 2007).
People not only judge diagnosticity in a biased way but also use non-diagnostic data or ignore diagnostic data. A representative example is dilution effect; people change their judgments when non-diagnostic information is added to diagnostic information (Meyvis and Janiszewski 2002; Zukier and Jennings 1983). Jurors are less likely to find a man guilty of murdering his aunt when diagnostic information (e.g., “He was known to have argued with his aunt”) is supplemented with non-diagnostic information (e.g., “The defendant is of average height and vision”) (Zukier and Jennings 1983). Similarly, ambiguous product experience enhances the perceived quality of an advertised product (Hoch and Ha 1986), valueless promotions or useless product features influence consumer choices (Simonson et al. 1994), and irrelevant product information weakens consumers’ beliefs about product benefits (Meyvis and Janiszewski 2002). People also ignore diagnostic data when they estimate the posterior probability of an event. They consider the provided probability information heavily and ignore diagnostic information such as false-alarm rate (Doherty et al. 1979) or base rate information (Kahneman and Tversky 1973; Bar-Hillel 1980), suggesting that people may not have a working knowledge of the concept of diagnosticity (Doherty et al. 1979, p. 118). In order to help people misjudge diagnosticity or use non-diagnostic information, MCPL literature suggests that the sequential learning strategy enables people to identify and use diagnostic information (Meyer 1987; West et al. 1996). It helps consumers identify the relationship between the attributes of a product and its overall quality (Meyer 1987) and predict others’ preferences for hard-to-decompose products (e.g., quilt) (West et al. 1996).

Secondly, the present work adds to the literature on MCPL by identifying the number of data sets as a moderator of the effectiveness of the sequential learning strategy. Numerous contextual variables have been identified that either facilitate or deter the learning effect including noise in environment, relationships among cues, number of predictions, and type and timeliness of feedback, to name a few (Karelaia and Hogarth 2008; Klayman 1984, 1988; Stewart and Rusk 1994).

8.2 Contributions to market research

The present work raises a rather ignored issue market research; how marketers use data and make predictions. Prior work focuses on marketers’ data collection and therefore pays considerable attention to developing market research tools. It sheds little light on whether market
research can produce inaccurate results because marketers make predictions in an inaccurate way even though data are accurate. I draw on the framework from the literature on MCPL and clarify why marketers tend to make predictions in a biased way and how they can avoid this tendency. Therefore, this work demonstrates that MCPL can play an important role in improving the quality of market research by helping people who use data.

8.3 Limitations and future research

This work is based on two assumptions; consumer preferences in different categories are independent from the similarity among the different categories and using the sequential learning strategy incurs no additional cost. I discuss the implications of sequential learning strategy when these two assumptions are not satisfied, followed by the limitation and future research.

Firstly, it has been well established in marketing that preferences are not consistent with overall categorical similarity. Studies have shown that consumers’ toy preference or their soft drink preference is not related with how consumers categorize toys or soft drinks (Shocker et al. 1990). Differently from study findings, however, consumers may infer their preference from past experiences in using products from other categories and the data-based target rule is in line with how data are categorized. For instance, some consumers are more likely to prefer a color in a product category or, alternatively, they may pursue a specific color in a product category to achieve “ensemble effect” (Bell, Holbrook and Solomon 1991). In this case, the categorization-based strategy has no problem and this argument was empirically supported in study 1 showing that the categorization-based strategy outperforms the sequential learning strategy when the two rules are congruent. However, designers are unable to know whether the two rules, categorization-based implicit rule and data-based target rule, are congruent or not in advance. Therefore, given that the average prediction accuracy favors the sequential learning strategy, I conclude that the sequential learning strategy is a better strategy for designers when analyzing data.

Secondly, switching from the categorization-based strategy to the sequential learning strategy may not be efficient if the cost associated with data collection and analysis is not covered by the benefits obtained from using the sequential learning strategy. In general, the sequential learning strategy, compared to the categorization-based strategy, requires of not only collecting a greater amount of data (multiple categories vs. single category) but also analyzing the collected data
more carefully (multiple predictions vs. single prediction). This suggests that in some cases, even when the proposed rational, regression model may make better predictions, the conventional, heuristic model may still be efficient given the cost of collecting and analyzing data.

A primary limitation of this work is that the moderating effect of data presentation on sequential learning strategy is unclear. Although data presentation was manipulated in study 2 whether data were provided as a single set or multiple sets, subjects in the multiple sets condition had opportunities to enjoy 3 breaks in the intermission of each set of data. Therefore, our findings that the sequential learning strategy performed better in the multiple sets condition compared to the single set condition cannot be because subjects inferred the rules of each set of data more carefully in the multiple sets condition but may be because a series of breaks helped subjects process the whole data more globally by reflecting what they learned. This alternative hypothesis is reasonable because subjects were informed in advance that they might encounter breaks, implying that different sets of data follow the same data-based target rule. In the future research, the effects of data presentation (data unpacking) and break of the sequential learning strategy need to be tested separately and more rigorously. For example, the effects of data presentation should be tested by comparing between when subjects are aware of and when they are unaware of whether multiple sets of data follow the identical data-based target rule. Besides, the effects of break should be tested by comparing between when subjects want to take a break and when they do not want to take a break.
Chapter 4

9 Discussion

9.1 Summary

Understanding and improving the design process has attracted much scholarly attention across various disciplines including design, engineering, and management (Cross 1982; Finger and Dixon 1989; Hauser et al. 2006; Ulrich and Eppinger 2000). However, the role of behavioural decision theory to inform design has been little discussed (Simonson 1993). In my dissertation, I study consumers’ decisions and designers’ decisions in two design tasks – concept testing and preference learning – and aim to help designers better acquire, analyze, and apply consumer data. In two essays, I identify a bias, provide a solution to eliminate the bias, and explore a boundary condition of the bias in each design task.

In the first essay, I examine whether consumers construct their preference in concept testing depending on question format and attribute evaluability. Findings from four studies suggest that when consumers are asked to choose, they tend to choose the product that serves their immediate purchase purpose, indicating biased preferences. However, when consumers are asked to predict enjoyment, they tend to indicate the preferences that reflect their consumption utility. This holds true when attributes are easy to evaluate; when attributes are hard to evaluate, changing the question format does not affect consumer preference.

In the second essay, I examine whether designers learn consumer preferences differently depending on prediction strategy and the number of data sets, even when they use the same consumer data. Empirical evidence collected from two studies suggests that designers tend to base their predictions on categorically similar data, predicting consumer preference in a biased way. On the other hand, designers increase their prediction accuracy when they use a sequential learning strategy. Moreover, predicting with consumer data in multiple sets further improves their prediction performance.
9.2 Contributions to decision making literature

My dissertation broadly contributes to the decision-making research by identifying and proposing approaches to eliminate biases in the context of design. Decision-making researchers have studied biases in a wide variety of contexts since Kahneman and Tversky (1974). For example, researchers have shown that people’s choices are influenced by the set of alternatives under consideration, purchase timing, and meaningless adding features (Gourville and Soman 1998; Huber et al. 1982; Simonson et al. 1994), and they have suggested that people can eliminate biases in their predictions and make accurate predictions, for example, when they replace or combine their predictions with models or they supplement the predictions with a data base (Blattberg and Hoch 1990; Dawes 1979; Hoch and Schkade 1996). The research into decision-making bias is extensive but has not specifically studied bias in the context of design.

Essay one contributes to the decision-making literature on preference construction and decision strategy. Firstly, it provides evidence that consumers construct their preferences depending on preference elicitation methods. Differently from prior work demonstrating that consumers indicate different preferences depending on different response formats, I show their preferences are determined by question formats (Tversky et al. 1988). Although some researchers have recently reported that people do not choose the product that they predict they will enjoy more, they proposed that easy-to-justify attributes are considered important in a choice question and easy-to-imagine attributes are emphasized in an enjoyment prediction question (Hsee et al. 2003; Shiv and Huber 2000). In this essay, I argue that choice discrepancies between two question formats result from different decision strategies, suggesting a new underlying mechanism. Secondly, this essay shows that consumers select different decision strategies depending on question format and attribute evaluability. A significant body of research on the topic of decision strategy suggests that when people find it cognitively or emotionally difficult to make trade-offs between attribute values, they use non-compensatory decision strategies (Bettman et al. 1998). I add to this body of knowledge by suggesting that question format and attribute evaluability affect people’s willingness to make trade-offs.

Essay two contributes to the decision-making literature on the topics of intuitive diagnosticity judgment and MCPL. Firstly, it provides evidence that categorization is a source of prediction bias. Previous work suggests that people often base their predictions not on diagnostic
information but on the information that is typical, that is easy to read, or that has small random errors (Klayman and Brown 1993; Shah and Oppenheimer 2007; York et al. 1987). I add to this body of research by demonstrating that people tend to base their predictions on categorically similar information and make biased predictions. Secondly, this essay adds to the literature on MCPL by replicating and improving the effect of a sequential learning strategy. Much discussion has been made whether and when a sequential learning strategy enhances prediction performance (Karelaia and Hogarth 2008; Klayman 1984). I add to this discussion by showing that predictions based on a sequential learning strategy are generally accurate and these predictions can be further improved when predictions are made with multiple data sets. I add to this knowledge by

9.3 Contributions to design literature

My dissertation broadly contributes to the design research by suggesting that decision-making framework helps in understanding and managing the design process. Historically, design researchers have illustrated in case studies the behaviors that consumers and designers exhibit, but paid little attention to examining these behaviors and generalizing these insights to multiple cases. Although some design researchers have applied decision-making framework to design and studied cognitive heuristics employed by designers (Yilmaz and Seifert 2010) or decisions in the product development process (Krishnan and Ulrich 2001), bias in the design process has not been examined.

My thesis contributes to the prior literature discussing different design tasks. Firstly, essay one contributes to the attempts that behavioral researchers have made to improve conjoint analysis, an attribute-based concept testing. Researchers have long suggested that response format or presentation format affects the weighting of product attributes (Green and Srinivasan 1990). For example, price receives more weight when responses are measured by a choice scale than when measured by a likelihood-of-purchase scale (Huber 1997), and stylistic attributes receive more weight when products are presented in pictures than when described verbally (Holbrook and Moore 1981). I add question format to these variables by showing that question format can have a considerable effect on the weighting of product attributes.

Next, essay two suggests that preference learning is a potential research topic in design research. Considerable discussion has been made on how to collect consumer data (Zaltman 1997), but little is known about how designers predict consumer preference by analyzing and applying the
collected consumer data. While such questions have been addressed for engineers and managers (Hauser and Clausing 1988; Hoch and Schkade 1996), I shed light on a new topic in design to understand and help designers.

9.4 Managerial implications for design practice

My dissertation broadly benefits designers by providing insights into how designers should collect consumer data and analyze the collected consumer data. The first essay suggests that when designers collect consumer preference for testing concepts, they should select the question format carefully so that it serves their objectives of concept testing. When designers attempt to identify the market behavior of consumers or the market share of the products, the conventional choice question is appropriate. However, when they predict the consumers’ post-purchase enjoyment or the products’ long-term market performance, an enjoyment prediction questions is a better option. This essay also suggests that designers can use the enjoyment prediction question to test whether consumers over-emphasize an attribute while they answer the choice question. If consumers show inconsistent preferences between two questions, these findings indicate that consumers place too much emphasis on one attribute in the choice task. However, if consumers’ preferences do not differ between the two questions, these findings indicate the attribute considered important in the choice task actually dominates other remaining attributes.

The second essay suggests that designers should carefully apply a large amount of cross-category consumer data. Designers are increasingly using various research methods to collect consumer data across domains. For example, when the Mayo clinic improved its services, IDEO designers observed patients in the hospital as well as people in public spaces such as subway stations, theaters, and shopping malls (Kelley 2001). Similarly, when Harley-Davidson wanted to serve its rider communities better, designers from Jump Associates investigated its own communities and Disney’s communities (Patnaik and Mortenstein 2009). Designers will make better predictions using these data only when they avoid using a heuristic prediction strategy, such as a categorization-based strategy.

9.5 Future research

I have conducted two studies in essay two using undergraduate students as research subjects in order to understand and improve the prediction strategies used by professional designers.
However, professional designers do not necessarily learn consumer preferences in the same way as undergraduate students. Previous research offered two conflicting hypotheses concerning the relative performance of the preference learning between professional designers and undergraduate students. According to the research on expertise, prior experience leads experts to focus on diagnostic information and disregard irrelevant information, suggesting that professional designers outperform undergraduate students (Alba and Hutchinson 1987). However, design research suggests that individual designers rely heavily on their own heuristics when performing a design task, such as developing concepts, and these heuristics are developed by the repetition of similar tasks (Yilmaz and Seifert 2010). Future research should examine whether prior experience helps or hurts professional designers in learning consumer preference.

Another future research is to study how designers use their heuristics strategically to learn consumer preference accurately: they can offset the bias in the consumer data or they do not collect consumer data at all. My two essays suggest that designers collect biased consumer data and that they use consumer data in a biased way. Paradoxically, it seems that two wrongs may make a right: designers use the biased data in a biased way, and end up making unbiased predictions. This argument is supported by Burson et al. (2008) who have studied how people predict others’ preferences under uncertainty. They found that, firstly, predictors anticipate others’ beliefs about the likelihood of uncertain events inaccurately and that, secondly, predictors anticipate the weight that beliefs will have on others’ choices inaccurately. Predictors typically err at both steps, but the errors they make are often of opposing directions. Where predictors think others are more optimistic about likelihood than they actually are, predictors also think that others will weigh beliefs more negatively than they actually do. Likewise, where predictors think that others are more pessimistic about likelihood than they actually are, predictors also think that others will weigh beliefs more positively than they actually do. Thus, people’s errors often offset to yield predictions that are “accidentally accurate” overall. Alternatively, designers do not use consumer data at all to avoid any biased conclusion. This conjecture is supported by the decisions made by the product designers for Bang and Olufsen and Allessi, who intentionally avoid conducting market research because, they believe, survey responses do not reflect consumers’ true preferences (Verganti 2006). Future research should examine whether designers’ heuristic decisions regarding consumer data can result in accurate preference learning.
References (chapter 1)


Cross, Nigel (2006), Designerly Ways of Knowing, Springer: Germany.


References (chapter 2)


References (chapter 3)


References (chapter 4)


Patnaik, Dev and Peter Mortensen (2009), Wired to Care: How Companies Prosper when They Create Widespread Empathy, Upper Saddle River, New Jersey: FT Press.


Appendices

APPENDIX A: CHOICE QUESTION AND ENJOYMENT PREDICTION QUESTION (Hsee et al. 2003)

Choice question: Which option would you choose?
Enjoyment prediction question: Which option will you enjoy more when you use it?

Appendix B: A QUESTION FOR MEASURING CONSUMER TRAIT IN STUDY 2, CHAPTER 2

Imagine that you consider purchasing a digital dictionary. Please write as many reasons as you could in the bullet point form why you purchase a digital dictionary.

APPENDIX C: QUESTIONS FOR MANIPULATION CHECK OF PRODUCT TYPE IN STUDY 1, CHAPTER 2 (Davies et al. 1999; Bloch et al. 2003)

How much do you agree with the following four sentences? (1 = not at all, 7 = very much)
Smart phones are supposed to provide sensory pleasure and, when they serve any performance purposes, they are serious defects.
Mouse pads are supposed to provide sensory pleasure and, when they serve any performance purposes, they are serious defects.
A design of the smart phones is a source of pleasure.
A design of the mouse pads is a source of pleasure.

APPENDIX D: STIMULI FOR STUDIES 1 – 4 IN CHAPTER 2

Smart phones in study 1: Here are two newly developed smart phones. They are equipped with the same processor and the same camera, and priced similarly. Option B (A) has 16 MB of expandable memory, whereas Option A (B) has 8MB of memory.

Mouse pads in study 1: Here are two newly developed mouse pads. They have the same size (11.5” width x 12.5” depth) and cost about $10. Option B (A) has an adhesive on the back so that it stows on back of notebook.
Digital dictionary in study 2: Here are two newly developed digital dictionaries. They are equipped with the same CPU and priced similarly. Option B (A) translates among 5 languages (English, French, German, Spanish, and Italian), whereas Option A (B) translates between 2 languages (English and French).

Digital cameras in study 3: Here are two newly developed digital cameras. They offer 10 megapixels, store about 150 high-resolution pictures, and have an automatic flash. Option B (A) is water-proof but Option A (B) is not.

E-book readers in study 4: Here are two newly developed E-book readers. They are both weighted about 10 ounces, hold over 1500 reading materials, and cost around $350. Option B (A) has a 9-inch display with the resolution of 480x320 pixels, whereas Option A (B) has a 6-inch display with the resolution of 960 x 640 pixels.

APPENDIX E: MANIPULATION OF PURCHASE PURPOSE IN STUDY 3, CHAPTER 2

Performance purchase purpose condition: Imagine that you consider purchasing a digital camera to take pictures of the sport activities during your vacation.

Aesthetic purchase purpose condition: Imagine that you consider purchasing a digital camera to take pictures of the daily life of your boyfriend or girlfriend.

APPENDIX F: MANIPULATION OF ATTRIBUTE EVALUABILITY IN STUDY 4, CHAPTER 2

Easy-to-evaluate condition: The display size of the e-book readers available in the market varies between 6 and 10 inches diagonally and their display resolution varies between 480 x 256 and 1024 x 640 pixels.

Hard-to-evaluate condition: The display size of the e-book readers available in the market varies between 4 and 15 inches diagonally and their display resolution varies between 240 x 124 and 2048 x 960 pixels.