ABSTRACT

Title: THE EFFECTS OF ORDER AND
                                         DIFFERENTIATING INFORMATION IN
                                         DECISION MAKING

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A condition under which both primacy and recency effects occur is demonstrated. Primacy and recency are observed in decisions among alternatives that do not have differentiating information. Decision makers, however, need to base their decisions on differentiating information; individuals search for information that may assist them in discriminating options. Only under the absence of such information order effects influence decisions.

THE EFFECTS OF ORDER AND DIFFERENTIATING INFORMATION
IN DECISION MAKING

By

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Dedication

I dedicate this thesis to my family. It has been through their love and support that I have been able to achieve this work.

Acknowledgements

I wish to thank the members of my committee for their support and patience. I would like to thank specially my major advisor, Dr. Kent L. Norman, without his guidance the completion of this work would not have been possible.

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Chapter 1: The Effects of Order and Differentiating Information in Decision Making

Internet shopping is now a widespread occurrence. The four most commonly reported reasons that consumers use the Internet for purchases are for convenience, the availability of vendor information, avoidance of sales pressure, and time (Graphical, Visualization and Usability Center, 1998). However, just as one of the strengths of the Internet in commerce is the availability of hundreds of vendors for each product, it is also one of its challenges. When a retail or business consumer uses the Internet to select a product, he/she needs to search through countless vendors and product choices. Presentation formats that provide shopping assistance can provide services that maximize the advantages of the Internet. If a consumer is searching for a product, he/she can compare different characteristics, different prices, different brands, different retailers, etc. The usual layouts for comparison-shopping websites are in the form of lists or matrices. Then the question is, "Does the order of this information matter?"

Research that predates the Internet indicates that the order in which individuals receive their information affects their decision making and judgment (Hogarth & Einhorn, 1992). Better understanding of how this order affects purchase decisions is important for both consumers and merchants. Consumers ought to know that the layout of the information they are researching may unconsciously affect their final decision. Merchants could take advantage of these possible effects and present information that can help maximize their sales. This study will evaluate position effects presented in a comparison matrix in consumer decision making.

An overview of online shopping

Online shopping provides the capability for consumers to obtain more information about both price and non-price attributes (Degeratu, Rangaswamy, & Wu, 2000). In addition, when compared to traditional shopping, online consumers can evaluate a vast quantity of products. For this thesis, online shopping will be conceptualized as "a shopping activity performed by a consumer via a computer-based interface, where the consumer's computer is connected to, and can interact with, a retailer's digital storefront through a network (i.e. the WWW)" (Häubl & Trifts, 2000). The products are not physically present nor there is personal assistance from a sales-representative.

Consumer Decision Making

Consumer purchase decisions are conditional on the same factors that describe decision making, individuals, and the social context. Bettman, Luce and Payne (1998) maintain that choice among options is context dependent and is conditional on how the choice set is represented. Context dependence implies that an option's value is determined by the attributes it possesses and by the attributes of the other available options. The framing of the choice set has been shown to influence the decision maker. Different representations, although equivalent from a normative perspective, may result in different decisions (Tversky & Kahneman, 1981).

Consumers vary in their attitudes towards product characteristics (Swait & Sweeney, 2000). Consumers' preferences and their final choices result from the comparison between the products to a set of criteria. Decisions to purchase a particular product from a set of alternatives are generally based on multiple criteria – weights and values. The subjective value for each alternative is derived by integrating each attribute's weights and

values; where weights are independent of the scale unit used for attribute values. Comparison between dissimilar alternatives is possible since the subjective value of each option is represented in the same interval scale unit (Norman, 1976). The weights given to each attribute vary for each decision maker. For instance, when purchasing a car, the model's fuel efficiency and safety record are more important for an utilitarian consumer; while the model's status and horsepower are more important for a hedonic consumer. The values of all the criteria are processed for each alternative and a preference structure is built. The hierarchy of this structure determines which products will be purchased or rejected (Matsatsinis & Samaras, 2000).

Subjective values can be processed with different decision making strategies, i.e. weighted adding, lexicographic, satisficing, elimination-by-aspects, etc. When selecting a strategy, decision makers try to reduce the cognitive effort necessary to process the product information and to increase the accuracy of the decision (Shugan, 1980). Furthermore, the choice of strategy is specific to situations and environments; strategies will vary depending on the properties of the decision task (Bettman et al., 1998). Research has found that decision makers are willing to settle for imperfect accuracy in return for a reduction in effort (Bettman, Johnson & Payne, 1990; Bettman, Johnson, Luce & Payne, 1993). This is particularly common when alternatives are numerous and/or difficult to compare (Häubl & Howes, 2000).

Design Issues

Consumers, particularly online, are demanding higher levels of product information before making purchasing decisions. The Internet provides the decision maker with numerous sources of information. Designing sites that contain hundreds of items of

merchandise can be very challenging. Norman (2000) states, "the design of the human-computer interface is a multidisciplinary approach". For consumer websites, the specific design is dependent not only on the available technology, or the company's marketing plan but also on the cognitive constraints of the end-user (Norman, 2000). Online merchants should be aware of the limited processing capacity of consumers; offerings should be organized in a way that reduces user workload and that is relevant to the user. Designers should consider all possible cognitive aspects that are involved in the task (information search, product comparison, purchases, etc.) and understand that different designs may produce different cognitive demands. Users have been shown to perceive these demands and to prefer designs that minimize them (Norman, 1997). Users need to be able to scan, evaluate, and select items easily and effectively. The choice and structure of the information presented can have a major impact on the purchasing decision (Pereira, 1999). Retailers need to consider carefully what information to present and how to present it.

Comparison Matrix

The usual method of presentation for comparison shopping sites is the comparison matrix, which is based on a table format. It is designed to aid consumers to make a detailed comparison among alternatives by organizing attribute information about multiple products in an alternatives-by-attributes (rows-by-columns) matrix (Häubl & Trifts, 2000). This format maximizes the comparison of attributes across products.

In addition, comparison matrices directly support a consumer's comparison goals and makes selecting a product less time-consuming. Miles and Howes (2000) assert that a comparison matrix can maximize the match of the selected product with the consumer's

goals while minimizing the information processing demands of the decision-making process.

Order Effects

Kleinmutz and Schkade (1993) assert that the different properties of an information display influence decision strategies. They enumerate three properties: form, organization and sequence. *Form* refers to the presentation mode of the information, i.e. numeric, verbal or graphic. *Organization* is the structural property information can have, i.e. groups, hierarchies, lists or patterns. The most common representation of this property is a table or matrix. The order in which items or groups of items appear defines the *sequence* of the display. These properties can vary independently between displays. The researchers state that *sequence* often determines the order in which information is read and processed. If the decision maker decides to reduce cognitive effort and select the first acceptable alternative, the options listed first in the sequence have a higher probability of being selected, while the last options listed may not be even observed. In a similar manner, the decision maker may reduce effort by scanning quickly the alternatives presented without thoroughly comparing them, consider that all have a similar degree of acceptability and select one of the last alternatives instead of reading the list again.

Anderson's (1981) Information Integration Theory considers the order in which information is presented plays an important role when information is processed serially. An averaging model is used to describe how responses to presented stimuli are obtained (Anderson, 1981, 1982; Shanteau, 1970, 1975). Each stimulus presented has a scale value (s_i) and a weight (w_i) value. The response (R_n) at a position *n* is the weighted sum of the scale values for both the current and previous stimuli (Equation 1). Scale values are

constant and independent of its position and of previous stimuli. The weight values sum up to 1.00 and depend solely on serial position. Shanteau (1970) showed empirically that the serial position weights were proportional to the differences in the marginal means obtained from serial judgments.

$$R_n = \sum_{i=0}^{n} w_i s_i, \qquad \left(\sum_{i=0}^{n} w_i = 1 \right)$$

(1)

A primacy effect is observed when the first pieces of information are given a higher weight. This bias is theorized to occur when earlier stimuli are considered more central to the judgment and leads to discount later stimuli, especially when the information presented is of a mixed nature (i.e. for or against the initial impression). Recency effects are observed when the last pieces of information are given a higher weight. This bias can be explained by memory limitations; the first stimuli may be forgotten causing the later stimuli to be considered more important. Anderson (1982) states that both order effects are due to attention; this process affects the weight of a stimulus at each particular position. If a response is elicited at the end of the presentation, attention is considered to decrease across the sequence causing a primacy effect. If a response is elicited after each stimulus is presented, attention is considered to increase across the sequence causing a recency effect.

Integration Theory assumes two psychological operations: a valuation and an integration operation. Valuation assigns a psychological value to each piece of information by means of two parameters, weight and scale values. Integration combines all these values into a single psychological value that renders a response. The manner in which the integration is performed has been debated. Anderson (1981) proposed that an averaging model should be used to describe the integration operation. Shanteau (1970, 1975) compared an

additive model with a multiplying model and concluded that the additive model was a better fit for the empirical data. The additive model used is the same as the averaging model mentioned earlier, both models required that the weight values sum to unity. Wallsten (1976) evaluated Shanteau's (1975) study and indicated that the results did not show conclusive support for an averaging model against a multiplying model. He proposed that more sophisticated versions of both models could provide a better description of the data and that a multiplying model can be changed into an additive model by means of a logarithmic transformation. Wallsten and Sapp (1977) presented an additive-difference model that was able to account for sequential order effects. The authors stated that the averaging model failed to describe sequential processing unless both an initial scale value and an initial weight value were incorporated.

Hovland's (1957) book, "Order of Presentation in Persuasion" presented mixed findings for order effects. A study by Peterson and DuCharme (1967) showed a primacy effect in subjective probability revision but argued that it could not be explained and called for additional experiments to understand the presence of order effects. Anderson and Barrios (1961) observed primacy effects in a list of personality adjectives used to assess impression formation and recency effects in the recall of that same list of adjectives. Hovland proposed a list of propositions for when primacy, recency or no effects can be expected. A more detailed approach to predict order effects is presented in Hogarth and Einhorn's (1992) Belief-Adjustment Model. This model requires several parameters: information complexity, length and consistency, encoding, processing and response mode. Information can be *complex* or *simple* – large amount of information or unfamiliar stimuli versus small amount of information or familiar stimuli. The length of information

can be characterized as *long* or *short* – more than 12 items versus 12 items or less. Information can be *consistent* or *mixed* – all positive or all negative versus mixed positive and negative. Information can be encoded relative to the level of current belief, *evaluation*, or in an absolute manner, *estimation*. In terms of Information Integration Theory, evaluation implies a bipolar scale value and estimation implies a unipolar scale value. Information can be processed as an End Of Sequence (EOS) process, after all information is presented the decision maker processes all scale and weight values; or as a Step By Step (SBS) process, the decision maker processes scale and weight values after each piece of information is presented. Anderson (1981) considered two processing modes. One that functioned under a memory storage mode, where each stimulus is received and stored, and the integration is made after the last stimulus is received. This mode would be equivalent to an EOS processes. The other processing mode, functioned under a cumulative average mode, integration is performed as it is received and only the cumulated value is stored in memory, similar to a running average strategy. This mode would be equivalent to an SBS process. However, Anderson supported only the latter process. Response mode refers to when the response is elicited, EOS or SBS. It is assumed that people generally match the information process with the response mode. However, in an EOS response mode if the information presented is cognitively demanding, the decision maker may use an SBS process. Table 1 presents the predictions as per the Belief-Adjustment Model.

Table 1. Belief-Adjustment Model: Summary of Order Effect Predictions.

Encoding:	Estimation		Evaluation			
Evidence:	Mixed / Consistent		Mixed		Consistent	
Response Mode:	EOS	SBS	EOS	SBS	EOS	SBS
Short - Simple Series	Primacy	Recency	Primacy	Recency	Primacy	No effect
Short - Complex Series	Recency	Recency	Recency	Recency	No effect	No effect
Long Series	Force toward primacy	Force toward primacy	Force toward primacy	Force toward primacy	Primacy	Primacy

A criticism of this model is that some of its parameters are of a subjective nature. The definition for complexity is confounded with length. In addition, unfamiliar stimuli could be ones that the decision maker has not seen yet or that do not belong to that person's area of expertise. Length categorization is constrained by number of items; but the term "item" is not operationalized, it could be a word, a number, a sentence, etc. If the scale that defines an item has a positive range, is the combination of low and high values consistent or mixed information? Theories that make use of objective parameters, such as encoding, processing and response mode, among others, are needed to predict order effects in judgment and decision making.

Hastie and Park (1986) used memory as an indicator of the presence of order effects in judgment tasks; judgments were "on-line" or memory based. If participants are aware that a judgment response will be elicited, their judgments are being formed "on-line", as information is being received. On-line judgments are similar to SBS processes, where decision makers are continuously updating their beliefs after each stimulus is presented. If participants do not know that a judgment response will be elicited, their judgments are memory based; they have to remember the previously observed information in order to make a judgment. Memory-based judgments are similar to EOS processes; integration of the stimuli is performed at the end of the presentation. Their study showed that primacy

and recency effects were found only for memory-based judgments. On-line judgments were not affected by presentation order.

Weber, Goldstein, and Busemeyer (1991) argued that the previous findings could not account for all results; research has shown significant order effects in on-line judgments. They proposed that a distributed associative memory model, such as Murdock's (1983) TODAM, can account for the presence of order effects in judgment without assuming that participants are consciously accessing memory, as the previous research assumes.

Weber, Goldstein and Barlas (1995) propose an additional process, to Hastie and Park's (1986) on-line and memory-based processes, which they labeled *composite-memory recall*. Applying distributive associative memory theory, impression formation is obtained by "the retrieval of a composite impression that is formed effortlessly in memory by the spontaneous superposition of informational items during memory storage" (p. 40). Composite-memory recall is hypothesized to be used when both the task and the instructions encourage participants to create a composite storage vector with all relevant item information. Since this strategy is considered to require low cognitive effort, it implies that set size would not affect judgment reaction time (RT). Empirical data supported this hypothesis; set size did not affect RT for the composite-memory recall condition. An additional experiment was conducted that investigated order effects in choice tasks. Preference was elicited between two gambles. The results showed that choice was influenced by the order in which the payoff information was received. There was a bias towards gambles that had positive payoffs in the beginning or end of the sequence. Both primacy and recency effects were observed within a same subject. Both Hogarth and Einhorn (1992) and Hastie and Park's (1986) models would imply the use of

different processing strategies in order to obtain both primacy and recency. However, Weber et al. (1995) argued that this explanation is not required; an encoding strategy that simplifies cognitive processes, such as composite-memory recall, is the source of the effect. The pattern of their results suggested that participants in fact were attempting to reduce the difficulty of retaining information in memory by encoding it in a simplified manner.

Numerous studies have been undertaken to evaluate order effects in judgment and decision making. Different models appear to predict different results. Objective parameters are needed to predict order effects in a consistent manner. Following, several studies are summarized and common features will be ascertained in order to find these objectives parameters.

Primacy and Recency in Judgment Tasks

Schwarz, Strack, Hippler and Bishop (1991) investigated the relationship between presentation mode and order effects. They found that when surveys were presented on show-cards or self-administered questionnaire, a primacy effect was observed (if the selected item was plausible). The response mode for this research can be characterized as EOS. In addition, they found that when surveys were read to the respondents, a recency effect was observed (if the selected item was plausible). Although the responses were elicited after all the information was read, it could be argued that a SBS judgment took place. Participants may have been aware that they would need to rely on their memory to answer the question; instead of attempting to remember all the alternatives listed, they could have been making sequential judgments after each alternative was read so that they needed to remember only one piece of information.

The order of negative and positive pieces of information was manipulated in investing data, in the form of the president's letter in the company's annual report. MBA students judged the companies' past performance and future expectations based on these letters. Responses were elicited after reading each letter (EOS). Their judgments were biased towards the information presented early (Baird & Zelin, 2000).

The type of information presented and the context surrounding the decision can determine whether primacy or recency affect a decision. Adelman, Bresnick, Christian, Gualtieri and Minions (1997) investigated the relationship between context and order effects. Patriot air defense operators participated both individually and in pairs; the decision tasks were to decide whether an approaching aircraft was friendly or hostile. An initial (friendly or hostile) cue was provided. Two different information sequences were used: cues started confirming and then disconfirming the initial cue and vice versa. Judgments were made with descriptive information. The layout of the radar screen was considered the context of the decision task. Primacy effects were found if the context could rationalize the last cues presented, recency effects were found if it did not.

Patients considered proposed low- and medium-risk treatments less favorable when the list of risks was presented last. Treatments were described with risk and benefit information. This recency effect was not observed when benefits were presented last or with the high-risk treatment. This tendency was observed for both patients with low and expert knowledge regarding the disease. The authors propose that risks affect judgments more than benefits (Bergus, Levin, & Einstein, 2002).

Response mode and background information interact with order effects in assessments of guilt. Kersholt and Jackson (1998) manipulated the order of defense and prosecution

evidence (descriptive information), the presentation or lack of presentation of background information and the type of response: Step-By-Step (SBS) and End-Of-Sequence (EOS). Recency effects were found in SBS judgments. EOS judgments showed recency effects when background information was provided and primacy effects when no background information is provided. The authors suggested that SBS judgments are due to an anchoring and adjustment process, where each piece of information is averaged with the current assessment of guilt; that in EOS judgments recent information is given more weight because they are memory based. They proposed that the primacy effect observed in EOS with no background information is because early information is processed at a deeper semantic level, thus primacy offsets recency,

Primacy and Recency in Decision Tasks

Weber et al. (1995) questioned why order effects have been mainly studied in judgment tasks and not in decision tasks. If the order in which the information is presented can bias one's attitude for a particular item, it could potentially bias one's choice among a set of items. Hogarth and Einhorn's (1992) Belief-Adjustment Model, which describes the effect of sequentially presented information about one alternative on judgment about that alternative, may be applicable to judgments of sequentially presented alternatives. Anderson and Norman (1964) performed an experiment to study the effects of order in impression formation. They used four classes of stimuli, a set of adjectives describing a person, of foods describing a meal, of headlines describing a newspaper, and of life events describing a week in a person's life. Participants had to provide their impressions by stating how much they preferred the stimuli described. Although a judgment task was

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performed in this experiment, it is apparent that a choice task could be used with the food and headline sets.

Primacy is defined as a bias toward selecting the first object considered in a set (Krosnick, 1991). This bias is considered to be due to the tendency to search for information about an object by looking for reasons to select answer choices rather than reasons not to select them, creating stronger positive attitudes towards the first alternatives in the sequence; and thus, selecting them. This term is referred as confirmation bias (Koriat, Lichtenstein & Fischhoff, 1980). Simon's (1955) satisficing theory is another explanation for primacy effects; decision makers select the first acceptable solution they encounter. If they follow the sequence presented, they would be biased towards the first items in the list. Primacy effects have been observed in a variety of decision tasks.

Recency is defined as a bias toward selecting the last object considered in a set (Miller & Krosnick, 1998). This bias can be explained when the selection process is the opposite of confirmation bias; due to a lack of positive information, negative information drives choice. Decision makers survey a list of options by looking for reasons not to select an alternative, creating stronger negative attitudes towards the first alternatives in the sequence; and thus selecting the later alternatives.

Analysis of the 1998 Democratic primary in New York City showed order effects in 71 of the 79 precincts favoring the first position listed in the ballot. In addition, in 17 precincts the lead the first position received was higher than the winner's margin of victory (Koppell & Steen, 2004). Only candidates names appeared on the ballots, information was presented without descriptive information. The Democratic primary

rotated the candidates' names within ballots; thus, primacy did not affect the outcome. The authors caution that rotation is performed in only 14 states in the U.S. statewide, and two additional states do so in some jurisdictions.

Miller and Krosnick (1998) mentioned a study performed by Cronbach (1950). Students showed a bias towards selecting answers offered early in a list with no descriptive information when taking multiple choice knowledge tests; resulting in higher scores when the correct answer was listed first rather than last.

On occasions, both primacy and recency effects arise during decision making. Analyses of 1992 election returns in Ohio revealed order effects in 48% of races, and 89% of these effects were due to primacy. The magnitude of the effect was low; when the candidate was listed first he/she received 2.33% more votes than when the candidate was listed last (Miller & Krosnick, 1998). The magnitude of these order effects was stronger when there was a lack of information regarding the candidate (i.e. non-partisan races), for races with low news media coverage and for races that had the highest rates of rolloff. The researchers used data collected by exit polls and found a negative relationship between strength of order effects and educational attainment, i.e. the county with the strongest name-order effects was the county which had voters with the lowest educational degrees. These findings led the researchers to conclude that order effects are observed when there is little or no information regarding the alternative set.

Geys and Heyndels (2003) observed both primacy and recency effects in their analysis of several districts during the 1995 Brussels' Regional Parliament elections. They were able to compare different ballot layouts for the same set of candidates, four districts used electronic ballots and four districts used paper ballots. The layout for paper ballots

presented a single list of 75 candidates (L75) per political party. Two types of layouts were used for electronic ballots, due to computer screen limitations: (i) three columns with 22 and one with 9 candidates (L22) per political party and (ii) five columns with 15 candidates (L15) per political party. Candidates who appeared at the top or bottom of a column in L22 and L15 obtained more votes than what they obtained in their middle positions in L75.

Darcy (1986) presented a study in party column ballots where no significant order effects were found. An experiment was conducted altering the order of the actual ballots used in for counties in Oklahoma and Colorado. This finding does not undermine order effect research. The ballots used for the experiment were for races ranging from President of the United States to local offices; additionally, the ballots contained party affiliation information. Several of the races were highly publicized. For races with obscure offices, participants could have relied on cues such as party affiliation to make their decision. Thus, no order effect should have been expected.

Predictions

Summarizing the findings in the judgment tasks, primacy effects were present when EOS response modes were elicited. A recency effect appeared with an EOS response mode (in Schwarz et al., 1991); but it was argued that an SBS process might have taken place due to the mode of information presentation (auditory presentation). Context interacted with response mode in a manner that could reverse the presence of primacy and recency.

The findings in the decision task studies, with the exception of Weber et al. (1995), showed order effects when there was little to no information regarding the alternatives in the set. Since all these studies were undertaken in naturalistic settings, there were no

controls to see if all the information was observed. Thus we cannot truly assign a particular process or response mode. Weber et al.'s (1995) study used a combination of response modes, an EOS mode after the pair of gambles was shown and an SBS mode between all pairs. The researchers argued that their results showed that participants used a simplifying processing mode. This study presented both primacy and recency effects.

Most of the research in decision tasks has shown alternatives with very little descriptive information, as opposed to research in judgment tasks. When descriptive information is present, it not only describes each alternative, it also allows the decision maker to differentiate between them. Sometimes individuals need to select an option from a set of very similar alternatives. Descriptive information is provided but does not assist in discriminating among alternatives (all attributes are similar). It is predicted that order effects are expected to occur in a decision task that does not provide differentiating information between its alternatives.

This study uses a consumer decision task. Sometimes when consumers research products online the options offered are extremely similar. The information layout will be organized by means of a comparison matrix, which allows for a multi-product by multi-attribute representation. Purchasing decisions entail an End-Of-Sequence response mode; once the product is acquired the decision task has ended. However, the manner in which the consumer evaluates the information is not evident. The decision maker could make sequential judgments for each product or a final judgment after all products have been observed. If the products presented for this decision are not distinguishable, it is predicted that both primacy and recency effects will occur.

Chapter 2: Experiment 1

This first experiment required participants to select a restaurant (product) based on restaurant ratings. These ratings were in the form of 1-5 star rating scale, which was supposedly provided by different food critics. This information was organized as a 5x5 comparison matrix that presented 5 restaurants and 5 ratings per restaurant. Products and attributes (i.e. restaurants and food critics) were listed in either the rows or columns of the matrix.

Hastie and Dawes (2001) state that the most thorough and systematic strategy to evaluate alternatives is to use Multi-Attribute Utility Theory (MAUT). MAUT is an additive linear strategy. The first step is to consider the importance of each attribute and assign it a weight (w_j). Afterwards, each alternative is assessed by examining the value (v_j) each attribute has; these values are weighted by their importance. A global utility (U_i) is calculated for each alternative by adding the weighted values. See Equation 2.

$$U_i = \sum_{j=1}^{n} w_j v_j$$

(2)

If all the attributes are considered equally important, the weight factor is no longer required in the equation. The value for each alternative is the sum of its attribute values (Equation 3).

$$U_i = \sum_{j=1}^{n} v_j$$

(3)

The attributes that described the alternatives in Experiment 1 were fictitious food critics. It is assumed that there was no preferential bias for a particular critic; decision makers would consider all attributes equally important. Although each restaurant had distinct

ratings, if an MAUT strategy is used then all alternatives have the same global utility as per Equation 3. Thus, there is no differentiating information that could elicit preference for a particular restaurant. If order effects do not influence choice, all alternatives should have equal probability for being chosen.

It should be noted that the additive linear (MAUT) strategy is one among several strategies that a decision maker can use. In fact, this strategy is considered to be one that requires high mental effort. Research has shown that people select choice strategies by means of an effort-accuracy tradeoff (Bettman et al., 1990, 1993; Payne, Bettman & Johnson, 1990); this implies that MAUT would be used only when high accuracy is needed. However, the elimination of the weight factor for the decision task reduces the amount of cognitive effort usually associated with MAUT. The global utility for each alternative is the sum of its ratings. This mathematical operation is quite simple, since it involves single digits (ratings: 1 - 5); in addition, the stimuli were controlled so that all the rates within a row or column add up to 18. It is assumed that participants would use an MAUT strategy; it associated with high accuracy and the experimental conditions entail nominal effort.

Method

The comparison matrix was organized in two different structures: products x attributes and attributes x products; these two conditions were counterbalanced between subjects. Order effects for rows and columns were evaluated; Column and Row Position had five levels each and were within-subjects variables. The dependent variables collected were the preference for a particular restaurant and critic, and the recall of the individual ratings in the comparison matrix. These measures were collected twice per participant.

Participants

Sixty undergraduates from the University of Maryland participated in the study as a partial fulfillment of a course requirement.

Materials

A 5x5 comparison matrix was created (See Figure 1). The design of the comparison matrix controlled for labels, restaurant types and order effects. It was necessary to create a matrix were all the labels elicited the same awareness. If the matrix compared market products and price was among the attributes compared, the "price label" could elicit attention due to its connotation and not due to its position on the matrix. Thus restaurants were chosen as the compared product and food critic ratings were selected as the compared attributes. It should be noted that all restaurants and critics were fictitious. Additionally, the restaurants compared within each trial were always of the same type (all Italian, all Mexican, etc.); to avoid preference for a certain type of cuisine. Restaurants and food critics appeared in different order for every comparison.

Figure 1: Comparison Matrix.

	food.com	restaurants.com	foodexpert.com	dining.com	chef.com
The Alps	4	5	4	2	3
Little Switzerland	3	2	5	4	4
Bern	2	3	4	5	4
Geneva	5	4	2	2	5
Matterhorn	4	4	3	5	2

The ratings were presented in 5-point scale, similar to the common 5-star rating system. Before the experiment started the rating scale was explained to the participants.

Each restaurant had the same utility in order to control for preference. And the ratings for each critic always summed up to the same value so that none would be regarded as a harsh or lenient critic.

Procedure

The participant was greeted and the general instructions for the test were provided. A pre-test questionnaire and consent form were then administrated. The pre-test questionnaire gathered demographic data that showed non-significant results. The task consisted of selecting a restaurant based on the food critics' recommendations. The participant could look at the comparison matrix as long as he/she wanted. After pressing a continue button, the participant was asked to enter the preferred restaurant's name and, select from a list the critic that influenced his/her decision. After pressing a continue button, a memory test was performed where the participant had to enter all the ratings for the comparison matrix. Participants were informed that a memory test would take place before starting the experiment. All ratings had to be entered before the participant could continue with the following task. Participants were not allowed to go back and see their previous entries or the previous comparison matrices. This task was repeated three times. It was the participants' understanding that the first task was a practice session to get familiar with the experiment. The experiment lasted an average of 35 minutes.

Results

Statistical analysis showed that the counterbalancing conditions did not have significant effects on the results; thus they will not be discussed through the remainder of the section.

Preference

There were no significant differences for preference in Time 1 for neither Rows ($\chi^2(4)$=5.33, p>.05) nor Columns ($\chi^2(4)$=4.49, p>.05). Time 2 showed a significant preference for Rows 4 ($\chi^2(4)$=11.93, p<.05) but nothing for Columns ($\chi^2(4)$=1.17, p>.05). A meta-Chi-Square[1] was calculated for both Time 1 and 2, it showed significant preference for Rows ($\chi^2(8)$=17.26, p<.05) but not for Columns ($\chi^2(8)$=5.66, p>.05) (See Figure 2).

Figure 2. Preference Experiment 1 – (a) Rows. (b) Columns.

(a)   (b)
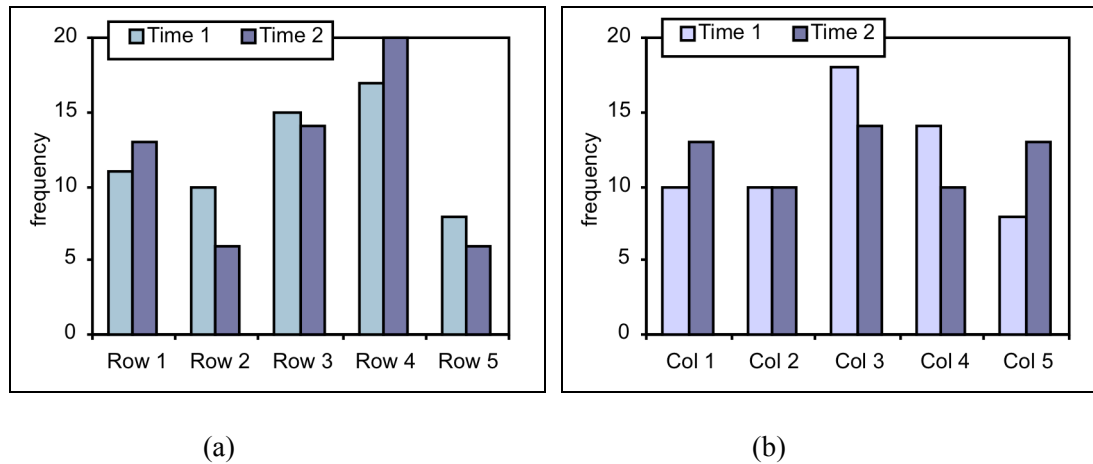
All restaurants had the same average rating; if the participants were selecting restaurants based on a particular rating composition (i.e. the restaurant that has the most 5 stars, even though it has 2 stars also) they should chose that rating composition both times. Figure 2a shows that in fact they did so. They significantly chose the fourth row both times ($\chi^2(16)$=27.04, p<.05), Row 4 had a rating composition with the following distributions: 2-2-5-5-4, 5-5-4-2-2, 2-5-5-4-2, 4-2-2-5-5.

Recall

Recall was scored as the ratio of correctly recalled cells over the total number of cells per row or column; i.e. if the participant recalled 4 cells in Row 1, the recall score for Row 1 would be 0.80 (4-correctly recalled cells / 5-total number of cells in each row). There were no significant differences for recall between Time 1 and Time 2 (Rows: $F(1,59)=1.63$, $p>.05$; Columns: $F(1,58)=1.99$, $p>.05$; No interactions), thus recall was collapsed into an average of recall for both Time 1 and Time 2. There was a main effect of position for recall in Rows ($F(4,236)=11.31$, $p<.001$) and Columns ($F(4,232)=3.04$, $p<.05$). A Bonferroni correction for multiple comparisons was used, the first row was recalled significantly more ($p<.001$) when compared to the other rows and the first column was recalled more ($p<.05$) when compared to the other columns (Figure 3). There were no interactions between rows or columns ($F(16,960)=1.10$, $p>.05$).

Figure 3. Recall Experiment 1– (a) Rows. (b) Columns.
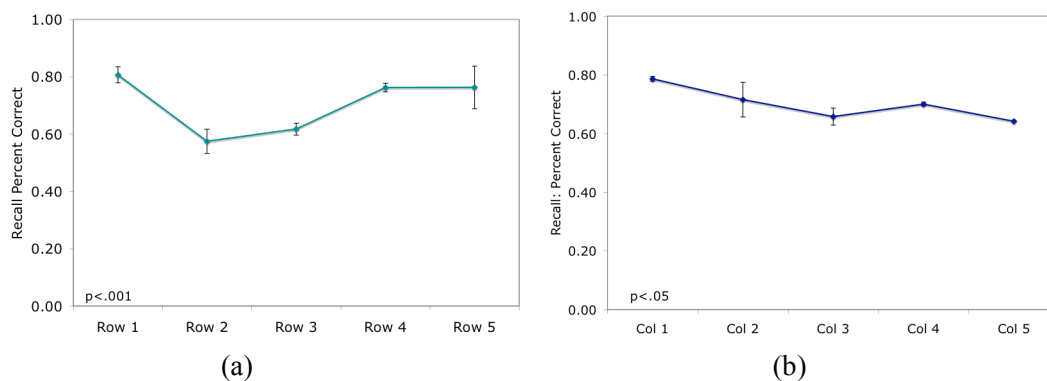

(a)   (b)

Figure 4 shows the distribution for the average of recall between Time 1 and Time 2 for each individual cell in the comparison matrix; it is apparent that the top-left cell is the one that contributes to the primacy effect for both rows and columns. This cell has the highest frequency (49) for a recall rate of 1.0.

Figure 4. Recall Experiment 1 – Frequency Distributions for the Average of Recall Between Time 1 and Time 2 By Cell.
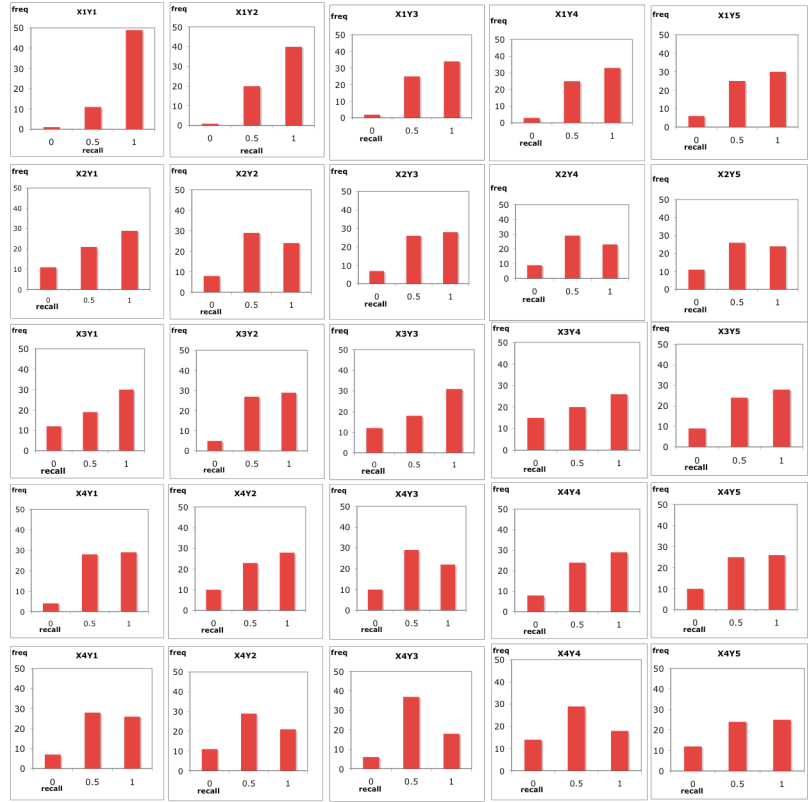
Probability of Recall given Preference

A new variable was coded to examine the probability of recall given preference (i.e. If Row 2 was preferred, what percentage is recalled for Row 2?)   For Time 1 the p(recall/preference) for Rows was not significant ($F_{(4,56)}=2.18$, $p>.05$) and was significantly different for Columns ($F_{(4,55)}=4.22$, $p<.01$). There were no significant differences for Time 2 (Row: $F_{(4,54)}<1.00$, Column: $F_{(4,55)}<1.00$). See Figure 5. All multiple comparisons were adjusted with Bonferroni corrections. Pair-wise comparisons for the Rows show a primacy effect; Row 1 has a higher probability of being recalled given that it's preferred when compared to Row 3 ($p<.05$) and Row 5 ($p<.01$). Note that in Figure 5a, for Time 1, Row 4 has the second highest probability, however this result was non-significant. Pair-wise comparisons for the Columns in addition of showing a

primacy effect show a unexpected result; Columns 1 and 4 have a higher probability of being recalled than the other columns (p<.001). In average, participants had a high recall rate (M=.70, SD=.10) for those items they preferred.

Figure 5. *p*(Recall | Preference) Experiment 1– (a) Rows. (b) Columns.

(a)   (b)
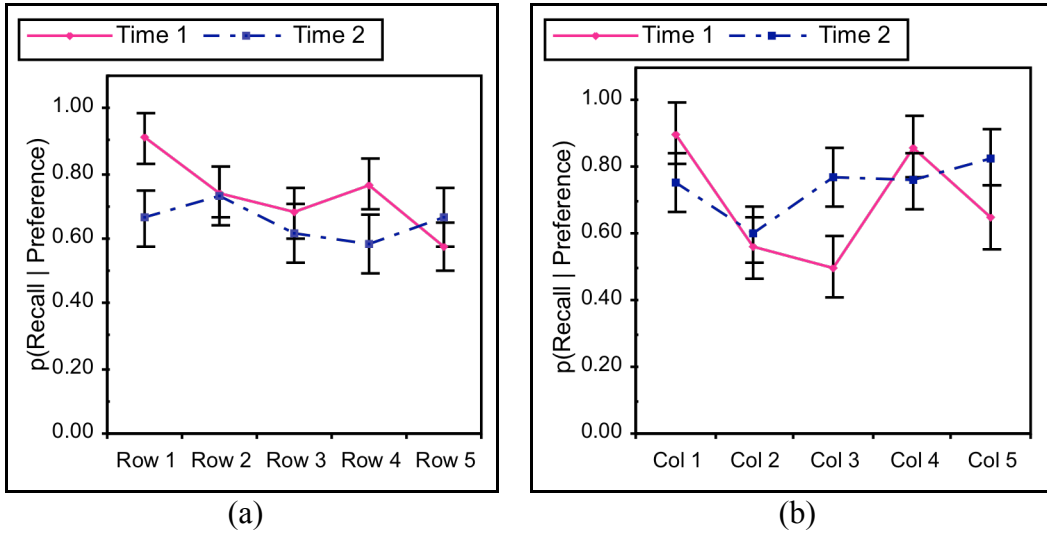
The probability of recall given preference was significantly higher than probability of recall given non-preference for both rows and columns (t(60)=2.11, p<.05). See Table 2 and Figure 6. There was a significant positive correlation (r_b=.11) between recall and preference (t(60)=2.11, p<.05).

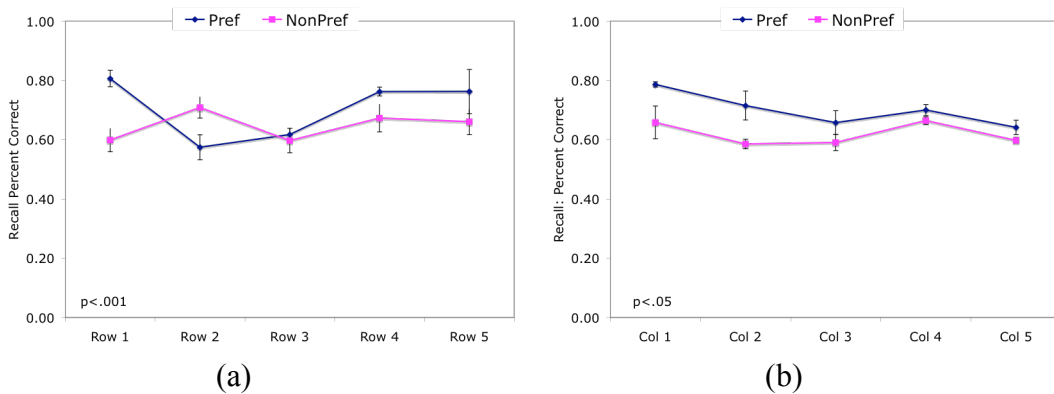Figure 6. Recall Preferred vs. Non-Preferred Items Experiment 1 – (a) Rows. (b) Columns.

(a)   (b)

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Table 2. Experiment 1 – p(recall | preference) vs. p(recall | non-preference)

| | p(recall \| preference) | | p(recall \| non-preference) | | t(60) |
	M	SD	M	SD	
Rows	0.69	0.23	0.64	0.22	1.78 *
Columns	0.71	2.29	0.63	0.21	2.70 **

* p<.05

** p<.01

Results for Labels

The same data set was analyzed in terms of the labels used: Restaurants and Critics. This was done in order to see if the results varied when compared to the previous data analysis. None of the analyses provided significant results.

Discussion

No order effects mediated choice. Preference was observed for the second to last row (Row 4). When further analyzing the materials, it was noticed that usually this row had a different distribution than the others. All rows had the same average rating; however, the fourth row had the higher combination of 5-star ratings. Perhaps this was a sufficient condition to differentiate the product listed in this position from the other products.

A primacy effect was observed in recall. Participants recalled the first position significantly more than the other positions. There were no order effects present for the probability of recalling preferred products; participants were able to recall correctly most of the items they preferred. Recall was higher for preferred items when compared to non-preferred items.

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[1] Both Chi-Square distributions and degrees of freedom possess additive properties. The meta- Chi-Square was calculated by summing all χ^2 variables and their corresponding degrees of freedom:

$$\chi^{2\prime} = \sum \chi_i^2 = \chi_1^2 + \chi_2^2 = 5.33 + 11.93 = 17.26$$

$$df\prime = \sum df_i = df_1 + df_2 = 4 + 4 = 8$$

$$\chi^2(8) = 17.26$$

Chapter 3: Experiment 2a

A second experiment was designed to further investigate the findings from the previous experiment. The hypothesis stated that both primacy and recency effects appear if there is no differentiating information between alternatives. Experiment 1 tried to control for differentiating information by manipulating the product's global utility; however, a particular distribution of ratings seemed to favor one specific product. It was necessary to create a comparison matrix with similar products (same utility) where the ratings would not be able to be considered as differentiating information. It was considered that numerical ratings allowed for easier discrimination, individuals could have compared patterns of distributions. Verbal ratings, alternatively, may be more difficult to be perceived as specific patterns, and thus, would not differentiate among products. In addition, it was necessary to evaluate whether in fact the distribution of ratings influenced the results in the previous experiment. The following experiment was divided in two sections: decision tasks involving either verbal (Experiment 2a) or numerical (Experiment 2b) ratings.

The verbal section of the second experiment (2a) required participants to select a movie (product) based on movie reviews. This information was organized as a 4x4 comparison matrix that presented 4 movies and 4 reviews per movie. Products (i.e. movies) were listed in the rows of the matrix and attributes (i.e. film critics) were listed in the columns. Although each movie had different reviews, all of them were obtained from reviews that had the same rating; thus, there was no differentiating

information that could elicit preference for a particular movie. If order effects do not influence choice, all alternatives should have equal probability for being chosen.

Method

Twelve conditions were created to counterbalance the type of rating (verbal or numerical) and task order (3 tasks per type of rating). Chapter 3 will report the verbal rating decision tasks (Experiment 2a); and Chapter 4, the numerical rating decision tasks (Experiment 2b).

Order effects for rows and columns were evaluated; Column and Row Position had four levels each and were within-subjects variables. The dependent variables collected were the preference for a particular movie and critic, the recognition of the reviews that corresponded to the preferred movie and the time each cell in the comparison matrix was observed. These measures were collected three times per participant.

Participants

Sixty undergraduates from the University of Maryland participated in the study as a partial fulfillment of a course requirement.

Materials

A 4x4 comparison matrix was created (See Figure 7). As in Experiment 1, the design of the comparison matrix controlled for labels, movie types and order effects. Movies were chosen as the compared product and film critic ratings were selected as the compared attributes. Movies were labeled A-through-D; while the critics were fictitious. Additionally, the movies compared in each trial were always of the same

type (Movie Type 1: Comedy, Movie Type 2: Drama, Movie Type 3: Romance) to avoid preference for a certain type of genre.

Figure 7: Comparison Matrix – Verbal Rating.

	Films.com	Movies.com	Critics.com	Reels.com
Movie A	Its silly, screeching, high-speed, non-stop action clearly defines it as a Fall popcorn picture.	45 of the funniest minutes I've spent at the movies this year. Too bad this movien runs more than twice that in length.	A completely inane buddy flick filled with ridiculous situations, cheap self-help advice, unabashed mugging and a few good laughs.	Despite its well-crafted look and its urban verve, the picture falters in its second half. The storyline just isn't there.
Movie B	When the script puts its faith in the audience the film is irresistible. Yet when the writers panic, upping the antic volume the lark stops.	The movie stalls when it pretends to have an interesting story to tell but flies when it simply lets the stars loose.	The director doesn't seem quite sure whether the movie is a social satire or a sugary story. Nor does he seem to have a specific audience in mind.	Story is everything and this movie's is rather thin and soupy, despite the winning improvisational skills of its actors.
Movie C	Although it is essentially entertaining ... it is also a derivative, formulaic and creatively tentative plaything.	Raunchy, offensive, and sometimes hilarious. There are some hearty laughs to be had, but they don't come frequently enough.	If you aren't entirely annoyed by the presence of every movie cliché ever written, you might get a kick out of how each and every one is worked into the dialogue.	By the end of the film it wasn't my stomach that was hurting from laughter; it was my butt that was sore from the pop culture/product placement spanking I was enduring.
Movie D	The movie has its funny moments and some outstanding design elements. But its story is fundamentally misconceived.	An example of the sort of fun you can have when you're not taking yourself -- or the job -- too seriously.	More often than not, the movie's tension gets in the way of its giggles, falling back on its stars' comedy instincts and over-extended running gags.	Funny bits abound, overstuffed to the point of tearing at the seams, the film might have benefited from a bit more cutting.

The verbal ratings (reviews) were obtained from a film website (www.rottentomatoes.com). The reviews belonged to movies that had the same average rating in order to control for preference, there were an average of 23 words per review.

The comparison matrices for Experiment 2 were initially shown with blank ratings information. Participants could view each individual review by hovering (the text appears once a particular cell is clicked, it disappears if another cell is clicked). See Figure 8.The hovering feature allows to record the amount of time a cell is observed and if they are revisited.

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Figure 8: Comparison Matrix – Verbal Rating: Hovering.

	Films.com	Movies.com	Critics.com	Reels.com
Movie A				
Movie B				
Movie C			If you aren't entirely annoyed by the presence of every movie cliché ever written, you might get a kick out of how each and every one is worked into the dialogue.	
Movie D				

Procedure

The participant was greeted and the general instructions for the test were provided. A consent form was then administrated. The task consisted of selecting a movie based on the film critics' recommendations. The participant could look at the comparison matrix as long as he/she wanted. In order to observe a review, the participant had to click each particular cell. After pressing a continue button, the participant was asked to enter the preferred movie; and select from a list the critic that influenced his/her decision. After pressing a continue button, a memory test was performed where the participant had to recognize the reviews that belonged to the movie they preferred. Participants were informed that a memory test would take place before starting the experiment. All reviews were presented in random order and four had to be selected in order to continue with the following task. Participants were not allowed to go back and see their previous entries or the previous comparison matrices. This task was

repeated four times: one practice trial and three test trials. It was the participants' understanding that the first task was a practice session to get familiar with the experiment. Experiment 2 (a and b) lasted an average of 45 minutes.

Results

Statistical analysis showed that the counterbalancing conditions had no significant effects on the results, thus they will not be discussed through the remainder of the paper.

Data was collected in three separate trials, where each trial refers to a different movie type. Order of trial presentation was counterbalanced. The terms, movie type or trial, will be used interchangeably.

Trace data was inspected to ensure that participants had observed the stimuli presented. It was found that nine participants did not look at all the cells in the corresponding comparison matrices. Two sets of statistical analyses were performed for all the results, one with all the cases and another one dropping these nine cases. Both results were very similar; I will report the results without dropping any cases.

Order of Information Acquisition

In the three trials, the starting cell was the top-left cell for approximately 55 subjects (Movie Type 1: $\chi^2(1)=41.67$, p<.001, Movie Type 2: $\chi^2(1)=35.27$, p<.001, Movie Type 3: $\chi^2(1)=45.07$, p<.001). Navigation through the comparison matrix had three different styles: by row, by column or random. The first two styles imply sequential navigation, i.e. by row – top-down; by column – left-right. Approximately 49 subjects navigated by row, 3 by column and 8 randomly (Movie Type 1: $\chi^2(2)=72.10$,

p<.001, Movie Type 2: $\chi^2(2)$=64.69, p<.001, Movie Type 3: $\chi^2(2)$=66.54, p<.001).

Approximately 53 participants revisited cells (Movie Type 1: $\chi^2(1)$=45.07, p<.001, Movie Type 2: $\chi^2(1)$=27.59, p<.001, Movie Type 3: $\chi^2(1)$=32.27, p<.001).

Preference

The last (bottom) and first (top) rows were preferred the most, receiving a tally of 61 and 55 respectively; followed by the third position (47) and the second row was preferred in the smallest amount (17). See Figure 9a. Three separate Chi-Squares were used to evaluate position preference for each trial, although statistical power is reduced when each preference response is analyzed separately (i.e. by movie type); these results showed significant differences (Movie Type 1: $\chi^2(3)$=11.87, p<.01, Movie Type 2: $\chi^2(3)$=30.00, p<.001, Movie Type 3: $\chi^2(3)$=24.13, p<.001).

Figure 9. Experiment 2a - Preference: (a) Rows. (b) Columns.



(a)   (b)
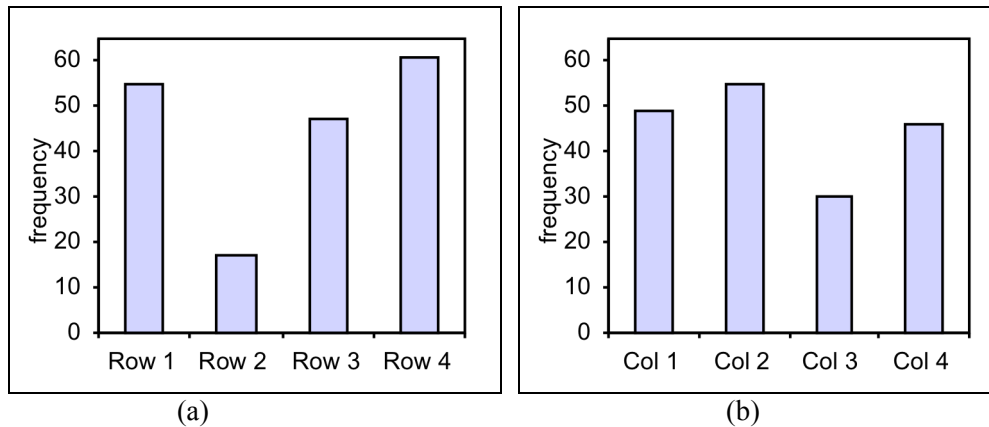
Preference for critics, showed that the second-from-left position was preferred the most, receiving a tally of 55; it was followed by the first (left-most) position (49), the last (right-most) position (46); and the third-from-left position was preferred in the smallest amount (30). See Figure 9b. Results for two of the three trials did not show

significant differences (Movie Type 1: $\chi^2(3)$=12.93, p<.01, Movie Type 2: $\chi^2(3)$=5.47, p>.05, Movie Type 3: $\chi^2(3)$=3.33, p>.05). A meta-Chi-Square was calculated for all trials, it showed a significant effect of preference on column position ($\chi^2(9)$=21.73, p<.01).

Probability of Recognition given Preference

A recognition response was obtained only for the preferred row; thus no analysis will be made regarding columns. Significant differences were found for two out of the three trials (Movie Type 1: $F(3,56)$=.34, p>.05, Movie Type 2: $F(3,56)$=3.45, p<.05, Movie Type 3: $F(3,56)$=7.47, p<.001). A Bonferroni correction for multiple comparisons was used; the two middle rows are significantly less recognized when preferred, Row 2 (p<.01) and 3 (p<.01) for Movie Type 3 and Movie Type 2 respectively. The other rows show a recognition rate above 0.70. See Figure 10.

Figure 10. Experiment 2a - p(Recognition | Preference): Rows.
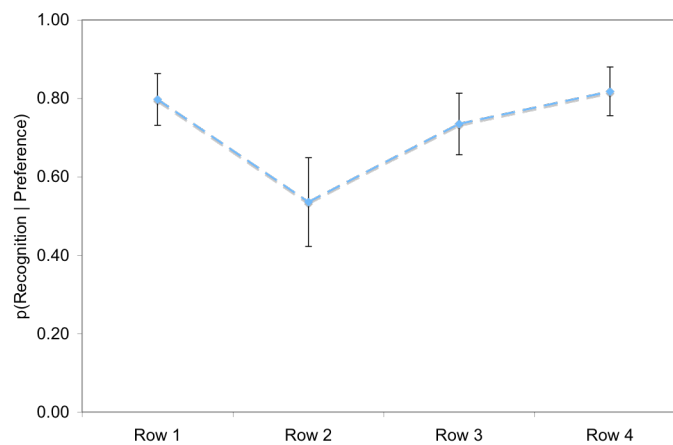
Time

Time to observe each cell was recorded. A repeated measures ANOVA was conducted with two within-subjects factors: Trial (3 levels) and Rows (4 levels). No effect of Trial was expected nor found ($F_{(2,118)}= 0.10$, $p>.05$). A significant effect was found for Row ($F_{(3, 177)}=4.15$, $p<.01$). There were no significant interactions. A pair-wise comparison, adjusted with the Bonferroni correction, showed that the second row from the top was observed for the least amount of time ($p<.05$). Time was longest for Row 1 ($M=29.794$, $SE=1.63$), followed by Row 4 ($M=28.98$, $SE=1.85$), Row 3 ($M=27.63$, $SE=1.46$) and Row 2 ($M=24.01$, $SE=1.50$). See Figure 11.

Figure 11. Experiment 2a - Time: Rows.
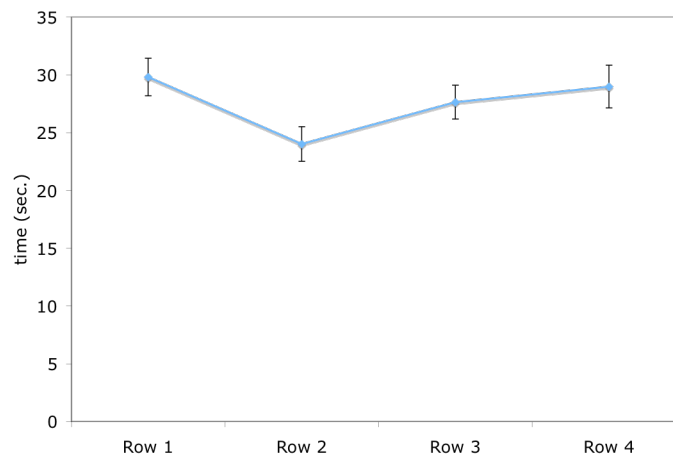
Time given Preference

Another issue that should be considered is the amount of time participants observed the information for the movie they preferred versus the movies they did not prefer. A repeated measure ANOVA was conducted with two within-subjects factors: Trial (3 levels) and Preference (2 levels). No effect of Trial was expected nor found ($F_{(2,118)}= 1.01$, $p>.05$). A significant effect was found for Preference ($F_{(1, 59)}=140.04$, $p<.001$). A Bonferroni correction for multiple comparisons was used;

preferred movies were observed for a longer period of time (p<.001); preferred movies (M=40.39, SE=1.95) and non-preferred movies (M=23.34, SE=1.08) . See Figure 12a. A significant interaction was found between Trial and Preference (F(2,118)=3.18, p<.05). This interaction was not expected. Figure 12b shows that although the same trend is observed for all trials (longer period for preferred movies versus smaller period for non-preferred movies), the trial labeled "M Type 2" does not show a significant difference between the preferred and non-preferred movies, M=33.73, SE=3.13 and M=25.13, SE=1.94 respectively. A significant positive correlation (r_b=.47) was found between time and preference (t(59)=4.08, p<.001).

Figure 12. Experiment 2a - Time for Preferred vs. Non-Preferred: (a) Overall. (b) By Trial.

(a)   (b)
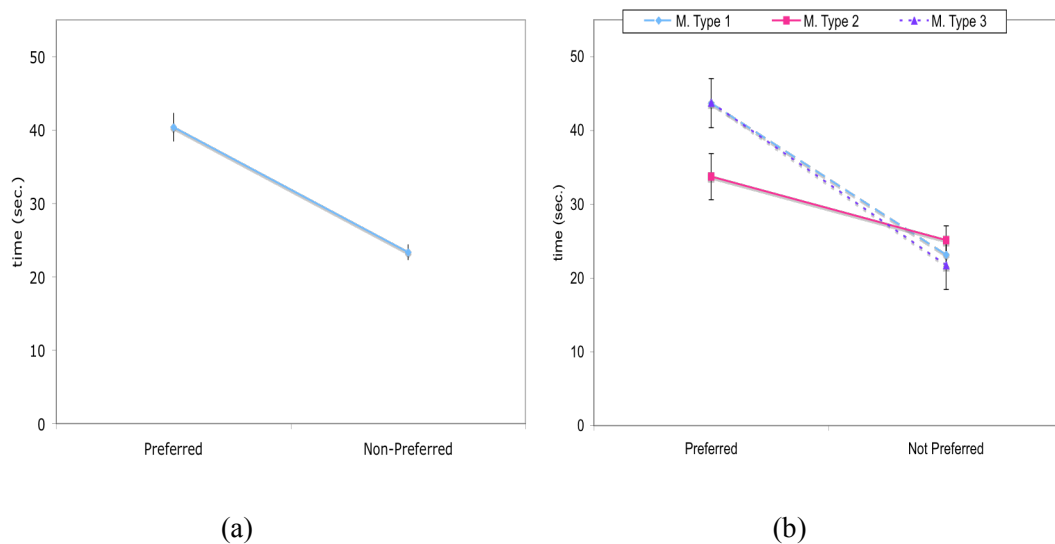
Discussion

Both a primacy and recency effect were observed to influence product preference. The first and last products in the matrix were more preferred. The preference for a particular critic, however, did not show these effects. The second critic listed was the most preferred followed by the first and last critics. A possible explanation for this

result is that the order effect may have been dissipated by the response format. When asked to select the critic that influenced their movie choices, the critics did not appear in the same layout as in the comparison matrix (i.e. critics were not presented horizontally (in columns), they were presented vertically (in a list)). Participants tended to select the first critics listed in the response section; however, there were no significant differences. Participants were able to recognize correctly the movies they preferred. However, their recognition rate decreased for the middle two rows.

Participants took a longer amount of time to observe the first and last row. A peculiar finding was that the first row was observed longer, even when individual cell data showed that the top-left cell was observed the least amount of time. Participants increased observation time by revisiting the cells in both the first and last position. They also took longer to read, and revisited more the products they preferred.

Chapter 4: Experiment 2b

The numerical section of the second experiment (2b) required participants to select a restaurant (product) based on ratings. These ratings were in the form of 1-5 star rating scale, which was supposedly provided by different food critics. This information was organized as a 7x12 comparison matrix that presented 7 restaurants and 12 ratings per restaurant. Products (i.e. restaurants) were listed in the rows of the matrix and attributes (i.e. food critics) were listed in the columns. The distribution of ratings was manipulated so that different ratings were showed, but all the products had the same sum of rating. If the distribution of ratings influences choice, then those distributions with higher rating combinations should be preferred. If the distribution of ratings does not affect choice, order effects should appear.

Method

Order effects for rows were evaluated; Row Position had seven levels and was a within-subjects variable. Distribution effects were evaluated; there were seven different distributions of ratings used. The dependent variables collected were the preference for a particular restaurant, the recognition of the ratings that corresponded to the preferred restaurant and the time each row in the comparison matrix was observed. These measures were collected three times per participant.

Participants

Sixty undergraduates from the University of Maryland participated in the study as a partial fulfillment of a course requirement.

Materials

A 7x12 (restaurants x critics) comparison matrix was created (See Figure 13). Restaurants were chosen as the compared product and food critic ratings were selected as the compared attributes. Both restaurants and food critics were fictitious. Additionally, the restaurants compared were always of the same type (all French, all Mexican, etc.) for each trial to avoid preference for a certain type of cuisine.

Figure 13: Comparison Matrix – Numeric Rating.

	restaurants.com	critic.com	diningout.com	foodexpert.com	chef.com	dinner.com	foodcritic.com	restaurantreviews.com	wheretoeat.com	dining.com	food.com	reviews.com
Trattoria	4	4	5	3	4	4	3	3	3	4	4	3
Il Ristorante	4	3	4	2	5	4	2	5	5	2	4	4
Milano	5	5	3	4	4	4	4	2	3	4	3	3
Cuomo	4	5	2	4	2	5	5	5	2	3	2	5
Firenze	5	2	2	4	2	5	5	5	2	5	5	2
Apeninos	4	4	5	2	5	3	3	3	5	4	2	4
Bramasol	3	4	4	4	3	4	4	4	4	3	3	4

The ratings were presented in 5-point scale, similar to the common 5-star rating system. Before the experiment started the rating scale was explained to the participants.

Each restaurant had the same sum of ratings in order to control for preference. However, they differed in their variability and the combination of ratings. See Table 3. Distributions were pseudo-randomly presented for each decision task.

Table 3. Experiment 2b – Restaurants' Distribution of Ratings

Pattern	Sum	M	SD	Num. 5 Stars	Num. 4 Stars	Num. 3 Stars	Num. 2 Stars
P1	44	3.67	0.49	0	8	4	0
P2	44	3.67	0.65	1	6	5	0
P3	44	3.67	0.89	2	5	4	1
P4	44	3.67	1.07	3	4	3	2
P5	44	3.67	1.15	3	5	1	3
P6	44	3.67	1.37	5	2	1	4
P7	44	3.67	1.50	6	1	0	5

The comparison matrices for Experiment 2 were initially shown with blank ratings information. Participants could view the ratings for each individual restaurant by hovering (the text appears once a particular row is clicked, it disappears if another row is clicked). See Figure 14.

Figure 14: Comparison Matrix – Numeric Rating: Hovering.

Procedure

The task consisted of selecting a restaurant based on the food critics' recommendations. The participant could look at the comparison matrix as long as he/she wanted. In order to observe the ratings, the participant had to click each

particular row. After pressing a continue button, the participant was asked to enter the preferred restaurant. After pressing a continue button, a memory test was performed where the participant had to recognize the ratings that belonged to the restaurant they preferred. All ratings were presented in random order and the participant had to answer before continuing with the following task. Participants were not allowed to go back and see their previous entries or the previous comparison matrices. This task was repeated four times: one practice trial and three test trials. It was the participants' understanding that the first task was a practice session to get familiar with the experiment.

Results

Data was collected in three separate trials, where each trial refers to a different restaurant type. Order of trial presentation was counterbalanced. The terms, restaurant type or trial, will be used interchangeably.

Trace data was inspected to ensure that participants had observed the stimuli presented. It was found that five participants did not look at all the rows in the matrices. Two sets of statistical analysis were performed for all the results, one with all the cases and another one dropping these five cases. The results did not differ significantly; I will report the results containing all cases.

Order of Information Acquisition

In the three trials, the starting row was the top row for approximately 57 subjects (Rest. Type 1: $\chi^2(1)=48.60$, p<.001, Rest. Type 2: $\chi^2(1)=50.27$, p<.001, Rest. Type 3: $\chi^2(1)=48.60$, p<.001). Navigation through the comparison matrix was sequential and had two different styles: top-down or bottom-up; approximately 56 subjects navigated

top-down (Rest. Type 1: $\chi^2(1)=44.09$, p<.001, Rest. Type 2: $\chi^2(1)=51.27$, p<.001, Rest. Type 3: $\chi^2(1)=44.09$, p<.001). Approximately 52 participants revisited a row (Rest. Type 1: $\chi^2(1)=32.67$, p<.001, Rest. Type 2: $\chi^2(1)=26.67$, p<.001, Rest. Type 3: $\chi^2(1)=38.40$, p<.001).

Preference

The bottom two rows in the comparison matrix were significantly preferred (Rest. Type 1: $\chi^2(6)=16.77$, p<.05, Rest. Type 2: $\chi^2(6)=25.63$, p<.001 Rest. Type 3: $\chi^2(6)=29.60$, p<.001). See Figure 15a. Even though all distributions had the same average rating, distribution P2 (See Table 3) was preferred; P2 had a higher combination of 5 and 4 star ratings with no 2-star ratings. The second most preferred distribution is P7; which had an even higher combination of 5 and 4 star ratings but also had 2-star ratings. See Figure 15b.

Figure 15. Experiment 2b - Preference: (a) By Position. (b) By Distribution.

(a)   (b)
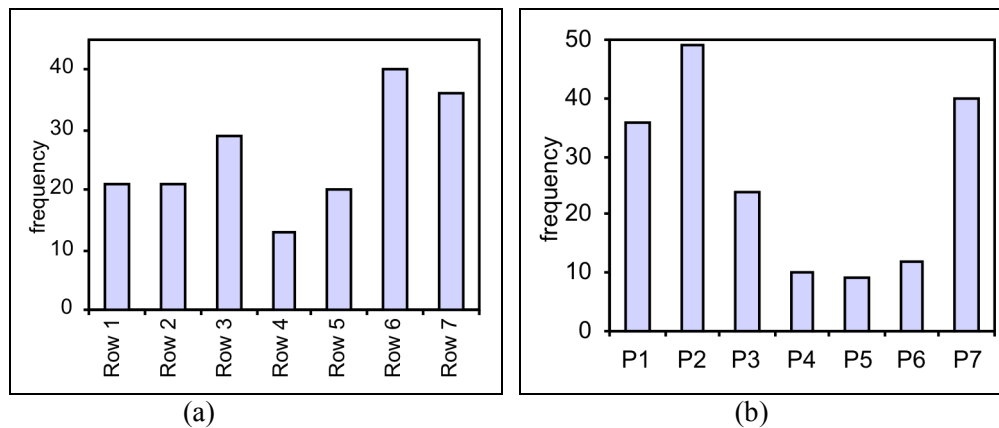
Recognition given Preference

Response was obtained only for the preferred restaurant. The majority of participants were able to correctly recognize the distribution for their preferred restaurant (Rest.

Type 1: $\chi^2(1)=19.93$, p<.001, Rest. Type 2: $\chi^2(1)=35.27$, p<.001, Rest. Type 3: $\chi^2(1)=29.40$, p<.001). There were no significant differences regarding the probability of recognition given a particular position preference. All positions and distributions had a recognition rate above 0.67, except for the second position in the trial labeled "Restaurant Type 3" which was recognized only one time out of the four times it was preferred (Rest. Type 1: $\chi^2(6)=4.27$, p>.05, Rest. Type 2: $\chi^2(6)=3.58$, p>.05, Rest. Type 3: $\chi^2(6)=18.25$, p<.05). The meta-Chi-Square did not show any significant differences either ($\chi^2(18)=26.11$, p>.05). See Figure 16b and c.

Figure 16. Experiment 2b – *proportion* (Recognition | Preference): (a) Average by Position. (b) Average by Distribution.

(a)   (b)
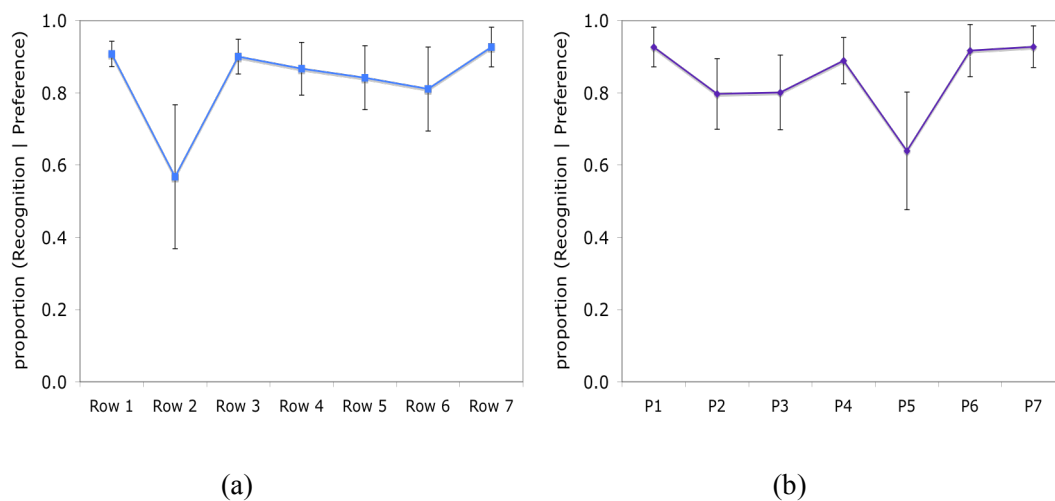
Time

A repeated measures ANOVA was conducted with two within-subjects factors: Trial (3 levels) and Rows (7 levels). No effect of Trial was expected nor found (F(2,118)= 1.30, p>.05). A significant effect was found for the position of the row (F(6, 354)=4.04, p<.01). There were no significant interactions. See Figure 17a. A pair-wise comparison, adjusted with the Bonferroni correction, showed that the second

row from the top was observed for the most amount of time (p<.05) and the bottom row for the least amount of time (p<.05). See Table 4. A significant effect was found for the distribution of the row (F(6, 354)=4.93, p<.001). There were no significant interactions. See Figure 17b. A pair-wise comparison, adjusted with the Bonferroni correction, showed that distribution P2 was observed for the most amount of time. See Table 5.

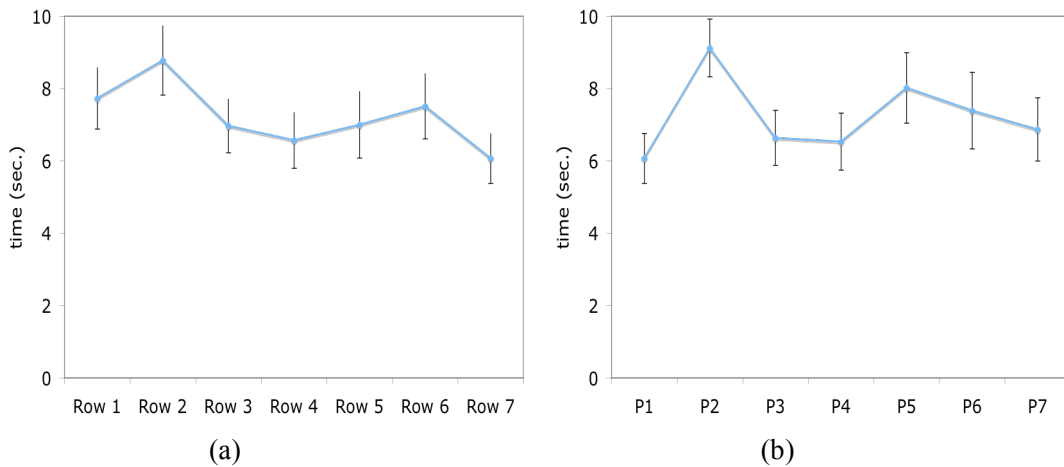Figure 17. Experiment 2b - Time: (a) Position. (b) Distribution.

(a)   (b)

Table 4. Experiment 2b – Time: Restaurants by Position

	M	SE	Pair-wise Comparisons
Row 1	7.73	0.85	p<.05: Row 4; p<.01: Row 7
Row 2	8.78	0.96	p<.05: Row 5,6; p<.001: Row 3,4,7
Row 3	6.97	0.75	p<.001: Row 2
Row 4	6.57	0.78	p<.001: Row 2
Row 5	7.00	0.93	p<.05: Row 2
Row 6	7.51	0.90	p<.05: Row 2; p<.001: Row 7
Row 7	6.07	0.69	p<.01: Row 1; p<.001: Row 2,6

Table 5. Experiment 2b – Time: Restaurants by Distribution

	M	SE	Pair-wise Comparisons
P 1	6.07	0.69	p<.01: P5; p<.01: P2
P 2	9.12	0.80	p<.05: P4; p<..01: P7; p<.001: P1,3
P 3	6.63	0.76	p<.05: P5; p<.001: P2
P 4	6.53	0.79	p<.05: P2; p<.01: P5
P 5	8.02	0.97	p<.05: P3,7; p<.01: P1,4
P 6	7.39	1.06	
P 7	6.87	0.87	p<.05: P5; p<.01: P2

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Time given Preference

Another issue that should be considered is the amount of time participants observed information for the restaurant they preferred versus the restaurants they did not prefer. A repeated measure ANOVA was conducted with two within-subjects factors: Trial (3 levels) and Preference (2 levels). No effect of Trial was expected nor found $(F(2,108)=2.29, p>.05)$. A significant effect was found for Preference $(F(1, 54)=9.95, p<.01)$. A pair-wise comparison showed that preferred restaurants were observed for a longer period of time $(p<.01)$; preferred restaurants $(M=9.02, SE=1.04)$ and non-preferred restaurants $(M=7.10, SE=0.76)$. See Figure 18a. A significant interaction between Trial and Preference $(F(2,108)=3.40, p<.05)$ was not expected. Figure 18b shows that although the same trend is observed for all restaurant types (longer period for preferred choices versus smaller period for non-preferred choices), the trial labeled "R Type 3" has a higher difference between preferred and non-preferred, $M=11.33$, $SE=1.52$ and $M=7.84$, $SE=1.18$ respectively. A positive correlation $(r_b=.20)$ was found between time and preference; this correlation was close to significance $(t(59)=1.51, p<.07)$.

Figure 18. Experiment 2b - Time for Preferred vs. Non-Preferred: (a) Overall. (b) By Condition.

(a)   (b)
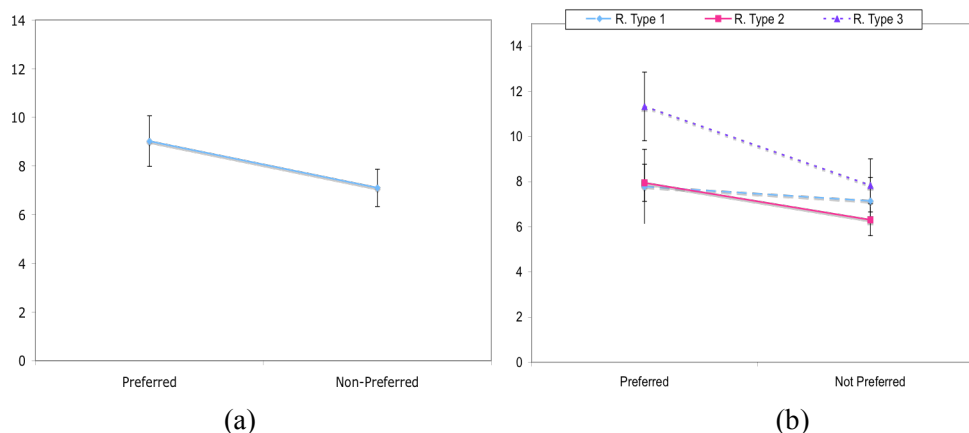
Discussion

A distribution effect was observed for preference, the rows that had no combinations of low ratings (2-stars) and higher counts of high ratings (5-stars) were selected more. These distributions were located in different positions in the comparison matrices, so that their effect would not interact with order effects. In fact, a recency effect was observed, the last two rows were preferred more.

Participants were able to recognize correctly the restaurants they preferred. The distribution that had the preferred combination of ratings was observed and revisited more than the rest of distributions. Primacy influenced time; the first two positions were observed for longer periods and were revisited more.

Chapter 5: General Discussion

Differentiating Information

The hypothesis was based on the assumption that the descriptive information for each product should not be differentiating. The attribute values should not allow for differentiation between the alternatives. If the stimuli presented could comply with this requirement; it was predicted that both primacy and recency effects would influence the decision.

Initially, numeric information was used to control that all options possessed an equal global utility as per MAUT. An alternative's value is calculated by summing the ratings assigned to it. If all alternatives have an equal sum, they all should have the same subjective value and there should be no preferences based on distribution of ratings. However, in the first experiment, a significant number of participants consistently selected the alternative that had a combination of higher numeric ratings. Participants perceive this specific distribution of ratings as the differentiating information that guides choice.

The second experiment supported this idea; different distribution combinations were presented. All alternatives possessed the same average value; however three alternatives (P1, P2, P7) had distinctive distributions. P1 and P2 did not have any 2-star ratings, and P7 had the highest number of 5-star ratings. Participants significantly preferred the P1, P2 and P7 distributions to the other distributions. Distribution effects influenced observation time; participants took a longer amount of time to observe the most preferred distribution, P2.

Weber et al.'s (1995) study between pair of gambles presented a similar effect regarding the gamble's payoff distribution. Each gamble had six different payoffs, depending on the role of a die (+2.5, +2.5, -5, -5, +2.5, +2.5). A primacy effect was found; this effect was enhanced for specific when payoffs occurred in a "run" (i.e. the first four or last four outcomes). This effect was magnified when the run presented mainly negative information in the first gamble. Future research could investigate what type of information decision makers consider more important when searching for differentiating information (i.e. low vs. high values, negative vs. positive values, etc.).

As per MAUT, there should be no differences between alternatives; they all have the same global utility. It appears that individuals, when presented with a choice between similar options, seek differences that will allow them to justify their choice. It should be noted that different strategies could elicit different predictions. Instead of being guided by the sum of ratings, one could use the mean and variance, or other measures of central tendency (i.e. mode or median). Other models can be developed using these parameters as predictors.

Kleinmutz and Schkade (1993) argued that the *form* (presentation mode) of the information influenced decision strategies. The results suggest that individuals find numerical information easier to differentiate than verbal information. Future research could investigate whether the presentation mode of the information influences differentiating information. Perhaps under specific cognitive processing conditions (divided attention or information overload), numerical information could not be used

as differentiating information. Additional forms of presentation could be evaluated, i.e. numerical, graphical, verbal, auditory, visual, etc.

Order Effects

Order effects, both primacy and recency, influenced choice when alternatives did not include differentiating information. The second experiment used verbal information to describe each alternative. All statements depicted options with the same average value. It was considered that this format would prevent participants from seeking distributions of preference. In this case, results showed a preference for items listed in the first and last position in the matrix. Order effects influenced observation time; participants took a longer amount of time to observe the first and last row. Participants increased observation time by revisiting information. These finding suggests that participants were drawn towards these two positions more than the middle positions. These results supported the hypothesis; participants were considering the information presented and not clicking the cells in the matrix aimlessly. Participants were able to correctly recall and recognize the alternatives they preferred. Again, these results were consistent with the predictions; participants were not selecting options randomly but rather paying attention to the decision task.

Miller and Krosnick (1998) argue that order effects, primacy and recency, are stronger when there is no descriptive information regarding the alternatives. This research suggests that these effects can still occur with the presence of descriptive information; on the condition that this information does not differentiate between alternatives.

The type of order effect that is observed, primacy or recency, has been linked to response mode; primacy for End-Of-Sequence (EOS) responses and recency for Step-By-Step (SBS) responses (Schwarz et al., 1991; Kerstholt & Jackson, 1998). The current research used an EOS response mode for both experiments; but it varied how information was presented. Experiment 1 used a simultaneous presentation and Experiment 2 used a serial presentation. Serial presentation could be argued to encourage a SBS response mode. A recommended follow-up study would be to investigate whether response mode may influence the appearance of order effects.

The significant positive correlation between recall and preference in Experiment 1 could be a measure of causality; people prefer to select the items they know more. In addition when the recall rate of non-preferred items was compared to the recall rate of preferred items, it was found to be significantly lower. However, this study does not make a strong assertion of causality since the recall rates for both preferred and non-preferred items were high.

Time and preference also showed positive correlations (Experiment 2a, $p<.05$; Experiment 2b, n.s.). This implies that people observe for longer periods of time the items they prefer; however a direction for causality will not be interpreted – it could be explained either way. Future research should investigate further this relationship.

The results of the current research carry interesting implications for a variety of areas; one of them is consumer decision making. Online retailers may use this study to market their products more effectively; consumer protection agencies can caution the public by communicating this type of research and by applying it when they provide product reports.

Conclusion

Primacy and recency effects are observed in decisions among alternatives that do not have differentiating information. Decision makers, however, need to base their decisions on differentiating information. If the alternatives in the set are of the same average value, individuals search for information that may assist them in discriminating options.

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