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# Imperfect Information in Pre-choice Screening of Options

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Three experiments examined decision makers' use of imperfect information in screening of decision options. It was found that: (1) when specific information about options was missing the absence was treated as a violation of the related decision criterion in the manner described by image theory (Beach, 1990; Beach & Mitchell, 1987)—rejection of options was a function of both the number of violations and the amount of missing information; (2) general paucity of information about options prompted rejection over and above the effects of violations, but paucity had about half the impact of violations or of missing information; (3) information about the probability that an option's outcomes actually will occur were it the final choice was integrated additively with other information in screening, as predicted by image theory, and was integrated multiplicatively with other information in choice, as predicted by expected utility theory. Together with the results of previous research, these results support the image theory view of decision making as a two-stage process, screening followed by choice, and demonstrate once again the pivotal role of screening in this process. 

The purpose of this research is to examine ways in which decision makers use imperfect information about options when screening them prior to choosing the best option from among the survivors of screening. We define information about an option as "imperfect" (1) when information about pertinent aspects of the option is missing, (2) when there is a general paucity of information about the option, and (3) when it is not clear what will happen were the option to end up being the one chosen. We will present three experiments that address each of these definitions.

Decisions that involve choosing from among multiple options frequently occur in two steps (Payne, 1976). The first step consists of *screening* out weak or unacceptable options, and the second step consists of *choosing* the best option from among the survivors of screening. Image

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theory (Beach, 1990; Beach & Mitchell, 1987) provides a descriptive model of this two-step process. It views the first step, screening, as a simple, noncompensatory process that focuses solely upon options' negative attributes. Options are considered individually, rather than being compared to one another, in terms of whether or not (0, −1) their attributes are compatible with criteria that are relevant to the decision.

Because the process only focuses on *in*compatibility, if an option's attributes are compatible with the relevant criteria, they each count as 0 and nothing happens. If one or more of the attributes violates a criterion, each violation counts as a −1 and the acceptability of the option decreases. Each violation is weighted by the importance of the violated criterion. Thus, the option's overall compatibility with a decision maker's criteria is the negative product-sum of the importance weights of the violated criteria, although unit weights often provide an adequate measure (Beach & Strom, 1989). A sum of zero indicates complete compatibility with the criteria and an increasingly negative sum indicates increasing incompatibility. At some point the sum is too negative, the option is too incompatible with the criteria for the decision maker to accept the option. This point is called the *rejection threshold,* and options that surpass it are rejected.

This process, called the *compatibility test,* can be summarized as:

$$C = \sum_{t=1}^{n} \sum_{c=1}^{m} W_c V_{tc}; \; V_{tc} = -1 \text{ or } 0, \tag{1}$$

where compatibility, $C$, is zero when a candidate has no violations and decreases (becomes more negative) as the number of violations increases; $t$ is a relevant attribute of the option; $c$ is a relevant standard; $V$ is a violation of a standard $c$ by attribute $t$ of the option; and $W$ is the importance weight for each of the relevant standards.

Research results support this view of screening and have made the difference between screening and choice fairly clear. First, the evidence suggests that screening is in fact based on a noncompensatory, additive combination of an option's weighted negative attributes, i.e., its violations (Beach, Smith, Lundell, & Mitchell, 1988; Beach & Strom, 1989). Second, the results show that information used in screening may be disregarded in subsequent choice if additional information is presented prior to choice (van Zee, Paluchowski, & Beach, 1992). Third, it is found that when the options that survive screening are no longer available when a choice is to be made, decision makers prefer to begin with a whole new set of options rather than rescreen the previously rejected options (Potter

& Beach, 1994). Fourth, results show that if subjects are forced to re-screen rejected options in order to derive a new choice set, they modify both their rejection thresholds and the criterion weights, in an effort to discount the incompatibility of the options to arrive at a new choice set (Potter & Beach, 1994). The present research seeks to expand this body of research by examining how decision makers deal with imperfect information during screening.

Experiment 1 examines how decision makers react to missing information. Subjects were given descriptions of options containing information about eight attributes; for some options, information about some of the attributes was pointedly omitted. The question is whether the fact that some of the information is missing is simply ignored or whether each piece of missing information is treated as a violation.

Experiment 2 examines how decision makers react to different overall amounts of information. This is very like the question about missing information, but the emphasis is slightly different. Here subjects are not led to expect information about a constant number of attributes for each option. Instead, for different options, information is provided on from 4 to 10 attributes, some of which are violations and some of which are not. The question is whether subjects are more inclined to reject options for which little information is provided and how this inclination interacts with observed violations in influencing actual rejection.

Experiment 3 contrasts the use of information about the probability that choice of an option actually will eventuate in desired outcomes in screening and in choice. In the most commonly prescribed model of choice, the Expected Utility model, the utility of the potential outcomes is discounted by *multiplying* it by the probability. In screening, image theory predicts that probability will be treated just like any other attribute of the option. That is, if the probability is sufficiently high, it will be regarded as a nonviolation of "obtainable outcomes" criterion for option acceptability, and, therefore, will not contribute to screening (Eq. (1)). In contrast, if the probability is so low as to be regarded as a violation of the criterion, it will contribute to incompatibility in an *additive* manner (Eq. (1)). In Experiment 3, subjects in a choice condition and subjects in a screening condition were given information about options' attributes and about their probabilities of occurring. The data from each condition were examined for multiplicative or additive combination of this probability information with the other information about the options.

## EXPERIMENT 1

### *Subjects*

Fifty-five business students participated for extra course credit.

*Procedure*

Following van Zee, Paluchowski, and Beach (1992) and Potter and Beach (1994), subjects were asked to assume that they had been asked for help by a friend who was coming to enroll in the University. The task was to look in the newspaper and, from among the rooms that were within the friend's price range, to compile a list of suitable rooms for rent so that the friend could visit them and choose one during a one-day visit on the following weekend.

After the subjects were given the instructions, they were asked to rate, on an 8-point scale, the importance of each of eight attributes in determining the acceptability of a rental room. This procedure served to call to subjects' attention to the fact that there were eight relevant attributes as well as to elicit the subjects' weights for computations of incompatibility (Eq. 1). As it turned out, the subjects' weights provided no greater predictive power than unit weights, so no more will be said here about the subjective weights.

Finally each subject proceeded through a randomly ordered booklet, each page of which described one of twelve rooms on each of eight attributes (noisy/quiet, good/poor repair, high/low utility bills, large/small, close/far from University, adequate/inadequate parking, close/far from shopping, close/far from recreation). However, for some attributes the information was missing. In its place there merely was a parentheses with the name of the attribute and a question mark, e.g., (quiet?). The subjects read each description and checked a blank if they did not think it would be worth their friend's time to inspect the room. In the language of image theory, the subjects screened the 12 rooms and rejected the ones they judged to be too incompatible to warrant inclusion in the choice set.

*Results*

The 12 options were created by crossing the amount of missing information (0 of the 8 attributes missing, 2 of the 8 attributes missing, and 4 of the 8 attributes missing) with the number of violations (0, 1, 2, 3) that were present in the non-missing information. This can be seen in Table 1, where the proportion of subjects rejecting each option is written in each cell. The results of the experiment are given by the pattern of the proportions in the cells.

First, if rejections were solely determined by observed violations and missing information was ignored or treated as nonviolations,

(1) all three proportions in each column would be the same, and

(2) the proportions in each row would be different and would increase from the left of the table to the right.

Clearly, (1) the proportions in each column are not the same but (2) the

TABLE 1

PROPORTION OF SUBJECTS REJECTING EACH OPTION FOR EACH COMBINATION OF THE NUMBER OF ATTRIBUTES FOR WHICH INFORMATION IS MISSING AND THE NUMBER OF VIOLATIONS PRESENT IN THE INFORMATION WHICH IS NOT MISSING

| | # Violations | | | |
|---|---|---|---|---|
| # Missing | 0 | 1 | 2 | 3 |
| 0 | .00 | .03 | .49<br>6 | .65<br>5 |
| 2 | .16<br>6 | .66<br>5 | .55<br>4 | .99<br>3 |
| 4 | .70<br>4 | .72<br>3 | .99 | .99 |

*Note.* The numbers in the lower left of the cells on the diagonals are the difference between the number of nonviolations and violations for each option.

proportion of rejections increases as the number of violations increases from 0 to 3.

Second, if rejections were solely determined by missing information and not by violations,

(1) all four proportions in each row would be the same, and

(2) the proportions in the columns would be different, decreasing from the top to the bottom of the table.

Here too, (1) the proportions in each row are not the same but (2) the proportion of rejections increases as the amount of missing information increases from 0 to 4 pieces.

Third, it is possible that image theory is completely wrong and subjects merely subtracted the number of violations in the non-missing information from the number of nonviolations. If this was what occurred,

(1) the proportions would be equal for pairs of similar differences on the diagonals from lower left of the table to the upper right (the differences are written in the lower left of each cell in the table in order to identify the pairs that define the diagonals), and

(2) the proportions on each diagonal would be equal but would decrease from one diagonal to the next from the top left of the table to the lower right.

Neither of these patterns is observed. Therefore, this alternative hypotheses can be ruled out.

Clearly, rejections are influenced by both increasing numbers of violations and by increasing numbers of missing data. This implies that missing information about an attribute is being treated as though it were a violation. Indeed, the sum of the violations and the number of attributes for which information is missing is highly correlated with the proportion of rejections ($r = .92$, $df = 10$, $p < .001$).

## EXPERIMENT 2

The purpose of this experiment was to observe the effects of paucity of information on screening. In addition, violations and nonviolations were completely correlated in Experiment 1. (This was because the sum of the violations and the nonviolations was equal to eight minus the number of missing attributes for every option.) Thus, even though the results were presented in terms of violations, it was not possible to rule out the possibility that screening was driven by nonviolations, even though past research suggests that the latter is not the case. In the present experiment, the correlation between violations and nonviolations was reduced to permit determination of which of the two drove screening.

*Subjects*

Fifty-four business students participated for extra course credit; these were not the same subjects as in Experiment 1.

*Procedure*

The instructions and materials were similar to those used in Experiment 1. This time, however, subjects did not begin by rating the importance of the attributes because we did not want to suggest that the rooms could be defined by a specific number of attributes. Furthermore, to reduce expectations about how much information about each option "should" be presented, there were only 8 options to be screened. These 8 options had attributes varying in number from 4 to 10, which varied the amount of information provided.

The options were generated by crossing violations (0, 1, 2, 3) with nonviolations (7, 6, 5, 4). Of the 16 possible options, 8 were selected to produce a low Pearson correlation between the violations and nonviolations across options ($r = -.20$, $df = 6$, n.s.). This selection was done so that there were two different numbers of violations for a given number of nonviolations and two numbers of nonviolations for each number of violations (listing nonviolations first and violations second, the 8 options were 7/1, 7/3, 6/0, 6/2/ 5/1, 5/3, 4/0, 4/2, for total numbers of attributes of 8, 10, 6, 8, 6, 8, 4, and 6 respectively).

Subjects were given the cover story about compiling a list of potential rooms for the friend and then read the 8 descriptions of rooms and checked a box under the description if they rejected the room.

*Results*

The results are reported in Table 2.

First, if rejections had been determined solely by observed violations, (1) the proportions in each column of Table 2 would be the same, and

(2) the proportions in each row would increase from left to right.

As in Experiment 1, (1) the proportions in each column are not the same but (2) the proportions in each row increase from left to right. The Pearson correlation between number of violations and proportion of subjects rejecting the option is $r = .64$ ($df = 6$, $p = .05$). The correlation between the number of nonviolations and the proportion of subjects rejecting the option is $r = -.41$ ($df = 6$, n.s.). The semi-partial correlations, which partial out the correlation of $-.20$ between violations and nonviolations, are .57 and $-.29$, respectively.

If rejections were determined solely by the difference between the number of nonviolations and the number of violations in the information provided about an option, the same proportion of subjects should reject options having the same difference. In fact, this was not observed: for a difference of 2, the proportions were .77 and .87; for a difference of 4, the proportions were .22, .46, .66, and .85; for a difference of 6, the proportions were .07 and .09.

Second, if rejections had been determined solely by the number of attributes about which information was provided,

(1) the proportions in each row of Table 2 would be the same, and

(2) the proportions in the columns would decrease from the top to the bottom of the table.

As can be seen in the table, (1) the proportions in each row are not the same but (2) the proportions in the columns decrease from the top of the table to the bottom. The Pearson correlation between the number of attributes about which information is provided and the proportion of subjects rejecting the option is $r = -.15$ ($df = 6$, n.s.).

Third, if rejections are influenced by the paucity of information about the options,

(1) the proportions for similar amounts of information (similar numbers of attributes) would be the same, and

(2) the proportions should become smaller from the top of the table to the bottom.

TABLE 2

PROPORTION OF SUBJECTS REJECTING EACH OPTION FOR EIGHT COMBINATIONS OF NUMBER OF ATTRRIBUTES PRESENTED AND NUMBER OF VIOLATIONS

| | Violations | | | |
|---|---|---|---|---|
| Attributes | 0 | 1 | 2 | 3 |
| 10 | | | | .85 |
| 8 | | .09 | .22 | .77 |
| 6 | .07 | .66 | .87 | |
| 4 | .46 | | | |

Clearly, (1) all proportions for similar amounts of information are not the same but (2) the proportions generally decrease from the top to the bottom of the table. For both 8 and 6 attributes there is an increase in the proportions as the number of violations increases, suggesting that both the amount of information and the number of violations influence the rejection rate. Using the number of attributes and the number of violations to predict proportion of rejections produces $R = .84$ ($F(2,5) = 6.26$, $p < .05$). Number of attributes had a $\beta$ weight of $-.87$ and number of violations had a $\beta$ weight of 1.32. This means that the less information available about an option and the greater the number of violations in that information, the greater the proportion of subjects who rejected the option. Moreover amount of information had roughly half the impact of number of violations on the rejection decision. In short, just as subjects in Experiment 1 treated missing information as violations, subjects in this experiment treated various degrees of paucity of information as violations, but paucity counts less than missing information and less than actual violations.

## EXPERIMENT 3

This experiment contrasts the use of imperfect information about outcomes in screening and in choice. The model for screening is described by Eq. 1, but before proceeding with the description of the study, it is important to clarify the model that will be used to examine choice.

### *Choice*

Image theory's view of the choice step in decision making differs from its view of screening (Eq. 1) in two key ways. First, choice may be either compensatory or noncompensatory, in contrast to screening which is exclusively noncompensatory. Second, while screening is accomplished using the single process (strategy) described by Eq. (1), choice can be accomplished using any of a variety of strategies, depending upon the circumstances (Beach & Mitchell, 1978; Beach & Mitchell, 1987; Payne, 1976; Payne, Bettman, & Johnson, 1993), some of which are compensatory and some of which are noncompensatory.

Maximization of expected utility (EU) is one of the choice strategies available to decision makers. This strategy is appropriate when the decision maker knows both the utility (value to him or her) of the outcomes that can result from choosing an option as well as the probability that those outcomes actually will result if the option is the one that is chosen. In this case, the overall utility is the (compensatory) sum of the positive utilities of favorable attributes and the negative utilities of unfavorable attributes multiplied by the probabilities of the outcomes occurring at all.

In the present paradigm, the utility of an options' attributes is defined by whether they satisfy the decision criteria. Therefore, *EU* becomes:

$$EU = \left[ \sum_{t=1}^{n} \sum_{c=1}^{m} (W_c N_{tc} + W_c V_{tc}) \right] P_a, \tag{2}$$

where $V_{tc}$ is a violation of criterion $c$ by attribute $t$ and is equal to $-1$, $N_{tc}$ is a nonviolation and is equal to $+1$, $W_c$ is the importance weight for criterion $c$, and $P_a$ is the probability that the attributes of the option (its outcomes) will accrue to the decision maker should he or she choose the option in question.

Equation (2) is a special case of *EU* because it reduces the utilities to (weighted) $-1$ and $+1$, but, as will become apparent, this is appropriate for the present research.

The crucial point is that image theory holds that information is used additively and noncompensatorially in screening and that only violations have an impact. It holds that choice can be made in any of a variety of ways, and *EU* maximization is one of those ways. If decision makers use the *EU* strategy for choice, they must *multiplicatively* combine probability information and the other information about the options (Eq. (2)). In contrast, image theory predicts that in screening the probability information will be *additively* combined with the other information (Eq. (1)). Moreover, a high probability should count as a nonviolation and not have an impact upon the screening of the options, whereas a low probability should count as a violation and, therefore, should contribute to rejection of the options.

### *Design*

Experiment 3 had two conditions, choice and screening. In the choice condition subjects were given a small set of options and asked to *choose* the best option in light of information about the attributes and about the probability that those attributes would materialize if the option were chosen. The choice condition actually is a control condition because pilot studies were run in order to find the circumstances and materials that encouraged subjects to use the information about options' attributes and probabilities in a manner consonant with the EU maximization model—i.e., in a multiplicative manner.

The screening condition is the experimental condition. Subjects were given both the options used in the first condition, together with additional options, and were asked to *screen* out the unacceptable options. Again the information presented was about attributes and probabilities and the prediction was that the probability information would be integrated additively with the attribute information.

The task used in this experiment differed slightly from the one used in Experiments 1 and 2. Here the subjects chose or screened condominiums in which they could buy a time-share, rather than compiling a list of rooms for a friend. The condo scenario permitted manipulation of probabilities by explaining that once the condo is purchased the subject's access to it when he or she wants it depends upon the probability that one of the other time-share owners is using it (the more share-holders, the lower the probability).

*Data Analysis*

In both conditions, subjects were first required to rate the various attributes in terms of their importance to the time-share purchase decision. Then, in the screening condition, subjects read each option description, rated their willingness to purchase a time-share in each condo, and indicated whether or not they wanted to retain (or reject) the condo for further consideration. In the choice condition, subjects reviewed all condos before rating each in terms of their willingness to purchase it, and then indicated their first, second, and third choices. Pretest results indicated that a probability of availability of .25 was unacceptable to most subjects (and thus is a violation). Therefore, in the option descriptions, .25 availability indicated low (violating) probability and .75 availability indicated high (nonviolating) probability.

The rating data from the willingness to buy scale were analyzed using an analysis of variance with a within-subjects, factorial design. The first, second, and third choice data are not amenable to ANOVA. Ordinarily, log linear regression would be appropriate, but this is prevented by the high correlation between the additive and multiplicative predictive models (Eqs. (1) and (2)) in both conditions of the experiment. As a somewhat compromised alternative, a semi-partial correlational analysis was performed on these ranking data. The alternative analysis is compromised because the dependent variable is ordinal, but to the degree that it yields results that are congruent with the ANOVA results on the ratings, we can be reasonably confident about the results in each condition.

The semi-partial correlation analysis combined the violation, nonviolation, and availability information as prescribed by the models in Eqs. (1) and (2) using each individual subject's weights (solicited at the beginning of the experiment). The additive model counts low availability as a violation and adds its weight to the summed weights of the other violations, increasing the (negative) sum for the option in question. If availability is high, it does not contribute to the sum. The multiplicative model sums the (positive) weights of the nonviolations and the (negative) weights of the violations, but treats probability separately, multiplying the sum by the probability (either .25 or .75).

The semi-partial correlation analysis yields the correlation with the rankings that is unique to each model after the correlation between the two models is partialed out (Nunnally, 1967). The high correlation between the models in the present experiment means that once their common variance is extracted, not much is left that is unique to each to account for the variance in the rankings; as a result the semi-partial coefficients of necessity are rather low. However, the size of the coefficients is less important than the story they tell. And, as shall be seen, the story is consistent for both the ANOVA results for the ratings and the semi-partial correlation results for the choice rankings.

## CHOICE CONDITION

The purpose of the choice condition was to demonstrate that the multiplicative model (*EU* theory) can account for subjects' behavior in a choice task.

### *Method*

The condition was a 2 × 2 within-subjects factorial design in which the utility of an option's attributes (none of six attributes was negative versus one of the six attributes was negative, 0 and 1) was crossed with two levels of probability that the option would be available (.25, .75), resulting in four options (see example below). The dependent variables were (1) the subject's rating on an 8-point scale of willingness to buy a time-share in each condo, and (2) the subject's first, second, and third choice.

*Subjects.* Twenty-three University of Arizona business undergraduates participated voluntarily for extra class credit.

*Task.* The scenario presented to the subjects asked them to consider the task of buying a time-share in one of four Hawaiian vacation condominiums. Subjects first rated the importance of the six attributes that each condo description would contain, from 1 (very unimportant) to 8 (very important). They then read the descriptions of the four condos and rated their willingness to purchase a time-share in each condo, from 1 (very unwilling) to 10 (very willing). Subjects then indicated which of the four condos was their first, which was their second, and which was their third choice. To determine whether or not these last two tasks influenced each other, one-half of the subjects did these tasks in the above order, and the order was reversed for the other half. Because order had no statistically significant effects, it will not be discussed further.

### *Materials*

Each subject received a 6-page packet of typewritten text. Page 1 gave a brief introduction to the scenario followed by instructions to rate the importance of six attributes, i.e., to assign weights to the decision criteria using the scale provided. The attributes were condition of the condo, size, distance to shopping and entertainment, presence of modern appliances, distance to the beach, and probability of availability. After this they proceeded to read the descriptions of the condos on the following pages.

Pages 2–5 of the packet contained the descriptions of the condos. Each description consisted of positive or negative statements about each of five of the six attributes; a negative statement representing a violation of that decision criterion. A sixth statement indicated the probability of the condo's availability. Based upon the results of pilot studies, high and low expected availability was .75 and .25.

As an example, an option with one negative utility, four positive utilities, and a low probability of availability might read:

This condo:

* is in good condition
* is small
* is close to shopping and entertainment
* has modern appliances
* is close to the beach
* you would have a 25% chance of getting to use the condo when you wanted it.

*Results*

A 2 × 2 (0 or 1 negative attributes by high or low availability) analysis of variance with rated willingness to buy as the dependent variable yielded significant main effects both for number of negative attributes, $F(1,70) = 11.981$, $p < .001$, and probability that the condo would be available when it was wanted, $F(1,70) = 48.546$, $p < .001$. There was a significant interaction, $F(1,70) = 7.090$, $p < .01$, indicating that the probability was combined multiplicatively with the information about violations. The interaction is illustrated in Fig. 1.

Across subjects, the mean correlation between the models was −.96. The semi-partial correlation analysis of the choice ranking data was done for each subject individually, yielding mean coefficients of .24 for the multiplicative model (Eq. (2)) and .08 for the additive model (Eq. (1)). The multiplicative model had a greater semi-partial correlation with choice ranking than did the additive model for 74% of the individual subjects. These results are congruent with the ANOVA result on ratings of willingness to buy. In short, the data indicate that the probability information was integrated multiplicatively, rather than additively, with the information about violations and nonviolations, an information integration strategy that is compatible with the EU model (Eq. (2)).

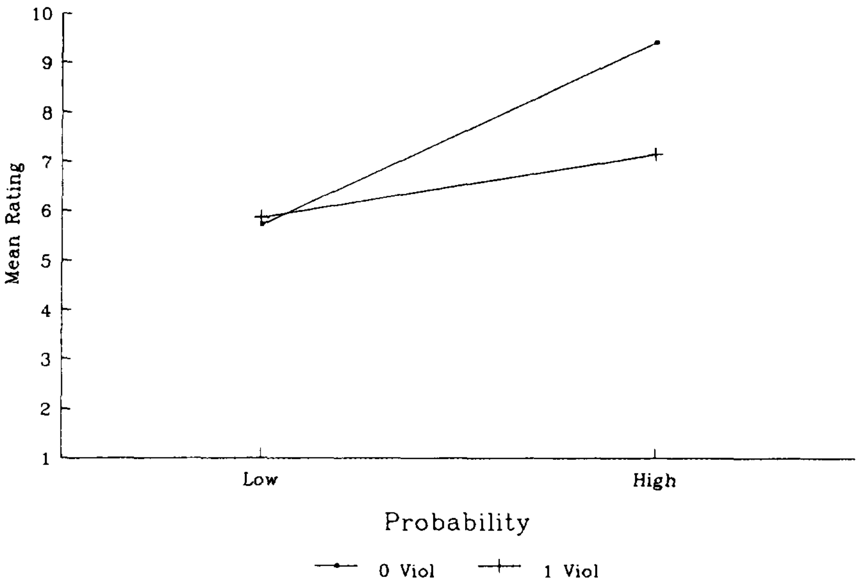


FIG. 1. Mean rated willingness to buy at low (.25) and high (.75) probability of availability for options having 0 violations and 1 violation for the choice condition of Experiment 3.

## SCREENING CONDITION

The purpose of the screening condition was to see whether, given the same kinds of stimuli for which the multiplicative model best accounted for choice data, the additive model (image theory) best accounts for screening data.

### *Method*

This condition was a 5 × 2 within-subjects factorial design in which the number of criteria an option violates (0 through 4) was crossed with two levels of probability of option availability (.25, .75). The dependent variables were (1) ratings of willingness to purchase, and (2), for each subject, the options that survived screening.

*Subjects.* Thirty-six University of Arizona business undergraduates participated voluntarily for extra class credit.

*Procedure.* Using the condominium time-share scenario described above, subjects first rated the importance of the six decision criteria (i.e., condo attributes) and then screened the 10 options by indicating whether each option was or was not acceptable for further consideration. Subjects also rated on an 8-point scale their willingness to purchase a time-share in each condo.

*Results*

A 5 × 2 analysis of variance with rated willingness to buy as the dependent variable yielded significant main effects both for number of violations, $F(4,359) = 83.782$, $p < .000$, and for probability of availability, $F(1,359) = 93.117$, $p < .000$. The interaction was *not* significant, $F(4,359) = 2.269$, $p = .061$, implying that low probability was treated as a violation and simply added to the sum of the other violations. The data are graphed in Fig. 2.

Across subjects, the mean correlation between the models was −.87. The semi-partial correlation analysis of the individual subjects' data was done on predicted (Eq. (1)) versus observed survival of screening by the 10 options. For Eq. (1) (additive, image theory) the mean semi-partial correlation was .17. For Eq. (2) (multiplicative, *EU*) the mean semi-partial correlation was .02. The additive model had a greater semi-partial correlation with option survival than did the multiplicative model for 69% of the individual subjects.

Together with the ANOVA results for the willingness to buy ratings, these results on choice ranking imply that probability information, which was used multiplicatively in choice was used additively in screening.

## DISCUSSION

These three experiments add to the growing empirical support for im-

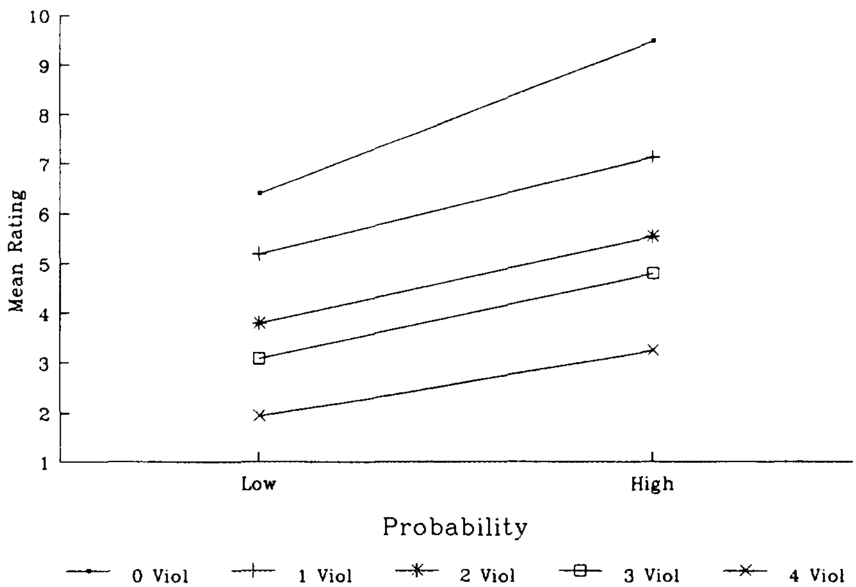


FIG. 2. Mean rated willingness to buy at low (.25) and high (.75) probability of availability for options having 0, 1, 2, 3, and 4 violations for the screening condition of Experiment 3.

age theory's contention that decision making consists of two very different steps, screening and choice, and, indeed, that screening actually may be the more important of the two. That is, screening serves to eliminate unacceptable options and choice selects the best from among the survivors of screening, the choice set. Screening may result in zero, one, or more than one survivor. If there are no survivors the decision maker must search for new options or rescreen the old options, which is resisted (Potter & Beach, 1994). If there is but one survivor, it becomes the decided upon option and choice does not occur. If there is more than one survivor, choice serves to break the tie. It would appear, therefore, that in some sense choice is of less importance than screening because screening can veto any or all options and, if only one option survives, screening actually makes the final decision. Choice, on the other hand, must always select the best of whatever it finds in the choice set, no matter what the quality.

Previous empirical work stemming from image theory has focussed upon the primary role of violations in screening (e.g., Beach & Strom, 1989), failure on the part of subjects to carry forward information used in screening for use in subsequent choice, thus emphasizing the distinct two-step nature of decision making (van Zee, Paluchowski, & Beach, 1992), subjects' unwillingness to rescreen when survivors become unavailable for choice (Potter & Beach, 1994), and subjects' compromise between altering their criterion weights and lowering their rejection thresholds when they are forced to rescreen rejected options in order to form a choice set (Potter & Beach, 1994). The present research extends this work by examining the use of imperfect information in screening.

Experiment 1 found that subjects treat missing information about options' attributes as though each missing attribute were a violation. Violations caused by missing information were regarded as important as actual violations in decisions about whether to reject options (the $\beta$ weights were equal).

Experiment 2 found that subjects are more inclined to reject options about which they know less than they are to reject options about which they know more; paucity of information encourages rejection. Over and above this, violations were again found to drive rejection and nonviolations were found to play little role, if any. Paucity of information is weighed about half as heavily as number of violations in decisions about rejection (the $\beta$ weight for amount of information is roughly half the size of the $\beta$ weight for number of violations).

Experiment 3 demonstrated that probability information that is used multiplicatively in choice is used additively in screening. In screening, moreover, probability information was treated just like other information about options; low probability was treated as a violation of a criterion about availability of the option and summed with other violations in evaluating the incompatibility of the option with the decision makers' criteria. These results show that the same kind of information (probability) may be used differently in screening and choice, which underscores the image theory contention that screening and choice are distinctly different processes.

A major implication of this line of research on screening, including the results of these three experiments, is that screening is not merely preliminary to choice. Image theory's contribution is not subsidiary to the recognition that screening exists in decision making; others have done this too (e.g., Payne, Bettman, and Johnson, 1993). Rather, its contribution is recognition of the primary importance of screening in decision making and the attempt to model the screening process.

The results of Payne's (1976) pioneering study of screening are broadly assumed to show that screening serves merely to reduce the number of options in the choice set in an attempt to reduce the cognitive effort needed to make the final choice. In contrast, image theory does not view screening as merely preliminary to the main event, choice. Rather, screening is viewed as the main event, and choice merely serves to break ties when more than one event survives screening. This may seem like too nice a distinction, but it is important because it prescribes how research effort and resources ought to be deployed. Almost all of the mainstream decision research is on choice, and almost none is on screening. The present research is an attempt to rectify this distribution error by adding to the small but growing body of research on the nature and role of screening in decision making.

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