Market Boundaries and Product Choice: Illustrating Attraction and Substitution Effects

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What happens to the share of choices each item receives when the choice set boundaries are extended by adding a new item that is extremely good on one dimension but poor on the others? First, there is a substitution effect whereby the new item takes choice share mainly from similar items in the set. Second, there is an attraction effect resulting in a general shift of preference toward the added item. Experimental studies show that choice patterns conflict with current theoretical and common-sense ideas about the effect of added alternatives on choice.

Choice researchers have long wished to account for the effect that adding a new alternative has on choice. While this problem has many facets, a particularly perplexing issue has been understanding what happens when the new alternative extends the boundaries of the existing choice set by being superior on some aspects but not on others. For example, consider a new automobile that is superior on mileage but worse on acceleration than its predecessor, or a detergent that is better at whitening but less effective at removing dirt. The central research question is the degree to which the positioning of the new alternative differentially affects choices in the core set.

THEORETICAL FRAMEWORK

Choice researchers have commonly used two general approaches to account for the way proximity of a new item affects choice. These approaches differ primarily in the way item similarity, as derived from the dimensional structure of the alternatives, is assumed to affect the choice process. The first proposition (proportionality) assumes that the new item takes share from existing items in proportion to their original shares (i.e., no similarity effect). The second proposition (substitutability) assumes that the new item takes share disproportionately from more similar items—i.e., the closer the added item is to existing items in the set, the more it "hurts" them (a negative similarity effect).

We offer a third proposition (attraction), which holds that a new item may increase the desirability of similar items (a positive similarity effect). These propositions are not mutually exclusive as descriptive explanations of the choice process. Rather, all three are necessary to account for patterns of choice across different choice sets.

Proportionality: No Similarity Effect

Models within the proportionality framework reject any similarity effect by assuming that a new item will take share from each of the existing items in proportion to their original shares. The basic model was elegantly developed by Luce (1959) and, due to its simplicity and mathematical tractability, has become the basis for a large number of marketing applications (Batsell and Lodish 1981; Gensch and Recker 1979; Green and Srinivasan 1978; Pessemier et al. 1971; Punj and Staelin 1978).

As a model of aggregate choice, the proportionality-based model seems to do a good job of accounting for empirical choice probabilities across different sets of alternatives (Bock and Jones 1968; Luce 1977). Considerable statistical support has been provided through chi-square goodness-of-fit tests. Typically, these tests of the deviation of the actual choices from predicted choice probabilities have been nonsignificant, or significant only with very large sample sizes. Furthermore, the model may be derived from either a fixed or a random utility framework (McFadden 1980) and thus has the advantage of accommodating either of two diverse theoretical bases. Yet even those who use

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the Luce model for its theoretical elegance and mathematical tractability admit that it does not account for the idea that greater substitution occurs for items similar to the added item than for those dissimilar to it (Green and Srinivasan 1978).

Substitutability: A Negative Similarity Effect

The idea that items take share primarily from those most similar has been dubbed the "similarity hypothesis" by Tversky (1972); this hypothesis reflects one of the more commonly accepted context effects, whereby the composition of items in a set affects judgments about individual members (Payne 1982). Tversky modeled the similarity effect in his elimination by aspects model. In that representation, choice is seen as the result of a hierarchical selection process in which aspects of items define the probabilities of particular branchings. Similar items that share aspects can be intuitively seen as dividing the loyalty of a potential user. This negative effect of similarity results from the idea that a new item takes share away from the items most proximate to it in the original choice set. In spite of many theoretically appealing properties, elimination by aspects has too many parameters to be of practical use for prediction. Consequently, researchers have turned to other representations to model the similarity effect.

Many stochastic models accounting for this effect are possible and have been reviewed elsewhere (Currim 1982). Briefly, there are (1) hierarchical models that represent choice by a fixed succession of decisions (McFadden 1980); (2) generalized PROBIT models that represent similarity between items as a positive covariance among alternatives in a random utility framework (Daganzo 1979); and (3) direct spatial adjustment to logit type models that generate choice probabilities (Batsell 1980; Huber and Sewall 1982; Urban 1975).

The success of these models that deviate from proportionality can best be described as equivocal. In one of the first studies that adjusted choice probabilities to account for similarity, Urban (1975) modified the PERCEPTOR model so that the effect of a new brand would take disproportionately more share from similar than from dissimilar brands. One might well intuit that those brands far from the new offering would be cannibalized least, and those closest would suffer most. Unfortunately, in the example given (Urban 1975, p. 869), the distance-adjusted model did not do as well in predicting ultimate market share as did the proportionality model. Part of the problem may have been that the factor spaces used to estimate distances lacked "obvious clusters of brands that could represent distinct competitive sets" (Urban, Johnson, and Brudnick 1979, p. 14).

Other researchers have made successful similarity adjustments to the proportionality model but have been less successful at relating those adjustments to known or perceived attribute levels. Both Currim (1982) and Batsell (1980) report strong increases in predictive accuracy with unconstrained similarity adjustments, but adjustments derived from perceived or actual attributes have been far less successful. In Currim's study, the adjustment that performed least well used similarity between items derived from their covariances with respect to attribute ratings, while the models that did best estimated covariance structures independently of perceptions. In a similar study of transit mode choice, Train (1976) reported very small improvements in fit using various hierarchical choice models. Modeling at the level of the individual subject, Batsell (1980) found good improvement in adjusted fit with unconstrained substitutability terms for each pair of items in the choice set. However, an attempt to derive these pairwise substitutability terms from physical attribute differences resulted in a very modest (5 percent) improvement in adjusted fit (Batsell 1981). Finally, Huber and Sewall (1982) found that attribute differences could account for a relatively small proportion (5 percent) of the residual variation from a Luce model, and that spatial representations quite unrelated to perceptual judgments could account for a substantial proportion (25 percent) of the residual variability.

These studies suggest a limit on our ability to use various forms of attribute information to account for differential substitutability among competing brands. Thus we propose one possible explanation for these difficulties and suggest an approach for reconciling them.

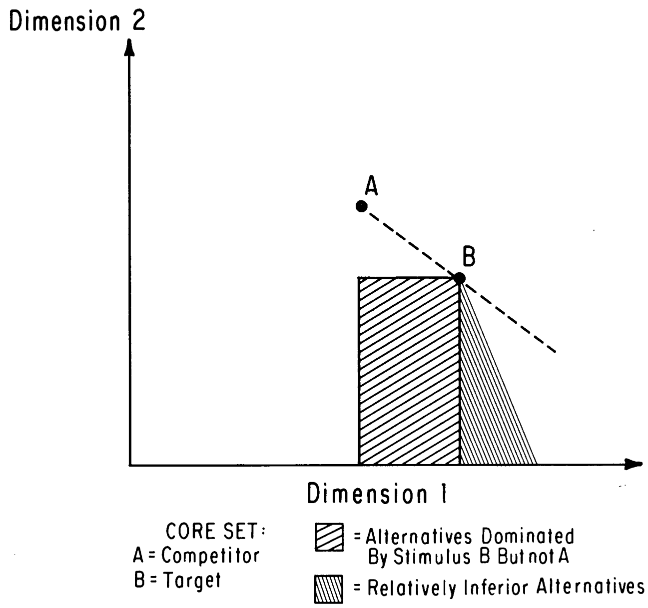
Attraction: A Positive Similarity Effect

"Attraction" is a gravitational metaphor that we use to describe the empirical finding that a new item can increase the favorable perceptions of similar items in the choice set. This effect was first demonstrated in a study by Huber, Payne, and Puto (1982) in which asymmetrically dominated alternatives were added to a choice set. As illustrated in Figure A, the core choice set included two options which were nondominating, i.e., one must give up some of one dimension to get a better level on another. The added item, called a decoy, was taken from the rectangular shaded region of Figure A. The decoy was dominated by one item in the set (the target) but not by the other (the competitor).

It was shown, both within individuals and across groups, that adding the decoy increases the probability of choosing the target. The result violates regularity (the idea that one cannot increase the probability of choosing an item by adding items to the set). This finding is important in itself, in that regularity is a minimum condition of most choice models (Luce 1977); what is more important is the possibility that the attraction effect may also occur in the nondominated case. Note that in the Huber et al. study, the decoy, being dominated, was chosen less than 2 percent of the time. Thus any substitution effect (which would tend to take share from the more proximate target) was negligible. Suppose, however, that an attraction effect occurs in conjunction with a substantial substitution effect, as might happen if the decoy was not a dominated but a viable alternative. In that case, the substitution effect would hurt similar alternatives and the attraction effect would help them, thus resulting in choice probabilities that, *by con-*

FIGURE A

POSITIONING OF ASYMMETRICALLY DOMINATED AND INFERIOR ALTERNATIVES



founding the two effects, may be well approximated by proportionality. Yet the Luce model would be correct not because of its universal applicability or the primacy of the axiom of independence of irrelevant alternatives, but because two conflicting forces (attraction and substitution) approximately cancel. Further, the general existence of an attraction effect would account for similarity adjustments to the Luce model producing only modest improvements in predictive results.

To explore this possibility and provide further support for the existence of the attraction effect, we present three studies in which the added alternatives are not dominated but are similar to those illustrated in the triangular segment of Figure A. While these decoys cannot be called "inferior" in an absolute sense without knowing a subject's individual utility function, they are "less desirable" in that they reflect a relatively worse tradeoff on the dimensions than that found in the core set. However, they are not so undesirable as to generate zero share. Further, the degree of relative inferiority is manipulated so that its effect can be isolated.

We examine these relatively inferior alternatives because their similarity relations are less equivocal. That is, for some of the dominated decoys in the Huber et al. study (1982), the relation between the decoy–target distance and the decoy–competitor distance depends on the weighting of the dimensions, whereas for relatively inferior alternatives, the decoy–target distance is less than or equal to the decoy–competitor distance on *all* dimensions. It follows that the decoy is closer to the target than to the competitor regardless of the dimensional weighting or the Minkowski metric used. This permits us to make more authoritative statements with respect to the effect of item similarity when an alternative is added to the set.

EXPERIMENTAL PROCEDURE

We conducted three studies testing the effects of boundary extensions. While the details of the studies are given later, when their results are described, their objectives can be briefly summarized. The first study permitted a test of the effect of adding alternatives to a two-item core set, both within and across subjects. The second study replicated the between-subjects aspects of the first study on different stimuli and a different subject population. The third study extended the results to cover four alternatives defined on three dimensions.

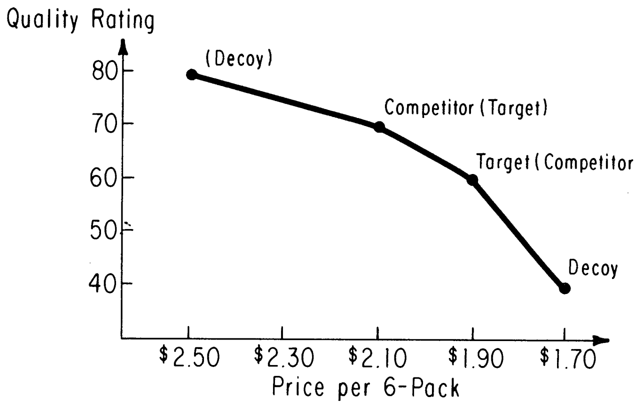
The three studies differed in terms of their specific content (product classes, alternatives, and dimensions), but the nature of the task remained constant. Stimuli booklets with a separate page for each choice problem were given to all subjects. Subjects were tested in groups, but the content of the problems differed across individuals. A choice problem for a given product class consisted of a brief situational description followed by the available choices, which were presented in an alternative (row) by attribute (column) matrix format. The Appendices show the framework of the three studies.

For each product class, subjects were asked to choose one alternative using only the information provided and to assume that all other (unmentioned) dimensions were identical across the choice set. The main differences across the three studies were the number of product classes (either 4 or 5), the number of alternatives in the choice set (either 3 or 4), and the number of dimensions given for each product class (either 2 or 3). With the exception of Study 1, which was a pretest–posttest design, subjects made only one choice from each product class.

Experimental manipulations added a decoy to different regions of the space defined by the core stimuli. Generally, there were at least as many product classes as there were positioning strategies, so that the effect of a strategy could be averaged across all product classes. This design can perhaps best be understood by examining one such manipulation in detail. Figure B is a graphic representation of the stimuli used to test the beer choice set in Study 2. All respondents were asked to choose from among a "core set" which included a higher-quality (70), higher-priced ($2.10) beer and a lower-quality (60), lower-priced ($1.90) beer, plus a third alternative which was the decoy. For one group the decoy was much higher on price ($2.50) and only slightly higher on quality (80), while for a second group it had a slightly lower price ($1.70) and much lower quality (40). Thus both the target and the competitor were defined by the location of the decoy—that is, the target was that member of the core set with a differential advantage surpassed by the decoy. By using a balanced design, this item was the low-priced brand for half of the subjects, while for the other half it was the high-priced brand. The overall

FIGURE B

GEOMETRIC ILLUSTRATION OF CHOICE SET EXPERIMENTAL CONDITIONS FOR MATCHED GROUPS[a] (BEER—STUDY 2)



[a]Stimulus set for the first group is in parentheses.

effect of the decoy was then roughly summarized by combining the target's share for these two groups.

We estimated the effect of the decoy in this way because it facilitates a comparison of proportionality, substitution, and attraction effects: (1) if the positioning of the decoy has no effect on the relative shares of the core set, then the appropriate model follows the proportionality assumption; (2) if a strong substitution effect is operant, the target should receive a lower share than the competitor; and (3) a strong attraction effect will result in larger shares for the target over the competitor.

Tests of the Different Models

To test the attraction effect, its directional distortion was compared within product classes to two null models—the Luce or proportionality model, and an extreme form of substitution model called a "fixed utility model." The tests were conducted within product classes, and because of small sample sizes, they had very little statistical power. To take maximum advantage of what little power there was, the Fisher exact test was used to test the null models within each product class. The probability values for these tests were then aggregated across classes by assigning a chi-square value that corresponds to the probability of the data given the null model ($\chi^2(2) = -2 \ln p$). Since the product classes reflected decisions on different items using very different dimensions, it was reasonable to assume that the resulting test statistics are independent. An aggregate test was then formed by using the additivity property of independent chi-square statistics. Complete p-values and associated chi-square statistics within each experimental group are given in the Appendices. The aggregate tests for each of the two null models (proportionality and fixed utility) differed and are discussed separately below.

TABLE 1

EXAMPLE OF WITHIN-PRODUCT TESTS OF PROPORTIONALITY AND FIXED UTILITY MODELS

Sample data: Calculator batteries (Study 2)

	Number choosing			
Dimensions	Left		Right	
	Decoy 1	Core 1	Core 2	Decoy 2
Expected life	14 hours	22 hours	28 hours	32 hours
Price	$1.50	$1.80	$2.10	$2.70
Group 1		2	10	3
Group 2	1	10	6	

I. Test of proportionality

Null hypothesis: Given that a person chooses within the core set, the proportion choosing Core 1 or Core 2 will not depend on the position of the decoy.

Alternative hypothesis: The item closest to the decoy will increase most.

Test: Directional Fisher exact test on core set

Test data

	Number choosing Core 1	Number choosing Core 2
Group 1	2	10
Group 2	10	6

Results: $p = 0.004$, corresponding $\chi^2(2) = 10.9$.

II. Test of fixed utility

Null hypothesis: The decoy only takes share from proximate competitor. Thus share of items on left should equal those on right regardless of the presence or absence of the decoy.

Alternative hypothesis: The side with the decoy will increase in share.

Test data

	Number choosing left	Number choosing right
Group 1	2	13 (= 10 + 3)
Group 2	11 (= 1 + 10)	6

Results: $p = 0.0006$, corresponding $\chi^2(2) = 15.0$.

The Test of Proportionality

Under the assumption of proportionality, the probability of choosing an item in the core set, *given that an item from the core is chosen,* is the same regardless of other items in the set. This restatement of the principle of independence of irrelevant alternatives (Luce 1959) permits an easy test of that model. Table 1 gives an example of the procedure used to test the probability that an attraction effect as large as—or larger than—that found in the data could have occurred in each product class. Data inconsistent with the null hypothesis result in a (numerically) high p-value and a correspondingly low chi-square statistic. The aggregate test then weighs the disconfirming cases against those that support the attraction effect.

The market shares used to describe the results across product categories were estimated within product classes, and then aggregated, because the aggregate of heterogeneous Luce choice processes will not generally exhibit proportionality (Luce 1959). Accordingly, the tests were performed within each product class and then aggregated for the general descriptive statistics.

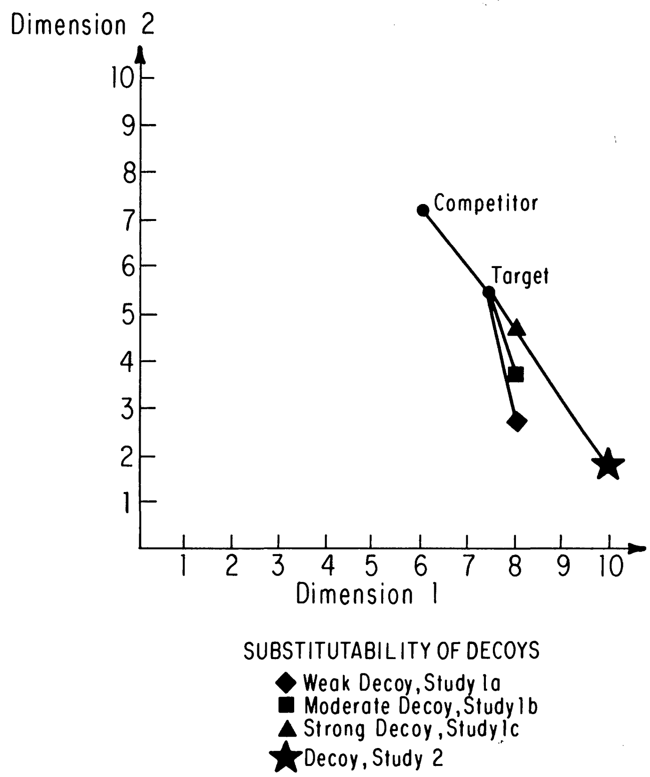
The Test of a Fixed Utility Model

The fixed utility model derives simply from the assumption that each individual has a fixed utility surface over the space that is not influenced by the actual options in the space. In other words, if one assumes that each individual can be represented as having nonconcave indifference curves in Figure B, it can easily be shown that the addition of a decoy can only take share from the more proximate target. This follows because the only people who are better off with the decoy are those who initially would have chosen the target. This process may be described as an individual deterministic utility maximization model, with heterogeneity of tastes across subjects. Because of its strong substitutability characteristics, this model is certainly a reasonable way to proceed; indeed, it forms the basis of Hauseman and Wise's (1978) probabilistic choice model. Further, it can be represented and tested by a hierarchical model which assumes that one first eliminates one side of the space and then chooses from among the items on the remaining side. Thus adding a decoy to one side or the other does not change the proportion choosing that side but only apportions share within that side. As shown in the bottom portion of Table 1, this assumption permits the pooling of the share of the decoy with that of the proximate member of the core set to test the null hypothesis of a strict utility model. The directional tests of the attraction effect are then aggregated using the chi-square statistic in the same manner as for the tests of proportionality.

As will be apparent shortly, the fixed utility model does very poorly with these data. However, there are two reasons why it is an important model. First, there are contexts in which it is likely to be an accurate model, as in choice between brands where the rank order of preferences is well-formed in customers' minds. Secondly, it is presented here as an extreme model of substitutability that would, by definition, have no attraction effect. As such, it represents a polar extreme of a model that is approximated in varying degrees by a number of models with strong substitutability effects. Thus, by comparing its predictions with the proportionality model, the implicit attraction component in the proportionality model becomes apparent.

FIGURE C

POSITIONING OF DECOYS REFLECTING DIFFERENTIAL SUBSTITUTABILITY RELATIVE TO THE TARGET



EMPIRICAL RESULTS

Three different studies were used to illustrate the existence of attraction and substitution effects within the context of relatively inferior additions to choice sets. The results are presented according to the nature of the choice sets: the first section discusses cross-subject results from choice sets defined on two dimensions; the second presents evidence for attraction and substitution effects on within-subject switching; and the final section generalizes these results to include choices among four items defined on three dimensions.

Choice Among Three Items, Two Dimensions

In two studies, respondents were asked to choose from among sets of three items within a product class defined on two dimensions. In Study 1, 120 undergraduate business students made choices within each of five product classes: beer, cars, restaurants, calculator batteries, and camera film. Study 2 was made at a different university and elicited choices from 32 undergraduate liberal arts students on beer, cars, restaurants and batteries. The first study varied the relative competitiveness of the decoy compared to the target, while the second study replicated this result for the strongest level of decoy competitiveness. Defining the sub-

TABLE 2

EVIDENCE OF AN ATTRACTION EFFECT MOVEMENT IN SHARE AWAY FROM COMPETITOR[a]

		Percent choice shares of:			Percent expected competitor share, given:	
Study	Number of choices	Decoy	Target	Competitor	Proportionality	Fixed utility
1a	126	7	60	33	43[b]	50[b]
1b	165	15	55	30	44[b]	50[b]
1c	126	15	51	33	51[c]	50[b]
2	128	24	46	30	38[c]	50[b]

[a]The data in this table were derived by taking those responses in the appropriate study from Appendices I and II. Thus there were 126 responses in Study 1a (i.e., the sum of all n's for 1a's = 126). The expected shares for the null models were estimated within each product class and then aggregated. It should be noted that these results will generally not be the same as those derived directly from aggregated data. For example, under aggregated data, the derived estimate for proportionality in Study 1a would be estimated as 46.5 percent, rather than the 43 percent shown. However, due to heterogeneity across product classes, such aggregate estimates are incorrect.

[b]Null model is rejected at $p \leq 0.01$ (see Appendices I and II).

[c]Null model is rejected at $p \leq 0.05$ (see Appendices I and II).

stitutability of the decoy as the amount of one dimension that must be given up to get a unit of the other, Figure C shows the levels of decoy substitutability in Studies 1 and 2. These variations are important in that the stronger the decoy relative to the target, the greater the substitution effect and, perhaps, the greater the distortion due to adding the decoy.

Consider evidence for an overall attraction effect. Table 2 gives the shares for the decoy, target, and competitor aggregated across product classes. The results within product classes and for all experimental conditions are given in Appendices I and II. Table 2 also shows the expected shares under the assumption of proportionality and the fixed utility model, plus the results of the aggregated chi-square tests. Notice that the competitor achieves considerably less share than expected under either null model, and that, as expected, the fixed utility model is even less accurate than proportionality in accounting for the competitor's share. Furthermore, the weakest deviations from the proportionality model occurred with the most substitutable decoys (Study 1c and Study 2). By extension, it can be inferred that an even stronger decoy would produce choices that deviate even less from the Luce model, and this is consistent with countervailing effects of substitution and attraction.

It is surprising that the share of the competitor does not seem to differ depending on the specific location of the decoy: the competitor receives about a one-third share regardless of the quality of the decoy. Put differently, the combined share of the target and the decoy remains roughly constant regardless of the quality of the decoy. This result is unexpected but important. Intuitively, one might expect that the attraction due to the decoy would be related to the degree to which it extends the boundaries of the choice set. This would be consistent with a range effects hypothesis (which is treated in depth in the discussion section). However, it appears that it is the order of the items on the dimensions (e.g., first, second, third), rather than their magnitude that drives the attraction effect.

Another interesting result is that the relative value of the decoy has a substantial effect on the target's share, as shown in Table 3. As the decoy becomes stronger, its shares increase relative to those of the target. This is evidence of a strong but local substitution effect—i.e., improving the decoy has relatively little effect on the competitor and a large effect on the target.

It is useful to summarize these effects before continuing because our later analyses serve largely to reiterate these results from different perspectives. As hypothesized, the data are consistent with an attraction effect. Adding a new, extreme item appeared to draw choices in its direction. This effect was more sensitive to the ordinal relations among alternatives than to their exact position within ordinal groupings. Second, the data are consistent with a substitution effect. New items tended to take share from similar items (the target), and this effect was very sensitive to the relative desirability of the added alternative.

If correct, this suggests the need for a two-stage attraction–substitution process to account for choice in the face of changes in market boundaries as new brands are added. The first stage involves an attraction effect, reflected in an increase in utilities near the new brand. The second stage entails a substitution effect, which takes share primarily from those items closest to the new item. Neither the fixed utility model nor proportionality accounts for these effects, although when substitution is strong (e.g., the decoy is strong), the proportionality assumption (a compromise between a fixed utility and a pure attraction model) may approximate the results quite well.

Within-Subject Switching

In Study 1, three weeks after making their choices from the three-alternative choice sets, a subset of the respondents made choices from the two-item core sets for all five products. For these subjects, it was possible to determine how the presence of the decoy affected switching patterns. An attraction effect should result in more people switching

TABLE 3

EVIDENCE OF SUBSTITUTION EFFECT: LOSS IN TARGET'S SHARE DUE TO VALUE OF THE DECOY

Study	Relative value of the decoy	Percent choice shares: Decoy	Percent choice shares: Target	Decoy/target ratio
1a	Poor	7	60	.12
1b	Moderate	15	55	.27
1c	Strong	15	51	.29
2	Strong	24	46	.52

TABLE 4

WITHIN-SUBJECT SWITCHING DUE TO ADDING A DECOY

Two-item choice set	Overall	Percent choosing alternative in augmented set given two-item choice: Competitor	Target	Decoy
Competitor (n = 204)	49[a]	36	53	10
Target (n = 210)	51	27	58	15

[a]Read: Of the 49 percent who chose the competitor in the two-item set, 36 percent chose the competitor in the augmented set.

from the competitor to the target than vice versa. Conversely, a substitution effect should result in more people switching to the decoy from the target than from the competitor.

As Table 4 indicates, both of these expectations were realized. Of those who chose the target in the two-item set, 27 percent switched to the competitor when the decoy was added. By contrast, for those who chose the competitor in the two-item set, 53 percent switched in the other direction. This difference is significant at the $p < 0.05$ level (McNemar test). The substitution effect also appears to be operant, in that 15 percent of those choosing the target switched to the decoy, while only 10 percent of those choosing the competitor did so. This difference is not statistically significant, but it is in the expected direction. These data represent further support for an attraction effect and somewhat weaker support for a substitution effect at the individual choice level.

Choice Among Four Alternatives, Three Dimensions

Studies 1 and 2 provide consistent support for substitution and attraction effects on relatively simple choices defined on two dimensions; Study 3 tested whether an attraction effect would occur despite increased dimensionality. A total of 111 MBA students were asked to make choices on alternatives defined on three dimensions. Choices were made across four product categories: beer, cars, restaurants, and calculator batteries.

As in the earlier studies, a core set of alternatives was created so that each alternative was better than the other two on exactly one dimension. An example of the stimuli is shown in Table 5. Item I is the best on ride quality, Item II is strongest on acceleration, and Item III has the best mileage.

Within each product class, respondents were randomly assigned to choose from one of four test sets. Each set included the core set plus one of the decoys. For purposes of analysis, the target was defined for each set as the item closest to the decoy, and the other two were defined as the competitors.

Table 6 gives the result of this coding. Notice that the target received higher shares than would be expected under proportionality, and much greater shares than expected under the fixed vector model. This increase in share for the target due to adding the proximate decoy is consistent with an attraction effect.

The expected shares, given the assumptions of proportionality and fixed utility, were derived by estimating the model's predictions within each product class prior to aggregating. The statistical test (details of which are in Appendix III) required some revision of the earlier procedure. For the test of proportionality, focus was once again on proportions within the core set, while for the fixed vector model, the share of the decoy and the adjacent target were aggregated. The test, however, was on a 3 × 3 matrix with a column for each alternative and a row for each experimental condition. Again, the alternative hypothesis was whether the target had greater share than would be expected given the null models. Unfortunately, a Fisher exact test is not available for the 3 × 3 matrix, so a simulation was used to estimate the required probabilities of the null models being correct. This was implemented as follows: for each 3 × 3 matrix, the simulation assumed that the probabilities expected from the null model were correct. The probability value for each row was then the proportion of times out of 1,000 trials that the null models resulted in the target's share being as high or higher than that actually found. These probabilities are given in Appendix III. Individual chi-square statistics were then aggregated to produce the test shown in Table 6. The aggregate statistic for proportionality was significant ($\chi^2(24) = 50.9$, $p < 0.01$), indicating that the target's share was significantly higher than predicted by the Luce model. The data are in even sharper disagreement with the fixed utility model ($\chi^2(24) = 76.2$, $p < .01$), thus strongly rejecting the hypothesis that the share gained by the decoy would come solely at the expense of the target.

Once again, these data support earlier findings that adding an extreme alternative may in fact help the brand that traditionally would have been expected to be hurt most. The structure of the stimulus set offers an interesting explanation as to why this effect might have occurred. Examining the stimuli in Table 5, the addition of the decoy

TABLE 5

EXAMPLE OF THREE-DIMENSIONAL DECOY STIMULUS

	Sample data: Cars (Study 3)		
Core set[a]	Ride quality (0 = worst; 100 = best)	Acceleration (seconds to go from 0 to 50 mph)	Mileage (mpg in city driving)
Item I	60	10	21
Item II	50	9	21
Item III	50	10	24
To which is added one decoy:			
Decoy 1	70	11	18
Decoy 2	40	8	18
Decoy 3	40	11	27

[a]Each item is best on one dimension, e.g., Item II is strongest on acceleration.

TABLE 6

RESULTS OF THREE-DIMENSIONAL DECOY STUDY

	Percent choosing		
	Target	Competitor 1 or 2	Decoy
Actual (n = 444)	34	54	12
Expected, given:			
Proportionality[a]	28	60	12
Fixed utility[a]	22	67	12

[a]Null model rejected at $p < 0.01$ level.

makes the target the middle or compromise candidate in every case. For example, when Decoy 1 is added, Item I (the target) has a middle level of ride quality, acceleration, and mileage. In the debriefing session, some of the subjects expressed the feeling that Item 1 was the "safe," "compromise" alternative. This is discussed in more detail in the next section.

DISCUSSION

Summary of Findings

To reiterate, the extension of the boundary of the choice set by adding a new item can be described as resulting in two effects:

- *A global attraction effect* occurs whereby preferences are drawn towards the new item. The degree of this preference shift appears to be unrelated to moderate adjustments in the degree of extension of the new item.
- *A local substitution effect* occurs once preferences have shifted. The new item then takes share predominantly from similar items, and this effect is highly sensitive to the positioning of the new item.

It is important to clarify what these results do and do not imply. First, neither the fixed utility model nor its more moderate forms have been invalidated so much as they have been restricted in their range of applicability. Indeed, the data show that a market extension can be seen as shifting the distribution of individual preferences. Once that shift has been made, one of a number of substitution models can be applied to the data. This shift is important in casting doubt on the standard microeconomic assumption of the stability of individual utility surfaces in the face of differing choice sets.

Second, the results are relevant to assessing the assumption of proportionality. The choice sets tested in our studies were specifically designed to isolate both the decoy and substitution effects. Because the assumption of proportionality embodied in the Luce (1959) model cannot account for the proposed attraction effect, it is not an appropriate description in these circumstances. However, the existence of the two opposing mechanisms reported here may actually enhance its validity as a predictive model for choice sets lacking clearly defined dimensionality. To clarify, recall that proportionality assumes that the relative share a new item takes from existing ones is independent of similarity among them. By contrast, in the proposed theoretical structure, the attraction effect helps—while the substitution effect hurts—those closest to the added item. The attraction effect demonstrated here was deliberately enhanced because the added item was a relatively weak substitute for the target. To the extent that typical markets lack such weak substitutes, the attraction effect and the local substitution effect could counterbalance each other and result in choice patterns closely approximated by the proportionality model.

Managerial Implications

The results of these studies do not set out rules for marketing practitioners, but indicate the need for further research. It may be true that most consumer decisions are made on the basis of a small number of alternatives within a consideration set defined on a few dimensions collapsed by the decision maker (Wright 1975; Olshavsky and Granbois 1979). It is not clear, however, how such decisions are related to those examined in this study, which utilized forced choice among products with *stated* levels on dimensions chosen by the experimenter. Further, while the range of a choice set was easily manipulated in the various experimental conditions, it is less clear how to change the *perceived* range of offerings in a market. Certainly, promoting an item as having new advantages may shift the perceived market boundaries, but only a rare new product extends the absolute limits of what was previously available. Thus the concept of extending the boundaries of a market must be tied to a shift in what is salient rather than to what is possible.

In an applied context, such salience would typically be induced by promoting or otherwise making a new brand visible. It may be that heavily promoted brand extensions have a general attraction effect that influences choices throughout the entire market. If so, Procter and Gamble's introduction of Luvs disposable diapers may have had the unexpected positive effect of increasing the shift from lesser perceived brands to Pampers, in addition to achieving the strategic goal of tapping a different market segment. Another firm that has prospered by introducing a market extension virtually on top of its own strength is the Anheuser Busch campaign for Michelob. Budweiser had the "number 1" position in the premium beer market. Its positioning of Michelob as a super-premium might at first appear to run counter to the dictum that new products should be as dissimilar as possible from current ones to minimize cannibalization (Copulsky 1976; Kerin, Harvey, and Rothe 1978). Yet the substitution effect may have been minimized by aiming Michelob at a different segment than Budweiser. More important from the perspective of the present analysis, the promotion of a super-premium may have made Budweiser seem less extreme, less expensive, and less elite. Thus, the attraction effect due to extending the subjective boundaries may have shifted the market towards the premium segment at the expense of the standard brands.

Explanations for the Attraction Effect

We have described what happens to choice shares as new items are added to the choice set, and have demonstrated that both substitutability and attraction need to be separated, rather than confounded as in the Luce model. While our major concern has been to document an empirical phenomenon, some useful speculations may be raised as to the mechanisms driving the attraction effect.

The idea of a range effect (suggested by Huber et al. 1982) is not supported by the data here. Such range effects have been found in perceptual judgments, where the addition of an extreme item to a stimulus set narrows the subjective category judgments on that dimension (Parducci 1974). For the choice sets tested here, the decoy extends the range of the dimension on which the target is unfavorably evaluated more than the dimension on which it is favorably evaluated. The greater extension of the unfavorable dimension may make the target's deficit on that dimension appear less great. A corollary to this mechanism is that the greater the relative range extension, the greater the distorting effect. But in Study 1 (Figure C), various positionings of the decoy had no significant impact on the magnitude of the attraction effect. Huber et al. (1982) found the same result with respect to the degree of extension of the dominated alternative: the more extreme alternative had no greater effect on choice reversals than did the less extreme one.

If further replicated, this lack of a range effect may indicate the existence of a rather different process for choice than for perceptual judgments. The apparent reduction of the interval information to rank order found here may turn out to be a common simplification strategy that differentiates direct attribute judgments from choice (Wright 1975).

Even though a direct range effect does not appear to account for the results in our studies, a relative attribute comparison might. That is, the same mechanism that made the decoy relatively inferior in the presence of the core set may also have made the competitor relatively inferior in the presence of the decoy.

Consider the relative inferiority of the decoy. An example, given in Figure B, involves the addition of a high quality, high priced decoy (Q = 80 for \$2.50) to a set which includes a target (Q = 70 for \$2.10) and a competitor (Q = 60 for \$1.90). The decoy's inferiority can be seen by looking at the decision of a person anchoring on the competitor and considering a switch. A move to the decoy costs 60¢ and gains 20 quality points, while one to the target costs 20¢ and gains 10 quality points. Thus the inferiority of the decoy relative to the target arises from the fact that there is a higher cost per quality unit of a switch to the decoy (3¢ per unit) over a switch to the target (2¢ per unit).

The symmetry of the situation makes the competitor relatively inferior in the presence of the decoy, and thus may account for the competitor's loss of value when the decoys are added.[1] That is, by anchoring on the decoy a switch to the competitor gains 60¢ at a cost of 20 quality units, while a switch to the target gains 40¢ at a cost of only 10 quality units.

In geometric terms, the presence of the decoy creates an "elbow" with the target at its apex (Figure B). This local superiority may increase the target's value relative to both the decoy and the competitor. If there were substantial numbers of respondents who examined differences (marginal gains and losses from switching) rather than evaluating each alternative separately, this mechanism could partially account for the attraction effects found.

Perhaps the most intriguing aspect of the relative attribute comparison explanation for the attraction effect is that it might constrain the attraction effect to relatively inferior additions to choice sets. Suppose a boundary extension was "relatively superior" in that it was an improvement over the relative tradeoffs found in the core set. In that case, the elbow would bend in the opposite direction, hurting the target and possibly helping the competitor. We have found evidence for an attraction effect even without an elbow—i.e., when all stimuli lay on a straight line. This indicates that an attraction effect can occur independently of the relative attribute comparisons (Huber 1982). However, an estimate of the strength of this mechanism would require a number of studies in which the degree of superiority of the added alternative is explictly manipulated.

The studies described here also cast doubt on the validity of a "process" explanation (suggested by Huber et al. 1982) as a possible mechanism that might generate an attraction effect. The process explanation owes its credibility

[1]The authors wish to thank Morris Holbrook for this important insight.

in the dominated case to the fact that the target–decoy decision is so easy when one dominates the other. A simplifying consumer may therefore make the target–decoy decision first and then stop processing, thus producing an attraction effect. In the present studies, which deal with "inferior" rather than dominated alternatives, the relationship between decoy and target is not as readily apparent. It is less likely, therefore, that the target–decoy decision would be made earlier than the decisions on other pairs. Naturally, other studies would have to be conducted to rule out such process explanations, but our evidence suggests that such explanations are unlikely to loom large in any ultimate explanation of the attraction effect.

The current set of experiments have cast doubt on some perceptual and processing explanations for the attraction effect, while increasing the reasonableness of others. We next consider higher-order explanations for the effect—i.e., the motives for the behavior. The degree to which these motives are reasonable is relevant to a normative assessment of any attraction effect.

Normative Implications

The attraction effect implies an instability of utilities that could lead to intransitivities in preferences across different choice sets. Thus this effect might be considered an irrational bias that should be purged for more effective decision making. Yet in the debriefings, subjects indicated two motives for the attraction effect which suggest that any "bias" toward the target may in fact be a rather useful decision heuristic.

The first motive reflects an inference to popularity (Huber et al. 1982). Subjects expressed uncertainty as to their ultimate reaction to the given attribute combinations. However, the fact that each alternative was offered might indicate that it was liked by some group (a reasonable inference from real products, where the selection of the alternatives comprising the choice set is market-driven). Thus subjects may generally use set information in a market setting and, quite rationally, carry over this choice heuristic to the experimental condition.

A second motive for choosing the target involved subjects indicating that it was "safe," "less risky," or a "compromise" alternative. Structurally, in all of the studies described here, the addition of the decoy moves the target from the edge of the choice set toward the middle. If one defines regret as the difference between the utility of the item chosen and the item that ultimately turns out to be best, then choosing a more central alternative reduces the maximum regret associated with the decision. While it is unlikely that any subjects were consciously using a minimax-regret strategy, a similar but automatic mechanism may account for their describing the target as a less risky alternative.

To separate these two effects, one might add a decoy to the interior of the choice set quite near the target. In that case, a risk-avoidance strategy would predict a negative attraction effect (since the target becomes more extreme), while a popularity explanation would predict a stronger attraction affect.

In summary, our results indicate a smaller likelihood that strict range interpretations or process models will ultimately account for the attraction effects found. On the other hand, the studies do suggest certain quite rational motives that may underlie the observed behavior. Process tracing methods and protocols (Payne 1976) are needed to validate these and other explanations for the attraction effect.

Toward a General Framework

Regardless of the explanation for the attraction effect, we have argued that its existence is consistent with the general robustness of the Luce model and with the modest predictive improvement wrought by various attribute-based similarity adjustments. However, to complete the account of the effect of added alternatives in choice, it is necessary to specify the contexts in which the hypothesized conflicting effects (substitution and attraction) occur. This effort may result in a framework that would enable one to predict whether the effect of similarity will be negative (substitution), positive (attraction), or neutral (proportionality).

Consider the contexts in which an attraction effect might be most salient. If defined as a movement in preferences towards the new alternative, the effect is likely to be most salient where information about the offered set is needed to help make a decision. This will occur within product classes for which one has very little information, or in which the meanings of the attribute levels are unclear, as in the present studies (e.g., how good is a three-star restaurant?). An attraction effect should be most salient in choosing among attribute-based products within classes for which attitudes towards alternatives are relatively fluid. This suggests that attraction effects will be more important in emerging markets or in segments where customers are in the process of forming brand preferences.

The substitution effect is expected to be most salient where there are relatively clear dimensions or similarity relationships on which a consumer can base a decision between competitive products. This clarity appeared in the present experiments, where objects were defined in terms of attributes; it may occur less with choice among branded products, particularly in product classes where attitude towards a brand is weakly related to its attributes. This reasoning suggests that a substitution effect will be more salient where multi-attribute decision making occurs. It should, therefore, be most apparent in major purchases (where attribute-based processing is more cost effective) and in product classes for which a limited number of attributes emerge that permit easy comparisons across alternatives. An example in which such attribute comparisons are unlikely is one in which the competitors rely on disparate images (e.g., cigarettes), thus complicating interbrand attribute comparisons. Since neither attraction nor substitution are expected in such a case, proportionality would be the likely result.

The contingent natures of substitution and attraction effects detailed above suggest that a more comprehensive model of choice should include implicit weights for these effects. In particular, attraction could be modeled as a prior editing step (cf. Payne 1982) whereby items closest to the added alternative have an increase in utility related to their proximity to it. The weight for this editing stage would (1) depend positively on decomposability (the degree to which the alternatives are dimensionally structured), and (2) be inversely related to affective rigidity (the degree of the decision maker's initial inflexibility about preference within this structure). Once the attraction effect has been accounted for by a modification in utilities, any of a number of models of substitutability can account for the ultimate choice (Batsell 1980; Currim 1982; Tversky 1972). Once again, the weight given to the similarity adjustment should be modified to be positively associated with the decomposability of the dimensional structure accorded to the stimuli, and directly related to the degree of prior certainty by which people attach preference to dimensional positioning.

A flexible way to parameterize these hypothesized relations would involve the multinominal probit model (Currim 1982; Daganzo 1979; Daganzo and Schoenfeld 1978). This model would permit the operational separation of the attraction and substitution mechanisms. In particular, attraction would be represented by an increase in the utilities of the items closest to the rank-order centroid of the choice set. In that way, the addition of an extreme item would move the centroid toward the extreme item and thereby increase the utility of items closest to it. The local substitution effect could be modeled as an increase in the covariance of utilities of items that are most similar in the choice set. The strengths of these two mechanisms could then be moderated at the individual level by measures of the decomposability of the stimuli and of the affective rigidity with which subjects view these stimuli.

While such a model must be considered speculative at present, it illustrates a way in which attraction and substitutability could be specified as part of a more general framework. The present studies manipulated the strength of the substitution effect by changing the relative attractiveness of the added item. Among studies needed to estimate a more complete model are those involving manipulation of stimulus decomposability and affective rigidity. Such new studies would begin to develop a conditional model enabling one to predict the effect of adding a new alternative to a choice set under very general conditions.

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APPENDIX I

Study 1

(120 undergraduate business students)

	Stimuli: Percent chosen						Statistical tests: Probability of result, given:	
Beer dimensions	Moderate decoys	Strong decoys	Core set		Strong decoys	Moderate decoys	Proportionality	Fixed vectors
Price/6-pack	$1.60	$1.60	$1.80	$2.60	$3.00	$3.40		
Quality rating (100 = best)	30	40	50	70	75	75		
Total n = 83			33%	67%				
Study 1c								
n = 19		0%	47%	53%			$p = 0.02$	$p = 0.02$
n = 21			14%	67%	19%		$\chi^2(2) = 7.7$	$\chi^2(2) = 8.3$
Study 1b								
n = 22	0%		46%	54%			$p = 0.0001$	$p = 0.0001$
n = 21			0%	90%		10%	$\chi^2(2) = 18.8$	$\chi^2(2) = 19.2$
Car dimensions	Weak decoys	Moderate decoys	Core set		Moderate decoys	Weak decoys		
Ride quality (100 = best)	75	75	70	50	30	20		
City mileage (MPG)	12	15	21	27	28.5	28.5		
Total n = 82			48%	52%				
Study 1b								
n = 19		0%	58%	42%			$p = 0.25$	$p = 0.01$
n = 20			15%	70%	15%		$\chi^2(2) = 2.8$	$\chi^2(2) = 12.9$
Study 1a								
n = 22	0%		73%	27%			$p = 0.0002$	$p = 0.0002$
n = 21			19%	81%		0%	$\chi^2(2) = 12.4$	$\chi^2(2) = 17.4$
Restaurant dimensions	Weak decoys	Strong decoys	Core set		Strong decoys	Weak decoys		
Driving time (minutes)	11	11	14	26	32	44		
Food quality (stars)	*½	**½	***	****	****½	****½		
Total n = 83			41%	59%				
Study 1c								
n = 22		0%	64%	36%			$p = 0.07$	$p = 0.05$
n = 21			24%	43%	33%		$\chi^2(2) = 5.2$	$\chi^2(2) = 6.1$
Study 1a								
n = 19	0%		26%	74%			$p = 0.15$	$p = 0.06$
n = 21			10%	76%		14%	$\chi^2(2) = 3.7$	$\chi^2(2) = 5.6$
Calculator battery dimensions	Moderate decoys	Strong decoys	Core set		Strong decoys	Moderate decoys		
Estimated life (hours)	32	32	30	22	18	14		
Price per pair	$2.70	$2.40	$2.10	$1.50	$1.35	$1.35		
Total n = 82			33%	67%				
Study 1c								
n = 21		29%	43%	28%			$p = 0.25$	$p = 0.09$
n = 22			47%	42%	11%		$\chi^2(2) = 2.7$	$\chi^2(2) = 4.9$
Study 1b								
n = 21	24%		52%	24%			$p = 0.03$	$p = 0.02$
n = 22			41%	59%		0%	$\chi^2(2) = 7.2$	$\chi^2(2) = 8.2$
Film dimensions	Weak decoys	Moderate decoys	Core set		Moderate decoys	Weak decoys		
Developing time (min)	½	½	1	5	9	11		
Color fidelity (100 = best)	70	74	82	90	92	92		
Total n = 83			45%	55%				
Study 1b								
n = 21		10%	38%	52%			$p = 0.17$	$p = 0.11$
n = 19			5%	26%	68%		$\chi^2(2) = 3.5$	$\chi^2(2) = 4.4$
Study 1a								
n = 21	0%		48%	52%			$p = 0.05$	$p = 0.01$
n = 22			18%	55%		27%	$\chi^2(2) = 6.1$	$\chi^2(2) = 15.0$

	Probability of result, given:	
Aggregate test: substitutability of decoy	Proportionality	Fixed vectors
Study 1a—weak decoy	$\chi^2(6) = 27.2, p < 0.01$	$\chi^2(6) = 38.0, p < 0.01$
Study 1b—moderate decoy	$\chi^2(8) = 32.3, p < 0.01$	$\chi^2(8) = 44.7, p < 0.01$
Study 1c—strong decoy	$\chi^2(6) = 15.6, p < 0.05$	$\chi^2(6) = 19.3, p < 0.01$

NOTE: All data represent subjects' *actual* choices.

APPENDIX II

Study 2

(32 liberal arts undergraduates)

	Stimuli				Statistical tests	
	Percent chosen				Probability of result, given:	
	Decoy	Core set	Core set	Decoy	Proportionality	Fixed vectors
Beer dimensions						
Price/6-pack	$2.50	$2.10	$1.90	$1.70		
Quality (100 = best)	80	70	60	40		
n = 15		47%	47%	7%	$p = 0.70$	$p = 0.20$
n = 17	47%	18%	35%		$\chi^2(2) = 0.7$	$\chi^2(2) = 3.0$
Car dimensions	Decoy	Core set	Core set	Decoy		
Ride quality (100 = best)	40	60	70	80		
Mileage (city mpg)	30	27	24	18		
n = 17		24%	18%	58%	$p = 0.10$	$p = 0.0005$
n = 15	7%	80%	13%		$\chi^2(2) = 4.6$	$\chi^2(2) = 21.1$
Restaurant dimensions	Decoy	Core set	Core set	Decoy		
Driving time (minutes)	32	20	14	8		
Quality (stars)	*****	****	***	*		
n = 17		73%	27%	0%	$p = 0.13$	$p = 0.05$
n = 15	41%	59%	0%		$\chi^2(2) = 4.1$	$\chi^2(2) = 6.0$
Calculator battery dimensions	Decoy	Core set	Core set	Decoy		
Expected life (hours)	14	22	26	30		
Price/unit	$1.50	$1.80	$2.10	$2.70		
n = 15		13%	67%	20%	$p = 0.004$	$p = 0.0006$
n = 17	6%	59%	35%		$\chi^2(2) = 10.9$	$\chi^2(2) = 14.9$

	Probability of result, given:	
	Proportionality	Fixed vectors
Aggregate test	$\chi^2(8) = 20.3$, $p < 0.05$	$\chi^2(8) = 45.0$, $p < 0.01$

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APPENDIX III

Study 3

(111 graduate business students)

	Stimuli: Percent chosen — Core set alternatives			Added alternatives			Statistical tests: Probability of result, given: Proportionality	Fixed vectors
Beer dimensions								
Price/6-pack	\$2.10	\$2.30	\$2.30	\$1.90	\$2.50	\$2.50		
Taste quality (100 = best)	50	60	50	40	70	40		
Age in weeks	4	4	3	5	5	2		
Choice probabilities								
n = 36	28%[a]	36%	33%	3%			$p = 0.48, \chi^2(2) = 1.5$	$p = 0.25, \chi^2(2) = 2.8$
n = 37	16%	45%[a]	8%		29%		$p = 0.01, \chi^2(2) = 9.2$	$p = 0.001, \chi^2(2) = 13.8$
n = 38	35%	35%	27%[a]			3%	$p = 0.32, \chi^2(2) = 2.3$	$p = 0.13, \chi^2(2) = 4.1$
Car dimensions								
Ride quality (100 = best)	60	50	50	70	40	40		
City mpg	21	24	21	18	27	18		
Acceleration 0–50 mph (seconds)	10	10	9	11	11	8		
Choice probabilities								
n = 37	46%[a]	46%	8%	0%			$p = 0.10, \chi^2(2) = 4.6$	$p = 0.03, \chi^2(2) = 7.0$
n = 38	19%	56%[a]	3%		22%		$p = 0.01, \chi^2(2) = 9.2$	$p = 0.002, \chi^2(2) = 12.4$
n = 36	37%	39%	18%[a]			5%	$p = 0.03, \chi^2(2) = 7.1$	$p = 0.01, \chi^2(2) = 9.2$
Restaurant dimensions								
Driving time (minutes)	14	21	21	7	28	28		
Food rating (stars)	**	***	**	*	****	*		
Atmosphere rating (stars)	**	**	***	*	*	****		
Choice probabilities								
n = 36	32%[a]	53%	8%	8%			$p = 0.12, \chi^2(2) = 4.2$	$p = 0.08, \chi^2(2) = 5.1$
n = 37	16%	59%[a]	8%		16%		$p = 0.17, \chi^2(2) = 3.5$	$p = 0.10, \chi^2(2) = 4.6$
n = 38	25%	64%	11%[a]			0%	$p = 0.30, \chi^2(2) = 2.4$	$p = 0.27, \chi^2(2) = 2.5$
Calculator battery dimensions								
Expected life (hours)	22	18	18	26	14	14		
Price/pair	\$2.60	\$2.20	\$2.60	\$3.00	\$1.80	\$3.00		
Probability of corrosion	10%	10%	8%	12%	12%	6%		
Choice probabilities								
n = 38	38%[a]	3%	32%	27%			$p = 0.62, \chi^2(2) = 1.0$	$p = 0.14, \chi^2(2) = 3.9$
n = 36	61%	11%[a]	25%		3%		$p = 0.18, \chi^2(2) = 3.4$	$p = 0.09, \chi^2(2) = 4.8$
n = 37	47%	8%	32%[a]			13%	$p = 0.29, \chi^2(2) = 2.5$	$p = 0.05, \chi^2(2) = 6.0$

Aggregate statistics	Probability of result, given: Proportionality	Fixed vectors
Beer	$\chi^2(6) = 13.0, p < 0.05$	$\chi^2(6) = 20.7, p < 0.01$
Cars	$\chi^2(6) = 20.9, p < 0.01$	$\chi^2(6) = 28.6, p < 0.01$
Batteries	$\chi^2(6) = 6.9$, NS	$\chi^2(6) = 14.7, p < 0.05$
Restaurants	$\chi^2(6) = 10.1$, NS	$\chi^2(6) = 12.2$, NS
Overall	$\chi^2(24) = 50.9, p < 0.01$	$\chi^2(24) = 76.2, p < 0.01$

[a]Indicates alternative closest to added item.