# Adapting Cutoffs to the Choice Environment: The Effects of Attribute Correlation and Reliability

JOEL HUBER
NOREEN M. KLEIN*

Consumers frequently simplify complex choices by setting attribute cutoffs, which are minimum acceptable levels that an alternative must possess to be considered further. We explore the extent to which consumers adapt these cutoffs to the choice environment. We show that, as the reliability of information about the attribute increases, consumers make more severe cutoffs (i.e., fewer attribute levels are acceptable). Further, positive correlations between attributes elicit more severe cutoffs than negative correlations do, and consumers' expectations about the choice outcome partially mediate this relationship. The format of correlational information also affects adaptation: consumers adapt their cutoffs when they are given direct information about the correlation, but not when they are allowed to infer the correlation from a set of alternatives. Overall, consumers appear to adapt to information about reliability and correlations, but they have difficulty assessing correlation from the choice environment.

Marketers know that consumers simplify decisions in the marketplace. One common simplification process is the use of a noncompensatory cutoff, that is, establishing a minimum acceptable level on an attribute that an alternative must possess to be considered further. The choice of cutoff levels determines which alternatives pass the initial screen and enter the final choice stage. Using cutoffs saves decision time and effort because alternatives that fail to surpass a cutoff need not be thoroughly evaluated. However, cutoffs also carry an opportunity cost of possibly eliminating an optimal alternative. Therefore, a consumer facing a purchase decision should select cutoffs that strike a sensible balance between the benefit of reduced decision time and effort and the risk of lost utility.

Cutoffs are central to well-known choice models, such as elimination-by-aspects (Tversky 1972) and the conjunctive model (Lynch 1982). Because cutoffs are pervasive choice heuristics, it is important that consumers who wish to function effectively in the marketplace select appropriate ones. Marketers must also understand consumer cutoffs, because a brand below a cutoff on even one attribute may not be considered. Despite their theoretical and practical importance, few studies have investigated the basis for cutoff selection (see Grether and Wilde 1984; Klein 1983; Klein and Bither 1987). The factors that determine the severity of a cutoff (how many levels of an attribute are considered unacceptable) are not yet well explicated.

In keeping with the accumulating evidence that choice strategies are adaptive (Payne, Bettman, and Johnson 1988), we explore the impact of the choice environment on cutoff severity. Empirical evidence of adaptivity exists in studies that indicate an increased use of cutoffs under time pressure (Wright 1974) or when information load is high (Lussier and Olshavsky 1979; Payne 1976). However, empirical studies have tended to focus on task factors, which change the structure of the choice environment in relatively obtrusive ways. We know less about consumers' reactions to more subtle changes in the values that alternatives in the choice set possess, typically called context factors (Payne 1982). Context has been shown to affect the difficulty and accuracy of a choice, which in a cost-benefit framework implies that changes in context will cause consumers to adapt their choice strategies (Johnson and Payne 1985). However, some aspects of context, such as attribute correlation, involve complex relationships among attribute values that consumers may not perceive accurately (Klein and Yadav 1989). Thus, there

*Joel Huber is associate professor of marketing at the Fuqua School of Business, Duke University, Durham, NC 27707, and Noreen M. Klein is associate professor of marketing at the R. B. Pamplin College of Business at Virginia Polytechnic Institute and State University, Blacksburg, VA 24061. The authors would like to thank James Bettman, Fred Fineberg, John Lynch, Ruth A. Smith, Wilfred von Honacker, and three anonymous reviewers for their insightful comments. We also thank Rick Andrews and Soeun Hyun for assistance with data collection.

is a real question as to whether consumers successfully adapt to context, as a normative analysis would imply.

This article examines how cutoff severity is affected by two context characteristics: the correlation between attributes and the reliability of information about attributes. A cost-benefit analysis of cutoff severity yields hypotheses about how consumers should respond to changes in these characteristics. We also propose that consumers' expectations about the choice outcome mediate the effect of correlation on cutoff severity and test whether information format moderates adaptation to correlations.

## A COST-BENEFIT ANALYSIS OF CUTOFF SEVERITY

Before predictions about cutoff severity can be made, we must define the choice process under which cutoffs are assumed to occur. There is compelling evidence that consumers frequently use a multistage choice process (Klein 1983; Lussier and Olshavsky 1979; Payne 1976; Wright and Krewall 1980). Early stages simplify the decision by reducing the number of alternatives while later stages generate the final choice. Initial stages typically rely on efficient, noncompensatory decision rules while later stages employ more burdensome, but more precise, compensatory processes.

We focus on the first stage of this process in which the consumer defines cutoff levels on one or more attributes; these cutoffs limit the alternatives that will be further examined. Later stages involve more elaborate evaluation of remaining alternatives. The primary benefit of the initial cutoff stage is that it efficiently reduces the number of alternatives. Its cost is the risk of screening out the best alternative before it can be evaluated in later stages. More severe cutoffs reduce evaluation costs by eliminating more alternatives but increase the opportunity cost of missing the best choice. As will be shown, context factors like attribute correlation and reliability also affect the opportunity cost of using cutoffs. Changes in these context variables should therefore cause consumers to reevaluate the basic cost-benefit tradeoff and adapt the severity of their cutoffs.

We assume a negligible cost of identifying those alternatives that will not be evaluated. This assumption of a low processing cost for cutoffs may seem unrealistic, but it is satisfied in a wide range of consumer decisions. For example, consumers may make a priori decisions not to examine apartments in particular neighborhoods or those above a given price. They may refuse to test-drive any automobile with four cylinders or those made in a certain country. Perhaps the most ubiquitous source of two-stage processing is in the reaction to brand names in which consumers may greatly reduce search if well-known brand names are provided (Hoyer and Brown 1990; Jacoby, Szybillo, and Busato-Schach 1977). Notice that in all of these examples the primary cost of the cutoffs is the possible utility lost in screening out a superior alternative. It is this fundamental opportunity cost, weighed against the benefit of lowered evaluation or processing costs, that drives our predictions about context effects on the severity of cutoffs.

The multistage process we assume is not the only one in which cutoffs may occur. Grether and Wilde (1984) examined cutoff use within a conjunctive process in which consumers choose the first alternative to satisfy all cutoffs. For Grether and Wilde, the primary processing cost is the one that we assume is negligible, that is, the cost of screening alternatives. By contrast, we assume in the multistage process that the cost of screening alternatives (applying the cutoffs) is negligible relative to the evaluation costs incurred in the later stages. Note the implications of the different processes for the consumers' costs and benefits. In the Grether and Wilde conjunctive process, severe cutoffs increase processing costs because a consumer is likely to screen more alternatives before finding one that satisfies all cutoffs. In the multistage model, more severe cutoffs reduce processing costs because fewer alternatives reach second-stage evaluation.

We can also contrast opportunity costs in the two models. In Grether and Wilde's model, more severe cutoffs increase the expected utility of the final choice because it then must meet more stringent criteria. However, in our multistage model more severe cutoffs reduce expected utility because of the increased risk of inadvertently eliminating the best alternative. Changing cutoff severity therefore has opposite effects on processing and opportunity costs for multistage and conjunctive decision processes. Although not all predictions about context effects on cutoffs differ for the two processes we have contrasted, it is important to recognize that these models apply in different situations and that their predictions will sometimes diverge.

It is also useful to contrast our approach with Hauser and Wernerfelt's (1990) consideration-set model. Their model focuses on the dynamic inclusion or exclusion of brands from an ongoing consideration set. They provide indirect evidence that cutoffs adapt to market characteristics. For example, as the percent of industry sales volume to promotion increases, more brands are considered (cutoffs are less severe). However, they acknowledge the need for more microlevel, experimental testing and/or detailed process measures for full verification of the theory (Hauser and Wernerfelt 1990, p. 405). The current study provides just such an individual-level analysis of cutoff adaptation.

## THE EFFECTS OF ATTRIBUTE RELIABILITY AND CORRELATION

In a multistage choice process, the benefit of a more severe cutoff comes from a reduction in the evaluation costs of later stages. Its cost is a function of the probability that the best alternative might be unwittingly screened out and the amount of utility likely to be lost in the resulting suboptimal choice. We examine these costs and benefits with respect to two changes in the choice context: the reliability of an attribute and its intercorrelation with other attributes.

To motivate and simplify the discussion, imagine a student at a new university who is faced with choosing an apartment. Three attributes are salient: the apartment's rent, quality, and travel time to campus. A student service provides quality information on a scale with one to four stars. Figure 1 shows a hypothetical consumer's distribution of expected total utility for apartments with either two- or three-star ratings. The variability of these distributions is due to two factors. First, the quality rating itself may not be a good indicator of an apartments' actual quality, either because of the rating's truncated nature or because the service's judgments differ from those of the consumer. Second, total utility is also determined by attributes other than quality (travel time and rent) that vary for apartments with the same quality rating. Assume all apartments have two or three stars and that the decision is whether to consider two-star apartments or to establish a cutoff that eliminates them.

In this context, the cutoff dilemma is clearly exposed. On one hand, one can suffer the cost of evaluating at least one two-star apartment and find it no better than the best of the three-star apartments. On the other hand, one can eliminate from consideration all two-star apartments and suffer the opportunity cost of possibly missing the best choice. In general, the smaller the overlap between the two distributions in Figure 1, the lower is the probability that some two-star apartment will surpass the best of the three-star apartments. The smaller the overlap between the distributions, the greater is the justification for more severe cutoffs. By examining the cost and benefits of making the cutoff more or less severe, we are able to make predictions as to how changes in attribute correlation and reliability should alter cutoff levels.

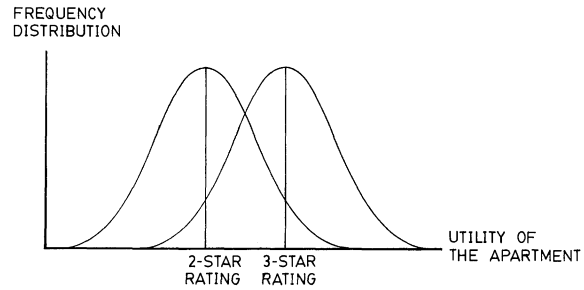
## Attribute Reliability and Cutoff Severity

Attribute reliability is the precision with which a consumer can predict the real value of an attribute for some alternative on the basis of its stated value on that attribute. It is important to note that this definition is broader than the idea of statistical reliability. Consider what would happen to quality cutoffs if the consumer learned that the quality ratings came from a much less reliable source. Below, a cost-benefit analysis gives two ways in which less reliable information about an attribute could produce less severe cutoffs on that attribute.

First, as the quality rating becomes less reliable, it is less diagnostic as a measure of ultimate satisfaction with the apartment. This decrease in diagnosticity can be shown as increased variance and increased overlap in the two distributions of Figure 1. The consumer should therefore be less willing to use the quality rating to

**FIGURE 1**

EXPECTED DISTRIBUTION OF APARTMENT UTILITY GIVEN ITS QUALITY RATING




eliminate alternatives that may be superior on other attributes, such as price or travel time. Second, as the reliability of a cutoff attribute decreases, the value added by the later evaluation stage of the decision process may increase. The possibility of getting more precise information on an unreliable attribute during a later evaluation stage should make the consumer less willing to make severe, early cutoffs on that attribute. Thus, both consideration of diagnosticity and value added in the evaluation stage lead to the prediction that a decrease in attribute reliability results in less severe cutoffs.

**H1:** When attribute reliability is low, cutoffs on that attribute are less severe than when attribute reliability is high.

## Attribute Correlation and Cutoff Severity

Two attributes are defined here to be negatively correlated if alternatives in the choice environment with desirable levels on one attribute are less likely to have desirable levels on the other. In the apartment example, price and quality are generally thought to be negatively correlated because higher-quality apartments tend to have higher (worse) rents. By contrast, quality and travel time to campus could have either a negative or a positive correlation depending on whether the closest apartments have better (positive) or worse (negative) quality. This indeterminacy permits us to manipulate the correlation between these two attributes.

We predict that changing the sign of the correlation of an attribute pair from positive to negative lowers cutoffs. Assume that Figure 1 shows the distributions of expected utility for two- and three-star apartments when there is a negative correlation between the quality rating and travel time. If this correlation becomes positive, the expected difference in the average utility of two- and three-star apartments increases because three-star apartments are now expected to have better travel times as well as higher quality. The means of the two distributions therefore move farther apart, making it less likely that a two-star apartment will be best. Because the benefit of evaluating two-star apartments in the second stage is thereby lowered, the quality cutoff can be made more severe.[1]

> **H2:** When a positive correlation exists between two attributes, cutoffs on those attributes are more severe than when there is a negative correlation of equal magnitude.

The hypothesis above states that consumers will adapt cutoff severity on both of the correlated attributes. However, a rational consumer might also adapt cutoffs on only one of the two attributes, particularly if one attribute is very important relative to the second one or if the cutoff on one attribute is easier to change. It is also possible that adapting cutoff severity on a pair of correlated attributes will have cross effects on other attributes. For instance, if a positive correlation induces more severe cutoffs on the correlated attributes, the consumer may tend to relax cutoffs on other attributes to ensure that at least one alternative passes the screen. We leave hypotheses about specific interrelationships among cutoffs to future research but acknowledge the existence of such cross effects.

A complexity that we do address involves the processing of environmental information. Implicit in the discussion of context effects on cutoff severity is the assumption that consumers are sufficiently sensitive to environmental changes for adaptation to occur. We therefore examine the format of environmental information, which may affect information processing and moderate the hypothesized effects of context on cutoff severity.

## Format Effects Moderating Cutoff Adaptation

The premise that consumers successfully adapt cutoffs to the choice environment presupposes that they can effectively interpret that environment. There is little reason to question consumers' ability to detect changes in some overt task characteristics, like time pressure, distraction, or the number of salient attributes. However, consumers may be less attuned to more subtle aspects of the choice context, such as attribute correlations or reliability. Indeed, evidence suggests that, while consumers can accurately assess correlations between simple rank orders (Bettman, John, and Scott 1986), they are less accurate with more complex stimuli (Crocker 1981).

These findings suggest that consumers' adaptation to correlation may depend on the format in which correlational information is presented. Correlational information is not always inferred from an assessment of choice alternatives. Instead, consumers may learn rules of thumb that express correlational relationships. These rules may be particular to one market (e.g., "The apartments close to campus are all firetraps.") or may generalize across markets (e.g., "You get what you pay for."). Access to a correlational rule may produce more effective adaptation of cutoffs because an effortful assessment of choice alternative data is not required.

A clear prediction of how information format (correlational rule vs. choice alternative data) will affect adaptation is complicated by the fact that the process of adaptation may vary between formats. A correlational rule facilitates a top-down adaptation process in which the consumer deduces the impact of the correlation on the costs and benefits of a cutoff. However, a consumer who has access only to choice alternatives may avoid the need for a direct correlational assessment by adapting through a data-driven, bottom-up process (Bettman 1988). In bottom-up processing, the consumer's choice strategy is shaped by concrete information about alternatives that are encountered in the course of making a choice. For instance, a negative correlation creates an environment in which it is difficult to find an alternative with good values on both attributes. A consumer in this frustrating situation may develop more pessimistic expectations on those attributes and make cutoffs less severe to be consistent with those new expectations. Thus, a consumer might adapt to an environmental correlation without consciously assessing it or even being able to articulate it. This bottom-up process is not constrained by the consumer's ability to accurately identify the environmental correlation.

Adaptation of cutoffs to correlations is possible with either top-down or bottom-up processing, but we know little about their relative efficacy or the conditions that elicit the use of each type (cf. Park and Smith 1989). One could argue that a priori correlational rules are more likely to influence cutoffs because the consumer need only realize the logical implication of the relationship. However, bottom-up processing of choice alternative data requires minimal deliberation about the choice environment because there is no need to understand a general relationship between attributes or deduce its implications. Because we can identify feasible methods for adapting to correlation with both correlational-rule and choice-data formats, we hypothesize equal adaptation in both cases.

> **H3:** The adaptation of cutoff severity to correlation does not depend on the format of correlational information. Adaptation will occur when consumers are given a correlational rule,

[1] As the correlation approaches −1.00 and the two distributions move closer together, all alternatives become more similar in total utility; a good value on one attribute is offset by a poor value on the other. In an extreme case, the variance in total utility could become quite small. For example, if only two attributes are salient, they are equally important, and they have a correlation of −1.00, then all alternatives have equal utility. In this situation there is zero opportunity cost to any cutoff, and a severe cutoff could be used to make a convenient choice. This result would run counter to the hypothesis, but we believe that such extreme conditions are rare. We are indebted to an anonymous reviewer for suggesting this boundary condition for the effect of negative correlations.

as well as when they are given only choice alternative information.

## The Role of Expectations

Choice expectations are defined here as the level of each attribute that the consumer anticipates the chosen alternative will possess. In everyday language, such expectations are reflected in statements such as "In this town I'll probably have to settle for a mediocre apartment," or "Prices are so low that I can afford a large apartment." Expectations about choice outcomes are hypothesized to mediate the relationship between attribute correlations and the adaptation of cutoff severity. In a top-down process, deductions about the correlation's effect on choice outcomes shift expectations, whereas with bottom-up processing expectations gradually shift as initial expectations are disconfirmed by experience with specific alternatives. This mediation is especially important in the case of bottom-up processing because it explains how consumers who may not be able to report the correlational context accurately are nonetheless able to adapt to it in normatively appropriate ways.

It is worth noting that expectations may mediate a variety of effects on cutoff severity. In general, expectations about choice outcomes may change either because (1) the consumer's perceptions of the availability of attribute levels in the choice environment change or (2) the consumer's priorities about attaining a particular attribute level change. A correlation should affect perceptions about the joint availability of the correlated attributes; therefore, we predict that expectations mediate the impact of correlation on cutoff severity. Reliability, on the other hand, should affect neither a consumer's priorities nor the perceptions of the levels available in the environment, and we do not predict that the reliability effect is mediated by choice expectations.

**H4:** The effect of attribute correlation on cutoff severity is mediated by the decision maker's expectations about the values that the choice outcome will have on the correlated attributes. (*a*) Expectations about choice outcomes on correlated attributes will be higher for positive correlations than for negative correlations. (*b*) When the effect of expectations on cutoff severity is taken into account, the hypothesized relationship between correlation and cutoff severity will be significantly reduced or eliminated.

**H5:** Expectations about choice outcomes will not differ for an attribute under high- and low-reliability conditions.

# AN EMPIRICAL STUDY OF CUTOFF SEVERITY

The study has two objectives. The first is to test our previously stated hypotheses about how attribute reliability, attribute correlation, and expectations about choice outcomes affect cutoff severity. The second objective is to assess the extent to which information format moderates the proposed effects of correlation.

Previewing briefly, we present subjects with the hypothetical problem of having to find a new apartment. They are able to reduce the number of apartments on a large list by using cutoffs that eliminate apartments with unacceptable attribute levels. We explore the adaptation of cutoffs to choice context in two experimentally controlled, hypothetical environments that vary in attribute reliability and correlations between attributes. We measure choice expectations to test their mediation of the cutoff process. Finally, we exàmine the impact of different information formats on adaptation to correlations between attributes.

## Subjects

We recruited 229 students from business classes at a large state university and asked them to come to a computer lab on campus. Each sequence of 12 subjects was randomly assigned to one of the 12 treatments described below. The subjects received a diskette containing a self-administered, computer-interactive questionnaire created on the Ci2 System (Sawtooth Software 1986). They were given either class credit or a small prize in return for their participation in the sessions, which averaged 17 minutes. Three subjects were eliminated because their completion times of five minutes or less were judged too rapid to have adequately read the questions, resulting in a final sample size of 226.

## Task

Subjects considered the problem of transferring to another school and having to find an apartment, which was initially described by its rent, quality, and travel time to campus. After receiving information about the new community, subjects provided their choice expectations and cutoffs for rent, quality, and travel time. They could place cutoffs on any or all of the three attributes, whose levels are shown in Table 1. We then repeated the process for a second community with different characteristics. Details of this procedure are given below.

## Cutoff Measures

To measure cutoffs, subjects were told that a free student service could provide them with the addresses of up to 100 available apartments. The service could also screen from the list any apartment with an undesirable level on an attribute. Subjects indicated their cutoffs in three steps. First, the computer asked whether they wished to receive the complete list of 100 addresses or whether they wished the service to screen out some of the apartments. Subjects who desired the screening were

**TABLE 1**

RESPONSE SCALES FOR CUTOFF AND EXPECTATION MEASURES

| Response scale | Quality[a] | Monthly rent ($ per person) | Travel time (minutes) |
|---|---|---|---|
| 7 | 90–99 (Excellent) | Under 200 | Under 5 |
| 6 | 85–89 | 200–249 | 5–9 |
| 5 | 80–84 (Good) | 250–299 | 10–14 |
| 4 | 75–79 | 300–349 | 15–19 |
| 3 | 70–74 (Fair) | 350–399 | 20–24 |
| 2 | 65–69 | 400–449 | 25–29 |
| 1 | 60–64 (Poor) | 450 or more | 30 or more |

[a]The quality scale was defined for subjects as follows: 90–99 (Excellent), the apartment is in great condition, quiet, and spacious; 80–89 (Good), the apartment is in good condition, relatively quiet, with adequate space; 70–79 (Fair), the apartment is in fair condition, somewhat noisy, with small rooms; and 60–69 (Poor), the apartment is in poor condition, very noisy, and cramped.

asked to specify the attributes (rent, quality, and travel time) on which screening should occur and to indicate the screening for these attribute levels on the 1–7 response scales shown in Table 1. We define cutoff severity as the number of undesirable levels eliminated for each attribute on which screening occurred.

## Manipulations in the Hypothetical Environments

We told subjects that good information about apartment quality was hard to come by and that a local realtor who owned several of the available apartments had provided the service's quality ratings on the 60–99 scale shown in Table 1. Reliability was then manipulated between subjects by displaying the results of an independent quality check of six apartments, as shown in Table 2. In the high-reliability condition, the average difference between realtor and independent ratings was less than two points while in the low-reliability condition the average difference was 16 points.

Attribute correlation was manipulated within subjects, with quality and travel time to campus negatively correlated in one hypothetical community and positively correlated in the other. For the positive-correlation environment, apartments closer to school had higher quality than those farther away while in the negative-correlation environment they had lower quality. The presentation sequence of the positive and the negative environment was counterbalanced to control for order effects.

We manipulated the format of correlational information to test whether it moderates the level of cutoff adaptation. In the description format, subjects read direct statements about the ranges and average levels of attributes. The quality-time correlation was manipulated by a statement that apartments closer to campus have either better quality (positive correlation) or worse quality (negative correlation) than apartments that are

**TABLE 2**

COMPARISON USED IN RELIABILITY MANIPULATION

| Apartment | Realtor rating | Appraiser rating (reliable) | Appraiser rating (unreliable) |
|---|---|---|---|
| A | 60 | 61 | 80 |
| B | 65 | 65 | 84 |
| C | 73 | 74 | 93 |
| D | 85 | 84 | 66 |
| E | 88 | 88 | 85 |
| F | 93 | 92 | 76 |

farther away. In contrast, in the sample format subjects were shown a sample of typical apartments from each new community, with each apartment described by its quality rating, rent, and travel time to campus. Within these samples, the ranges and average levels of attributes were equivalent to the values stated in the description format. The sample apartments had quality-time correlations of .76 and −.73 for the positive- and negative-correlation environments, respectively. Table 3 shows the sample apartments for the two new environments, the average attribute levels and ranges for both samples and descriptions, and the attribute correlations for the sample apartments. Note the relative difficulty of finding good-quality apartments close to campus in the negative-sample environment in Table 3 as compared with the positive environment. A third, combined format gave both the descriptive and the sample information about the new communities.

We reinforced the correlation manipulation in two ways. First, for the sample and combined formats, we asked subjects to make their first and second choice from the given samples of nine apartments ("to give you a feel for what apartment hunting might be like"). Second, in all conditions, we redisplayed either the sample of nine apartments (in the sample and combined formats) or the environmental description (in the description format) during the cutoff tasks.

## Other Measures

Earlier research has shown that cutoffs are more severe for more important attributes (Klein and Bither 1987). We therefore measured attribute importance prior to exposing subjects to any choice environment. Subjects rated the importance of the difference between two levels of each attribute on a 41-point analog scale anchored with "not at all important" and "very important." The specific differences (5 vs. 20 minutes, 70 vs. 85 quality points, and $200 vs. $350 rent) spanned the second and fifth response categories shown in Table 1. In each environment, subjects reported for each attribute separately the expected level for their new apartments by checking one of the seven levels of quality, travel time, and rent shown in Table 1. These re-

**TABLE 3**

SAMPLE APARTMENTS AND DESCRIPTIONS

| | Negative environment | | | Positive environment | | |
|---|---|---|---|---|---|---|
| | Time (minutes) | Quality rating | Rent/month ($) | Time (minutes) | Quality rating | Rent/month ($) |
| Sample apartment: | | | | | | |
| 1 | 2 | 80 | 400 | 4 | 85 | 600 |
| 2 | 4 | 56 | 240 | 6 | 80 | 295 |
| 3 | 5 | 73 | 190 | 9 | 90 | 380 |
| 4 | 8 | 63 | 570 | 10 | 93 | 310 |
| 5 | 14 | 69 | 345 | 11 | 65 | 160 |
| 6 | 19 | 86 | 515 | 15 | 79 | 215 |
| 7 | 22 | 76 | 235 | 20 | 71 | 410 |
| 8 | 26 | 90 | 255 | 25 | 75 | 340 |
| 9 | 35 | 92 | 385 | 37 | 53 | 435 |
| Mean | 15 | 76 | 348 | 15 | 77 | 349 |
| Range | 2–35 | 56–92 | 190–570 | 4–37 | 53–93 | 160–600 |
| Description: | | | | | | |
| Mean | 15 | 75 | 350 | 15 | 75 | 350 |
| Range | 3–40 | 55–95 | 150–600 | 3–40 | 55–95 | 150–600 |

| | Negative environment | Positive environment |
|---|---|---|
| Sample correlations: | | |
| Quality-time | −.73[a] | +.76 |
| Quality-rent | −.07 | −.09 |
| Rent-time | +.01 | +.05 |

[a]A negative correlation means that desirable levels of one attribute are associated with undesirable levels of the other.

sponses, taken before the cutoff measures, measured choice expectations, which are hypothesized to mediate the effect of correlations on cutoff severity.

## Manipulation Checks

After cutoffs were made in the second hypothetical community, subjects rated the accuracy of the quality ratings (reliability), their perceptions of the pairwise correlations among attributes in that community, and the relative attractiveness of the two hypothetical communities. The last measure was of interest because, as stated earlier, consumers using bottom-up processing may adapt cutoffs to changing perceptions of the environment without explicitly articulating the correlation involved.

Earlier attempts in our pretests to measure correlation had shown that subjects had difficulty expressing the strength of correlations. A simple directional measure of correlation was therefore used. Subjects categorized the relationship between two attributes as one of the following: "apartments with shorter travel times to campus tend to have higher/lower quality than those with longer travel times," "there is no relationship between apartment quality and travel time to campus," or "I don't know enough about apartments in (the community) to judge whether quality and travel time are related."

# RESULTS

## Manipulation Checks

The reliability of the quality information was successfully manipulated. The proportions of subjects perceiving large, small, and no differences between quality ratings and actual quality were 36, 64, and 0 percent in the low- and 0, 64, and 36 percent in the high-reliability condition.

Results for the correlation-manipulation check suggest that information format is an important moderator of consumers' ability to accurately identify correlations. The percentage of subjects who accurately identified the direction of the quality-time correlation in the second new community was 86 percent for the description format, 71 percent for the combined format, but only 29 percent for the sample format. Although sample-format subjects did not report the correlation accurately, they did recognize that the two choice sets were not equally attractive. When asked in which of the two new communities they would rather apartment hunt, those who expressed a preference chose the positive over the negative correlation environment in the following (approximate) ratios: 2.4 to 1 for the sample format, 3 to 1 for the description format, and 4 to 1 for the combined format. Sample-format subjects therefore show

**TABLE 4**

ANOVA RESULTS FOR CUTOFF SEVERITY

| | Quality cutoff severity ($N$ = 127) | | Rent cutoff severity ($N$ = 172) | | Travel-time cutoff severity ($N$ = 153) | |
|---|---|---|---|---|---|---|
| Effect | $\eta$[a] | $p$[b] | $\eta$ | $p$ | $\eta$ | $p$ |
| Reliability (R) | .19 | .04 | .03 | .73 | .01 | .92 |
| Correlation (C) | .08 | .39 | .03 | .73 | .39 | <.001 |
| Order (O) | .03 | .71 | .02 | .81 | .16 | .06 |
| Format (F) | .10 | .57 | .23 | .01 | .11 | .40 |
| R × C | .06 | .53 | .01 | .87 | .08 | .37 |
| R × O | .04 | .64 | .10 | .21 | .09 | .31 |
| R × F | .16 | .24 | .11 | .37 | .06 | .80 |
| C × O | .04 | .67 | .01 | .88 | .16 | .05 |
| C × F | .18 | .15 | .02 | .98 | .20 | .05 |
| O × F | .07 | .72 | .15 | .16 | .05 | .83 |
| R × C × O | .03 | .74 | .05 | .52 | .05 | .52 |
| R × C × F | .17 | .19 | .10 | .42 | .10 | .77 |
| R × O × F | .08 | .72 | .19 | .05 | .06 | .46 |
| C × O × F | .16 | .23 | .03 | .92 | .19 | .07 |
| R × C × O × F | .02 | .97 | .12 | .31 | .13 | .33 |

[a]The parameter $\eta$ is a measure of effect size. According to Cohen (1977), small, medium, and large effect sizes for $\eta$ are .10, .24, and .37; $\eta = \sqrt{F(\mathrm{df})/[F(\mathrm{df}) + \mathrm{df} \cdot sb - 2\ mm \cdot cterror \cdot sb \cdot \mathrm{ct}]}$.

[b]The $\mathrm{df}_{\mathrm{error}}$ = 115 for the quality analysis, 160 for the rent analysis, and 141 for the travel-time analysis.

some sensitivity to the effects of the correlational change.

## Cutoff Severity in the Two Environments

*Overview.* All analyses of cutoff severity within the two hypothetical environments were performed separately for each attribute with subjects who had indicated a desire to place a cutoff on that attribute. One hundred and seventy-two subjects qualified for the rent analyses, with an average level of cutoff severity of 2.9 (i.e., an average of 2.9 out of seven response categories were eliminated). The 126 subjects in the quality analyses had an average cutoff severity of 2.6 while the 153 subjects in the time analyses had an average cutoff severity of 2.9.

The adaptation of cutoff severity to environmental manipulations is tested with a four-way ANOVA of cutoff severity, in which the factors are reliability (high or low), quality-time correlation (positive or negative), presentation order of the two-correlation environments (positive presented first or negative presented first), and information format (sample, description, or combined). This ANOVA, referred to here as the base model, is shown in Table 4 for each attribute. For the sake of brevity, the discussion focuses on effects that are significant at the .05 level.

To establish that expectations mediate the correlation effect, it must be shown that (1) attribute correlations significantly affect expectations and that (2) when both correlation and expectations are used to predict cutoff severity the effect of correlation is diminished (Baron and Kenny 1986). To test the first condition, we ran the base model to predict expectations rather than cutoff severity. We tested the second condition by adding expectations to the base model as a covariate.

*Reliability.* As Hypothesis 1 predicts, quality cutoffs in the high-reliability condition are more severe than in the low-reliability condition (means = 2.8 and 2.4, respectively; $\eta$ = .19; $p$ = .04). As expected, reliability does not affect quality expectations ($F(1,115)$ = .50, $p$ = .48), showing that expectations do not mediate reliability effects. Subjects make less severe cutoffs on the basis of unreliable information but do not lower their expectations about the eventual outcome on that attribute. Rent and time cutoffs were also unaffected by the reliability of quality information. In total, the hypothesis about the adaptation of cutoff severity to reliability is supported.

*Correlation.* We hypothesize that cutoffs will be more severe for positively than for negatively correlated attributes. Manipulating the quality-time correlation should therefore affect the severity of cutoffs for quality and/or time. The results show a large effect on cutoff severity for time ($\eta$ = .39, $p$ < .001). Subjects eliminated an average of 3.0 time levels when time was positively correlated with quality but only 2.3 levels when they were negatively correlated. As shown in the next section, this shift in cutoff severity was not equally strong in all information formats.

The tests for expectations' mediation of this effect indicate a partial mediation. The negative correlation does significantly reduce time expectations (4.7 vs. 5.2 on a seven-point scale, $F(1,141) = 12.78$, $\eta = .29$, $p < .001$), the first necessary condition for mediation. In addition, when expectations is added to the base model as a covariate, the effect size for correlation is reduced (from $\eta = .39$–.31, $F(1,140) = 14.54$, $p < .001$), which is also consistent with mediation. However, the correlation effect is still large and significant at $p < .001$, indicating that correlation has a residual impact on cutoff severity that is not predicted by expectations.

Quality cutoffs are slightly less severe when quality and time are negatively correlated (2.5 vs. 2.6) but not significantly so ($p = .39$). However, in this situation quality expectations drop significantly from 5.3 to 4.9 ($F(1,115) = 28.63$, $\eta = .45$, $p < .001$). Thus, negative correlations changed subjects' expectations about both quality and travel time, but they chose to adjust their cutoffs on travel time.

One possible explanation for the tendency to adapt travel-time cutoffs rather than quality cutoffs is that quality tends to be more important than time, and subjects resist lowering their quality standards. To test whether consumers adapt their cutoffs more for less important attributes, subjects who had given a higher importance rating to either quality or time were placed into two groups. A two-way ANOVA of cutoff severity was run with correlation and importance as factors. However, the interaction between importance and correlation was not significant for either quality ($F(1,114) = .39$, $p = .54$) or time ($F(1,133) = 1.23$, $p = .27$) cutoffs, indicating that the change in cutoff severity between correlation environments was not affected by which of the correlated attributes was more important. Thus, the lack of adaptation for quality cutoffs is not explained by the importance of quality relative to travel time; we discuss this result in more detail later. Overall, the analyses show that consumers do adapt their cutoffs to changes in correlation in the hypothesized direction and that this effect is partially mediated by expectations.

*Format.* The impact of format is estimated by examining the extent to which the three formats (sample, description, and combined) facilitated cutoff change. Recall that the experimental correlation manipulation had a significant effect on cutoff severity for travel time. Format moderated this effect, as shown by a significant interaction between correlation and format for time cutoffs ($\eta = .20$, $p = .05$). The means for time cutoff severity for the positive and negative correlation environments in the three formats were 3.1 and 2.1 (combined), 2.9 and 2.1 (description), and 2.9 and 2.6 (sample), respectively. Subjects in the description and combined formats adapted their time expectations and cutoffs to the correlation change significantly more than did subjects in the sample format. In fact, for the sample format, cutoff severity was not significantly different in the positive- and negative-correlation environments. This result is consistent with the earlier finding that subjects were unable to specify correlations correctly in that format.

In total, cutoff adaptation depends on the format in which environmental information is received. A correlational rule produces effective adaptation in the hypothesized direction, but providing choice alternatives that reflect a strong correlation has no significant effect.

Format also had an unanticipated effect on cutoff severity for rent ($\eta = .23$, $p = .01$). Cutoffs were higher in the sample format (mean = 3.3) than in the combined (2.9) or description (2.5) formats. One post hoc explanation is that rent information was more effectively conveyed by description than by example. The average rent in the experimental environments ($350) was significantly higher than the rents currently paid by the subjects (typically between $150 and $250). Subjects in the sample format may not have been as pessimistic about finding an acceptable, low-rent apartment as were subjects in the combined and description formats, and therefore they made more severe cutoffs on rent.

The main effect of format on rent cutoffs is complicated by a three-way interaction with reliability and order ($\eta = .19$, $p = .05$). The nature of the interaction is as follows. When the quality information is unreliable, order and format have no effect on cutoff severity for rent. However, when quality information is reliable, rent cutoffs in the description and combined formats are more severe when the positive correlation environment is presented first. The sample-format cutoffs change in the opposite direction; they are higher when the negative environment is presented first. We do not understand this interaction and are reluctant to attempt a post hoc explanation. It is possible that adaptation of the rent cutoff in some way reflects the interrelationships among cutoffs suggested earlier.

*Order of Environment Presentation.* The order in which the positive- and negative-correlation environments were presented had a nearly significant, unhypothesized effect on the severity of time cutoffs ($\eta = .16$, $p = .06$). Cutoffs were more severe when the negative environment was presented first. This effect is most easily understood by examining the interaction between presentation order and correlation, which had an equally strong effect ($\eta = .16$, $p = .05$). Regardless of order, subjects made their time cutoffs less severe in the negative correlation environment. However, those who went from the positive to the negative environment adapted their cutoffs to a greater degree than those who went from the negative to the positive environment, causing more severe cutoffs overall in the latter condition.

This interaction suggests that subjects adapt to the first community and use it as a reference point for evaluating the second. Those who move from the negatively correlated environment to the positive one experience some improvement in the attractiveness of the apartments offered, while those who move in the opposite direction experience some deterioration. The larger adjustment in the second case is consistent with prospect theory, which predicts that a perceived loss will have more impact than an equivalent perceived gain (Kahneman and Tversky 1979).

*Summary.* The results warrant five major conclusions. First, when the reliability of attribute information increases, subjects make more severe cutoffs on that attribute, as predicted. This is the first time that attribute reliability has been shown to affect a choice heuristic. Second, cutoffs are more severe in a positive- than in a negative-correlation environment, although this effect is significant for only one of the two correlated variables. Third, this relationship between cutoffs and correlation appears to be partially mediated by expectations. Fourth, the impact of correlation on cutoffs is greater when the correlational relationship is directly stated than when it has to be inferred from raw data. Finally, cutoff change is greater when moving to a less attractive environment (from a positive to a negatively correlated environment) than it is in the reverse situation.

The finding that quality cutoffs were not adapted, whereas time cutoffs were, was not sufficiently explained by the relative importance of the two attributes. Three post hoc explanations seem plausible. The first involves familiarity with the travel-time versus quality attributes. Subjects may have been more reluctant to adjust cutoffs using the relatively unfamiliar quality metric. Consumers may also be more experienced in making cutoffs on travel time (location) than on the typically less accessible quality variable, and, therefore, they may have been more comfortable in adapting the familiar heuristic. A final possibility is that we inadvertently anchored subjects' attention on the travel-time attribute by the way in which we expressed our correlation manipulation. The statement "apartments with shorter travel times to campus tend to have better/worse quality than those with longer travel times" may implicitly make travel time the logical referent.

The impact of format on correlation was unexpected in that we had anticipated that adaptation would occur under all formats. Sample information about correlation changes did not elicit significant adaptation. It may be that consumers need more experience within the choice environment than was given in the current experiment. In addition, the effectiveness of the description format may have been heightened by the ease with which the information "high-quality apartments are close to campus" can be translated into a search strategy. That is, one simply restricts search to those apartments close to campus. The lack of response to sample information raises the question of the degree to which consumers can effectively adapt to environmental correlations that are not explicitly framed for them. These issues frame important future research topics.

# DISCUSSION

We began by defining a choice process in which low-cost processes are available to make first-stage cutoffs. These initial cutoffs limit the alternatives that will be thoroughly evaluated in the second stage. While our results generalize only to environments in which consumers use our postulated process, the data were generally consistent with our hypotheses. The empirical results lead to several conclusions that we examine below.

## Cutoffs Adapt to the Choice Environment

If cutoffs partition attributes into inherently acceptable and unacceptable levels, then cutoffs once fixed should be maintained over a long period of time. Our view, which is supported by the current study, is that cutoffs are instrumental heuristics highly conditional on the characteristics of the choice environment. Consumers adapt cutoffs to changes in the environment according to the impact of those characteristics on the cutoffs' costs and benefits.

Our study is the first to show that consumers adapt cutoffs to changes in the reliability of information and to changes in the correlations between attributes. This adaptability to the choice environment is also found by Payne et al. (1988), who show that consumers alter their application of decision rules to suit a particular choice context. The order in which subjects encountered the positive and negative correlation environments also mattered, which indicates an adaptation-level effect. A deteriorating choice context evidently has more impact on cutoff severity than an improving context.

## Mediation by Choice Expectations

Here choice expectations reflect the perception of how good one expects the ultimate choice to be on an attribute. We believe that these expectations provide a simple mechanism whereby consumers intuitively adapt cutoff severity to environmental changes without undergoing a complex normative analysis. Expectations mediated the correlation effect, but correlations appear to exert a direct influence on cutoff severity as well. Also important is the predicted finding that expectations do not mediate the effect of reliability on cutoff severity. Further investigation of the role of expectations and the nature of its relationship to cutoff severity is needed.

## Format Effects on Cutoff Adaptation

Format was varied to give subjects either choice alternatives with a particular correlation or a direct statement of the environmental correlation. When the correlation rule was directly stated in the description and combined formats, decision makers remembered it and adjusted their cutoffs in the predicted directions. By contrast, decision makers whose environmental information came in the form of sample apartments could not report the direction of the correlation accurately. In addition, they did not adapt to correlational changes.

Our expectation that subjects would avoid the explicit analysis of correlation in the sample format and yet adapt effectively through bottom-up processing was not supported.

One explanation for these results is that consumers' ability to infer correlation from information about alternatives is poor. Bettman et al. (1986) report accurate estimates of correlation in a variety of formats using rank-order data. However, in the current study information was presented in metrics for which the ordering of alternatives on each attribute was less transparent. Considering that typical marketplace information is even more disorganized and less likely to facilitate estimates of correlation, future research on the contexts in which consumers are able to "read" covariation information in the marketplace should have high priority.

A second possibility is that decision makers were not motivated to assess and use correlational information, except when they were given a readily available correlational rule. Simmons and Lynch (1991) found that subjects seldom used correlations to infer the values of missing attributes in an evaluation task, even though they used correlational rules when inferences were prompted. In this study, the relative inaccessibility of the correlational information in the choice alternative data may have inhibited the use of the correlational inferences needed for cutoff adaptation.

## Future Research into Cutoff Severity

We tested only a few of the environmental influences that may affect cutoff severity. A systematic normative analysis of the possible effects of other task and context factors would be a productive step in understanding the use of cutoffs in choice strategies. In light of the current findings about format effects, such research must also examine issues related to consumers' ability to understand the choice context.

Our hypotheses deal with the severity of a cutoff given that one is to be made on an attribute; we do not address the important issue of the selection of attributes on which to make cutoffs. One approach to predicting attribute selection for cutoffs simply extends the logic of the current hypotheses, with the assumption that the same factors that make a cutoff more severe should also increase the likelihood of *any* cutoff being placed on an attribute. However, decisions about using cutoff heuristics may be more strongly influenced by certain individual factors, like attitude toward risk, than are decisions about the severity of the cutoffs once made.

Other extensions involve relaxing the assumptions of the multistage process and examining the normative predictions about cutoff severity under different processes. One such extension removes the assumption that alternatives dropped from consideration are eliminated permanently. In most cases this assumption is unrealistic—a cutoff that is too severe can generally be relaxed, and one that is too easy can be tightened (for a good illustration of just how adaptive cutoffs can be, see Widing, Burnkrant, and Talarzyk [1986]). However, we believe these adaptations will be largely consistent with the hypothesized relationships in our model if they are adjusted for the decision maker's current beliefs. For example, if evaluations of the three-star apartments exceed expectations, one may reverse an earlier decision to evaluate two-star apartments. In effect, new information from the evaluation of alternatives updates one's expectations and shifts cutoffs; thus, the direction of these shifts is expected to follow the current hypotheses.

Another important direction for future research is to model exploratory behavior, such as testing alternatives beyond a current cutoff. For example, one might explore an apartment with a price above one's original price limit just to see how much better it is. If it greatly exceeds expectations, the cutoff may be shifted; however, if prior expectations are confirmed, the cutoff is reinforced. The current multistage process does not explicitly model such exploratory behavior, but this behavior defines an important area for future research.

A final extension is to broaden the criterion by which cutoff severity is defined. In the current study cutoff severity is defined as those attribute levels that alternatives must pass to be more thoroughly evaluated. These cutoffs then determine the number of alternatives expected to reach the second stage. In different environments one might be able to specify this number directly. For example, a screening committee might be charged with identifying the *three* best candidates for a job. Alternatively, one might use progressive attribute cutoffs until the appropriate number of alternatives is found. The properties of such quota cutoffs have not been thoroughly explored but would provide a fruitful avenue for theoretical and behaviorial research.

One goal of this article has been to illustrate the value of taking a cost-benefit perspective to generate hypotheses about consumers' use and adaptation of cutoffs. Research needs to proceed both in testing the implications of the multistage choice process presented here as well as in the development of related models that are appropriate in different decision environments. Progress on both tracks is needed to understand the complex and adaptive process of cutoff selection.

[*Received July 1988. Revised May 1991.*]

## REFERENCES

Baron, Reuben M. and David A. Kenny (1986), "The Moderator-Mediator Variable Distinction in Social Psychological Research: Conceptual, Strategic, and Statistical Considerations," *Journal of Personality and Social Psychology,* 51 (December), 1173–1182.

Bettman, James R. (1988), "Processes of Adaptivity in Decision Making," *Advances in Consumer Research,* Vol. 15, ed. Michael J. Houston, Provo, UT: Association for Consumer Research, 1–4.

———, Deborah Roedder John, and Carol A. Scott (1986), "Covariation Assessment by Consumers," *Journal of Consumer Research,* 13 (December), 316–326.

Cohen, Jacob (1977), *Statistical Power Analysis for the Behavioral Sciences,* New York: Academic Press.

Crocker, Jennifer (1981), "Judgment of Covariation by Social Perceivers," *Psychological Bulletin,* 90 (September), 272–292.

Grether, David and Louis Wilde (1984), "An Analysis of Conjunctive Choice," *Journal of Consumer Research,* 10 (March), 373–385.

Hauser, John R. and Birger Wernerfelt (1990), "An Evaluation Cost Model of Consideration Sets," *Journal of Consumer Research,* 16 (March), 393–408.

Hoyer, Wayne D. and Steven P. Brown (1990), "Effects of Brand Awareness on Choice for a Common, Repeat-Purchase Product," *Journal of Consumer Research,* 17 (September), 141–148.

Jacoby, Jacob, George J. Szybillo, and Jacqueline Busato-Schach (1977), "Information Acquisition Behavior in Brand Choice Situations," *Journal of Consumer Research,* 3 (March), 209–216.

Johnson, Eric J. and John W. Payne (1985), "Effort and Accuracy in Choice," *Management Science,* 31 (April), 395–414.

Kahneman, Daniel and Amos Tversky (1979), "Prospect Theory: An Analysis of Decision under Risk," *Econometrica,* 47 (March), 263–291.

Klein, Noreen M. (1983), "Utility and Decision Strategies: A Second Look at the Rational Decision Maker," *Organizational Behavior and Human Performance,* 31 (1), 1–25.

——— and Stewart Bither (1987), "An Investigation of Utility Directed Cutoff Selection," *Journal of Consumer Research,* 14 (September), 240–256.

——— and Manjit S. Yadav (1989), "Context Effects on Effort and Accuracy in Choice," *Journal of Consumer Research,* 16 (March), 410–420.

Lussier, Denis A. and Richard W. Olshavsky (1979), "Task Complexity and Contingent Processing in Brand Choice," *Journal of Consumer Research,* 6 (September), 154–165.

Lynch, John G., Jr. (1982), "Looking for Confirming Evidence: The Case of the Elusive Conjunctive Consumer Decision Process," working paper, Center for Consumer Research, University of Florida, Gainesville.

Park, C. Whan and Daniel C. Smith (1989), "Product-Level Choice: A Top-Down or Bottom-Up Process?" *Journal of Consumer Research,* 16 (December), 289–299.

Payne, John W. (1976), "Task Complexity and Contingent Processing in Decision Making: An Information Search and Protocol Analysis," *Organizational Behavior and Human Performance,* 16 (August), 366–387.

——— (1982), "Contingent Decision Making," *Psychological Bulletin,* 92 (September), 382–402.

———, James R. Bettman, and Eric J. Johnson (1988), "Adaptive Strategy Selection in Decision Making," *Journal of Experimental Psychology: Learning, Memory and Cognition,* 14 (July), 534–552.

Sawtooth Software (1986), *Ci2 System for Computer Interviewing,* Ketchum, ID: Sawtooth Software.

Shugan, Steven M. (1980), "The Cost of Thinking," *Journal of Consumer Research,* 7 (September), 99–111.

Simmons, Carolyn J. and John G. Lynch, Jr. (1991), "Inference Effects without the Inference Making? Effects of Missing Information on Discounting and Use of Presented Information," *Journal of Consumer Research,* 17 (March), 477–491.

Tversky, Amos (1972), "Elimination-by-Aspects: A Theory of Choice," *Psychological Review,* 79 (July), 281–299.

Widing, Robert E., Robert E. Burnkrant, and W. Wayne Talarzyk (1986), "Computer Assisted and Static Information Provision Formats: Comparisons on Reactions, Time and Accuracy," *Proceedings: American Marketing Association,* ed. Terry Shimp et al., Chicago: American Marketing Association, 74–79.

Wright, Peter (1974), "The Harrassed Decision Maker: Time Pressures, Distractions, and the Use of Evidence," *Journal of Applied Psychology,* 59 (October), 555–561.

——— and Mary Ann Krewall (1980), "State of Mind Effects on the Accuracy with Which Utility Functions Predict Marketplace Choice," *Journal of Marketing Research,* 17 (August), 277–293.