The Zero-Comparison Effect

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This research investigates the effect of a zero-value attribute on consumer choice. It is argued that a zero attribute removes a reference point that consumers use to evaluate the size of attribute differences. As a consequence, the shift from a number to zero can make an advantage (or disadvantage) that seemed large and clear in the presence of a reference point become less clear and thus less impactful when a reference point is removed. This leads to an interesting effect, whereby an option can improve its choice share by increasing the level of an undesirable attribute from zero or decreasing the level of a desirable attribute to zero. A series of four experiments provide supporting evidence for this new choice phenomenon.

Consumer decision making frequently involves uncertainty about the benefits provided by different levels of product attributes. For example, a consumer shopping for yogurt may need to understand the meaning of 5 grams of fat before deciding whether to buy a product. Is a yogurt with this amount of fat a low-fat yogurt? Or is 5 grams actually a high fat content? A large body of research has shown that oftentimes preferences are formed at the time of choice or evaluation and are influenced by the context (Bettman, Luce, and Payne 1998; Huber, Payne, and Puto 1982; Simonson 1989; Simonson and Tversky 1992). An important context characteristic is whether a product is evaluated alone or in the presence of another alternative (Hsee and Leclerc 1998). The presence of another product provides a reference against which attributes of a focal product can be compared. Next to a product with fat content of only 1 gram, 5 grams may look unattractive, as it is five times larger. However, compared to 20 grams, a yogurt with 5 grams of fat may look very attractive, as it contains four times less fat. Yet what happens when this yogurt is compared to one with no fat? Clearly, 0 is better than 5 grams of fat, but how much better? More broadly, how do consumers evaluate an attribute value when it is compared to zero?

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According to the principle of diminishing sensitivity (Kahneman and Tversky 1979; Tversky and Kahneman 1991), the perceived difference between two quantities decreases as both quantities increase by the same amount. In other words, the difference between 10 and 20 is perceived as larger than the difference between 110 and 120, even though in both cases the difference is 10 units. Values are not evaluated in isolation or as absolute differences. Rather, individuals focus on relative differences. Twenty is the double of 10, or 100% more, whereas 120 is roughly 10% more than 110. One advantage of this type of comparison is that it helps in providing meaning to absolute differences. In the yogurt example, whereas a judgment of the value of 5 grams of fat may require some expertise, the result of a relative comparison indicating that a product has five times less fat than another may be much easier to interpret. In this sense, the type of comparison affects the trade-offs consumers make when selecting a product. For example, a shopping decision may be framed as a contrast between a 10% difference in price versus a 30% difference in quality, as opposed to an evaluation of the dollar difference in price compared to the absolute difference in quality. An important limitation of this type of comparison occurs when one of the attributes is zero. In relative terms, compared to zero, any number is infinitely larger, so this type of comparison becomes meaningless. In this case, consumers lose the reference point that allows them to use relative comparisons, and as a result, they have to focus on absolute differences instead. An important question is, does the removal of a reference point ultimately affect decisions in a systematic way?

In the current research, I propose that zero is a special value that prevents consumers from using relative comparisons when making decisions. An interesting consequence

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for consumer behavior is investigated, whereby a change in an attribute—to or from zero—that makes an alternative objectively inferior (superior), can actually make it appear more (less) attractive. This happens because a change to (from) zero removes (creates) the reference against which the attribute value of the other alternative is compared. In the yogurt example, a difference between 1 and 5 grams of fat may be more meaningful to consumers than a difference between 0 and 5 grams. In the former, consumers can give meaning to the difference, noting that one is five times larger than the other—a substantial difference. In the latter, however, consumers have to understand what 5 grams of fat represent. Thus, compared to a product with 5 grams of fat, one with 1 gram has a clear and meaningful advantage. However, compared to a product with 5 grams of fat, a product with no fat has a clear but harder to interpret advantage. I argue that this creates a situation in which a product actually fares better than one that is objectively superior to it (e.g., 1 vs. 0 grams) when each is compared to a common alternative (e.g., 5 grams). In other words, an objective improvement of an offering may decrease its choice share.

In what follows, I review the relevant research and describe the theoretical bases that lead to the proposition of this new situation, whereby enhancing an alternative decreases its attractiveness. Next I report on four studies that provide empirical support for my hypotheses and reject alternative explanations. The article concludes with a discussion of the current findings in light of related literature and implications of the current research.

THEORETICAL DEVELOPMENT

Contextual Influences

A significant body of literature has shown that oftentimes consumers do not have predetermined preferences that are simply retrieved from memory whenever they need to make judgments or choices (Bettman et al. 1998). Rather, consumers are affected by elements of the context, such as the choice set. Frequently, consumers are aware of contextual influences and intentionally use this information as input for choice. For example, the compromise effect (Simonson 1989; Simonson and Tversky 1992) occurs as consumers deliberately choose a middle option in a set. In this case, choice may not reflect true preferences but rather the application of a decision rule (Amir and Levav 2008). Although the context may be arbitrary in an experimental setting, it has been argued that in real situations, this rule can be considered rational, as consumers use their personal preferences and information about market offerings to make inferences about the utility of a product (Wernerfelt 1995). A discussion about the (possible) rationality behind the use of other alternatives to determine the value of a given alternative is beyond the scope of the current work. More important, extant research has shown that consumers routinely engage in this type of process, extracting information from the choice set to evaluate each alternative.

In some demonstrations of context effects, researchers contrast choices from binary sets with choices from extended sets, which include an additional option. It is shown that the presence of this option increases the attractiveness of one of the original alternatives, as consumers use information from the entire set to make their decisions. The tendency to rely on contextual cues is so strong that effects have been shown even when the additional option is dominated (Huber et al. 1982) or unavailable (Hedgcock, Rao, and Chen 2009; Simonson 1989). Research by Hsee and colleagues (Hsee 1996; Hsee and Leclerc 1998; Hsee and Zhang 2004) has shown that contextual influences can occur even in binary sets. Contrasting separate and joint evaluations, this line of research has shown that attribute values of an alternative are used as references in the judgment of the attractiveness of another alternative. For example, in one his studies, Hsee (1996) showed that in separate evaluations, a dictionary with 10,000 entries in good condition is better evaluated than one with 20,000 entries but with a torn cover. However, in a joint evaluation task, most people prefer the dictionary with 20,000 entries. Hsee reasoned that in separate evaluation it is hard to judge the number of entries in a dictionary. In this sense, participants are relatively insensitive to a difference between 10,000 and 20,000 when only one of the dictionaries is presented.

In a review of preference reversals, Slovic et al. (2002) reported a study that illustrates the impact of reference in providing meaning to numbers. Participants in their study were asked to choose between a gamble and a sure gain. Whereas only 33.3% chose a gamble consisting of a 7/36 chance of gaining $9 over a sure gain of $2, 60.5% preferred the gamble when a 29/36 chance of losing 5¢ was added to it. In other words, adding a possible small loss to the gamble made it more attractive. Slovic et al. argued that whereas it may have been hard for participants to determine how attractive $9 is as an outcome of a gamble, the large ratio between $9 and 5¢ seemed to provide a more meaningful input for evaluation.

The importance of reference points in judgment and decision making was recognized by Tversky and Kahneman (1991) in their extension of prospect theory (Kahneman and Tversky 1979) to riskless choice. Reference dependence is one of the fundamental principles of their proposed value function, which is also characterized by loss aversion and diminishing sensitivity. According to diminishing sensitivity, individuals are more sensitive to relative differences between values than absolute ones. For example, a 5-month difference is perceived as larger when two competing products offer 5 and 10 months of warranty than when they offer 25 and 30. Although the difference is the same number of months, 25 and 30 are perceived as much closer than 5 and 10. There is diminishing sensitivity to change. An interesting consequence of this principle is that consumers' perceptions can be influenced by how one frames a difference between alternatives. For example, the sound quality of hi-fi systems can be expressed as *audio signal delivery* or as its complementary value, *audio distortion*. Wong and Kwong (2005)

showed that in a choice task between two hi-fi systems, a difference in audio signal had a stronger impact when it was described as audio distortion (.003% vs. .01%) than when it was described as audio signal delivery (99.997% vs. 99.99%). Although the absolute difference is the same in both cases (.007%), consumers tend to be influenced by relative differences. In the former, consumers may interpret the difference not as .007% but instead by noting that one quantity is roughly three times the other. However, in the latter, this type of interpretation leads consumers to conclude that the two quantities are roughly the same.

I investigate what happens when differences are not between two small numbers or two large numbers but between a number and zero. When one of the attributes is zero, consumers cannot use it as a reference point to evaluate the relative difference between the options since any number is infinitely larger than zero. In this case, consumers can only focus on the absolute difference. This type of evaluation can be viewed as analogous to a separate evaluation (Hsee 1996) because in both situations consumers do not have a proper reference point to facilitate the evaluation of the magnitude of an attribute value or an attribute difference. I argue that a difference between two numbers that is clear when there is a reference point and relative differences can be used (e.g., .003% vs. .01%) becomes less clear and thus less impactful when consumers have no reference point and have to evaluate an absolute difference or value (e.g., .00% vs. .01%).

In sum, past research has shown that consumers use information from competing options to evaluate attributes. This process occurs even in binary sets and with attributes that consumers can completely comprehend (Tversky and Simonson 1993). In this process, advantages and disadvantages are assessed in relative terms and not as absolute quantities. However, when an attribute value is zero, consumers can no longer use relative differences as inputs for choice. Zero eliminates the reference that consumers use to make relative comparisons. The consequence is that a shift from a small number to zero makes an advantage (or disadvantage) that seemed clear when there was a reference point, and relative difference could be used, become less clear and thus less impactful. This leads to an interesting effect, whereby an option can improve its choice share by increasing the level of an undesirable attribute from zero or decreasing the level of a desirable attribute to zero. In the next section, I briefly review research that has examined the impact of zero on consumer judgment and choice.

Zero as a Special Number

Research on several aspects of human psychology has shown that zero is used in a qualitatively different manner than other numbers, often causing discontinuity in the transition from small numbers to zero. For example, consumers use market norms when the price is nonzero but revert to social norms when the price is zero (Heyman and Ariely 2004). Zero probability is also viewed as substantially dif-

ferent from very small probabilities (Kahneman and Tversky 1979).

More relevant to the current investigation is the study of zero in a product choice context. In a recent article, Shampanier, Mazar, and Ariely (2007) examined the impact of zero price on consumers' choice. In one of their experiments, participants were offered a choice between a cheaper lower-quality chocolate (Hershey's) and a more expensive higher-quality one (Ferrero Rocher). The price of the chocolates was manipulated between subjects in the following manner: 2¢ and 27¢, 1¢ and 26¢, and zero and 25¢. Results showed that whereas there was roughly an even split between the two chocolates in the first two conditions, 90% chose Hershey's when it was free, indicating a discontinuity in the cost-benefit evaluations. In other words, consumers overreacted to the free chocolate.

If one were to generalize the impact of zero price to any zero attribute, the prediction would be the exact opposite of my hypothesis. For undesirable attributes, that is, those in which lower values are preferred to higher values, zero would be disproportionately attractive. For example, compared to a yogurt with 10 grams of fat, one with no fat would be viewed as much more attractive than one with 1 gram of fat.

Conversely, if one were to apply the rationale on the basis of reference point to price, one should predict the opposite of what was found. Taking the perspective that a small number provides a reference, whereas zero takes the reference away, consumers in the first two conditions should consider Ferrero Rocher as very expensive since it is being sold for more than 10 times the price of Hershey's. Therefore, compared to the zero and 25¢ condition, Hershey's should get a greater choice share when it has a very small price. This was clearly not the case. So what leads consumers to overreact to zero price, and why shouldn't we expect this to generalize to most attributes?

Shampanier et al. (2007) examined potential explanations and concluded that affect is the most likely account. They argued that zero price provides not only reduced cost but also additional benefits, as free offers evoke higher positive affect. Consistent with this reasoning, they showed that forcing participants to make more cognitive and deliberate evaluation of the alternatives before making a choice eliminated the effect.

In contrast to zero price, I do not expect consumers to exhibit strong affective reactions to other zero attributes. Rather, I predict that for other attributes, in general consumers will follow a more cognitive route considering trade-offs between alternatives. This is consistent with the vast literature on decision making reviewed in the previous section, which provides solid evidence for the influence of context (Simonson and Tversky 1992; Tversky and Kahneman 1991). In this sense, I argue that the effect of zero price is a special situation, as it is not driven by changes in context but by affective reactions to a focal option. This is not to say that there are no other attributes that will generate this type of emotional reaction, but it is expected that they

will be the exception, rather than the norm. Therefore, I do not expect my hypothesis based on reference point to generalize to price, but I also do not expect affective reactions evoked by zero price to generalize to most attributes. Next, I report on four studies that provide supporting evidence for these predictions.

STUDY 1: THE ZERO-COMPARISON EFFECT

Method

One hundred and fourteen undergraduate students from Indiana University completed a consumer behavior survey, in which this study was embedded, in partial fulfillment of a course research requirement. The survey was conducted on computer stations in a laboratory. Participants read a scenario adapted from Wong and Kwong's (2005) study 1a, in which they were interested in buying a hi-fi system and were considering two alternatives that only differed in terms of sound quality and CD-changer capacity, as shown in table 1. Sound quality was described as an audio-signal distortion, such that lower numbers were better than higher numbers. Sound quality of option A was the only factor manipulated between conditions, as .003% in the control condition and .00% in the zero-value condition. Each participant was randomly assigned to one of these two experimental conditions.

Results and Discussion

In the control condition, 50 participants chose option A, while only 10 preferred option B. In the zero-value condition, where option A was objectively better than in the control condition, only 30 participants chose it, while 24 preferred option B. In other words, as A's signal distortion improved from .003% to 0%, its choice share dropped from 83% to 56% ($\chi^2(1) = 4.26$, $p < .05$).

These results provide initial support for the hypothesis that a product may lose choice share when there is an objective improvement in an attribute. Previous research (Tversky and Kahneman 1991; Wong and Kwong 2005) has shown that consumers tend to focus on relative differences when comparing competing alternatives. In the control condition, participants are able to do this and can see that the signal distortion produced by option B is three times that produced by option A, which suggests a substantial difference in quality in favor of option A. However, in the zero-value condition, participants do not have a reference point and thus cannot use this same comparison process since in relative terms any number is infinitely large compared to zero. In this case, they have to evaluate the meaning of a .01% difference in signal distortion. Although zero distortion is clearly better than .01%, participants may have a hard time quantifying how much better this is. This lack of clarity about how much better the sound of A is led participants to attribute a smaller advantage to it compared to the control condition, where they could see that A's sound was three times better than B's sound.

TABLE 1

CHOICE SETS FOR STUDY 1

	Control		Zero value	
	Option A	Option B	Option A	Option B
CD-changer capacity	2	10	2	10
Sound quality (%)	.003	.01	.00	.01

NOTE.—CD-changer capacity is the number of CDs the hi-fi system can hold. Sound quality is expressed as audio signal distortion. It is calculated as the amount of noise signal/an audio signal output (expressed as a percentage; the lower, the better).

It must be acknowledged that this study used an attribute for which most people would have difficulty in judging the values in isolation. It is probably hard for participants to fully comprehend the meaning of .003% distortion or how different the sound would be compared to a .01% distortion. This definitely raises concerns about the generalizability of the phenomenon. Similarly, one may argue that in the zero-value condition, participants may not realize the possible variance of the sound distortion attribute, leading them to view the two values as roughly equal. It should be noted that the literature on context effects has shown that participants commonly derive meaning for attribute values from their relationships to other options in a set. Nevertheless, to test this possible limitation and to increase the generalizability of the finding, the hypothesis is tested in the next study using more common domains, in which participants are more familiar with the attributes.

STUDY 2: INSTANTIATING A REFERENCE POINT

Study 2 was designed with two goals in mind. First, it should replicate the zero-comparison effect in different domains. Second, it should provide evidence for the proposed mechanism. I have argued that when an attribute is zero, consumers have difficulty in judging the value of a competing alternative due to a lack of reference, which may decrease the perceived magnitude of an advantage as it prevents one from considering a relative difference. If this is correct, one way to eliminate the effect is to allow consumers to form their evaluations with an appropriate reference before introducing a zero-value attribute. This way, when a choice involving an option in which a zero-value attribute is presented, those who have had the chance to evaluate the magnitude of an attribute with a reference should be less likely to be affected by a lack of reference, that is, a zero value.

Method

Participants were 198 Australian residents recruited through a research company. They were randomly assigned to one of four conditions and completed this study online. Attribute value (zero vs. control) and reference point instantiation (present vs. absent) were manipulated between subjects, whereas product category (yogurt vs. credit card)

was a within-subjects factor. Thus, it was a 2 × 2 × 2 mixed design.

As shown in table 2, options in the credit card target set were described in terms of APR (annual percentage rate) and annual fee. Participants were asked to consider that they did not own any credit cards. In the yogurt category, alternatives were described in terms of sodium and fat content. Participants were asked to consider that they were on a diet trying to minimize their intake of both substances.

In conditions in which reference points were not instantiated, participants simply made a choice in the target set for each product category. However, in the reference-point-instantiated conditions, before making their choices in the target sets, participants made choices in two preliminary sets for each category. For credit card, the first set was composed of option M (APR: 1%; cash back reward per $100 spent: $0.50) and option N (APR: 20%; cash back reward per $100 spent: $1.00), whereas the second set was a choice between option P (APR: 1%; mileage points rewards: 5 miles/dollar) and option Q (APR: 20%; mileage points rewards: 15 miles/dollar). For yogurt, the first set was formed by option M (fat: 1 gram; calories: 200) and option N (fat: 10 grams; calories: 100), whereas the second set was a choice between option P (fat: 1 gram; price: $2.00) and option Q (fat: 10 gram; price: $1.50).

Results

The choice shares of option A in the target sets are examined. When no reference point was instantiated through preliminary choice sets, credit card A obtained 49% choice share when it offered 0% APR. When its APR was 1%, which is objectively worse than 0%, its choice share increased to 73%. Similarly, the choice share of yogurt A rose from 35% to 55%, as it increased its fat content from 0 to 1 gram. These results replicate the finding of study 1 in which a product increased its choice share by becoming objectively worse.

The key hypothesis for study 2 was that when participants have a chance to establish a reference for the magnitude of an attribute value, they would be less likely to be affected by a zero value (or lack of reference) in the target choice task. In the reference-point-instantiated condition, the choice share of credit card A in the target set was not affected by the zero-value manipulation, as it was 68% when it offered 0% APR and 69% when it offered 1%. A similar pattern occurred for yogurt, in which the share of A remained practically unchanged, shifting from 44% when it had 0 grams of fat to 48% when it had 1 gram of fat. Choice shares in the initial sets did not differ between conditions (all p's > .35).

The significance of these results was tested using a logistic regression predicting choice in the target set as a function of attribute value (zero vs. nonzero), reference point instantiation (present vs. absent), and product category (yogurt, credit card). The inclusion of product category as an independent factor is a common practice that helps increase the power of the analysis (Gunasti and Ross 2009; Hamilton,

TABLE 2

TARGET CHOICE SETS FOR STUDY 2

	Control		Zero value	
	Option A	Option B	Option A	Option B
Credit card:				
Annual fee ($)	45	15	45	15
Annual percentage rate (%)	1	20	0	20
Yogurt:				
Sodium (mg)	90	30	90	30
Fat (g)	1	10	0	10

Hong, and Chernev 2007; Palmeira and Krishnan 2008; Sood, Rottenstreich, and Brenner 2004). As expected, product category did not interact with any factor, indicating that the pattern of results was consistent across categories. However, it produced a main effect ($\chi^2(1) = 15.81$, $p < .01$) indicating that option A was generally more attractive, that is, chosen more often in the credit card sets. This result has no theoretical relevance and is merely a function of the overall attractiveness of the options in the sets. Results also revealed a main effect for attribute value ($\chi^2(1) = 6.27$, $p < .05$) but not for reference instantiation ($\chi^2(1) = .82$, NS). More important, there was a significant interaction between attribute value and reference instantiation ($\chi^2(1) = 4.09$, $p < .05$). Further analysis showed that attribute value had a significant effect on choice when a reference point was instantiated ($\chi^2(1) = 10.38$, $p < .001$) but no impact when it was not ($\chi^2(1) = .16$, NS).

Discussion

Study 2 extends the findings of study 1 in two important ways. First, it provides a replication of the zero-comparison effect in more familiar domains. In this sense, results for credit card are especially interesting, as APR is likely to be one of the core attributes that affects choice of a credit card, as suggested by its prominence in marketers' communications. The second contribution of study 2 is to provide evidence for the proposed mechanism. Results showed that when participants had a chance to develop a proper reference for a value, they were not influenced by the zero attribute manipulation in the target choice sets. Specifically, making choices in just two initial choice sets involving different trade-offs was enough to establish a proper reference point for a value (20% APR, 10 grams of fat) that could be used when one of the options had a zero value (0% APR, 0 grams of fat). It is important to note that the initial choice sets involved trade-offs that were different from the trade-offs in the target set. This way, participants were allowed to establish references for the key attributes (APR, fat) but were prevented from establishing trade-offs that could be used in the target set.

Studies 1 and 2 have shown that increasing an undesirable attribute from zero, making an option worse, can in fact lead to an increase in choice share. Naturally, this phenom-

enon should only occur within reasonable boundaries since there is certainly a point at which increasing the amount of an undesirable attribute will indeed be detrimental to the focal option. For example, in a comparison with a credit card with 20% APR, moving from 0% to 1% may make a credit card appear more attractive in a choice task. However, further increments can only decrease its attractiveness. In other words, at some point between 1% and 20%, a higher APR will indeed be worse than a zero APR. This boundary condition is investigated in the next study.

In addition, a possible limitation of studies 1 and 2 is the focus on attributes in which lower numbers are better than higher numbers. For sound distortion, fat, and APR, a value of zero is always better than any other value. The proposed mechanism, however, is by no means restricted to this condition. Thus, a more complete investigation of the zero-comparison effect requires a test using attributes in which higher numbers are better than lower numbers. This is also addressed in study 3.

STUDY 3: GENERALIZING THE EFFECT AND BOUNDARY CONDITION

Method

Two hundred and forty participants recruited through a research company took part in this online study. Participants' ages ranged from 19 to 67 years, with a median age of 32, and 46% were female. They were randomly assigned to one of four experimental conditions. As in the previous studies, participants made choices in binary choice sets described on two common attributes. The value of the focal attribute was manipulated at four levels: zero, low, medium, and high. For example, in the yogurt category, fat content of option A was 0, 1, 5, or 8 grams. All participants made choices in the following categories: coffee maker, credit card, yogurt, and digital camera. Complete stimuli are presented in table 3.

Results

Each of the 240 participants made four choices, yielding a total of 954 observations (six missing data points). In this study, there were two types of attributes with respect to the impact of zero. For credit card and yogurt, the focal attributes (APR and fat) follow the same pattern of those used in studies 1 and 2, that is, lower numbers are better—zero being the best possible value. I refer to them as "favorable zero" attributes. However, the focal attributes used for camera and coffee maker follow the opposite pattern: higher numbers are better. I call them "unfavorable zero" attributes. As figure 1 shows, in the favorable zero categories, as the value of option A increases from zero to a high value, its choice share first increases but then decreases. For example, choice share of yogurt A shifts from 30% to 66% as its fat content increases from 0 to 1 gram, but then it drops to 53% at 5 grams of fat and finally to 35% at 8 grams. However, in the unfavorable zero categories, as the value of option B

TABLE 3

CHOICE SETS FOR STUDY 3

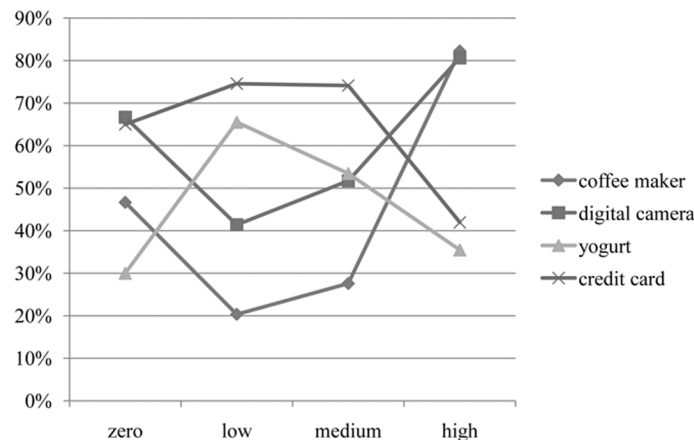|	Option A	Option B
Credit card:		
Annual fee ($)	45	15
Annual percentage rate (%)	0, 1, 5, 16	20
Yogurt:		
Sodium (mg)	90	30
Fat (g)	0, 1, 5, 8	10
Coffee maker:		
Price ($)	75	50
Free coffee pods	50	0, 5, 10, 40
Digital camera:		
Sharpness (0–100)	80	95
Free pictures	200	0, 10, 40, 160

increases from zero to a high number, its choice share first decreases but then increases. For example, choice share of coffee maker B decreases from 47% to 20% when the number of free coffee pods increases from zero to five. It then increases to 28% with 10 pods and finally to 82% when it offers 40 coffee pods.

In order to test the significance of these results, three logistic regressions were run on choice of the manipulated option as a function of focal attribute value, type of category (favorable vs. unfavorable zero), and their interaction. The manipulated option was A for the favorable zero categories and B for the unfavorable zero categories (see table 3). In the first regression, I compared zero and low attribute conditions. The analysis revealed a main effect for category type ($\chi^2(1) = 11.27$, $p < .01$), indicating that the manipulated option was generally more attractive, that is, chosen more often in the unfavorable zero categories (yogurt and credit card) than in the favorable zero categories (camera and coffee maker). As pointed out in study 2, this main effect has no theoretical relevance and is merely a function of the overall attractiveness of the options in the sets. There was no main effect for focal attribute value ($\chi^2(1) = .16$, NS), but a significant interaction between the two factors ($\chi^2(1) = 29.58$, $p < 001$). Further analysis revealed a significant effect for attributes in the favorable zero sets ($\chi^2(1) = 17.31$, $p < .001$) as well as in the unfavorable zero sets ($\chi^2(1) = 12.46$, $p < .001$).

In the second regression, I compared zero and medium attribute conditions. Results were very similar to those of the previous analysis. There was a marginally significant main effect for category type ($\chi^2(1) = 2.74$, $p < .10$) and no main effect for focal attribute value ($\chi^2(1) = .01$, NS) but a significant interaction ($\chi^2(1) = 13.55$, $p < .001$). Further analysis revealed a significant effect for attributes in the favorable zero sets ($\chi^2(1) = 7.13$, $p < .01$) as well as in the unfavorable zero sets ($\chi^2(1) = 7.41$, $p < .01$).

Finally, I compared zero and high attribute conditions. The analysis revealed a main effect for category type ($\chi^2(1) = 37.28$, $p < .001$) and focal attribute ($\chi^2(1) = 3.55$, $p = .06$) and an interaction ($\chi^2(1) = 15.59$, $p < .001$). Further analysis revealed a significant effect of the focal attribute

FIGURE 1

CHOICE SHARE OF THE MANIPULATED OPTION (STUDY 3)

NOTE.—Option A was manipulated in yogurt and credit card choice sets. Option B was manipulated in coffee maker and digital camera choice sets.

manipulation in unfavorable zero sets ($\chi^2(1) = 18.96$, $p <$ .001) but not in the favorable zero sets ($\chi^2(1) = 1.94$, NS). Note that the effect of the attribute manipulation is in the opposite direction in this comparison, that is, when an option's attribute improves, its choice share increases.

Discussion

One goal of study 3 was to extend the demonstration of the zero-comparison effect to attributes in which zero is an unfavorable value. Consistent with the predictions advanced here, results from the current study show that the effect occurs when an undesirable attribute, like fat, as well as when a desirable one, like free pictures, is manipulated. The stimuli used in study 3 also address another possible concern regarding the generalizability of the findings. In study 1 the focal attribute was one for which participants would have difficulty in deriving meaning without a frame of reference. This was addressed in study 2 using a credit card set, in which APR was the focal attribute. Still, one could have argued that even though APRs are frequently highlighted in credit card advertisements, many consumers do not fully understand what they mean. The same cannot be said about the attributes used in the current study, like free pictures or coffee pods, whose meaning and values are quite clear. The generalization of the effect is in line with a large body of literature on context effects that has shown that even when participants can completely comprehend the level of an attribute, a reference still influences them in the assignment of a subjective value to that attribute level, ultimately affecting decisions (Huber et al. 1982; Simonson and Tversky 1992).

The second goal of study 3 was to examine the limits of the zero-comparison effect. I have argued that compared to zero, a nonzero value creates a reference that allows consumers to evaluate relative differences. In turn this can make a positive feature, like 200 free pictures, appear more attractive when compared to 10 than when compared to zero. However, as the number of free pictures increases further, there is no additional disadvantage due to a reference point, and the relative difference becomes smaller. Therefore, as this number grows, the choice share of this option increases and at some point becomes higher than in the zero condition. This pattern is clearly depicted in figure 1 for digital camera and coffee maker. The corresponding pattern occurred for yogurt and credit card. Results for yogurt are especially noteworthy. As the fat of yogurt A increases from 1 to 5 to 8 grams, its choice share decreases, but even at 8 grams of fat its choice share (35%) is not inferior to when it has 0 grams (30%), suggesting that the effect can occur even for high attribute values.

STUDY 4: REJECTING POTENTIAL RIVAL EXPLANATIONS

Across three studies, I have presented evidence indicating that the zero-comparison effect occurs in a range of product categories, including both familiar and unfamiliar attributes, as well as using favorable and unfavorable attributes. In addition, the limits of the effect were examined by varying the value of the attributes (study 3), as well as by allowing consumers to establish a reference point in a prior task (study 2). Although these results are consistent with the proposed mechanism, there still may be rival explanations. Specifi-

TABLE 4

MEASURES AND COMPARISONS FOR STUDY 4

	Fat (manipulated)			Sodium (fixed)		
	Control	Zero value	*p*-value	Control	Zero value	*p*-value
Similarity	2.15	2.25	.61	2.28	2.14	.50
Ease of imagination	2.40	2.41	.98	2.54	2.44	.66
Anticipated regret	3.16	3.09	.76	3.09	2.89	.36
Anticipated satisfaction	2.77	2.64	.48	2.84	2.84	.97
Importance	3.79	3.78	.97	3.53	3.54	.96
Goal oriented	3.02	3.22	.35	2.89	3.07	.39
Pleasure oriented	2.70	2.96	.23	2.70	2.76	.78
Functional	3.16	3.24	.71	3.21	3.23	.92
Indulgent	3.14	3.04	.64	3.03	2.85	.38

cally, one may be concerned that to some extent participants may treat a zero value in a way similar to how they treat an attribute with unavailable information, which has been shown to systematically affect choices (Kivetz and Simonson 2000). The first goal of study 4 is to examine this alternative account.

Past research has shown that consumers' choices are affected by product and attribute characteristics such as ease of imagination/visualization (McGill and Anand 1989), perceived difference between values (Mellers and Cooke 1994), importance (Chernev 1997), the extent to which it is viewed as hedonic or utilitarian (Strahilevitz and Myers 1998), and the extent to which it leads consumers to anticipate regret (Simonson 1992) or satisfaction (Shiv and Huber 2000). One may argue that changing an attribute value from zero to a nonzero number may change participants' information processing in ways different from what had been proposed in this research. Therefore, the second goal of study 4 is to test a series of alternative explanations based on unanticipated shifts in the way participants process product information.

Method

One hundred and eighty participants recruited through a research company took part in this online study. Participants' age ranged from 18 to 54 years with a median of 29, and 39% were female. They were randomly assigned to one of three experimental conditions (control, zero, and information not available) and asked to make a choice in the yogurt category. In control and zero conditions, the sets were the same as those used as target sets in study 2. In the third condition, fat content of option A was described as "information not available." After making a choice, participants in the control and the zero conditions answered a series of questions about each of the attributes on 5-point scales. These questions included how similar the options were (not at all–very), how easy it was to imagine or visualize the attribute (not at all–very), how much anticipated regret was brought by considerations of the attribute (no regret at all–a lot of regret), how much anticipated satisfaction was brought by considerations of the attribute (no satisfaction at all–a lot of satisfaction), and how important the attribute was (not

at all–very). In addition, for each attribute participants were asked to rate their agreement with four statements measuring the extent to which an attribute was perceived as hedonic or utilitarian (adapted from Dhar and Wertenbroch 2000) on 5-point scales (strongly disagree–strongly agree). The statements used were "the attribute is goal-oriented," "the attribute is pleasure-oriented," "the attribute is mostly functional," and "the attribute is mostly indulgent." Attribute question order was counterbalanced, such that half of the participants first responded about fat content (the manipulated attribute), whereas the other half first responded about sodium content (the fixed attribute).

Results

Replicating previous studies' results, the choice share of option A moved from 35% to 59%, when its fat content increased from 0 to 1 gram ($\chi^2(1) = 7.51, p < .01$). However, it fell from 35% to 18% when information about option A's fat content was not available ($\chi^2(1) = 4.42, p < .05$). This clearly indicates that participants perceived zero fat to be superior to a lack of information about fat, thus rejecting a rival account that these two situations would be treated similarly by participants.

Another goal of study 4 was to test whether changing an attribute value to zero would lead to unanticipated changes in information processing, such as a shift in the levels of anticipated satisfaction or regret. Question order did not affect any of the measures. Table 4 displays the average response for each measure along with the *p*-value resulting from the *t*-test used to compare control and zero-value conditions. None of the comparisons approached significance. Therefore, study 4 was successful in rejecting a series of alternative explanations that suggested that the presence of a zero as an attribute value could change characteristics of the information process in ways different from the one proposed in this current research.

GENERAL DISCUSSION

This research investigates the effect of a zero-value attribute on consumer choice. Contrary to normative predictions, it

is found that worsening a product by reducing the level of a desirable attribute to zero or increasing the level of an undesirable one from zero can increase its choice share. I termed this the "zero-comparison effect." Study 1 showed that the choice share of a product increased when it had a small negative attribute instead of zero. Study 2 showed that when participants had a chance to develop a reference for an attribute value through choices in two preliminary sets, they were not affected by the manipulation. The third study extended the phenomenon to additional product categories using both desirable and undesirable attributes and showed that the zero-comparison effect decreases as an attribute value increases and eventually ceases. Finally, study 4 rejected rival explanations suggesting that the core manipulation could have altered other characteristics of the decision-making process.

I presented a theoretical account based on the influence of reference points in decision making, which posits that, in general, consumers derive subjective value to attributes from comparisons to available reference points. Previous research has established that individuals tend to focus more on relative rather than absolute differences (Tversky and Kahneman 1991; Wong and Kwong 2005). This means that the size of a difference is judged in the context of a reference point (the value of one of the options). For example, when comparing a 10-point difference between 100 and 110, individuals tend to evaluate 10 not by itself but in relation to 100. This makes the difference of 10 look smaller than the same difference in a comparison between 40 and 50. However, when one of the attributes is zero, the difference cannot be judged in the context of a reference point because compared to zero all numbers are the same, that is, infinitely larger. In this situation, consumers have to evaluate the magnitude of a value without a reference, focusing on the absolute difference instead. Previous research has shown that judgments without reference points are harder to make and tend to be less sensitive to changes (Hsee 1996). Thus, compared to a situation in which a reference point can indicate a clearly large difference (e.g., 10 vs. one), when zero is one of the values, the size of the difference becomes less clear. This in turn reduces the impact of this difference leading to this counterintuitive effect, whereby a product can increase its choice share by reducing a desirable attribute to zero or by increasing the level of an undesirable attribute from zero.

As a limitation, it must be acknowledged that although I referred to a switch from relative comparisons to absolute ones, no direct evidence was provided for this shift. Instead I have relied on previous research to argue that individuals tend to focus on relative differences (Tversky and Kahneman 1991; Wong and Kwong 2005) and reasoned that this cannot be done when one of the values is zero. I did find direct evidence for the role of a reference point, which lies at the core of my argument. In study 2, participants that were allowed to establish a reference point for a given value through preliminary choice tasks were unaffected by a zero value in the focal attribute in the target set. In addition,

results from study 4 showed that the presence of a zero-value attribute in a choice set did not lead to changes in properties of the attributes (e.g., more vs. less hedonic, utilitarian) or the decision maker's mind-set (e.g., minimize regret, anticipate satisfaction), rejecting potential rival explanations. Nevertheless, future research may investigate whether a shift to zero causes other changes in the comparison process that have a direct influence on the effect that cannot be explained by the removal of a reference point.

Although I do not view this phenomenon as a context effect, as there is an actual change in one of the focal options, these findings share an important element with this literature. Articles from this stream of research have shown how characteristics of the choice context, like the addition of an alternative, affect the way consumers make comparisons. One way in which this occurs is through changes to the frame of reference that make one attribute value become more or less attractive (Simonson and Tversky 1992). The current investigation adds to this literature by showing a novel way in which changes to the set can alter the comparison process.

At a broader level, these findings contribute to the literature on the special effects of zero. Research has shown that consumers' reactions to zero are qualitatively different from reactions to small numbers when it comes to reward (Heyman and Ariely 2004), probability (Kahneman and Tversky 1979), and price (Shampanier et al. 2007). This literature is useful in informing the limitations of the zero-comparison effect. Specifically, Kahneman and Tversky (1979) argued that changes in probabilities to and from zero (or 100%) are treated differently than changes in other ranges. They illustrated this point using a Russian roulette scenario, in which one could purchase the removal of a bullet from a loaded gun. The authors argued that most people feel they would be willing to pay much more to reduce the bullets from one to zero (a death chance reduction from 1/6 to zero) than from four to three (a reduction from 4/6 to 3/6). Similarly, people prefer a certain loss of $5 to a 0.1% chance of a $5,000 loss, even though the expected values are the same. There is a discontinuity in how individuals weight a probability as it approaches zero (or 100%). In this sense, probability is a special type of attribute, for which these results do not apply. Research examining the effect of zero price also illustrates how price is a special attribute. In Shampanier et al. (2007), a product received a disproportionately high choice share when it was offered for free. As discussed in the theoretical development, this finding is not explained by contextual influences but rather by a strong affective reaction evoked by a zero price. I reasoned that, in general, affective reactions to zero price should not generalize to many other attributes. Rather, it is expected that in general for other attributes, consumers would follow a more cognitive route consistent with the large body of research on contextual influences, considering trade-offs between different attributes.

The present investigation can also be viewed in light of structural alignment theory (Gentner and Markman 1994;

Markman and Medin 1995). Alignable differences are those related to commonalities, whereas nonalignable differences are related to unique characteristics. Previous research has shown that alignable attributes receive more weight than nonalignable ones. For example, in one study, Slovic and MacPhillamy (1974) asked participants to indicate which of a pair of students was likely to have a higher grade point average. Participants attended more to a test that both had taken (i.e., an alignable difference) than to one that only one student had taken (i.e., a nonalignable difference). More recently, Kivetz and Simonson (2000) showed that an attribute loses weight when information about it is missing for one of the options (i.e., when it becomes nonalignable). For unfavorable zero attributes, one may argue that these predictions are analogous to those made by structural alignment theory. For example, when comparing a camera that offers a few free pictures to one that does not, free pictures may be considered a nonalignable attribute and receive less weight in choice. One should note that a value of zero is different from unavailable information, and while the latter truly creates a nonalignable difference, it is less clear whether the former would do the same. In terms of the present studies in which options were described on common attributes (i.e., alignable dimensions), it seems unlikely that the presence of a zero would make an attribute nonalignable. In addition, as shown in study 4, a zero value for attributes, like APR, fat, and sound distortion, should clearly be viewed as a positive feature and not as an absence of a feature altogether. Although relying on markedly different processes, both structural alignment theory and the present research share a common ground: they examine comparison processes and their impact on choice.

The current investigation also shares some commonalities with the work of Liu (2006). She has shown that when a focal product dominates another by a small margin, consumers are more likely to purchase it (as opposed to defer purchase) than when it dominates another by a large margin. This occurs because a competitor that is slightly worse than a focal alternative provides a stronger test of preference than a competitor that is dominated by a large margin. Thus, like in the current research, Liu (2006) has also shown that a product may fare better against a stronger, as opposed to a weaker, competitor. There are, however, noteworthy differences between Liu's work and the present investigation. First, in her research one alternative is fully dominated. Second, the dependent variable is not which option is chosen but whether one makes a choice. These are very important differences. Although a dominated strong competitor may be useful for the focal option because it provides a stronger test of preference, a strong but nondominated competitor can be detrimental because it may very well be chosen instead of the focal option, as was often the case in the current studies. In addition, results of study 3 highlight that there is a clear limit to the benefit of a stronger competitor. While at first a stronger competitor increases a focal option's choice share, as the competitor gets even stronger, the choice share of the focal option decreases.

These findings carry implications for marketers. In terms of desirable attributes, a small amount can be worse than nothing. As shown in the digital camera scenario, when a competitor offers 200 free pictures, it is better not to offer anything than to offer 10. In other words, if a competitor's attribute value is large, it may be better to have zero than to have a small number that can highlight how large the competitor's number is. Conversely, if it is an attribute in which lower numbers are preferable, it may be better to have a little of it than nothing. For example, study 1 showed that a hi-fi system increased its choice share when it had a small audio signal distortion, as opposed to no distortion.

This implication however must be used with caution. As shown in study 3, although 10 free pictures may be worse than nothing, or 1 gram of fat may be better than no fat, as these numbers increase and approach the value of the competing alternative, the favorable impact of a reference point is eventually reversed. In other words, when a competitor is offering 200 free pictures, although it may be worse to offer 10 or even 40 instead of zero, it is clearly better to offer 160 than zero.

Another important point to consider is how consumers make decisions in a given context. In the present studies, participants made choices in sets of alternatives described on common attributes. Although this is a typical paradigm employed in consumer behavior research, it certainly does not capture all the different types of decision situations encountered by consumers. For example, unlike the current studies, oftentimes decisions involve uncertainty regarding attribute value, missing information or nonquantitative attributes. When trade-offs are less clear or refer to qualitative differences, this type of effect will not occur. In addition, some decisions are made in single-evaluation mode (Hsee 1996) in which only one option is present. In this type of situation, there is nothing to be gained by increasing the level of an undesirable attribute from zero, as it will not serve as a reference to evaluate a competitor's attribute value. In fact, I expect that in this case, zero can be substantially better than a small value, as it needs no reference. In other words, in isolation, it should be easier to assess the benefit of a zero-fat yogurt than a yogurt with 1 gram of fat.

Finally, consumer expertise should play an important role in the emergence of the effect. As in any context effect, novice consumers are more likely to evaluate an option on the basis of its relationships with other alternatives in a set than are expert consumers. However, the fact that the effect was found using commonly communicated attributes, like a credit card's APR, suggests that when clear quantitative trade-offs are present, the effect can be quite powerful.

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