Journal of Experimental Psychology: General
2004, Vol. 133, No. 1, 23–30

0096-3445/04/$12.00 DOI: 10.1037/0096-3445.133.1.23

Music, Pandas, and Muggers: On the Affective Psychology of Value

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This research investigated the relationship between the magnitude or scope of a stimulus and its subjective value by contrasting 2 psychological processes that may be used to construct preferences: valuation by feeling and valuation by calculation. The results show that when people rely on feeling, they are sensitive to the presence or absence of a stimulus (i.e., the difference between 0 and some scope) but are largely insensitive to further variations of scope. In contrast, when people rely on calculation, they reveal relatively more constant sensitivity to scope. Thus, value is nearly a step function of scope when feeling predominates and is closer to a linear function when calculation predominates. These findings may allow for a novel interpretation of why most real-world value functions are concave and how the processes responsible for nonlinearity of value may also contribute to nonlinear probability weighting.

How long would someone who is willing to work 3 hr for $30 be willing to work for $60? How much would someone who is willing to donate $10 to save one endangered animal be willing to donate to save four endangered animals? Such questions concern the relationship between the quantitative aspect or "scope" of a stimulus (e.g., the amount of financial reward, the number of endangered creatures) and a person's subjective value of that stimulus.

To elucidate the notion of subjective value, note that to gauge how much longer someone would work for $60 rather than $30, one must assess how much satisfaction or value the person accrues from either amount. If the satisfaction accrued from $60 is not much larger than that from $30, the individual will not work appreciably longer for the larger amount. Among other considerations, making a charitable donation presumably gives one moral satisfaction (e.g., Kahneman & Knetsch, 1992). Thus, to estimate how much more someone would donate to save four endangered animals rather than one, one must assess the extent to which an increase in the number of animals saved increases the amount of moral satisfaction.

As our disparate examples suggest, the notion of subjective value is very general and may be applied to just about any stimulus. The notion of scope is very general as well: Any quantitative aspect of a stimulus may form a scope variable. Perhaps not surprisingly then, the relationship between scope and value is of long-standing theoretical interest. For example, both the standard economic theory of consumption and prospect theory (Kahneman & Tversky, 1979) involve intricate analyses of this relationship.

In what follows, we examine the relationship between scope and value by using a process-based account of the determination of value. Recent literature identifies two distinct modes of thought, one deliberate and rule-based, the other associative and affect-based (e.g., Chaiken & Trope, 1999; Epstein, 1994; Kahneman & Frederick, 2002; Sloman, 1996). Building on such dual-process models, we distinguish between two psychological processes by which people might assess the value of a particular target: valuation by calculation and valuation by feeling.

We suggest that these two processes yield different relationships between scope and value, as depicted in Figure 1. Specifically, we suggest that under valuation by calculation, changes in scope have relatively constant influence on value throughout the entire range. The corresponding value function is relatively steep throughout (the dotted line). However, we suggest that under valuation by feeling, value is highly sensitive to the presence or absence of a stimulus (i.e., a change from 0 to some scope) but is largely insensitive to further variations in scope. The corresponding value function is relatively flat except for an initial rise (the solid line). We next provide examples and definitions of valuation by calculation and valuation by feeling.

Consider decisions of how much to pay for a second-hand box set of either 5 or 10 Madonna compact discs (CDs). Valuation by calculation might appeal to the typical cost or worth of a single used CD (e.g., $3) and then account for the number of discs, perhaps leading to a willingness-to-pay of approximately $15 for the 5-CD set and $30 for the 10-CD set. In contrast, valuation by feeling might focus on feelings evoked by Madonna songs and images. Because such feelings should be independent of the number of discs available, using them as a cue for value might lead to roughly equal willingness-to-pay for either set.

More generally, we use the term *valuation by calculation* for determinations of preference on the basis of some algorithm (e.g., involving the typical cost of a disc) that takes into account both the nature of the stimulus (e.g., the box set consists of Madonna discs) and its scope (e.g., there are five discs in the collection). We use the term *valuation by feeling* for determinations of preference on the basis of one's feelings toward the stimulus (e.g., one's liking of

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This project has benefited greatly from discussions with many colleagues. We are especially indebted to Reid Hastie, Danny Kahneman, John Lynch, and Paul Slovic. We thank the University of Chicago Graduate School of Business and the China Europe International Business School, where Christopher K. Hsee visited during part of this research project, for their support.

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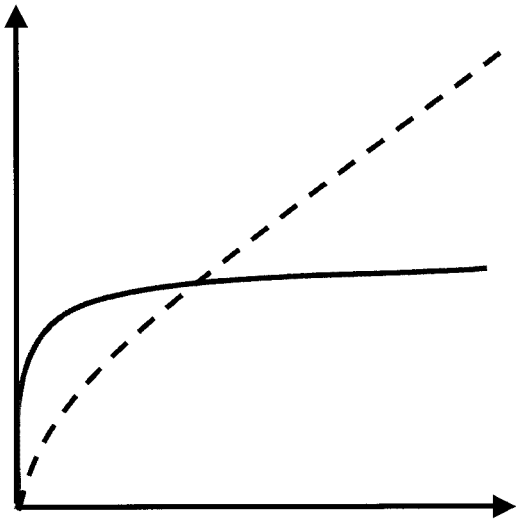

Figure 1. Value functions based on calculation (dotted line) and based on feeling (solid line). The *x*-axis of the function is the scope of a stimulus, and the *y*-axis is subjective value.

Madonna). In essence, feelings depend on the nature of a stimulus but not on its scope, whereas calculations explicitly consider scope. Feelings are relatively qualitative; calculations are relatively quantitative. Thus, feelings yield marked sensitivity to the presence or absence of a stimulus (i.e., the change from 0 to some scope) but yield little sensitivity to subsequent increments of scope. In contrast, calculations yield relatively constant sensitivity throughout the entire range. For the sake of brevity, we henceforth say that feeling yields scope-insensitivity and calculation yields scope-sensitivity.

We emphasize that at any given scope level, feeling may generate either greater or lesser value than calculation, depending on the intensity of the relevant affect. For instance, someone who loves Madonna may establish a higher willingness-to-pay under feeling than under calculation for either the 5- or 10-disc collection, whereas someone who dislikes Madonna may establish a lower willingness-to-pay under feeling than calculation for either collection. A *crossover,* wherein feeling yields greater value at low scope but calculation yields greater value at high scope, emerges if valuation by feeling taps affect of intermediate intensity.

We later detail how our notion of valuation by feeling is closely connected to the works of Kahneman, Ritov, and Schkade (2000); Finucane, Alhakami, Slovic, and Johnson (2000); and Slovic, Finucane, Peteres, and MacGregor (2002) and to a recent research trend that highlights the use of affect as a cue for value (e.g., Frederick, 2002). For now, we note only that we build on such analyses by explicitly juxtaposing feeling with calculation to provide a process-based account of the determination of value.

Study 1: Madonna

Method

In this study, we attempted to manipulate participants' tendency to engage in either valuation by calculation or valuation by feeling, using an ostensibly unrelated priming task. The context of the study was similar to that of the Madonna CD example.

University of Chicago students ($N = 115$) were recruited in a public place on campus, where they individually completed a short questionnaire packet in exchange for payments varying between $2 and $4. Participants were told that the questionnaires in the packet were unrelated to one another. Most were indeed unrelated, but two formed the current study. One constituted a priming task; the second immediately followed the first and presented our main dependent measure.

Respondents were randomly assigned to one of four conditions of a 2 (scope) $\times$ 2 (priming) between-subjects design. The priming questionnaire attempted to encourage either valuation by calculation or valuation by feeling. In the calculation-priming condition, participants answered five questions requiring conscious and deliberate calculations. Two of the questions were as follows:

> If an object travels at five feet per minute, then by your calculations how many feet will it travel in 360 seconds?
>
> If a consumer bought 30 books for $540, then, by your calculations, on average, how much did the consumer pay for each book?

In the feeling-priming condition, participants answered five questions that required them to examine and report their feelings. Two of the questions were as follows:

> When you hear the name "George W. Bush," what do you feel? Please use one word to describe your predominant feeling.
>
> When you hear the word "baby," what do you feel? Please use one word to describe your predominant feeling.

The main questionnaire asked participants to assume that, for family reasons, a friend of theirs who was from a foreign country had to unexpectedly leave the United States. They were told that the friend was a Madonna fan, owned a number of Madonna CDs, and wanted to sell the CDs to them as a bundle. Participants' response to the question "What is the maximum you would be willing to pay for the bundle of CDs?" formed the study's dependent measure. Note that participants were not explicitly instructed to rely on calculations or on feelings when indicating the maximum they would be willing to pay. The number of CDs in the bundle formed the scope variable. In one version of the questionnaire, the bundle contained 5 CDs; in another version, 10 CDs.

We predicted that participants primed to calculate would decide how much to pay for the bundle of CDs by essentially counting the number of discs available and multiplying that count by a monetary figure reflecting the typical cost or worth of a single used disc. We further predicted that participants primed to feel would be less likely to count and would instead focus on their feelings for Madonna. Reliance on a calculation involving a count should yield relative scope-sensitivity, but because one's feelings for Madonna should be independent of the number of discs available, reliance on feelings should yield relative scope-insensitivity.

Results and Discussion

The results are consistent with our predictions. When primed to calculate, participants were willing to pay significantly more for the 10-CD set than for the 5-CD set ($M = 28.81$, $SD = 25.21$ for the 10-CD set, and $M = 15.10$, $SD = 11.43$ for the 5-CD set), $t(55) = 2.69$, $p < .01$. However, when primed to feel, participants were essentially insensitive to the number of CDs available ($M = 19.77$, $SD = 18.07$ for the 10-CD set, and $M = 22.64$, $SD = 18.14$ for the 5-CD set), $t(54) < 1$, *ns.* Analysis of variance (ANOVA) revealed a significant Scope $\times$ Priming interaction effect, $F(1, 109) = 5.57$, $p < .05$, $MSE = 348$, $\eta^2 = 0.05$, but no significant

main effect of either scope or priming, $F(1, 109) < 1$, *ns*; $F(1, 109) = 2.32$, *ns*.[1]

The data also yield a crossover effect. At the 5-CD level, participants were willing to pay more when primed to feel than when primed to calculate ($22.64 vs. $15.10), $t(56) = 1.91$, $p = .06$. In contrast, at the 10-CD level, participants were actually willing to pay less when primed to feel ($19.77 vs. $28.81), $t(53) = 1.51$, *ns*. As we have mentioned, a crossover suggests that the feelings engendered by Madonna were on average of moderate intensity. Had these feelings been more positive, mean willingness-to-pay may have been greater in the feeling conditions at both scope levels. Conversely, had these feelings been less positive, mean willingness-to-pay may have been lower in the feeling conditions at both scope levels.

We emphasize that the main questionnaire in this study was identical across the feeling and calculation conditions. An ostensibly unrelated questionnaire was the sole instrument used to prime one or the other valuation process. Such a priming manipulation is by its nature quite subtle. Because it does not require participants to rely on either feelings or calculations, it avoids potential pitfalls associated with demand characteristics. At the same time, despite its subtlety, priming presumably influences the actual process used to assess value. As such, the present priming manipulation provides an operational definition of valuation by calculation and valuation by feeling.

Manipulations targeted directly at the valuation process itself, as used in Study 1, have certain experimental advantages. However, most real-world situations involve indirect manipulation of the valuation process: Whether people rely on calculation or feeling typically varies with (a) the target being valued and (b) the manner in which that target is presented. That is, varying the target being valued or the manner in which that target is presented (indirectly) influences which valuation process predominates, because certain targets and presentations may encourage valuation by calculation, whereas others may encourage valuation by feeling.

In particular, we suggest that relatively affect-rich targets and presentations engender more valuation by feeling, leading to scope-insensitivity, whereas relatively affect-poor targets and presentations engender more valuation by calculation, leading to scope-sensitivity. We next present three studies examining this hypothesis. Study 2 examines (a) the valuation of two different targets, one affect-rich, the other affect-poor, and Studies 3 and 4 examine (b) the valuation of a given target presented in either an affect-rich or an affect-poor manner.

Study 2: Music Book Versus Cash

Method

University of Chicago undergraduates ($N = 331$) were recruited in a public place on campus, where they individually completed a short packet containing several unrelated studies in exchange for payments varying between $2 and $4. They were asked to imagine that they could work temporarily at the campus bookstore and to indicate how long they would work for a certain reimbursement, using a scale from 0 to 10 hr.

Participants were randomly assigned to one of four conditions of a 2 (scope) × 2 (target) between-subjects design. The two targets were a music book and cash. Participants in the music book condition were asked to imagine that they would be reimbursed with a copy of a book that was required for a music course they would soon take. They were instructed to imagine that they loved music and that they expected the book to be one of the most enjoyable works they would ever read. Participants in the cash condition were simply told that they would be reimbursed in cash (but were given no further instructions about how to consider this form of reimbursement).

We suggest that the music book is relatively affect-rich and that the cash is relatively affect-poor. To confirm this claim, we later asked a separate group of participants (recruited in a similar place and manner) "Which form of reimbursement would be emotionally more appealing?" A large majority, 76%, indicated that the music book was more emotionally appealing ($N = 49$, $p < .01$ by binomial test).

The financial value of the reimbursement formed the scope variable. Participants in the book conditions were told that the list price of the book was either $30 or $60. Participants in the cash conditions were told they would be paid either $30 or $60.

If the affect-poor cash encourages valuation by calculation, whereas the affect-rich music book encourages valuation by feeling, then the cash should yield relative scope-sensitivity, and the music book should yield relative scope-insensitivity. In the cash conditions, participants may appeal to a reference wage of $10 per hour. Using this modulus, calculations suggest working approximately 3 hr for $30 or approximately 6 hr for $60. Even allowing for adjustments from these anchors, responses in the cash condition should be scope-sensitive. In contrast, one may feel just as fond of a $30 book as of a $60 book; indeed, participants in the music book conditions had essentially been instructed to do so. If participants in the music book condition decided how long to work by consulting their feelings for the book, then responses in this condition should show little scope-sensitivity.

Results and Discussion

As expected, participants in the affect-poor cash conditions were willing to work much longer for $60 than for $30 ($M = 5.39$, $SD = 1.93$ for $60, and $M = 3.23$, $SD = 1.46$ for $30), $t(162) = 8.06$, $p < .01$, whereas participants in the affect-rich music book condition were less sensitive to the list price of the book ($M = 5.33$, $SD = 2.63$ for the $60 book, and $M = 4.40$, $SD = 2.03$ for the $30 book), $t(165) = 2.54$, $p < .05$. ANOVA revealed a significant Scope × Target interaction effect, $F(1, 327) = 7.48$, $p = .01$, $MSE = 4.26$, $\eta^2 = 0.02$, indicating less scope-sensitivity in the music book than cash conditions. Although they are not of theoretical interest here, ANOVA also revealed significant main effects of scope, $F(1, 327) = 46.33$, $p < .01$, $\eta^2 = 0.12$, and target, $F(1, 327) = 5.92$, $p < .01$, $\eta^2 = 0.02$.

Furthermore, the data again yielded a crossover. At $30, participants were willing to work more for the affect-rich music book than for the affect-poor cash (4.4 hr vs. 3.2 hr), $t(158) = 4.19$, $p < .01$. In contrast, at $60, participants were willing to work slightly (but not significantly) less for the music book (5.3 hr vs. 5.4 hr), $t(169) < 1$, *ns*.

We recognize that this study is somewhat stylized and that the cash and the music book differ in many potentially important ways. Despite these drawbacks, we feel that contrasting the cash and music book holds an important advantage of ecological validity: There are many real world situations in which the valuation process that predominates will depend on the nature of the target being valued. Juxtaposition of the cash and music book is instruc-

[1] We excluded two respondents from our analysis: One indicated a negative willingness-to-pay, and the other indicated a willingness-to-pay of $200, twice as much as the next largest value across all conditions.

tive to the extent that it mimics these types of real-world circumstances.

Our next studies adopt the general approach of Study 2, yet circumvent some of its limitations. Study 2 indirectly manipulated the valuation process, encouraging either calculation or feeling by changing the target being valued. The following studies also indirectly manipulate the valuation process; however, these studies hold constant the target being valued and encourage one or the other valuation process by changing the presentation of the target.

Study 3: Saving Pandas

Method

University of Chicago undergraduates ($N = 137$) were recruited in a public place on campus and individually completed a short questionnaire for $1. They were asked to imagine that a team of Chicago zoology students had discovered a number of pandas in a remote Asian region; the team intended to save these endangered animals and was soliciting donations for the rescue effort.

Respondents were randomly assigned to one of four conditions of a 2 (scope) $\times$ 2 (presentation) between-subjects design. The scope variable concerned the number of pandas discovered. Participants were told that the team had found either one or four pandas.

Presentation was either affect-poor or affect-rich. Participants were shown a table indicating the number of pandas found. In the affect-poor conditions, the table depicted each panda by a large dot. That is, in the affect-poor conditions the table included either one or four dots. In the affect-rich conditions, the table depicted each panda with a cute picture, reproduced in Figure 2. That is, in the affect-rich conditions, the table contained either one cute picture or four copies of the same cute picture.

Manipulation checks, conducted after completion of the study and using a new pool of participants recruited in a similar place and manner, confirmed that the pictures evoked considerably greater affective reactions than the dots. Participants were asked "How much emotion is evoked when you look at the dot(s) (picture[s])?" On a 10-point scale ranging from 1 (*a little*) to 10 (*a lot*), mean responses were 3.8 for the dots versus 7.0 for the pictures ($N = 25$ in each condition), $t(48) = 4.95$, $p < .01$. Participants were also asked, "How strong of an emotional appeal is the team's request for donations?" On a 10-point scale ranging from 1 (*very weak*) to 10 (*very strong*), mean responses were 4.5 for the dots versus 5.9 for the pictures ($N = 25$ in each condition), $t(48) = 1.95$, $p = .06$.

The study's dependent measure asked participants to indicate "the most you would be willing to donate" by having them circle either $0, $10, $20, $30, $40, or $50. The response scale was placed just above the table, so that the $10 option was above the first dot or picture, the $20 option was above the second dot or picture, and so forth. This placement was meant to make salient a "one panda merits $10" modulus.

Figure 2. Picture used in the affect-rich condition of Study 3 (saving pandas).

We predicted that participants encountering the affect-poor dots would be relatively likely to base their donation on a calculation or, to be specific, on a count of the number of pandas and an appeal to the suggested modulus. On the other hand, we predicted that participants encountering the affect-rich pictures would be relatively unlikely to count and would instead consider feelings engendered by the pictures. Reliance on a count and modulus should yield relative scope-sensitivity. In contrast, feelings concerning one cute picture should essentially match feelings concerning four cute pictures, yielding scope-insensitivity.

Results and Discussion

The results are consistent with our analysis. The dots yielded a fair degree of scope-sensitivity; mean donations were greater given four pandas rather than one ($M = 22.00$, $SD = 16.48$ for four pandas, and $M = 11.67$, $SD = 11.47$ for one panda), $t(58) = 2.82$, $p < .01$. In contrast, the pictures revealed dramatic scope-insensitivity; mean donations were virtually identical across the two scope levels ($M = 18.95$, $SD = 15.21$ for four pandas, and $M = 19.49$, $SD = 14.13$ for one panda), $t(75) < 1$, *ns.* The data revealed a significant Scope $\times$ Presentation interaction, $F(1, 133) = 4.76$, $p < .05$, $MSE = 209$, $\eta^2 = 0.03$, and a significant main effect of scope, $F(1, 133) = 3.86$, $p = .05$, $\eta^2 = 0.03$, but not of presentation, $F(1, 133) < 1$, *ns.*

Once more, the data revealed a crossover. Given one panda, participants donated more in the picture than in the dot condition ($19.49 vs. $11.67), $t(67) = 2.47$, $p < .05$, but given four pandas, participants donated slightly (but not significantly) less in the picture condition ($18.95 vs. $22.00), $t(66) < 1$, *ns.* Again, a crossover suggests that feelings engendered by the picture were of moderate intensity. Had the picture been even cuter (e.g., a mother panda caressing her young), affect-rich donations may have been greater at both scope levels. On the other hand, had the picture been aversive (e.g., an ugly panda biting a snake), affect-rich donations may have been smaller at both scope levels.

Study 4: Sentencing a Mugger

In Study 3, the affective intensity of the presentation was varied by the introduction of either an affect-rich or affect-poor cue (pictures vs. dots). In Study 4, exactly the same cues were provided to all participants, and the affective intensity of the presentation was manipulated using an empathy instruction that required participants to generate affect on their own.

Method

University of Chicago undergraduates ($N = 274$) were recruited in a public place on campus and individually completed a short questionnaire for $1. They were asked to recommend a prison sentence of up to 10 years for an individual convicted of mugging a fellow student at night.

Respondents were randomly assigned to one of four conditions of a 2 (scope) $\times$ 2 (empathy) between-subjects design. Scope was manipulated by varying the number of previous mugging convictions attributed to the offender—zero or four. Empathy consisted of two conditions: empathy (affect-rich) and no empathy (affect-poor). In the empathy condition, prior to recommending a sentence, participants were told to "Put yourself in the position of the victim(s) and think about how you would feel when being

mugged at night. Please write a sentence below to describe your feelings." In the no-empathy condition, these instructions were omitted.

Besides holding external cues constant, two additional aspects of the present methodology merit mention. First, in our previous studies, the targets being valued—CD bundles, reimbursement for work performed, endangered pandas to be saved—were all affectively positive. In the present study, the target being valued—crimes committed by a mugger—was affectively negative. We expected that our results in the positive domain would generalize to the negative domain. Second, unlike Studies 2 and 3, which facilitated calculation by making salient some modulus (i.e., \$10 for an hour, \$10 for one panda), the present study provided no explicit modulus and thus required that participants establish a calculative rule by their own initiative (e.g., "Four prior offenses merits many years in prison").

People often base punitive decisions largely on feelings, even without explicit instructions to do so (e.g., Sunstein, Kahneman, & Schkade, 1998). We predicted that this tendency would be especially pronounced in the affect-rich conditions. Compared with participants in the no-empathy conditions, participants in the empathy conditions should be even less likely to count offenses and more likely to base their sentence on the feelings they were asked to generate. These feelings should be essentially equivalent given either four or zero prior offenses.

Results and Discussion

The results accord with our analysis. In the no-empathy conditions, recommended sentences were highly sensitive to scope ($M = 2.56$, $SD = 2.49$, given no previous offense, and $M = 5.78$, $SD = 3.39$, given four previous offenses), $t(136) = 6.37$, $p < .01$. In contrast, in the empathy conditions, recommended sentences were less sensitive to scope ($M = 3.43$, $SD = 2.84$, given no previous offense, and $M = 4.65$, $SD = 3.39$, given four previous offenses), $t(134) = 2.17$, $p < .05$. ANOVA revealed a significant Scope × Empathy interaction, $F(1, 270) = 7.72$, $p < .01$, $MSE = 9.35$, $\eta^2 = 0.02$. The ANOVA found a significant main effect of scope, $F(1, 270) = 35.35$, $p < .01$, $\eta^2 = 0.11$, but not of empathy, $F(1, 270) < 1$, *ns.* As in the previous studies, there is a crossover. Given no prior offenses, the empathy instruction yielded longer sentences (3.4 vs. 2.6 years), $t(132) = 1.99$, $p < .05$, but given four prior offenses, the empathy instruction yielded shorter sentences (4.7 vs. 5.8 years), $t(138) = 1.99$, $p < .05$.

General Discussion

Across a diverse set of scope variables and dependent measures, we observed a consistent pattern of results: relative scope-insensitivity when valuation by feeling is encouraged, and relative scope-sensitivity when valuation by calculation is encouraged. We next discuss (a) the relationship between the present research and the existing literature on scope neglect, (b) other factors that may influence valuation, (c) the relationship between scope-insensitivity and probability weighting, and (d) implications of the present research for interpretations of the concavity revealed by most real-world value functions.

Relationship With Prior Research on Scope Neglect

Researchers interested in people's preferences for nonmarket goods—such as the rescue of endangered species—have conducted studies closely related to ours. In a representative experiment, Desvousges et al. (1993) asked (separate groups of) participants how much they would donate to save 2,000, 20,000, or 200,000 migrating birds from drowning in oil ponds. The mean responses, \$80, \$78, and \$88, respectively, showed astounding neglect of scope (for similar findings see Baron & Greene, 1996; Boyle, Desvousges, Johnson, Dunford, & Hudson, 1994; Carson & Mitchell, 1993; Fetherstonhaugh, Slovic, Johnson, & Friedrich, 1997; Frederick & Fischhoff, 1998).

Kahneman et al. (2000) explained these results by arguing that Desvousges et al.'s (1993) questions evoked "a mental representation of a prototypical incident, perhaps an image of an exhausted bird, its feathers soaked in black oil, unable to escape" (p. 652) and that participants decided how much to donate on the basis of their affective reactions to this image. More generally, Kahneman et al. (2000) used the term *affective valuation* to refer to assessments of preference on the basis of "the sign and intensity of the emotional response to objects" (p. 643) and stressed that affective valuations are scope-insensitive because "the attitude to a set of similar objects is often determined by the affective valuation of a prototypical member of that set" (p. 645).

Our notion of valuation by feeling is taken from the work of Kahneman et al. (2000). It also follows Slovic et al.'s (2002) and Finucane et al.'s (2000) investigation of affect as a cue for value (see also Frederick, 2002; Zajonc, 1980). We build on these analyses by explicitly juxtaposing valuation by feeling with valuation by calculation. In demonstrating that factors affecting the relative salience of these two processes moderate the degree of scope-sensitivity, we offer a process-based account of the determination of value.

In another related study, Dhar and Wertenbroch (2000) found that "hedonic" goods reveal greater loss aversion than "utilitarian" goods. This observation may provide a parallel to our findings: Hedonic goods may be thought of as affect-rich and utilitarian goods as affect-poor, and affect may influence not only scope-sensitivity, but loss aversion as well.

Complexity of Valuation Processes

Although we have offered an account that juxtaposes calculation and feeling, we emphasize that valuation is a complex process open to the influence of many variables. For instance, we speculate that joint valuations of multiple targets will yield greater scope-sensitivity than separate valuations of the same targets. To illustrate, consider a hypothetical modification of Desvousges et al. (1993) study in which each participant makes three responses, indicating in turn a donation to save 2,000, 20,000, and 200,000 endangered birds. It seems likely that such joint valuations will yield pronounced scope-sensitivity. Hsee (1996; Hsee et al., 1999; Hsee & Zhang, in press) provided detailed analysis of the distinction between joint and separate evaluations.

In a slightly different vein, it is clear that valuations are often influenced by diverse considerations such as "What can I use this for?" or "What am I supposed to do?" that fall neatly into neither the category of calculation nor that of feeling. Gilbert, Gill, and Wilson (1998) provided an especially compelling example that contrasts preferences constructed by feeling with preferences constructed with an eye toward what one is supposed to do. These authors had grocery shoppers list the items they intended to purchase. Only some shoppers were allowed to retain their list during their actual shopping trip. Furthermore, some shoppers were asked

to eat a quarter pound of muffins before shopping. Among list-less shoppers, those who were unfed bought more unlisted items than those who were well-fed. However, among shoppers retaining their lists, those who were unfed did not buy more unlisted items. Presumably, list-less shoppers experienced more positive affective reactions to unlisted items when unfed ("Those cookies look delicious!") than when well-fed ("I never want to eat again"). Shoppers with lists surely had the same affective reactions but evidently decided whether to purchase an appealing item by checking their list to see if they were supposed to buy it rather than by following their affective reactions.

The conclusions we have drawn about how feeling and calculation yield different reactions to scope are not meant to deny the importance of other influences on valuation nor the inherent complexity of valuation. On the contrary, in our opinion that systematic differences arise between valuation by feeling and calculation even though many factors might dilute such differences, demonstrates the importance of distinguishing between these valuation processes.

Implications for Probability Weighting

Rottenstreich and Hsee (2001) observed probability by affect-richness interactions that parallel the scope by affect-richness interactions we report. In one experiment, participants were asked for their willingness-to-pay for either a 1% or 99% chance of winning a $500 coupon. The coupon could be used either for tuition payments (affect-poor) or toward expenses associated with a vacation to Paris, Venice, and Rome (affect-rich). At 1%, people were willing to pay more for the vacation coupon, but at 99%, people were willing to pay more for the tuition coupon. In other words, people were more sensitive to variation in probability between 1% and 99% when the prize was affect-poor than when it was affect-rich. These results parallel the Scope × Affect-Richness interaction we have observed, with probability in the role of scope.

The distinction between calculation and feeling may explain probability by affect-richness interactions much as it explains scope by affect-richness interactions. Rottenstreich and Hsee's (2001) results suggest that the value of affect-poor prospects reveals relatively constant sensitivity to probability throughout the entire range of probability, from 0 to 1 (see the dotted line in Figure 3). Relatively constant sensitivity is consistent with the notion that affect-poor prospects engender valuation by calculation. Furthermore, Rottenstreich and Hsee's results suggest that the value of affect-rich prospects is hypersensitive to the presence or absence of uncertainty (i.e., a change from a probability of 0 or 1 to some intermediate probability) but largely insensitive to further variations in probability (see the solid line in Figure 3). This pattern is consistent with the notion that affect-rich prospects engender valuation by feeling.

Most real-world valuations consist of a mix of calculations and feelings. The resulting probability weighting function is more regressive than the nearly linear dotted line in Figure 3 but is less regressive than the nearly step-function solid line in Figure 3. Many researchers have observed exactly this pattern of probability weighting (Tversky & Kahneman, 1992; see also Abdellaoui, 2000; Bleichrodt & Pinto, 2000; Camerer & Ho, 1994; Gonzalez & Wu, 1999; Kilka & Weber, 2001; Wu & Gonzalez, 1996, 1998).

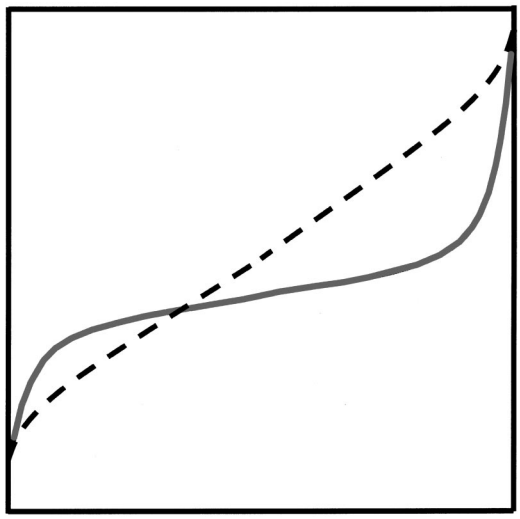

Figure 3. Probability weighting functions based on calculation (dotted line) and based on feeling (solid line). The *x*-axis of the function is stated probability, and the *y*-axis is the weight or impact of this probability on value.

To appreciate why valuation by feeling may yield hypersensitivity near the end-points of the probability scale and insensitivity at intermediate probabilities, consider a thought experiment by Elster and Loewenstein (1992). Picture a fatal car crash involving your closest friend. This harrowing image might make you drive more carefully. In other words, the possibility of a terrible crash may lead to an affective reaction to a salient image, and this feeling (not explicit consideration of the scenario's probability) may guide behavior. Such feelings will be hypersensitive to departures from a probability of 0 or 1, because the difference between no chance and some chance or between some chance and certainty activates either an image of the potential outcome or a counterimage accentuating its absence. In contrast, such feelings will be independent of intermediate probability variations (whether the chances of a crash are 1 in 1,000 or 100,000), because intermediate variations will not alter the associated image. (For related hypotheses concerning how affect influences probability weighting, see Wu, 1999, and Brandstätter, Kühberger, & Schneider, 2002.)

Accounting for Concavity

Real-world value functions are typically concave—constant increments of scope yield successively smaller increments of value. Although our experimental data do not directly address this issue, we speculate that concavity arises in part because most real-world valuations mix calculation and feeling. Indeed, appropriate mathematical combinations of the two extreme functional forms previously mentioned (the linear and step functions in Figure 1) yield a concave function. In such mixes, greater reliance on feeling yields greater concavity.

Consider, the family of functions $V = A^{\alpha}S^{1-\alpha}$. Here, V denotes subjective value, A the affective intensity of the target, S its scope, and α is an affective focus coefficient bound by 0 and 1. When α is small, value depends mostly on scope rather than affect; when α is large the reverse is true. This form is equivalent to the Cobb–

Douglas utility function often invoked in economics; for a given (A, α) pair, it reduces to the power law of psychophysics (Stevens, 1975).

To see how this family of functions captures the data from our experiments, let us apply it to the results of the pandas study. In that experiment, S may be either 1 or 4 (the number of pandas), and A is larger in the picture than dot conditions (denote the particular values of A by $A_{\text{picture}} > A_{\text{dot}}$). For simplicity, suppose affect-poor presentations focus participants entirely on scope, yielding $\alpha = 0$, and affect-rich presentations focus participants entirely on feelings, yielding $\alpha = 1$. Then, the subjective value of the pandas will equal 1 and 4 in the two dot conditions but will be constant, equal to A_{picture}, across the two picture conditions. Thus, the model generates pronounced scope-insensitivity when feeling predominates and generates marked scope-sensitivity when calculation predominates. If $1 < A_{\text{picture}} < 4$, it yields the empirically observed crossover.

The illustrations above set α equal to either 0 or 1, making V either a step-function or a linear function. Intermediate values of α yield a concave value function. As we mentioned, most real-world value functions are concave. Previous theoretical analyses explain concavity by the principle of satiation, according to which the more units of a good an individual consumes (e.g., reimbursement from work, pandas saved, steaks for dinner, anything else), the less one desires (and thus the less one values) additional units of this good. By this view, the faster the rate of satiation, the more concave is the value function. Although satiation is surely an important influence on value, the present analysis suggests another interpretation of concavity. The value function may be highly concave when feeling predominates (α approaches 1) and less concave when calculation predominates (α approaches 0). In other words, the extent to which different processes are used to assess value, not just the nature of consumption and satiation, may be an important determinant of the shape of the value function.

We close by noting that the model $V = A^{\alpha}S^{1-\alpha}$ highlights two mechanisms that might contribute to the influence of feelings on preferences. First, as captured by A, affect may be a source of value. Second, as captured by α, a person may focus on either affect or scope. Presumably, higher values of A will often coincide with higher values of α, because pronounced affect typically draws attention to itself (e.g., we have presumed that a cute panda picture is captivating or that strong empathy for a mugging victim is engrossing). The notion that affect tends to focus attention on certain attributes and draws attention away from others is consistent with the findings of Wright and Lynch (1995) and the accessibility–diagnosticity framework of Feldman and Lynch (1988). Nevertheless, A and α need not be perfectly correlated and could in principle operate independently. Indeed, in Gilbert, Gill, and Wilson's (1998) example, shoppers who retain their lists appear not to focus on their strong affective reactions.

Our experiments aimed to provide guidelines for predicting when people will be either scope-sensitive or scope-insensitive. Thus, they merely corroborate differences in the assessment of subjective value under affect-rich and affect-poor presentations. We hope that future work more carefully investigates the specific mechanisms contributing to such differences.

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Received January 20, 2003
Revision received October 30, 2003
Accepted October 31, 2003 ■