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MUSIC, PANDAS, AND MUGGERS:

ON THE AFFECTIVE PSYCHOLOGY OF VALUE

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Abstract

We investigate the relationship between the magnitude or scope of a stimulus and its subjective value, by contrasting two psychological processes that may be used to construct preferences: *valuation by feeling* and *valuation by calculation*. We show that when people rely on feeling, they are sensitive to the presence or absence of a stimulus (i.e., the difference between zero and some scope) but 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 closer to a linear function when calculation predominates. We discuss how our findings may allow for a novel interpretation of why most real-world value functions are concave and how the processes responsible for non-linearity of value may also contribute to non-linear probability weighting.

How long would someone who is willing to work three hours 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 an individual'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. Making a charitable donation presumably gives one moral satisfaction (e.g., Kahneman & Knetsch, 1992). Thus, to gauge 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 forms 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, 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 predict that under valuation by calculation, changes in scope will have relatively constant influence on value throughout the entire range. The corresponding value function will be relatively steep (the dotted line). On the other hand, we predict that under valuation by feeling, value will be highly sensitive to the presence or absence of a stimulus (i.e., a change in scope from zero to one), but largely insensitive to further variations in scope. The corresponding value function will be 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 composed of either five or ten 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 coming 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 feeling toward the stimulus (e.g., one's liking of Madonna). In essence, feelings depend on the nature of a stimulus but not on its scope, whereas calculations explicitly consider scope. Thus, feeling yields marked sensitivity to the presence or absence of a stimulus (i.e. the change from zero to some scope) but little sensitivity to subsequent increments of scope; calculations, on the other hand, 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*. This summary characterization abstracts away from what occurs in the neighborhood of zero scope, but is exactly valid at all other scope levels.

We wish to 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 five or ten disc collection, whereas someone who dislikes Madonna may establish a lower willingness-to-pay under feeling than under calculation – for either collection. A "cross-over," wherein feeling yields greater value at a low scope level but calculation yields greater value at a high scope level, will emerge if valuation by feeling taps affect of intermediate intensity.

We later discuss in detail how our notion of valuation by feeling is closely connected to the works of Kahneman, Ritov and Schkade (1999), Finucane et al (2000), and Slovic et al. (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 wish to 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 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 is similar to that of the Madonna CD example.

University of Chicago students (N=115) completed a packet containing several questionnaires, for payments varying between $2 to $4. Participants were told that the questionnaires were unrelated to one another. Most of the questionnaires were indeed unrelated, but two formed the current study. The first constituted a priming task, and the second presented our main dependent measure.

The study followed a 2 Scope x 2 Priming between-subjects design. The priming questionnaire was meant to encourage either valuation by calculation or by feeling. In the calculation-priming condition, participants were asked five questions requiring conscious and deliberate calculations. The five questions were:

> If an object travels at five feet per minute, then by your calculations how many feet will it travel in 360 seconds? _____ feet
>
> Suppose a student bought a pen and a pencil for a total of $11, and that the pen cost $10 more than the pencil. Then, by your calculations how much did the pencil cost? $_____

If a consumer bought 30 books for $540, then, by your calculations, on average, how much did the consumer pay for each book? $____

If a baker bought nine pounds of flour at $1.50 per pound, then, by your calculations how much did the baker pay in total? $____

If a company bought 15 computers for $1200 each, then, by your calculations, how much did the company pay in total? $_____

In the feeling-priming condition, participants were asked five questions that required them to examine and report their feelings. The five questions were:

When you hear the name "Adrien Brody," what do you feel?

Please use one word to describe your predominant feeling: _____

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 name "Princess Diana," what do you feel?

Please use one word to describe your predominant feeling: _____.

When you hear the words "9/11," 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 followed the priming questionnaire. In the main questionnaire, participants were asked to assume that, for family reasons, a friend of theirs who was from a foreign country had to unexpectedly leave the U.S. 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 was composed of 5 CDs, in another version of the questionnaire the bundle was composed of 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 of the number of discs available 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, detailed in Figure 2, corroborate 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; $t(55)=2.69$, $p<.01$). But 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, $t<1$, *n.s.*). Analysis of variance reveals a significant Scope x 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.[1]

Note that the data yield a cross-over effect. At the 5-CD level, participants were willing to pay significantly more when primed to feel than when primed to calculate ($22.64 versus $15.10; $t(56)=1.91$, $p=.06$). In contrast, at the 10-CD level, participants were actually willing to pay slightly (but not significantly) less when primed to feel than when primed to calculate ($19.77 versus $28.81; $t(53)=1.51$, *ns*). As we have mentioned, such a "cross-over" 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. On the other hand, had these feelings been less positive, mean willingness-to-pay may have been lower in the feeling conditions at both scope levels.

We wish to emphasize that the main questionnaire used 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, such a manipulation is also *direct*: priming influences the actual process theorized to moderate scope sensitivity. In fact, the priming manipulation in this study provides an operational definition of valuation by calculation and valuation by feeling.

Direct manipulation of valuation processes has 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 facilitate valuation by calculation while others facilitate 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 of which is affect-rich and one of which is affect-poor. Both studies 3 and 4 examine (b) the valuation of a given target presented in either an affect-rich or affect-poor manner.

Study 2: Music Book versus Cash

Method

University of Chicago undergraduates (N=331) were asked to imagine that they could work temporarily at the campus bookstore. Participants indicated how long they would work for a certain reimbursement, using a scale of 0 to 10 hours.

The study followed a 2 Scope X 2 Target between-subjects design. The two targets we studied 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 a relatively affect-rich target and that the cash is a relatively affect-poor target. To confirm this claim, we later asked a separate group of participants which of these targets was more emotionally appealing to them; an overwhelming majority, 76%, indicated that the music book was indeed more emotionally appealing than the cash (N=49, p< .0001 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 participants in the affect-poor cash conditions tend to rely on valuation by calculation, whereas participants in the affect-rich music book conditions tend to rely on valuation by feeling, then the cash conditions should yield relative scope-sensitivity, whereas the music books conditions should yield relative scope-insensitivity. For instance, in the cash conditions, participants may appeal to a reference wage of $10 per hour. Based on this modulus, calculations suggest working approximately three hours for $30 or approximately six hours for $60. Even allowing for adjustments from these values, responses in the cash condition should be highly 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 have essentially been instructed to do so. If participants in the music book condition indeed decide how long to work by consulting their feelings for the book, then responses in this condition should show little sensitivity to scope.

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, $t(162)=8.06$, $p<.001$), 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, $t(165)=2.54$, $p<.05$). Analysis of variance revealed a significant Scope x Target interaction effect ($F(1,327)=7.48$, $p=.007$, $MSE=4.26$, $\eta^2 = 0.02$), indicating less scope-sensitivity in the music book than cash conditions. Although they are not of theoretical interest here, analysis of variance also revealed significant main effects of Scope ($F(1,327)=46.33$, $p<.001$, $\eta^2 = 0.12$) and Target ($F(1,327)=5.92$, $p<.01$, $\eta^2 = 0.02$).

Note that the data again yield a cross-over effect. At the $30 level, participants were willing to work more in the affect-rich music book condition than in the affect-poor cash condition ($4.4 hours versus 3.2 hours; $t(158)=4.19$, $p<.001$). In contrast, at the $60, participants were actually willing to work slightly (but not significantly) less in the affect-rich music book condition than in the affect-poor cash condition (5.3 hours versus 5.4 hours; $t(169)<1$, *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 this study 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 instructive to the extent that it mimics these types of real-world circumstances.

Our next two studies build on Study 2, by adopting its general approach while circumventing some of its limitations. Study 2 indirectly manipulated the valuation process, facilitating either valuation by calculation or by feeling by changing the target being valued. The following studies also indirectly manipulate the valuation process. However, these studies each hold constant the target being valued and facilitate one or the other valuation process by changing the manner in which the target is presented.

Study 3: Saving Pandas

Method

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

The study followed a 2 Scope x 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. All participants were provided with a table indicating the number of pandas found. In the affect-poor conditions, the table depicted each panda by a single large dot. That is, participants in the affect-poor conditions were shown a

table containing either one or four dots. In the affect-rich conditions, the table depicted each panda with a cute picture:

That is, participants in the affect-rich conditions were shown a table containing either one cute picture or four copies of the same cute picture.

Manipulation checks, conducted after the completion of the study and using separate pools of participants, confirmed that the picture presentation evoked considerably greater affective reactions than the dot presentation. We asked participants how much emotion they experienced when they examined the table describing the number of pandas found. Participants answered using a 10-point scale with the end-points labeled "little" and "a lot." Mean responses were 3.8 in the dot condition versus 7.0 in the picture condition (N=25 in each condition; p<.0001by t-test). We also asked participants how emotionally appealing they found the team's request for donations. Participants answered using a 10-point scale with the end-points labeled "very weak" and "very strong." Mean responses were 4.5 in the dot condition versus 5.9 in the picture condition (N=25 in each condition; p=.06 by t-test).

The study's dependent measure had participants indicate "the most you would be willing to donate" by circling $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.

We predicted that participants encountering the affect-poor dots would 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 unlikely to "count" and would instead consider feelings engendered by the pictures. Reliance on a count and modulus should give rise to relative scope-sensitivity. In contrast, the feelings engendered by one cute panda picture should essentially match the feelings engendered by four cute panda pictures, yielding scope-insensitivity.

Results and Discussion

The main results, detailed in Figure 3, corroborate our predictions. The dot conditions revealed a fair degree of scope-sensitivity; the mean donation for four pandas was significantly greater than the mean donation for one panda (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 picture conditions 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, $t<1$, *n.s.*). Analysis of variance revealed a significant Scope x Presentation interaction ($F(1,133)=4.76$, $p<.05$, $MSE = 209$, $\eta^2 = 0.03$), suggesting greater scope-sensitivity in the dot

conditions than picture conditions. The ANOVA revealed a significant main effect of Scope ($F(1,133)=3.86$, $p=.05$, $\eta^2 = 0.03$) but no main effect of Presentation.

Note that, yet again, the data reveal a cross-over. Given one panda, participants donated more in the picture than in the dot condition ($19.49 versus $11.67; $t(67)=2.47$, $p<.05$), but given four pandas, participants donated slightly (but not significantly) less in the picture than in the dot condition ($18.95 versus $22.00; $t(66)<1$, *ns*). Again, the observation of a cross-over suggests that the feeling engendered by the panda picture was of moderate intensity. Had the picture been even cuter (e.g., a mother panda caressing her young), mean donations may have been greater in the affect-rich conditions at both scope levels. On the other hand, had the picture been aversive (e.g., an ugly panda biting a snake), mean donations may have been greater in the affect-poor conditions 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 cue (the pictures) or an affect-poor cue (the dots). In Study 4, exactly the same cues are provided to all participants; the affective intensity of the presentation is manipulated using an empathy instruction, which asks participants to generate affect on their own.

Method

University of Chicago undergraduates (N=274) completed a 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.

The study followed a 2 Scope x 2 Empathy between-subjects design. Scope was manipulated by varying the number of previous mugging convictions attributed to the offender – zero or four. Empathy was designed to manipulate affect-richness, and consisted of two conditions: empathy (affect rich) and no empathy (affect poor). In the empathy condition, prior to recommending a sentence, participants were asked 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 – is 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 provides no explicit modulus and thus requires that participants establish a calculative rule by their own initiative (e.g., "four prior offenses merits many years in prison").

There is evidence that people often base punitive decisions largely on feelings, even without explicit instructions to do so (e.g., Sunstein et al 2000). We predicted that this tendency would be especially pronounced in the affect-rich conditions. Compared to participants in the affect-poor conditions, participants in the affect-rich conditions should be even less likely to "count" offenses and more likely to base their sentence on feelings of empathy they were

explicitly asked to generate. Feelings of empathy should be essentially equivalent no matter how many prior offenses the perpetrator has committed.

Results and Discussion

The results, depicted in Figure 4, accord with our predictions. In the affect-poor no-empathy condition the mean 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, $t(136)=6.37$, $p<.001$). However, in the affect-rich empathy condition, the mean recommended sentences became 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, $t(134)=2.17$, $p<.05$). Analysis of variance revealed a significant Scope x Empathy interaction ($F(1,270)=7.72$, $p<.01$, MSE = 9.35, η^2 = 0.02). The ANOVA found a significant main effect of Scope ($F(1,270)=35.35$, $p<.001$, η^2 = 0.11) but not of Empathy. As in the previous studies, the data also produced a cross over. Given no prior offenses, the empathy instruction yielded longer sentences (3.5 versus 2.6 years; $t(132)=1.99$, $p<.05$), but given four prior offenses, the empathy instruction yields shorter sentences (4.6 versus 5.8 years; $t(138)=1.99$, $p<.05$).

General Discussion

Across diverse manipulations of valuation processes, scope variables, and a number of dependent measures, we observed a consistent pattern of results: relative scope-insensitivity under valuation by feeling, and relative scope-sensitivity under valuation by calculation. In the remainder of the article, we discuss (a) how the present research is inspired by and can potentially contribute to the existing literature on scope neglect, (b) what other factors may

influence valuation, (c) the relationship between the present work on scope-sensitivity and prior research on 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 non-market goods– such as the rescue of endangered species – have conducted studies closely related to ours. In a representative experiment, Desvousges et al. (1992) 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 et al 1994; Carson and Mitchell, 1993; Fetherstonhaugh, Slovic, Johnson & Friedrich, 1997; Frederick & Fischhoff, 1998).

In an influential paper, Kahneman et al (1999) explain these results by arguing that Desvousges et al's questions evoke "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. use 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 stress 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. 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 the degree of scope-sensitivity, but the degree of loss aversion as well.

Complexity of Valuation Processes

Although we have offered an account that juxtaposes the roles of calculation and feeling, we wish to 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. (1992) study in which each participant makes three responses, indicating in turn a donation for 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, 2003) provides detailed analysis of the distinction between joint and separate assessments.

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)

provide an especially compelling example that contrasts preferences constructed by feeling with preferences constructed with an eye towards 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 shoppers who did not have their lists, those who did not eat muffins bought more items they had not previously listed than those who ate muffins. Presumably, shoppers who did not have their lists experienced more positive affective reactions to unlisted items when unfed ("those cookies look delicious!") than when well-fed ("I never want to eat again"). But, among shoppers retaining their lists, those who were unfed did not buy more unlisted items than those who were well-fed. Shoppers with lists surely had the same affective reactions as shoppers without lists but evidently decided whether to purchase each item by checking to see if it appeared on their list so that 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 diminish the importance of other influences on valuation nor to deny the inherent complexity of the valuation process. On the contrary, in our opinion that systematic differences arise between valuation by feeling and valuation by calculation even though many factors might dilute such differences only testifies to the importance of the distinction between these two 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% chance or a 99% chance of winning a $500 coupon. The coupon could be used either for tuition payments (affect-poor) or towards expenses associated with a vacation to Paris, Venice, and Rome (affect-rich). At the 1% probability level, people were willing to pay more for the vacation coupon, but at the 99% probability level, 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 the prize was affect-rich. These results parallel the scope x affect-richness interaction we have observed in the present research, 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 results suggest that the value of affect-poor prospects reveals nearly constant sensitivity to probability throughout the entire range of probability, from zero to one (the dotted line in Figure 5). 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 hyper-sensitive to the presence or absence of uncertainty (i.e., a change from zero probability to some intermediate probability or from some intermediate probability to a probability of one) but largely insensitive to further variations in probability (the solid line in Figure 5). 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 will be more regressive than the nearly linear dotted line in Figure 6, but less regressive than the nearly step-function solid line in Figure 6. Many researchers have observed exactly this pattern of probability weighting (Tversky & Kahneman, 1992; see also

Abdellaoui, 2001; Bleichrodt & Pinto, 2000; Camerer & Ho, 1994; Gonzalez & Wu, 1999; Kilka & Weber, 2001; Wu & Gonzalez, 1996, 1998).

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. The harrowing image that emerges 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 zero or one, 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 counter-image 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.

Accounting for Concavity

Empirical analyses indicate that 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, an appropriate mathematical combination of the two extreme functional forms previously mentioned (the linear and step functions depicted in Figure 1) would yield a concave function. In such mixes, greater reliance on feeling yields greater concavity.

Consider, for instance, the family of functions $V=A^{\alpha}S^{1-\alpha}$. Here, V denotes subjective value, A represents the affective intensity of the target, S its scope, and α is an "affective focus coefficient" bounded 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 $A_{picture}>A_{dot}$). For simplicity, suppose affect-poor presentations focus participants entirely on scope, yielding α=0, and affect-rich presentations focus participants entirely on feelings, yielding α=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. In this way, the model generates pronounced scope-insensitivity when feelings predominate and marked scope-

sensitivity when calculation predominates. If $1<A_{picture}<4$, it yields the empirically observed "cross-over."

The illustrations above set α equal to either zero or one, making *V* either a step-function or a linear function. Intermediate values of α yield a concave value function. As we have 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 one 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 may be captivating or that strong empathy for a mugging victim might be engrossing). The notion that affect tends to focus attention on certain attributes and draw 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 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 – which may be captured by the model we have offered or by some alternative account – contributing to such differences.

Footnotes

[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.

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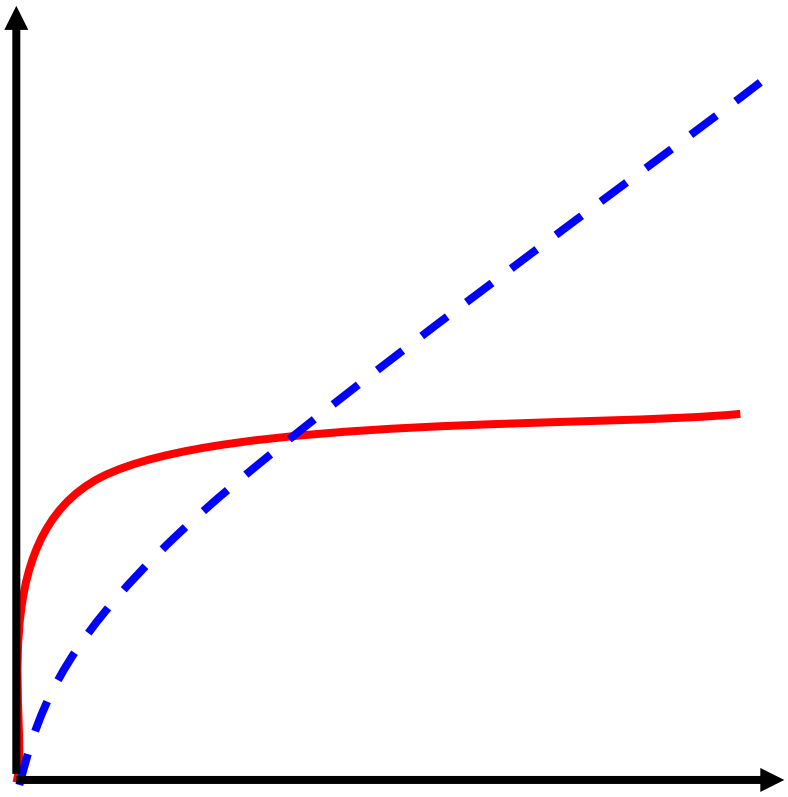

Figure 1. Value functions under calculation (dotted line) and under feeling (solid line). The x-axis of the function is the scope of an event and the y-axis is subjective value.

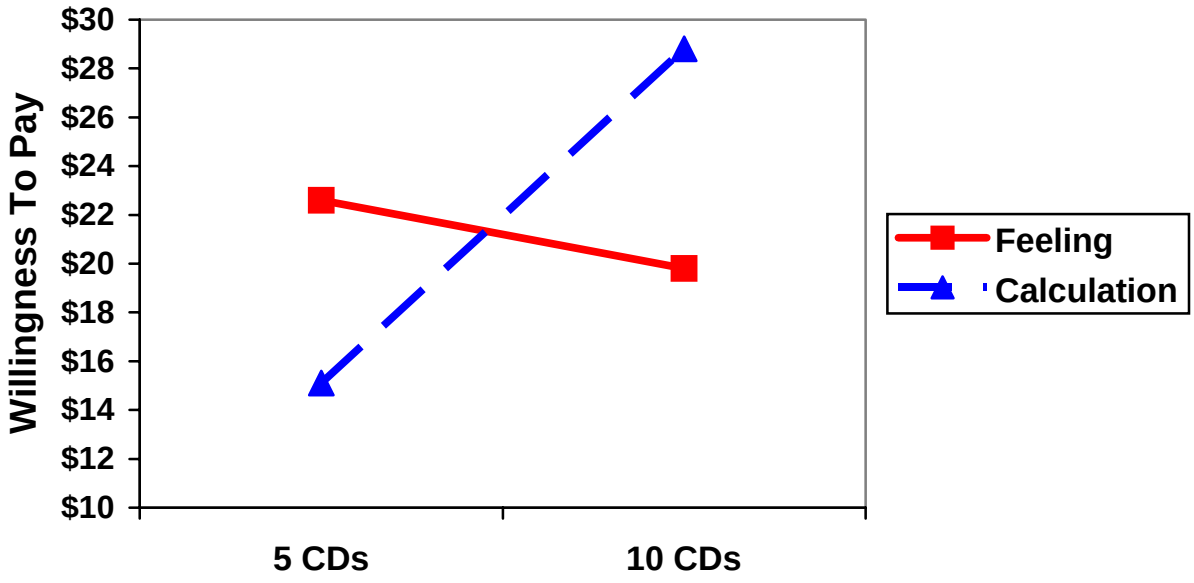

Figure 2. Results of Study 1. Mean willingness to pay for 5 or 10 Madonna CDs under the feeling priming condition and the calculation priming condition.

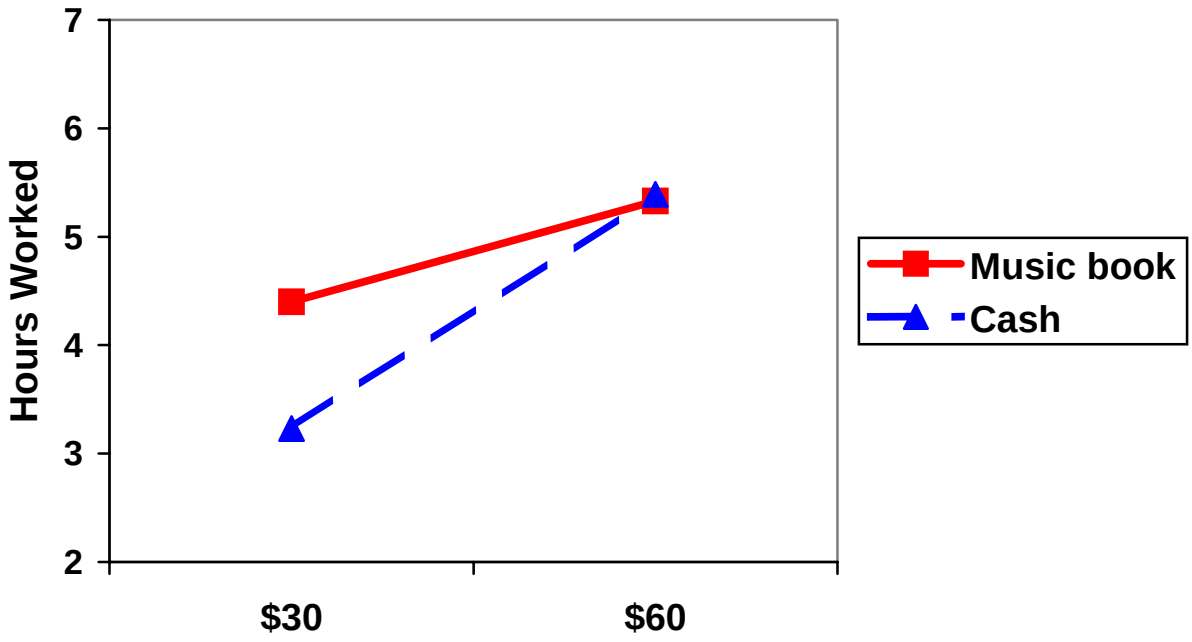

Figure 3. Results of Study 2. Mean number of hours participants were willing to work as a function of type and financial value of reward.

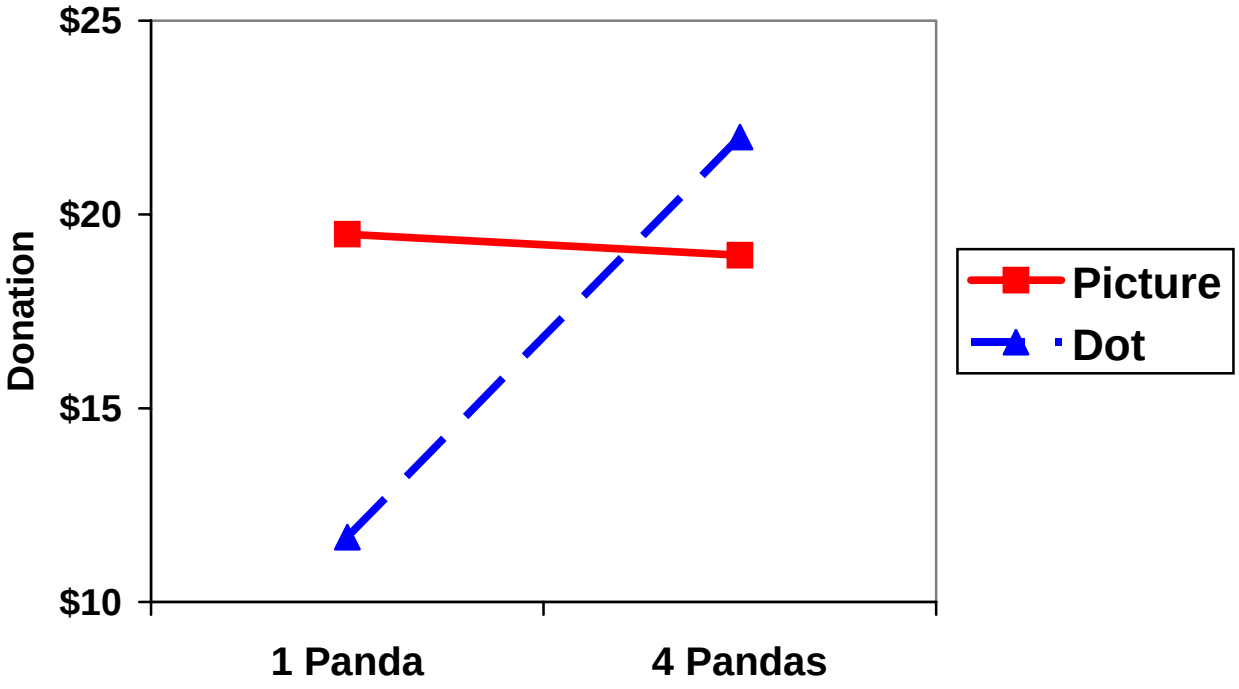

Figure 4. Results of Study 3. Mean donations as a function of presentation method and number of pandas to be saved.

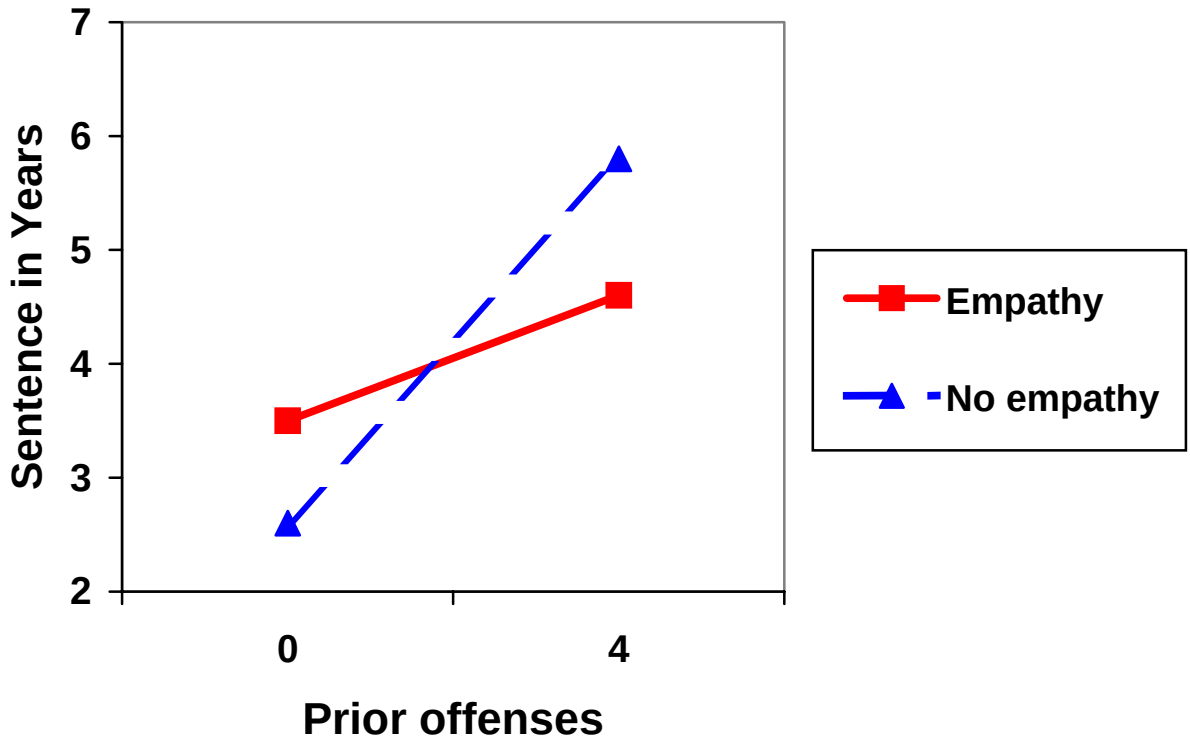

Figure 5. Results of Study 4. Mean length of sentences recommended as a function of empathy manipulation and number of prior offenses.

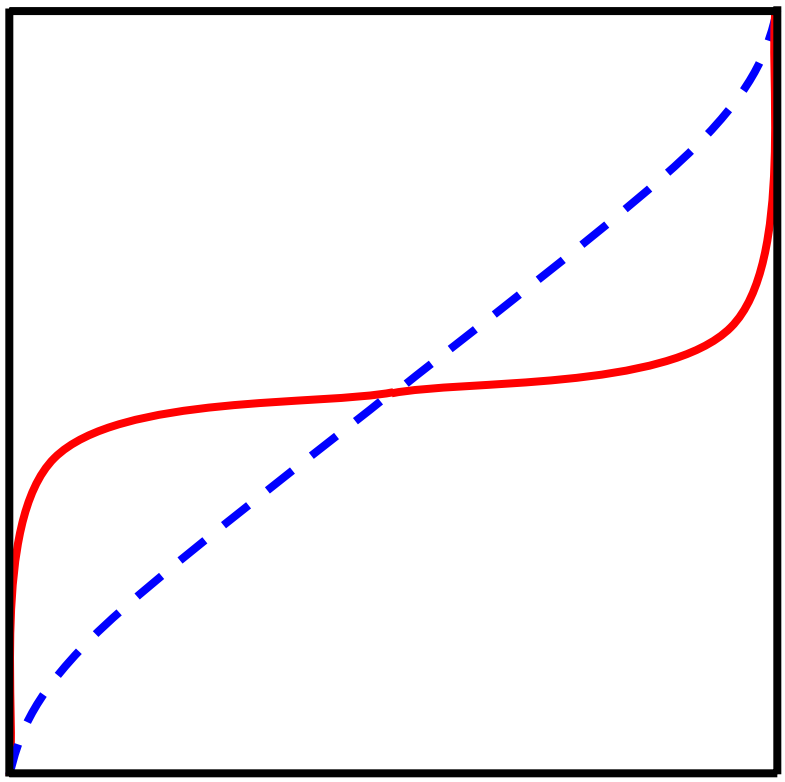

Figure 6. Probability weighting functions based on calculation (dotted line) and based on feeling (solid line). The x-axis of the function corresponds to stated probability and the y-axis to the weight or impact of this probability on value.