Affect as an Ordinal System of Utility Assessment

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Abstract

Is the perceived value of things an absolute measureable quantity associated with each object, as in economists’ notion of “cardinal utility,” or a relative assessment of the various objects being evaluated, as in economists’ notion of “ordinal utility”? This paper suggests that the answer lies in part in which judgment system underlies the evaluation. We propose that the affective system of judgment is inherently more ordinal (less cardinal) than the cognitive system. That is, the affective system is designed to perform evaluations in a manner that is inherently more comparative than the cognitive system, focusing more on the relative ranking of various alternatives rather than their assessment in absolute terms. The inherent ordinality of the affective system may be linked to its distant evolutionary roots. Results from eight studies provide converging support for this general proposition, which helps explain a variety of findings in the judgment literature.

Keywords: affect; emotion; ordinal utility; judgment; decision making
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An essential aspect of life is a constant need to assess the value of things. This is reflected in the major role that valuation plays in the social sciences, across fields as diverse as economics, behavioral finance, law and ethics, organizational behavior, management, and marketing. Historically, the assessment of value has been primarily conceptualized as a “cognitive,” computation-like process involving operations such as belief formation, inference making, attribute weighting, and value integration (Anderson, 1981; Bettman, Luce, & Payne, 1998; Fishbein & Azjen, 1975; Simon, 1957). However, more recent research has shown that the assessment of value often involves affective processes, whereby people evaluate objects based on their momentary feelings toward these objects (Bechara, Damasio, Tranel, & Damasio, 1997; Epstein, 1994; Pham, 1998; Schwarz & Clore, 2007; Slovic, Finucane, Peters, & MacGregor, 2002). Affective processes of evaluation seem to tap into a feeling-based system of judgment that is distinct from the cognitive, computational system typically examined in judgment and decision making research (Epstein, 1994; Pham, 2007).

In the present research, we investigate how the reliance on affect in evaluative judgment changes the way that value is assessed. A fundamental question in the assessment of value is whether the perceived value of things takes the form of an absolute measurable quantity associated with each target object (“A is worth X,” “B is worth Y,” “C is worth Z”), or rather the form of a relative assessment of the various objects being evaluated (“A is worth more than B”, “C is worth less than B”). This basic question has been raised across different fields. In economics, it has fueled a major debate about whether the central notion of utility is best defined as “cardinal”—that is, quantifiable and measurable on an interval scale (see Stevens, 1946)—or “ordinal”—that is, as an ordered set of preferences that is measurable only on an ordinal scale.
In consumer psychology, researchers have asked whether consumers make purchase decisions based on the absolute value of products or based on their relative value (Hsee, 1996; Simonson, 2008). In the happiness literature, a perennial question has been whether happiness is a function of people’s absolute level of wealth or instead a function of their relative wealth position compared to others (Diener, Sandvik, Seidlitz, & Diener, 1993; Hsee, Yang, Li, & Shen, 2009; Lutmer, 2005).

From a judgment process perspective, absolute or cardinal conceptions of value assume a rating form of judgment, wherein each object is assigned a numerical value, whereas relative or ordinal conceptions of value are more compatible with a ranking form of judgment, wherein each object is assigned a relative rank.

We propose that the reliance on affect in judgment fundamentally changes whether value is assessed in an absolute (cardinal) fashion or in a relative (ordinal) fashion. Specifically, valuations that tap into the affective system of judgment tend to be more ordinal than valuations that tap into the cognitive system of judgment, which tend to be more cardinal. Consistent with this proposition, across eight studies, we find that (a) people have an intuitive preference for ranking (as opposed to rating) when making affective evaluations (as opposed to cognitive evaluations); (b) people perceive a greater fit of ranking (vs. rating) when making affective evaluations; (c) increased engagement of the affective system increases overall confidence in ranking but not in rating; and (d) people induced to make affective evaluations exhibit more process evidence of ordinal mental operations. The results additionally show that the greater ordinality of affect-based evaluations helps explain well-known judgment phenomena such as (e) the greater reference-dependence of affect-based judgments (Hsee, Zhang, Yu, & Xi, 2004;
Tversky & Griffin, 1991) and (f) the greater scope-insensitivity of affect-based valuations (Hsee & Rottenstreich, 2004). Substantive and theoretical implications are discussed.

The Affective System and the Assessment of Utility

Affect as a Distinct System of Evaluation

Over the past 30 years, numerous studies from different disciplines have shown that value is often assessed affectively by monitoring how one feels toward the object to be evaluated (Bechara et al., 1997; Epstein, 1994; Pham, 1998; Schwarz & Clore, 2007; Slovic et al., 2002). For example, judgments of life satisfaction are often based on the pleasantness of how people feel as they reflect on their lives (Schwarz & Clore, 1983). Similarly, product and consumption choices are often based on how consumers feel toward available alternatives (Pham, 1998). Likewise, choices between risky gambles are largely governed by subjective feelings of risk that people associate with the various options (Bechara et al., 1997; Loewenstein, Weber, Hsee, & Welch, 2001).

Many emotion theorists conceptualize affect as reflecting the operation of a genuinely distinct system of judgment (Damasio, 1994; Pham, 2007; Plutchik, 1980; Zajonc, 1980). This system is generally believed to be more basic and primary, and evolutionarily older than the system that supports the more cognitive or computational form of judgment (Epstein, 1990; Plutchik, 1980; Zajonc, 1980). Consistent with the view that affect taps into a distinct system of judgment, numerous studies have shown that affective evaluations exhibit distinct characteristics compared to cognitive evaluations (see Pham, 2007, for a review). For example, affective judgments tend to be more holistic than cognitive judgments, which tend to be more analytic (Epstein, 1990). To illustrate, whereas a cognitive evaluation of different colleges will generally focus on their specific attributes (e.g., location, student housing, financial aid), an affective
evaluation is more likely to be based on feelings toward the various colleges as a whole. Compared to cognitive evaluations, affective evaluations additionally tend to be *scope-insensitive* in that they seem less responsive to the quantitative magnitude of the target (Hsee & Rottenstreich, 2004; see also Dunn & Ashton-James, 2008; Fetherstonhaugh, Slovic, Johnson, & Friedrich, 1997). For instance, people’s willingness to donate to save endangered pandas has been found to be less sensitive to the number of pandas at stake when the pandas were described in an affect-rich manner than when the pandas were described in an affect-poor manner (Hsee & Rottenstreich, 2004). Finally, compared to cognitive evaluations, affective evaluations tend to be more *reference-dependent* in that they usually respond to the focal object or outcome not in isolation but in relation to other objects or outcomes (Pham, 2007). For example, in job evaluations, social comparisons (e.g., how one’s salary or office size compares with those of other colleagues) have a greater influence on affective judgments of happiness with different jobs than on choices between jobs, which are presumably performed more rationally (Hsee et al., 2004; Tversky & Griffin, 1991). Affective evaluations are also particularly sensitive to outcome counterfactuals. For example, emotional responses to gamble outcomes are driven not only by the monetary value of the actual outcome but also by how the realized outcome compares with other unrealized outcomes (Mellers, Schwartz, Ho, & Ritov, 1997).

**Absolute versus Ordinal Conceptions of Value**

As mentioned earlier, a long-standing tension in various conceptualizations of perceived value revolves around whether it is best defined as an absolute, measurable quantity associated with each target object—akin to the notion of cardinal utility in economics—or rather as a relative assessment of the various objects being evaluated—akin to the notion of ordinal utility in economics. Whether the assessment of value is absolute or only relative has important theoretical
and substantive implications. From a theoretical standpoint, for instance, the basic notion of expected utility in standard microeconomics makes little sense if people have only ordinal utilities (see von Neumann & Morgenstern, 1944). For expected utility to be defined, it should be meaningful to multiply the utilities of alternative outcomes by the statistical probability of each outcome—an operation requiring that utilities be defined at least on an interval scale (Stevens, 1946). Similarly, the principle of decreasing marginal utility—another mainstay of standard microeconomic theory—also loses much of its meaning if people assess utility only ordinally.

From a substantive standpoint, public policies that are meant to increase overall welfare have to be designed very differently, depending on whether individuals are assumed to have cardinal utilities or only ordinal utilities (Harsanyi, 1995; Pareto, 1909). Conjoint analysis, a major tool in market research (Green & Srinivasan, 1990), would have to be rethought completely if consumers have only ordinal utilities, as opposed to the cardinal utilities traditionally assumed in conjoint analysis.

Besides implying different levels of measurement, absolute versus ordinal conceptions of values imply different mental operations in judgment. An absolute or cardinal conception of value implies that each object is assigned a specific value on the evaluative continuum and that this assignment is performed independently for each object being evaluated (e.g., “Employee X is worth paying $85,000 a year”; “On a 0-10 scale of fun, a spring break vacation in Cancun is a 7”). Quantitative information such as magnitude of differences in value is meaningful (e.g., “The 8% raise that Employee X received compared to last year is justified”). An ordinal conception of value implies that each object is evaluated in comparison with others and is assigned a relative rank, rather than a specific value (e.g., “Employee X should be paid more than Employee Z”; “A
spring break in Cancun is not as fun as a spring break in Hawaii”). Quantitative information beyond rank receives less attention.

**The Affective System of Evaluation is More Ordinal**

The systematic differences in how affective evaluations are performed compared to cognitive evaluations raise the possibility that the system that generates affective evaluations has a fundamentally different architecture from the system that generates cognitive evaluations (Pham, 2007). Here, we propose that an important way in which the two systems differ is that the former tends to assess value in a more ordinal fashion, whereas the latter tends to assess value in a more cardinal fashion. We attribute the inherent “ordinality” of affective evaluations to the older evolutionary roots of the system that generates them (Panksepp, 1998). Long ago, affective evaluations were presumably useful in guiding our ancestors through the various behavioral choices that they regularly faced, such as whether to engage in fight or flight, to ingest or reject, to continue or abandon, and so on (Cosmides & Tooby, 2000; Pham, 2007). An important characteristic of such basic behavioral choices is that unlike many modern-day decisions (e.g., how much to set aside in a retirement planning account), these basic choices only require ordinal assessments: Is A > B or B > A? Therefore, the affective system of evaluation may have historically been more concerned with the desirability ordering of alternative targets, courses of action, and states of the world than with their absolute desirability. One would expect that this system has retained some of its original ordinal orientation. This prediction would be broadly consistent with neuroscience evidence suggesting that certain areas of the human brain that are evolutionarily older and shared with other mammals process numbers in a more intuitive and approximate way compared to areas that are typically associated with formal thinking (Nieder & Miller, 2005). The notion of an original ordinal orientation of the affective system is also broadly
consistent with evidence showing that primates and young infants tend to represent quantities in a primarily ordinal fashion, whereas human adults have the ability to represent quantity in a more abstract fashion as well (Brannon, 2005). Moreover, it has been suggested that affect is an important part of gist-based reasoning, which tends to be more ordinal (Reyna & Brainerd, 1995).

A focus on rank-ordering would partly explain some of the distinct characteristics of affective evaluations mentioned above. First, it would explain why affective evaluations are generally found to be more reference-dependent, presumably because rank-ordering naturally requires comparisons. Second, it would partly explain why affective evaluations are generally found to be more scope-insensitive, presumably because rank-ordering does not require absolute valuation.

**Overview of the Studies**

We tested our general proposition in a series of eight studies using different operationalizations of affective evaluations and different indicators of ordinal evaluative processes. Study 1 shows that people have an intuitive preference for relative ranking when evaluating targets on affective dimensions and for absolute rating when evaluating targets on cognitive dimensions. Studies 2 and 3 show that people experience a better fit of ranking, as opposed to rating, when making affective evaluations, and a better fit of rating, as opposed to ranking, when making cognitive evaluations. Studies 4 and 5 show that increased engagement of the overall affective system increases overall confidence in ranking but not in rating. Study 6 shows that people induced to make more affective evaluations exhibit more process evidence of ordinal mental operations than do people induced to make less affective evaluations. The last two studies show that the greater ordinality of affective evaluations helps explain previously
documented properties of affect-based evaluations such as their greater reference-dependence (Study 7) and their greater scope-insensitivity (Study 8).

**Study 1: Intuitive Preference for Ranking (vs. Rating) in Affective (vs. Cognitive) Evaluations**

If affective evaluations arise from a system that is inherently more ordinal, people should have acquired a relative intuitive preference for ranking when performing various forms of affective evaluations as opposed to cognitive evaluations. This study tests this prediction by assessing people’s relative intuitive preference for ranking objects versus rating them when performing common types of evaluations that are either mainly affective or mainly cognitive.

**Method**

The study was conducted among a total of 539 participants from Amazon’s Mechanical Turk (MTurk) panel. Participants first received introductory explanations of the difference between ranking and rating. It was explained that in this study, ranking a set of items implied evaluating them based on relative preferences in relation to other items in the set. A lower number (higher rank) such as #1 indicated a higher evaluation, while a higher number (lower rank) such as #5 indicated a lower evaluation, with no ties allowed. In contrast, rating the same set of items implied evaluating them individually, independent from the other items in the set. A higher number (e.g., 9 out of 10) indicated a higher evaluation, and a lower number (e.g., 3 out of 10) indicated a lower evaluation, with ties allowed.

After reading these explanations, all participants were shown pictures of six target objects and asked to imagine having to evaluate these targets on two separate dimensions. The targets to be evaluated and the two dimensions on which participants would evaluate these targets were different across three replications of the study. In Replication A ($N = 231$, 59% women, mean
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age = 32, $SD = 12.25$), the targets to be evaluated were six pictured young individuals of the opposite sex. They were to be evaluated in terms of (a) attractiveness, which a pretest had shown to be a relatively more affective dimension ($M = 4.22$ on a seven-point scale [$1 = “I would rely mostly on logical considerations”$ to $7 = “I would rely mostly on what my emotions tell me”$]), and (b) intelligence, which a pretest had shown to be a relatively more cognitive dimension ($M = 3.36$, $t(72) = -2.31$, $p < .03$) (see also Pham & Avnet, 2009). In Replication B ($N = 141$, 41% women, mean age = 28.97, $SD = 9.12$), the targets were six pictured food dishes, to be evaluated in terms of (a) tastiness, which a pretest had shown to be a relatively more affective dimension ($M = 4.61$, on a seven-point scale), and (b) ease of preparation, which a pretest had shown to be a relatively more cognitive dimension ($M = 3.76$, $t(71) = -2.00$, $p < .05$). In Replication C ($N = 167$, 40.7% women, mean age = 28.72, $SD = 9.23$), the targets were six pictured products, to be evaluated in terms of (a) coolness, which a pretest had shown to be a relatively more affective dimension ($M = 4.24$ on a seven-point scale), and (b) usefulness, which a pretest had shown to be a relatively more cognitive dimension ($M = 3.18$, $t(72) = -2.43$, $p < .02$).

In all three replications, participants were told that they would have to use one evaluation method—ranking or rating—to evaluate the targets on one dimension (e.g., tastiness) and the other method to evaluate the same targets on the other dimension (e.g., ease of preparation). As the main dependent measure, participants were given a choice among three options: (a) I prefer to evaluate [attractiveness/tastiness/coolness] by rating and [intelligence/ease of preparation/usefulness] by ranking; (b) I prefer to evaluate [attractiveness/tastiness/coolness] by ranking and [intelligence/ease of preparation/usefulness] by rating; and (c) I have absolutely no preference. Both the order of the dimensions and the order of the first two choice options were
randomized. It was predicted that across replications participants would prefer ranking on the more affective dimensions and rating on the more cognitive dimensions.

After stating their preference, participants were asked to rate how much they would rely on their (a) emotional feelings and (b) logical considerations when evaluating the respective targets on each of the two dimensions (e.g., in Replication A, when evaluating pictured individuals on attractiveness/intelligence). These ratings were assessed with four seven-point items (1 = “Not at all” to 7 = “Totally”), one for each combination of dimension (e.g. attractiveness or intelligence) and basis of judgment (emotional feelings or logical considerations). These ratings served as manipulation checks of the mapping between the specified dimensions of judgment and the affective versus cognitive nature of the evaluations.

**Results**

**Preliminary analyses.** Manipulation checks confirmed that the two judgment dimensions for each target (e.g., attractiveness versus intelligence in Replication A) were indeed associated with different degrees of reliance on affect versus cognition. In all three replications, participants’ stated reliance on emotions was greater when judging the targets on the affective dimensions than when judging the targets on the cognitive dimensions (Replication A: $M_{\text{Affect-Cognition}} = 0.98, SD = 1.74, t(230) = 8.62, p < .001$; Replication B: $M_{\text{Affect-Cognition}} = 0.66, SD = 2.01, t(122) = 3.88, p < .001$; Replication C: $M_{\text{Affect-Cognition}} = 1.52, SD = 1.96, t(166) = 10.04, p < .001$).

Similarly, participants stated reliance on logical considerations was greater when evaluating the targets on the cognitive dimensions than when evaluating the targets on the affective dimensions (Replication A: $M_{\text{Affect-Cognition}} = -0.36, SD = 2.08, t(230) = -2.68, p < .01$; Replication B: $M_{\text{Affect-Cognition}} = -0.96, SD = 1.97, t(122) = -5.78, p < .001$; Replication C: $M_{\text{Affect-Cognition}} = -2.10, SD = 1.78, t(166) = -15.21, p < .001$).
Intuitive preference for ranking versus rating. Participants’ stated preferences for using ranking versus rating for the affective evaluations (versus the cognitive evaluations) are summarized in Table 1. In all three replications, the majority of participants stated that they would prefer to rank the targets (individuals/food dishes/products) on the more affective dimension (attractiveness/tastiness/coolness) and rate them on the more cognitive dimension (intelligence/ease of preparation/functionality). The proportion of participants who selected this option was significantly greater than the proportion of participants who indicated that they would prefer to rate the targets on the more affective dimension and rank them on the more cognitive dimension (all $p$’s < .05).

Discussion

The results indicate that across various common dimensions of judgment—attractiveness versus intelligence of people, tastiness versus ease of preparation of food dishes, or coolness versus functionality of products—people have an intuitive preference for ranking objects when evaluating them affectively and rating objects when evaluating them cognitively. Although only suggestive, these initial findings are consistent with our general proposition. An obvious caveat of these findings, however, is that judgments of attractiveness versus intelligence, tastiness versus ease of preparation, and coolness versus functionality are only indirect indicators of affective versus cognitive evaluations. Nonetheless, the fact that the findings were very consistent across these various operationalizations of affective versus cognitive evaluations suggests that the observed findings were not idiosyncratic to any one of these operationalizations. As shall be seen in subsequent studies, very different operationalizations of
affective versus cognitive evaluations yield converging evidence of the greater ordinality of affective evaluations.

**Study 2: Relative Fit of Ranking versus Rating under Affective or Cognitive Evaluations**

In and of itself, the finding that people have an intuitive preference for ranking (as opposed to rating) when making various affective evaluations does not necessarily mean that affective evaluations are inherently more ordinal. While people have the intuition of preferring ranking over rating when they have to perform affective evaluations, in reality they may not perform affective evaluations in a more ordinal fashion. To verify that a preference for ranking in affective evaluation is more than a mere intuition, in this study participants were asked to both rank and rate targets on either affective or cognitive dimensions. We predicted that people would report experiencing ranking as providing a better fit in affective evaluations than in cognitive evaluations, and rating as providing a better fit in cognitive evaluations than in affective evaluations.

**Method**

Ninety-two online participants from the MTurk panel (62% female, mean age = 30.37, SD = 11.47) were asked to evaluate six pictured individuals of the opposite sex twice: once by rating them and once by ranking them. Half the participants were randomly assigned to rate and rank the target individuals in terms of attractiveness (a more affective judgment); the other half were assigned to rate and rank the same targets in terms of intelligence (a more cognitive judgment). In other words, the two tasks, ranking versus rating, were administered “within-subject,” but the dimension of evaluation, attractiveness versus intelligence, was manipulated between-subjects. The order of the tasks (ranking vs. rating) was counterbalanced across participants.
Before performing each evaluation task (ranking or rating), participants received instructions similar to those used in Study 1 explaining ranking or rating. To report their rankings (either in terms of attractiveness or in terms of intelligence), participants were asked to enter numbers from #1 to #6 in text boxes below each picture, with #1 indicating the highest rank. To report their ratings, participants were asked to enter numbers between 0 and 10 in similar text boxes, with 10 indicating the highest possible evaluation.

After submitting their rankings and ratings, as the main dependent measure, participants were asked to indicate “Overall, which method fits more with evaluating the faces on [attractiveness/intelligence],” the choice being either “ranking” or “rating.” As a manipulation check of the mapping of the judgment dimension onto affective versus cognitive evaluation, participants were asked to rate “How much did you rely on your emotions?” (when evaluating the pictures) and “How much did you rely on logical considerations?” on two seven-point items (1 = “Not at all” to 7 = “Very much”). As a confounding check for involvement, participants were asked to rate how engaged they were with the rating task and with the ranking task on two seven-point items (1 = “Not at all” to 7 = “Very much”); the time spent on these two evaluation tasks was also recorded.

**Results**

**Preliminary analyses.** To check the effectiveness of our manipulation of affective versus cognitive evaluation, we created an index of relative reliance on affect versus reason by subtracting participants’ stated reliance on logic in their evaluation of the pictures from their stated reliance on emotions. A 2 (attractiveness vs. intelligence) × 2 (task order) ANOVA of this index revealed only a main effect of type of evaluation ($F(1,88) = 4.44, p = .038, \eta^2 = .048$). As expected, the relative reliance on emotion was significantly higher in the attractiveness condition.
(M = 1.02, SD = 2.17) than in the intelligence condition (M = -0.02, SD = 2.39). Similar ANOVAs indicated that participants spent an equal amount of time evaluating the targets in the attractiveness condition (M = 95.23 sec, SD = 48.48) and in the intelligence condition (M = 91.45 sec, SD = 40.44; F < 1). Participants also reported being equally engaged across the two conditions (M_{Attractiveness} = 6.05, SD = 0.91 vs. M_{Intelligence} = 5.84, SD = 1.20; F(1,88) = 1.12, p = .29). These results make issues of differential involvement across conditions unlikely.

Perceived fit of ranking versus rating. Participants’ selections of which evaluation method—ranking or rating—fit better were submitted to a logistic regression with type of evaluation (attractiveness vs. intelligence), task order, and their interaction as contrast-coded predictors. The analysis revealed only a main effect of type of evaluation (Wald χ² = 4.89, p < .03). Consistent with the main proposition, participants were more likely to perceive a better fit of ranking when judging the attractiveness of the targets (59.5%) than when judging their intelligence (36.4%; t(90) = 2.17, p = .03) (and conversely, a better fit of rating when judging the intelligence of the targets [63.6%] than when judging their attractiveness [40.5%]).

Discussion

The results suggest that people’s intuitive preference for ranking (as opposed to rating) when making affective (as opposed to cognitive) evaluations is more than a lay belief. Even after experiencing both modes of evaluation, participants were more likely to perceive a greater fit of ranking when judging the attractiveness of other individuals than when judging their intelligence (and conversely, more likely to perceive a greater fit of rating when judging the intelligence of other individuals than when judging their attractiveness). Together with the results of Study 1, these results are consistent with the notion of a greater inclination toward ranking, that is, ordinal evaluation, when making judgments that are more affective.
An obvious limitation of this study is that judgments of attractiveness versus intelligence may differ on dimensions other than affective versus cognitive evaluation. For example, one could argue that these two types of judgments elicit different levels of involvement, which may account for differences in perceived fit of ranking versus rating. The data suggest, however, that participants’ involvement with the task was comparable across conditions. Moreover, as shall be shown in the next study, similar results are obtained when the judgment dimension is held constant and the reliance on affective versus cognitive evaluations is induced by other means.

**Study 3: Relative Fit of Ranking versus Rating under Affective or Cognitive Evaluations, Holding the Judgment Dimension Constant**

The purpose of this study was to replicate the findings of Study 2 by using more direct manipulation of affective versus cognitive evaluation, while holding the judgment dimension constant. Participants were asked to estimate the popularity of same-sex target individuals by simply looking at their pictures. Half the participants were instructed to complete this task by relying on their emotional feelings; the other half were instructed to complete the same task by relying on logical considerations. As in Study 2, each participant had to do this task twice: once by ranking the targets and once by rating them. We predicted that participants would perceive a greater fit of ranking if they were instructed to rely on their emotional feelings than if they were instructed to rely on logical considerations. Conversely, we predicted that participants would perceive a greater fit of rating if they were instructed to rely on logical considerations than if they were instructed to rely on their emotional feelings.

**Method**

One hundred and fifty-five online participants from the MTurk panel (55% female, mean age = 29.00, \(SD = 9.60\)) were randomly assigned to one of two main experimental conditions:
instructions to rely on emotional feelings or instructions to rely on logical considerations. All participants were asked to estimate the popularity of six target individuals of the same sex based on their pictures. Similar to Study 2, they were asked to make these judgments of popularity twice: once by ranking the six targets and once by rating them, with the order of the tasks counterbalanced across participants.

Unlike in Study 2, participants were told that they had to use a specific judgment strategy to make these predictions. Depending on their condition, participants received specific instructions to either rely on their feelings or rely on logical considerations—instructions adopted from Pham, Cohen, Pracejus, and Hughes (2001). After receiving one of the two sets of instructions, half the participants were given a brief explanation of what ranking means and asked to rank the six targets in terms of popularity. Participants reported their ranking by entering numbers from #1 to #6 in text boxes below each picture. After submitting their rankings, participants were asked to evaluate the popularity of the same six targets again, but this time by rating them on a 0–10 scale to be entered in text boxes below each picture. The other half of the participants completed the same two tasks in the reverse order.

After submitting their evaluations, as the main dependent variable participants were asked to indicate which method of evaluation, ranking or rating, fit better with predicting the popularity of the target individuals. They were given three (randomized) response options: (a) “Rating,” (b) “Ranking,” and (c) “Both ranking and rating are absolutely the same.” To further check the effectiveness of the instruction manipulation, participants were asked to rate “How much did you rely on your emotions?” (when predicting the popularity of the targets) and “How much did you rely on logical considerations?” on two seven-point items (1 = “Not at all” to 7 = “Very much”). As a confounding check for involvement, participants were asked to rate “How
engaged were you while evaluating the popularity of the individuals?” on a 1(“Not at all”) to 7 (“Very much”) scale; the time that they spent on these two evaluation tasks was also recorded.

Results

Preliminary analyses. To check the effectiveness of the manipulation of affective versus cognitive evaluation, the same index of relative reliance on affect versus reason as described in Study 2 was submitted to a 2 (instruction) × 2 (task order) ANOVA. The analysis revealed only a main effect of instruction, showing that the relative reliance on emotion was significantly higher in the instruction-to-rely-on-feelings condition (M = 2.68, SD = 2.37) than in the instruction-to-rely-on-logic condition (M = -2.11, SD = 2.41, F(1,151) = 147.86, p < .001, η² = .494). A similar analysis of participants’ self-reported engagement showed no differences across conditions (all F’s < 1). Participants took slightly less time to evaluate the targets in the feeling-instruction condition (M = 90.6 sec, SD = 28.01) than in the logic-instruction condition (M = 101.7 sec, SD = 41.67; F(1,150) = 3.64, p = .07, η² = .022). While not anticipated, this effect is not totally surprising, as feeling-based judgments often take less time than logic-based judgments (Pham, Cohen, et al., 2001; Verplanken, Hofstee, & Janssen, 1998; Zajonc, 1980). As reported below, however, this result did not account for the study’s main findings.

Perceived fit of ranking versus rating. Participants’ selections of which method of evaluation was a better fit were submitted to an ordinal logistic regression with “ranking” set as the highest response category, “ranking and rating the same” as the middle category, and “rating” as the lowest category, with instruction condition (feelings vs. logic), order of the tasks, and their interaction as contrast-coded predictors. The analysis revealed only a main effect of instruction (χ²(2) = 8.44, p < .05). Consistent with the results of Study 2, participants in the feeling-instruction condition were more likely to select ranking as a more fitting evaluation method (P =
46.1%) than were participants in the logic-instruction condition \((P = 26.5\%)\), whereas participants in the logic-instruction condition were more likely to select rating as a more fitting evaluation method \((P = 48.1\%)\) than were participants in the feeling-instruction condition \((P = 38.2\%)\). To investigate whether these effects could be due to the small difference in the amount of time that participants spent evaluating the targets across conditions, we reran the analyses with amount of time as a covariate. Controlling for time spent as a covariate does not affect the nature of the findings: the main effect of instruction remains significant \(\chi^2(2) = 6.21, p < .05\).

**Discussion**

The results show that even when the judgment dimension is held constant, people experience ranking as providing a relatively better fit when making affective evaluations than when making cognitive evaluations. These results therefore replicate those of Study 2, despite using a very different operationalization of affective versus cognitive evaluations and a very different judgment task. The similarity between Study 2’s and Study 3’s findings suggests that the phenomenon is not due to a mere difference in judgment dimensions across conditions, but rather to inherent differences between affective and cognitive evaluations. Therefore, people not only have an intuitive preference for ranking (vs. rating) when making affective (vs. cognitive) judgments (Study 1), they also experience ranking (vs. rating) as fitting affective evaluations better than cognitive evaluations (Studies 2 and 3).

**Study 4: Confidence in Ranking and Rating as a Function of Affect Engagement**

Studies 2 and 3 show that compared to rating, ranking is perceived to provide a better fit when making affective evaluations than when making cognitive evaluations. If a ranking mode of evaluation is generally more compatible with the affective system, one would expect that greater engagement of the overall affective system would increase people’s confidence in
evaluative ranking, but not necessarily in evaluative rating. To test this prediction, in this study participants were asked to evaluate their desire to eat different fresh-baked breads by either ranking them or rating them. The level of engagement of the overall affective system was manipulated by presenting the breads using either vivid, color pictures or more pallid black-and-white pictures (Lee, Amir, & Ariely, 2009). Previous research has shown that compared to more pallid information, vivid pictorial information increases the engagement of the “hot” affective system (Metcalfe & Mischel, 1999; Mischel & Moore, 1973; Shiv & Fedorikhin, 1999). We predicted that compared to black-and-white pictures, evaluating the breads based on color pictures would make participants more confident in their rankings of the breads but not in their ratings of the breads.

**Method**

A total of 216 online participants from the MTurk panel (43% female; mean age = 31.54, \(SD = 10.54\)) were randomly assigned to one of four conditions of a 2 (color vs. black-and-white pictures) \(\times\) 2 (ranking vs. rating) between-subjects design. Participants were asked to evaluate six pictured fresh-baked breads in terms of “how much you want to eat them right now.” Half the participants were asked to provide their evaluation by entering a rank from #1 to #6 in a text box underneath each picture; the other half were asked to provide their evaluation by entering a numerical rating from 1 to 10 in similar text boxes. Instructions explaining the meaning of ranking or rating were the same as in the previous studies. To manipulate the degree of affect engagement while holding the judgment task constant, half the participants were shown the breads in color pictures; the other half were shown the breads in black-and-white pictures (see Lee et al., 2009, for a similar manipulation of affect engagement).
After evaluating the breads, participants were asked to assess their overall confidence in their ranking or rating on three items: (a) “Evaluating these breads by giving each of them a [rating/ranking] felt right to me” (1 = “Strongly disagree”; 7 = “Strongly agree”); (b) “It felt natural to me to [rate each bread on a 0-10 scale/rank each bread from #1 to #6]” (1 = “Strongly disagree”; 7 = “Strongly agree”); and “How confident are you of your [rankings/ratings] of the various breads” (1 = “Not at all” to 7 = “Very much”). The three items were highly correlated (α = .80) and averaged into an index of overall judgment confidence, which was the main dependent measure.

Results and Discussion

A two-way ANOVA of participants’ overall judgment confidence revealed no main effect of evaluation method \((F < 1)\) and no main effect of picture type \((F(1, 212) = 1.35, p = .246)\). However, there was significant interaction between evaluation method and picture type \((F(1, 212) = 5.27, p = .023, \eta^2 = .024)\). As predicted, participants who evaluated the breads by ranking them expressed greater judgment confidence in the color-picture condition \((M = 5.76, SD = 0.93)\) than in the black-and-white-picture condition \((M = 5.26, SD = 1.13; F(1, 212) = 5.73, p = .018, \eta^2 = .026;\) see Figure 1). In contrast, participants who evaluated the breads by rating them did not express greater judgment confidence in the color-picture condition \((M = 5.37, SD = 1.17)\) than in the black-and-white-picture condition \((M = 5.53, SD = 0.93; F < 1)\). This pattern of results is consistent with the proposition that greater engagement of the affective system facilitates the process of ranking, thus increasing overall judgment confidence in ranking, but it does not facilitate the process of rating.

[Insert Figure 1 about here]
The results of this study lend further support to the proposition that the affective system is generally more compatible with ordinal processes of evaluation than with cardinal processes. These results extend those of Studies 2 and 3 in two ways. First, the results of Study 4 suggest that affect is generally more compatible with ranking even when the contrast between ranking and rating is not salient (when ranking vs. rating is manipulated between-subjects rather than within-subject, as in the previous studies). Second, the results suggest that the compatibility between affect and ranking produces greater judgmental confidence.

**Study 5: Confidence in Ranking and Rating as a Function of Affect Engagement, Holding Stimulus Information Constant**

The purpose of this study was to replicate the findings of the previous study using a different manipulation of affect engagement: one that holds all stimulus information constant. Research indicates an intimate connection between the sensory sense of smell and the affective system (Willander & Larsson, 2007). The primary brain structures involved in olfaction are anatomically connected to brain structures that are heavily involved in the experience of emotion, such as the amygdala (Aggleton & Mishkin, 1986). As a result, the experience of smell tends to trigger engagement of the overall affective system, especially when the smell is congruent with the objects being evaluated (Bosmans, 2006). Building on these prior results, in this study participants were asked to evaluate how appetizing different pastries were by either ranking them or rating them. Half the participants performed their evaluations with an ambient scent of fresh pastries diffused in the room; the other half performed their evaluations without this ambient scent. Consistent with the predictions of Study 4, it was predicted that exposure to an ambient scent of pastries would make participants more confident in their rankings of the pastries but not in their ratings of the pastries.
Method

Sixty-one students (67% female; mean age = 21.89, SD = 3.53) from a large American university were randomly assigned to the conditions of a 2 (aroma of pastries absent vs. present) × 2 (ranking vs. rating) between-subjects design. The study was conducted in a behavioral laboratory using two identical rooms with a single computer station to which participants were randomly assigned. Participants were told that they would have to evaluate various types of pastries from a local bakery, and that “to make this study more realistic,” the “room was set up to make it easier for you to simulate the experience of being inside a bakery store.” Consistent with this cover story, both rooms featured identical color posters showing pictures of a bakery and breads. However, in one of the two rooms, the scent of fresh pastries was diffused through aromatic candles placed out of participants’ view. The other room was not scented.

Participants were asked to evaluate six pastries shown in color pictures in terms of how appetizing the pastries were. As in Study 4, participants in the ranking condition were asked to provide their evaluation by entering a rank from #1 to #6 in a text box underneath each picture, whereas participants in the rating condition were asked to provide their evaluation by entering a numerical rating from 1 to 10 in similar text box. After reporting their evaluations, as the main dependent variable participants were asked to report their overall judgment confidence on the same three items as in Study 4 (α = .86).

Results and Discussion

A two-way ANOVA of participants’ overall judgment confidence revealed no main effect of evaluation method (F < 1) and a small but not significant main effect of scent (F(1, 57) = 2.64, p = .109) indicating slightly greater confidence in the pastry-scented condition (M = 5.54) than in the unscented condition (M = 5.06). More important, there was significant interaction
between evaluation method and scent ($F(1, 57) = 5.35, p = .024, \eta^2 = .086$). As predicted and consistent with the results of Study 4, participants who evaluated the pastries by ranking them expressed greater judgment confidence in the pastry-scented condition ($M = 5.90, SD = 0.81$) than in the no-scent condition ($M = 4.70, SD = 0.92; F(1, 57) = 7.94, p = .007, \eta^2 = .122$; see Figure 2). In contrast, participants who evaluated the pastries by rating them did not express greater judgment confidence in the pastry-scented condition ($M = 5.02, SD = 1.62$) than in the unscented condition ($M = 5.24, SD = 1.19; F < 1$). These results replicate closely those of Study 4 and lend further support to the proposition that greater engagement of the overall affective system facilitates the process of ranking— but not of rating— thereby increasing overall judgment confidence in ranking (vs. rating).

[Insert Figure 2 about here]

**Study 6: Process Evidence of Ordinal Assessment in Affective Evaluations**

In the first five studies, participants were explicitly asked to perform their evaluations by ranking and/or rating. This raises the question of whether people would spontaneously use ordinal evaluative operations when making affective evaluations in the absence of any explicit instruction to rank. The purpose of this study was to provide process-level evidence that compared to cognitive evaluations, affective evaluations do spontaneously trigger more ordinal mental operations.

Participants were asked to evaluate different individuals of the opposite sex either as potential dates, which was expected to trigger more affective evaluations, or as potential teammates for a project, which was expected to trigger more cognitive evaluations (Pham, 1998; Pham, Meyvis, & Zhou, 2001). It was predicted that, compared to participants evaluating the targets as potential project teammates, participants evaluating the same targets as potential dates
would show stronger evidence of ordinal operations on different process indicators of ordinal assessment.

**Method**

**Design and procedure.** A total of 138 students (62% women, mean age = 22.72, SD = 4.51) from a large university were asked to evaluate individuals of the opposite sex as either potential dates or potential teammates for a class project. Data from eight participants (across the two conditions) who indicated a preference for same-sex dates were excluded from the analyses, leaving 130 observations. A pretest confirmed that affective attributes of the target (e.g., attractiveness, charm) were perceived to be more important in the potential-date condition (M = 5.34 on a seven-point scale) than in the project-teammate condition (M = 4.63, F(1, 60) = 8.74, p < .01), whereas non-affective attributes (e.g., intelligence, competence) were perceived to be more important in the project-teammate condition (M = 4.99) than in the potential-date condition (M = 3.56, F(1, 60) = 16.47, p < .001).

The study was administered via computers in a lab setting. As the main task, participants were presented with pictures of 12 individuals of the opposite sex, shown on a single screen in a 3 (rows) × 4 (columns) array, with the positions of the targets randomized across participants. Participants were asked to rate each pictured individual on a 0–100 scale using a sliding scale located underneath each picture. Participants in the potential-date condition were asked to rate how excited they would be to go out for a drink for two or three hours with each pictured individual. In contrast, participants in the project-teammate condition were asked to rate how effective they expected it to be to work on a class assignment with each pictured individual for two to three hours. Participants could take as much time as they needed to provide their evaluations. The main dependent measures were not the actual ratings of the targets, but three process indicators of ordinal evaluation.
Dependent measures and predictions. The first indicator was the sequence in which participants input their ratings. If affective evaluations are inherently more ordinal, they should involve more mental ordering of the targets compared to cognitive evaluations, which presumably involve a more absolute and therefore independent assessment of each target. As a result, participants performing affective evaluations should be more likely to evaluate the targets in their own self-generated sequence as opposed to the sequence suggested by the arrangement of the targets in the display. It was therefore predicted that, compared to participants in the project-teammate condition, participants in the potential-date condition would be more likely to rate the targets in their own idiosyncratic sequence, as opposed to the reading-pattern sequence suggested by the display (left to right from top row to bottom row).

Our second process indicator was based on participants’ memory for the respective locations of the target individuals on the array where they were displayed. If affective evaluations are inherently more ordinal, they should encourage cross-target comparisons. Therefore, participants performing affective evaluations should have better memory of the respective locations of the targets than participants performing cognitive evaluations.

Immediately after evaluating the targets, participants were presented with a 3 × 4 array of empty boxes and asked to indicate the original locations of the three pictures to which they had given the highest ratings. It was predicted that compared to participants in the project-teammate condition, participants in the potential-date condition would have a better recollection of these three targets’ locations.

Our third process indicator was based on participants’ memory for the ranking implied by their initial evaluations. If affective evaluations involve the translation of an internal rank-ordering of the targets, participants who have performed affective evaluations should be better
able to reproduce the rankings implied by these evaluations. So, participants were shown the pictures of the three individuals to whom they had given the second-highest, third-highest, and fourth-highest ratings and asked to explicitly rank these three targets according to the ratings that they had given them before. It was predicted that these explicit rankings would be more consistent with the rankings implied in the original ratings in the potential-date condition than in the project-teammate condition.

Finally, to control for the possibility that differences in the last two process indicators could be driven by differences in attention or involvement rather than the ordinality of the underlying evaluative operations, three measures of attention/involvement were included. First, the amount of time that participants spent evaluating the targets was recorded. Second, participants were shown the pictures of 18 individuals and asked to identify which nine they had previously evaluated. Finally, participants were asked to rate their task involvement on two seven-point items anchored on “not at all/extremely interesting” and “not at all/extremely engaged.”

Results

Preliminary analyses. There was no difference between the two conditions in terms of amount of time spent to evaluate the targets ($M_{Affective} = 87.35$, $SD = 48.90$ sec vs. $M_{Cognitive} = 84.48$, $SD = 33.90$ sec; $F < 1$) and ability to recognize the nine targets out of the 18 pictures ($M_{Affective} = 8.32$ vs. $M_{Cognitive} = 8.37$; $F < 1$). Participants in the project-teammate condition reported being somewhat more involved with the task ($M = 4.44$, $SD = 1.02$) than did participants in the potential-date condition ($M = 4.06$, $SD = 1.13$; $F(1, 128) = 4.06$, $p = .049$, $\eta^2 = .030$). However, controlling for involvement in the analyses reported below did not affect the results substantively.
**Input order.** To test the prediction that compared to participants in the project-teammate condition, participants in the potential-date condition would be more likely to input their ratings using their own order as opposed to the order suggested by the screen display, we computed two measures for each participant. The first was the rank-correlation (Kendall $\tau$) between (a) the order in which the participant input his or her evaluations of the targets and (b) the rank order of the various targets according to their own evaluations. The second measure was the rank-correlation between (a) the order in which the participant input his or her evaluations of the targets and (c) the (randomized) presentation order of the targets on the screen, which was coded based on a standard western reading pattern (1 for the left-most column of the first row through 12 for the right-most column of the last row). The two correlation measures were submitted to a mixed ANOVA with type of correlation as a repeated factor and condition as a between-subjects factor. (Transforming the correlations into Fisher Zs before analysis produces similar results.)

The analysis revealed a strong main effect of correlation type ($F(1, 128) = 163.50, p < .001, \eta^2 = .560$) indicating that, on average, participants’ input order was more strongly correlated with the screen order ($\tau = .677, SD = .397$) than with the ranking implied by their evaluations ($\tau = .037, SD = .329$). More importantly, there was a significant interaction between correlation type and condition ($F(1, 128) = 13.75, p < .001, \eta^2 = .097$). As illustrated in Figure 3, the input order was less correlated with the screen order in the potential-date (affective-evaluation) condition ($\tau = .579, SD = .431$) than in the project-teammate (cognitive-evaluation) condition ($\tau = .760, SD = .348; F(1, 128) = 7.01, p = .009, \eta^2 = .052$). On the other hand, the input order was more correlated with the rank order implied by participants’ own evaluations in the potential-date condition ($\tau = .135, SD = .346$) than in the project-teammate condition ($\tau = -.048, SD = .290; F(1, 128) = 10.68, p = .001, \eta^2 = .077$). Overall, these results are consistent with the
notion that compared to participants in the project-teammate (cognitive-evaluation) condition, participants in the potential-date (affective-evaluation) condition were less likely to follow the order suggested by the screen and more likely to input their evaluations based on an idiosyncratic order suggested by their own evaluations.

[Insert Figure 3 about here]

**Memory for locations of targets.** As a measure of participants’ ability to recollect the targets’ respective locations on the display, we computed the average Euclidian distance between the locations identified by participants for each of the three targets tested and the targets’ correct locations (with smaller distance indicating better memory for locations). An ANOVA of these distances indicated that participants’ memory for the targets’ locations was higher (distances lower) in the potential-date condition ($M = 0.91, SD = 0.70$) than in the project-teammate condition ($M = 1.19, SD = 0.67; F(1, 128) = 5.53, p = .020, \eta^2 = .041$). This finding is consistent with the notion that participants in the potential-date (affective-evaluation) condition performed more across-target comparisons than did participants in the project-teammate (cognitive-evaluation) condition.

**Ranking consistency.** The consistency between participants’ explicit rankings of their second-, third-, and fourth-highest evaluated targets and the rankings implied by their original ratings was assessed by counting the number of targets that subjects re-ranked correctly. An ordinal logistic regression indicated that participants re-ranked the targets more accurately in the potential-date condition ($M = 2.03, SD = 1.14$) than in the project-teammate condition ($M = 1.62, SD = 1.23; \chi^2 = 3.79, p < .05$). In other words, even though participants in the potential-date condition were not explicitly asked to rank the targets when they made their original evaluations,
they appeared to have tacitly registered rank-related information more than participants in the project-teammate condition did.

**Discussion**

Multiple process indicators suggest that affective evaluations of targets indeed spontaneously involve more ordinal operations than do cognitive evaluations of the same targets. First, compared with participants performing cognitive evaluations, those performing affective evaluations were more likely to enter their ratings in their own self-generated sequences as opposed to the sequence suggested by the display of targets. This is consistent with the idea that affective evaluations are more likely to involve some private ordering of the targets, whereas cognitive evaluations are more likely to involve independent assessments of the targets. Second, compared with participants in the cognitive-evaluation (i.e., project-teammate) condition, affective-evaluation (i.e., potential-date) participants had better memory for the locations of the targets. This is consistent with the idea that affective evaluations encourage cross-target comparisons, enabling participants to better remember the targets’ respective locations. Finally, compared with participants in the cognitive-evaluation condition, affective-evaluation participants’ recollections of the rankings implied by their original ratings were more accurate. This is consistent with the idea that people pay more attention to the relative rank-ordering of the target when making affective evaluations than when making cognitive evaluations. These effects cannot be attributed to a greater level of attention or involvement in the affective-evaluation condition because: (a) participants spent an equal amount of time evaluating the targets across conditions; (b) participants were equally able to recognize the targets across conditions; and (c) the effects were unchanged when controlling for involvement.
Study 7: Ordinality Helps Explain Reference-Dependence of Affective Evaluations

To recapitulate, our previous studies show that (a) people have an intuitive preference for ranking (rather than rating) when making affective evaluations (vs. cognitive evaluations); (b) people experience ranking (rather than rating) as a better fit when making affective evaluations than when making cognitive evaluations; (c) greater engagement of the affective system increases people’s overall confidence in ranking (but not rating); and (d) even people who are not explicitly asked to rank exhibit more process evidence of ordinal mental operations when performing affective evaluations than when performing cognitive evaluations. The purpose of Studies 7 and 8 is to show that the proposition that the affective system is inherently more ordinal helps explain interesting judgment and decision-making phenomena that have been documented previously in the literature. Specifically, both studies were designed to show that people’s tendency to exhibit well-known judgment and decision-making phenomena in a given domain can be predicted by their tendency to exhibit affective ordinality in a totally unrelated domain.

It has been suggested that one of the distinctive characteristics of affective evaluations (compared to cognitive evaluations) is that they tend to be more reference-dependent (Pham, 2007). One form of reference-dependence observed under affective evaluation is a sensitivity to outcome counterfactuals. According to decision affect theory (Mellers et al., 1997), emotional responses to gambling outcomes are not just a function of the amount of gains and losses that have been realized but also a function of the amount of gains or losses that could have been realized under alternative outcomes. For example, winning $10 in a gamble would be more pleasurable if the alternative outcome was winning $5 than if the alternative outcome was winning $15 dollars. We believe that this reference-dependence is linked to the inherent
Ordinality of the affective system of evaluation. The purpose of Study 7 was to demonstrate this link by showing that people who prefer to perform affective evaluations based on ranking (rather than rating) in an unrelated domain are more sensitive to outcome counterfactuals in gambling situations similar to those examined by decision affect theory.

**Method**

The study was conducted among 171 online participants from the MTurk panel (36% female; mean age = 28.19, SD = 8.15). As the main task, they were asked to imagine winning $25 in a coin-toss (50%-50% chance) lottery in which the alternative outcome was either winning $15 in the low-outcome-counterfactual condition or winning $50 in the high-outcome-counterfactual condition. As the main dependent measure, participants were asked to assess how excited they were about the outcome of the lottery on a 1 (“extremely disappointed”) to 7 (“extremely elated”) scale. Consistent with the propositions of decision affect theory, it was predicted that participants in the low-outcome-counterfactual condition would be more exited with the outcome than would participants in the high-outcome-counterfactual condition.

Prior to completing the main task, all participants were asked to complete the same task as in Study 1 as an indicator of the degree to which they tended to be ordinal in affective evaluations. The task required participants to choose whether they (a) would prefer using ranking to assess a target on an affective dimension and rating for assessing the same target on a cognitive dimension, (b) would prefer using rating to assess a target on an affective dimension and ranking for assessing the same target on a cognitive dimension, or (c) would be indifferent. As in Study 1, three replications of the task were used across participants: one involving the evaluation of faces on attractiveness and intelligence, one involving the coolness and usefulness of gadgets, and one involving the tastiness and ease of preparation of dishes. The overall
experiment therefore consisted of a 2 (outcome counterfactual) × 3 (replications) between-subjects randomized design.

At the end of the overall study, all participants were asked to guess the purpose of the “two studies” and report their sexual orientation.

Results

Preliminary analyses. Although seven participants suspected that the two studies might be related, only one was able to articulate the hypothesis of the study and was therefore removed from the analyses. Another five participants were removed from the face-evaluation replication condition because they reported having a homosexual orientation.

Ordinality and reference-dependence. Consistent with the results of Study 1, more participants (52.7%) preferred to use ranking to evaluate the targets on affective dimensions and ratings to evaluate the targets on cognitive dimensions than the reverse (33.9%; \( t(164) = 2.55, p = .012 \)) (13.3% were indifferent). In other words, a majority of participants had relative preference for ranking in affective evaluations. This effect was parallel across replication conditions (\( \chi^2(4) = 4.10, p > .39 \)).

A 2 × 3 ANOVA of participants’ emotional responses to the gamble uncovered a strong main effect of outcome-counterfactual (\( F(1, 159) = 42.60, p < .001, \eta^2 = .211 \)), indicating that participants were more excited with the outcome of the gamble if the alternative outcome was lower (\( M = 6.43, SD = 0.836 \)) than if the alternative outcome was higher (\( M = 5.27, SD = 1.283 \)). This effect replicates the basic reference-dependence effect predicted by decision affect theory. There was no main effect of replication (\( F(1, 159) = 1.93, p = .148 \)) and no outcome-counterfactual-by-replication interaction (\( F < 1 \)).
To test whether participants’ tendency to be ordinal in affective evaluations helps explain the reference-dependence observed in this study, we submitted participants’ emotional responses to an ANCOVA similar to the ANOVA above with two additional predictors as covariates: (1) an ordinality score for each participant—coded +1 if participants reported preferring ranking for affective evaluations and rating for cognitive evaluation, -1 if participants reported preferring the reverse, and 0 if participants reported being indifferent; and (2) the interaction between this ordinality score and outcome counterfactual. As predicted, the analysis revealed a significant interaction between the ordinality score and outcome counterfactual ($F(1, 157) = 4.05, p < .05; \eta^2 = .025$). Specifically, as illustrated in Figure 4, the effect of outcome counterfactual was stronger among participants who preferred to use ranking in affective evaluations (and rating in cognitive evaluations) ($M_{Low} = 6.43$ vs. $M_{High} = 5.04; F(1, 155) = 36.45, p < .001; \eta^2 = .190$) than among participants who preferred the reverse ($M_{Low} = 6.35$ vs. $M_{High} = 5.73; F(1, 155) = 4.37, p < .001; \eta^2 = .027$).

[Insert Figure 4 about here]

**Discussion**

Three sets of results emerged from this study. First, the study uncovered a preference for ranking in affective evaluation and rating in cognitive evaluation, thus replicating the results of Study 1. Second, the study showed that emotional responses to a hypothetical gamble are shaped in part by counterfactual responses to other possible outcomes of the gamble, thereby replicating a classic result of decision affect theory (Mellers et al., 1997). More importantly, the results show that ordinality in affective evaluation in a certain domain—face evaluation, gadget evaluation, or food-dish evaluation—can effectively predict reference-dependence in a totally unrelated domain (emotional responses to a gamble). The ability to predict one phenomenon with
another across domains is consistent with the notion that the reference-dependence of affective evaluations is partly connected to the inherent ordinality of affective evaluations.

**Study 8: Ordinality Helps Explain Scope Insensitivity of Affective Evaluation**

Another well-documented phenomenon is that, compared to cognitive evaluations, affective evaluations tend to be scope-insensitive—that is, less sensitive to the quantitative magnitude of the evaluated object (Dunn & Ashton-James, 2008; Hsee & Rottenstreich, 2004; Rottenstreich & Hsee, 2001). For example, Hsee and Rottenstreich (2004) found that people’s willingness to pay for a set of music CDs was less influenced by the number of CDs in the set when people were primed with an affective evaluation mindset than when they were primed with a cognitive evaluation mindset. Similarly, people’s willingness to donate to save the lives of pandas was less sensitive to the number of pandas at risk when the pandas were described in an affect-rich manner than when they were described in an affect-poor manner.

We believe that the scope-insensitivity of affective evaluations is also linked to the inherent ordinality of the affective system. That is, affective evaluations tend to be scope-insensitive because the overall affective system is more concerned with the evaluative rank-ordering of goal-relevant objects than with their quantification. To test this proposition, we followed a similar strategy as in Study 7. After recording participants’ tendency to perform affective evaluations based on ranking (rather than rating) in an unrelated domain, we asked participants to assess their willingness to pay (WTP) for a bundle of 5 versus 10 DVDs. We predicted that participants who exhibited ordinality in affective evaluations in the first task, would exhibit greater scope insensitivity (lower sensitivity to the number of DVDs) in their WTP in the second task.
Method

A total of 172 online participants from the MTurk panel (50% female; mean age = 31.49, \(SD = 10.68\)) were randomly assigned to one of the six conditions of a 3 (replication: faces vs. gadgets vs. food dishes) \(\times\) 2 (scope: 5 vs. 10 DVDs) between-subjects design. The study was conducted in two stages. The first stage was identical to the first stage of Study 7 and provided a measure of the degree to which participants preferred ranking in affective evaluations in some unrelated domains (faces, gadgets, or food dishes). In the second stage participants were asked to imagine that one of their friends who had a DVD collection of Oscar winning movies had offered to sell a number of these DVDs as a bundle. The bundle was described as containing either 5 or 10 DVDs. As the main dependent variable, participants were asked to indicate the maximum price that they would be willing to pay for the bundle, assuming that the average price of a new DVD in the market was $15.

At the end of the overall study, all participants were asked to guess the purpose of the “two studies” and report their sexual orientation.

Results and Discussion

Preliminary analyses. Although three participants suspected that the two studies might be related, none was able to articulate the main hypothesis. Eleven participants were removed from the face-evaluation replication condition because they reported having a homosexual orientation.

Ordinality and reference-dependence. As in Studies 1 and 7, more participants (50.9%) preferred to use ranking to evaluate the targets on affective dimensions and ratings to evaluate the targets on cognitive dimensions than to do the reverse (34.8%; \(t(160) = 2.25, p = .026\)) (14.3% were indifferent). In other words, again a majority of participants had relative preference
for ranking in affective evaluations. This effect was parallel across replication conditions ($\chi^2(4) = 3.69, p = .450$).

A 2 × 3 ANOVA of participants’ WTP showed a strong main effect of scope ($F(1, 155) = 22.46, p < .001, \eta^2 = .126$), indicating that, on average, participants were willing to pay more for a set of 10 DVDs ($M = $42.70, $SD = $26.08) than for a set of 5 DVDs ($M = $26.33, $SD = $14.53). There was no main effect of replication ($F(1, 155) = 1.15, p = .321$) and no scope-by-replication interaction ($F(1, 55) = 1.61, p = .204$). Although on average participants in this study were somewhat sensitive to the quantitative scope of the target, some participants were clearly more sensitive to scope than others. We predicted that participants who exhibited a relative preference for ranking in affective evaluations in the first task would be less scope-sensitive in their WTP for the DVD bundle. To test this prediction, participants’ WTPs were submitted to an ANCOVA similar to the ANOVA above with two additional predictors as covariates: (1) an ordinality score for each participant, computed in the same manner as in Study 7; and (2) the interaction between this ordinality score and scope (the number of DVDs). The analysis revealed a significant interaction between the ordinality score and scope ($F(1, 153) = 4.17, p = .043; \eta^2 = .026$). As predicted, the simple effect of scope was smaller among participants who preferred to use ranking in affective evaluations (and rating in cognitive evaluations) ($M_5 = $26.36, $SD = $14.27 vs. $M_{10} = $37.35, $SD = $24.84, $F(1, 151) = 5.72, p = .018, \eta^2 = .036$) than among participants who preferred the reverse ($M_5 = $26.64, $SD = $14.06 vs. $M_{10} = $53.57, $SD = $26.59, $F(1, 151) = 22.31, p < .001, \eta^2 = .129$; see Figure 5). Therefore, participants’ scope-insensitivity in one domain (WTP for DVDs) can be predicted by their relative preference for ranking in affective evaluations in an unrelated domain. This is consistent with the notion that the scope-insensitivity phenomenon is partly connected to the inherent ordinality of affective evaluations.
General Discussion

Affect and the Nature of Value

A fundamental question about the psychology of value is whether perceived value is an absolute measureable quantity associated with each target object—what economists call cardinal utility—or rather a relative assessment of the various target objects being evaluated—what economists call ordinal utility. This question has important theoretical implications, as illustrated by the long-standing debate in economics between “cardinalists” and “ordinalists.” It also has important substantive implications for public policy and major value-assessment techniques such as conjoint analysis.

This research suggests that part of the answer to this fundamental question resides in the judgment system that underlies the evaluation. We advance the theoretical proposition that the affective system of judgment is inherently more ordinal (less cardinal) than the cognitive, computation-like system of judgment that has been the focus of most prior research. We derive this proposition from the idea that as a remnant of our ancestral system of decision making (Panksepp, 1998; Plutchik, 1980), the affective system originally evolved to inform behavioral choices (Cosmides & Tooby, 2000; Pham, 2007), which require only ordinal assessments. Thus, the affective system may have historically been more concerned with the desirability ordering of alternative targets, courses of action, and states of the world than with any object’s absolute desirability—an ordinal orientation that this system has likely retained.

Therefore, value or utility is not necessarily absolute or cardinal, nor necessarily relative or ordinal. Instead, it is more likely to be ordinal in affect-based evaluations and more likely to be cardinal in cognitive evaluation. This distinction has important implications for various areas
of social science. For example, affective utility may be better characterized using ordinal utility functions that rely primarily on indifference curves. Such utility functions do not necessarily lend themselves to discounting or averaging, and concepts such as diminishing marginal utility may not be as meaningful in affect-rich contexts. Similarly, welfare analysis in affect-rich contexts may not lend itself to making tradeoffs between the absolute welfare of various constituencies. Finally, in affect-rich contexts, marketing research methods such as conjoint analysis may need to be adjusted to reflect the ordinality of preferences, and researchers may need to be cautious when making predictions of how consumers would trade off attributes for one another in such contexts.

**Evidence of Ordinality of Affect**

Our findings provide four types of evidence consistent with our main theoretical proposition. First, people have an intuitive preference for ranking when evaluating targets on affective dimensions and rating when evaluating targets on cognitive dimensions (Studies 1, 7, and 8). That is, people have a relative preference for ordinal (as opposed to absolute) evaluation when making everyday affective judgments. Second, this relative preference is more than a lay belief: After experiencing both modes of evaluation, people are more likely to perceive a greater fit for ranking when making affective evaluations than when making cognitive evaluations (and conversely, more likely to perceive a greater fit for rating when making cognitive evaluations than when making affective evaluations) (Studies 2 and 3). Third, greater engagement of the overall affective system increases people’s confidence in evaluative ranking but not in evaluative rating of targets (Studies 4 and 5). Finally, even people who are not explicitly asked to rank exhibit more process evidence of ordinal mental operations when performing affective evaluations than when performing cognitive evaluations (Study 6). While each of these four sets
of results, in isolation, does not conclusively establish that affective evaluations are indeed more ordinal, collectively they converge in revealing a consistent pattern of greater ordinality under affective evaluations.

**Limitations of the Empirical Evidence**

An important limitation of the research is that except for Study 6, our studies did not provide direct evidence of the specific processes at work. Part of the problem is that the difference between cardinal and ordinal evaluation is rather subtle and one for which people probably do not have strong introspective grasp. It is therefore difficult to solicit direct process measures of cardinal versus ordinal evaluation from the participants themselves. This problem is compounded by the fact that it can be difficult for participants to introspectively gauge the degree to which they rely on affect and feelings in judgment (see Nisbett & Wilson, 1977). Given the difficulty of measuring the specific processes at work, we therefore elected to manipulate them instead (see Spencer, Zanna, & Fong, 2005), using different operations across studies to obtain triangulation. Still it would be useful to extend this research by clarifying the exact processes at work under affective evaluation. For example, do people perform a complete rank ordering of the available options, or do they perform a cruder categorization of the options into ones that they like more versus ones that they like less? How does the process differ when people are expected to make a full ranking of all the targets in the set (as in all of our studies) versus a partial ranking of only the top targets in the set (e.g., the top three out of six)? When people make ordinal affective evaluations of more than two options, do they perform a complete rank-ordering, do they perform pairwise comparisons, or do they assess a preliminary preferred alternative against the remaining alternatives? How does the number of alternatives change the
exact process of affective evaluation? These are questions for which process-tracing methods such as eye-tracking would be helpful.

**Ordinality of Affect as a General Explanation for Judgment Phenomena**

The above limitations notwithstanding, the proposition that the affective system of evaluation is inherently more ordinal helps provide a general and parsimonious explanation for a variety of findings in the judgment literature. First, it helps explain why affective evaluations are generally found to be more reference-dependent. This is presumably because rank-ordering naturally requires a comparison of the target with other targets and benchmarks. Consistent with the notion that the reference-dependence phenomenon is linked to the ordinality of affect, our findings show that people’s sensitivity to outcome counterfactuals in a gambling task can be predicted by their relative preference for using ranking in affective evaluations in a totally unrelated task (Study 7).

Second, the ordinality of the affective system also helps explain why affective evaluations are generally found to be more scope-insensitive. This is presumably because the overall affective system is more concerned with the evaluative rank-ordering of goal-relevant objects than with their quantification. Rank-ordering does not require absolute valuation. Consistent with the notion that the scope-insensitivity phenomenon is linked to the ordinality of affect, our findings show that people’s scope-insensitivity in a given domain can be predicted by their relative preference for using ranking in affective evaluations in a totally unrelated domain.

We suspect that other judgment phenomena can also be explained by the inherent ordinality of the affective system. For example, an important dimension of rationality in standard economics is transitivity, which refers to the notion that if an object A is preferred to another object B, and object B is preferred to object C, then A should also be preferred to C.
Interestingly, it has been found that affective evaluations tend to be more transitive compared to cognitive evaluations (Lee et al., 2009). According to our proposition, the greater transitivity of affective evaluations may emanate from their inherent focus on rank-ordering, which produces a more explicitly ordered set of preferences. Indirect support for this interpretation comes from the re-ranking results of Study 6, which showed that participants who had performed affective evaluations of the targets were better able to reproduce the relative ranks implied by their evaluations than were participants who had performed cognitive evaluations of the same targets.

Broadly, the notion that the overall affective system of evaluation is inherently more ordinal than the cognitive system sheds new light on how to view different affective “biases” in judgments and decisions. Rather than being mere “biases,” the distinctive properties of affective evaluations may reflect more fundamental structural differences in the overall architecture of the affective system of judgments and decisions (Pham 2007)—fundamental differences that research such as ours aims to understand.
References


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Table 1

*Study 1. Intuitive Preference for Ranking vs. Rating as a Function of Judgment Dimension*

<table>
<thead>
<tr>
<th>Replication</th>
<th>Affective Dimension</th>
<th>Cognitive Dimension</th>
<th>Choice Share</th>
<th>t-value [Comparison between (a) and (b)]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>(a) Rank-Affective &amp; Rate-Cognitive</td>
<td>(b) Rate-Affective &amp; Rank-Cognitive</td>
</tr>
<tr>
<td>Replication A: Faces (N = 231)</td>
<td>Attractiveness</td>
<td>Intelligence</td>
<td>59.6%</td>
<td>28.3%</td>
</tr>
<tr>
<td>Replication B: Food dishes (N = 141)</td>
<td>Tastiness</td>
<td>Ease of preparation</td>
<td>56.0%</td>
<td>39.7%</td>
</tr>
<tr>
<td>Replication C: Products (N = 167)</td>
<td>Coolness</td>
<td>Usefulness</td>
<td>55.2%</td>
<td>39.5%</td>
</tr>
</tbody>
</table>

*Note. *: p < .05; **: p < .01*
Figure 1. Study 4: Overall confidence as a function of evaluation method and picture type.
Figure 2. Study 5: Overall confidence as a function of evaluation method and scent.
Figure 3. Study 6: Correlations between input order and own evaluation rank and screen order as a function of condition.
Figure 4. Study 7: Emotional response to outcome of gamble as a function of outcome counterfactual and preference for ranking in affective evaluations.
Figure 5. Study 8. Willingness to pay as a function of scope and preference for ranking in affective evaluations.