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Affect as an ordinal system of utility assessment

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ABSTRACT

Is the perceived value of things an absolute measurable quantity, as in economists' notion of "cardinal utility," or a relative assessment of the various objects being evaluated, as in economists' notion of "ordinal utility"? We believe that the answer depends in part upon which judgment system underlies the evaluation. Specifically, we advance the proposition that due to its distant evolutionary roots, the affective system of judgment is inherently more ordinal (less cardinal) than the cognitive system. That is, structurally, 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 than their assessment in absolute terms. Results from six studies provide converging support for this general hypothesis and show how this novel proposition can explain classic judgment phenomena such as the greater scope-insensitivity and reference-dependence of affect-based judgments.

1. Introduction

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 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 (Lange, 1934; Pareto, 1909; Samuelson, 1938; see Moscati, 2013, for a review). In consumer psychology, researchers have asked whether consumers make purchase decisions based on the absolute value of products or 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; Luttmer, 2005). From a judgment process perspective, absolute or cardinal conceptions of value assume a *rating* form of judgment, with each object assigned a numerical value, whereas relative or ordinal conceptions of value are more compatible with a *ranking* form of judgment, with each object 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

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ordinal than valuations that tap into the cognitive system of judgment, which tend to be more cardinal. Consistent with this proposition, across six 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 (1) the greater reference-dependence of affect-based judgments (Hsee, Zhang, Yu, & Xi, 2004; Tversky & Griffin, 1991) and (2) the greater scope-insensitivity of affect-based valuations (Hsee & Rottenstreich, 2004). Substantive and theoretical implications are discussed.

2. The affective system and the assessment of utility

2.1. 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).

2.2. Absolute versus ordinal conceptions of value

As mentioned, a long-standing tension in various conceptualizations of perceived value revolves around whether value 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 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 ordinal utilities only (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 presupposing different levels of measurement, absolute versus ordinal conceptions of value 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 Cancún 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 Cancún is not as fun as a spring break in Hawaii"). Quantitative information beyond rank receives less attention.

2.3. 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 require only ordinal assessments: Is A > B or B > A? (see Xu & Wyer, 2008, for relevant findings). 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 is 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 (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. This is presumably because rank-ordering naturally requires comparisons. As a result, when making affect-based judgments people have a built-in tendency to compare the objects of evaluation (e.g., a recent compensation bonus) against reference points such as social comparisons (e.g., how much their colleagues received) and outcome counterfactuals (e.g., how large the bonus could have been). This tendency to compare would transpire even if a comparison is not formally required (e.g., the person does not have to make a choice or is not explicitly asked to make a relative assessment). A focus on rank-ordering would additionally explain why affective evaluations are generally found to be more scope-insensitive. A system geared toward making ordinal assessments would naturally be less sensitive to absolute magnitudes. Moreover, a system designed to rank-order alternative courses of action (e.g., do I fight or take flight?) would primarily focus on the presence/absence and quality of the objects to be evaluated (e.g., is this a lion or a warthog?) rather than on their quantity (e.g., are there one or two lions?). Again, these built-in tendencies would promote scope-insensitivity even if the person is not explicitly required to make a choice or a relative comparison.

3. Overview of the studies

We tested our general proposition in a series of six studies using various 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. Study 2—as well as a conceptual replication of this study—shows 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. Study 3 shows that increased engagement of the overall affective system increases overall confidence in ranking but not in rating. Study 4 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—but not fully explained—properties of affect-based evaluations such as their greater scope-insensitivity (Study 5) and their greater reference-dependence (Study 6).

4. 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 an 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 intuitive preference for ranking objects versus rating them when performing common evaluations that are either more affective or more cognitive.

4.1. Method

The study was conducted among a total of 539 participants from Amazon's Mechanical Turk (MTurk) panel.[1] Participants first received introductory explanations of the difference between ranking and rating. It was explained that ranking a set of items implies 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 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 dimensions on which participants would evaluate these targets were different across three replications of the study. In Replication A ($N = 231$, 59% women, mean 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 ($M = 3.18$, $t(72) = -2.43$, $p < .02$).

[1] Amazon's MTurk is a crowdsourcing Internet platform that enables individuals to recruit registered workers to complete short online tasks (including surveys) in return for a small fee. The platform has been recognized as a valid source of data for social science research (e.g., Buhrmester, Kwang, & Gosling, 2011). In Studies 1–2 and 5–6, which relied on this pool of respondents, we recruited US-based participants with a job approval rating of at least 98% (i.e., whose previous jobs had been approved at least 98% of the time). The samples for these studies were independently recruited.

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.

4.2. Results

4.2.1. 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: $M_{\text{Feelings-Attractiveness}} = 5.21$, $SD = 1.41$ vs. $M_{\text{Feelings-Intelligence}} = 4.23$, $SD = 1.61$, $t(230) = 8.62$, $p < .001$; Replication B: $M_{\text{Feelings-Tastiness}} = 4.63$, $SD = 1.73$ vs. $M_{\text{Feelings-Ease of preparation}} = 3.98$, $SD = 1.76$, $t(140) = 3.84$, $p < .001$; Replication C: $M_{\text{Feelings-Coolness}} = 4.97$, $SD = 1.55$ vs. $M_{\text{Feelings-Usefulness}} = 3.45$, $SD = 1.60$, $t(166) = 10.04$, $p < .001$). Similarly, participants stated that 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: $M_{\text{Logic-Intelligence}} = 4.30$, $SD = 1.63$ vs. $M_{\text{Logic-Attractiveness}} = 3.94$, $SD = 1.68$, $t(230) = 2.69$, $p < .01$; Replication B: $M_{\text{Logic-Ease of preparation}} = 5.23$, $SD = 1.23$ vs. $M_{\text{Logic-Tastiness}} = 4.21$, $SD = 1.70$, $t(140) = 6.18$, $p < .001$; Replication C: $M_{\text{Logic-Usefulness}} = 6.17$, $SD = 0.94$ vs. $M_{\text{Logic-Coolness}} = 4.08$, $SD = 1.54$, $t(166) = 15.21$, $p < .001$).

4.2.2. 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).

4.3. Discussion

The results indicate that across various common dimensions of judgment—attractiveness versus intelligence of people, tastiness versus ease of preparation of food dishes, and 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 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 convergent evidence of the greater ordinality of affective evaluations.

5. 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. Even if 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 a dimension that was either more affective or more cognitive. We predicted that participants asked to perform an affective evaluation would report a greater fit of ranking compared to rating, whereas participants asked to perform a cognitive evaluation would report a greater fit of rating compared to ranking.

5.1. 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," whereas 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 on how to rank or rate the targets. To report their rankings (in terms of either attractiveness or 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

Table 1
Study 1. Intuitive preference for ranking vs. rating as a function of judgment dimension.

	Affective dimension	Cognitive dimension	Choice share			*t*-Value [comparison between (a) and (b)]
			(a) Rank-affective & rate-cognitive (%)	(b) Rate-affective & rank-cognitive (%)	(c) No preference between ranking and rating (%)	
Replication A: Faces (N = 231)	Attractiveness	Intelligence	59.6	28.3	12.2	5.38**
Replication B: Food dishes (N = 141)	Tastiness	Ease of preparation	56.0	39.7	4.3	2.01*
Replication C: Products (N = 167)	Coolness	Usefulness	55.2	39.5	5.4	2.11*

* $p < .05$.
** $p < .01$.

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.

5.2. Results

5.2.1. Preliminary analyses

To check the effectiveness of our manipulation of affective versus cognitive evaluation, we submitted participants' stated reliance on emotion and logic to a 2 (judgment process: emotion vs. logic) × 2 (judgment dimension: attractiveness vs. intelligence) × 2 (order: ranking first vs. rating first) mixed ANOVA with judgment process as a repeated factor and judgment dimension and order as between-subjects factors. As expected, the analysis revealed a significant interaction between judgment process and judgment dimension ($F(1,88) = 4.44$, $p = .038$, $\eta^2 = .048$). Simple effect tests show that stated reliance on emotion was marginally higher in the attractiveness condition ($M = 4.89$, $SD = 1.37$) than in the intelligence condition ($M = 4.31$, $SD = 1.57$; $F(1,88) = 3.09$, $p = .08$, $\eta^2 = .034$); the difference in stated reliance on logic between the intelligence condition ($M = 4.33$, $SD = 1.55$) and the attractiveness condition ($M = 3.86$, $SD = 1.64$), while not significant ($F(1,88) = 2.04$, $p = .16$, $\eta^2 = .023$), was in the expected direction.

Additional ANOVAs indicated that participants spent an equal amount of time evaluating the targets in the attractiveness condition ($M = 95.23$ s, $SD = 48.48$) and in the intelligence condition ($M = 91.45$ s, $SD = 40.44$; $F < 1$). In addition, participants reported being equally engaged across the two conditions ($M_{\text{Attractiveness}} = 6.05$, $SD = 0.91$ vs. $M_{\text{Intelligence}} = 5.84$, $SD = 1.20$; $F(1,88) = 1.12$, $p = .29$). These results make issues of differential involvement across conditions unlikely.

5.2.2. Perceived fit of ranking versus rating

Participants' selections of which evaluation method—ranking or rating—fit better were submitted to a logistic regression with judgment dimension (attractiveness vs. intelligence), task order, and their interaction as contrast-coded predictors. The analysis revealed only a main effect of judgment dimension (Wald $\chi^2 = 4.89$, $p < .03$). 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%]).

5.3. 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).

These results were replicated in a separate study in which the judgment dimension was held constant, and reliance on affect versus logic was manipulated directly via explicit instructions. In this study, 155 MTurk participants were asked to estimate the popularity of six target individuals of the same sex based on their pictures and were directed to rely on either emotional feelings or logical considerations, using instructions validated in prior research (Pham, Cohen, Pracejus, & Hughes, 2001). 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. After submitting their evaluations, participants indicated which method of evaluation fit better with predicting the popularity of the target individuals: (a) "Rating," (b) "Ranking," and (c) "Both ranking and rating are absolutely the same." 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 ($P = 38.2\%$; $\chi^2(2) = 8.44$, $p < .05$). The similarity in findings between this replication study and Study 2 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.

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. 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 (Study 2).

6. Study 3: Confidence in ranking and rating as a function of affect engagement

Study 2 shows 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, we capitalized on previous research showing an intimate connection between the sensory function 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 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. We 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.

6.1. Method

Ninety-nine students (65% female; mean age = 22.53, SD = 5.57) from a large U.S. 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. 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 a similar text box. 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 (c) "How confident are you of your [rankings/ratings] of the various breads?" (1 = "Not at all" to 7 = "Very much"). The three items were averaged into an index of overall judgment confidence (α = .83), which was the main dependent measure.

6.2. Results

A two-way ANOVA of participants' overall judgment confidence revealed neither a main effect of evaluation method (F < 1), nor a main effect of scent ($F(1,95)$ = 1.33, p = .25). However, there was significant interaction between evaluation method and scent ($F(1,95)$ = 4.92, p < .03, η^2 = .049). As predicted, participants who evaluated the pastries by ranking them expressed greater judgment confidence in the pastry-scented condition (M = 5.75, SD = 0.75) than in the no-scent condition (M = 4.97, SD = 1.15; $F(1,95)$ = 5.48, p = .02, η^2 = .054; see Fig. 1). In contrast, participants who evaluated the pastries by rating them did not express greater judgment confidence in the pastry-scented condition (M = 5.07, SD = 1.52) than in the unscented condition (M = 5.32, SD = 1.07; F < 1).

6.3. Discussion

The results suggest 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). We obtained similar results in a conceptual replication of this study in which 216 MTurk participants were asked to evaluate their desire to eat different fresh-baked breads by either ranking them or rating them, then to report their overall confidence in their judgment on the same items as in Study 3. 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 engagement of the "hot" affective system (Metcalfe & Mischel, 1999; Mischel & Moore, 1973; Shiv & Fedorikhin, 1999). Consistent with the results of Study 3, there was significant interaction between evaluation method and picture type ($F(1,212)$ = 5.27, p = .023, η^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, η^2 = .026). 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).

Thus, across two different manipulations of engagement of the affective system, we found that greater affective engagement increases overall confidence in ranking but not rating, suggesting that affective engagement facilitates the process of ranking. These results 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 Study 2 in two ways. First, whereas in Study 2 the greater compatibility of the affective system with ordinal assessment was inferred from subjective perceptions of fit, in Study 3 this compatibility was revealed by downstream judgments of evaluative confidence. Second, Study 3's results suggest that affect is 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).

While we see the overall pattern of results of Study 3 as consistent with those of the first two studies, one may wonder why in Study 3 confidence in rating was not significantly greater under low affective engagement as compared to high affective engagement (i.e., why the interaction did not fully cross over), whereas in Study 2 participants did report a greater perceived fit of rating when performing a cognitive judgment compared to an affective judgment. We believe that the inconsistency is more apparent than real. First, in Study 2 the contrast between ranking and rating was more salient than in Study 3 because in Study 2 the two methods of evaluation were administered within-subject, whereas in Study 3 they were administered between-subjects. A more salient contrast between ranking and rating would naturally accentuate any perceived difference in fit with affective versus cognitive judgments. Second, the dependent measures were different across studies. In Study 2 the dependent measure was an explicit assessment of perceived fit, whereas in Study 3 the dependent measure, which

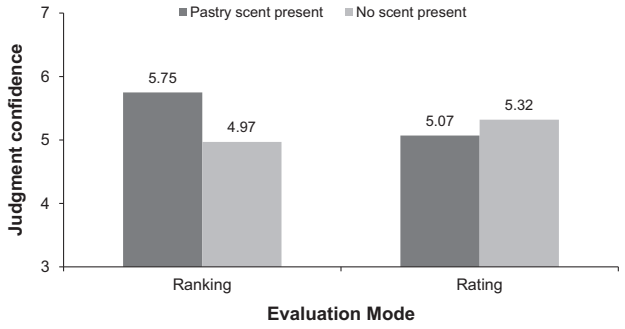

Fig. 1. Study 3: Overall confidence as a function of evaluation mode and presence of ambient scent.

involved judgmental confidence, was more subtle. Third, unlike Study 2, Study 3 did not pit affective evaluation against cognitive evaluation; it prompted different levels of affective engagement in order to obtain a more focused test of the connection between affect and ordinality. Finally, it should be noted that our main hypothesis is comparative: that the affective system is more ordinal (less cardinal) than the cognitive system, not that the affective system is absolutely ordinal and that the cognitive system is absolutely cardinal.

7. Study 4: Process evidence of ordinal assessment in affective evaluations

In the first three 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 various process indicators of ordinal assessment.

7.1. Method

7.1.1. 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) $\times$ 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.

7.1.2. 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 $\times$ 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."

7.2. Results

7.2.1. 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 s vs. $M_{Cognitive}$ = 84.48, SD = 33.90 s; $F < 1$) 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.

7.2.2. 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 τ) 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 (τ = .677, SD = .397) than with the ranking implied by their evaluations (τ = .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 Fig. 2, the input order was less correlated with the screen order in the potential-date (affective-evaluation) condition (τ = .579, SD = .431) than in the project-teammate (cognitive-evaluation) condition (τ = .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 (τ = .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.

7.2.3. 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.

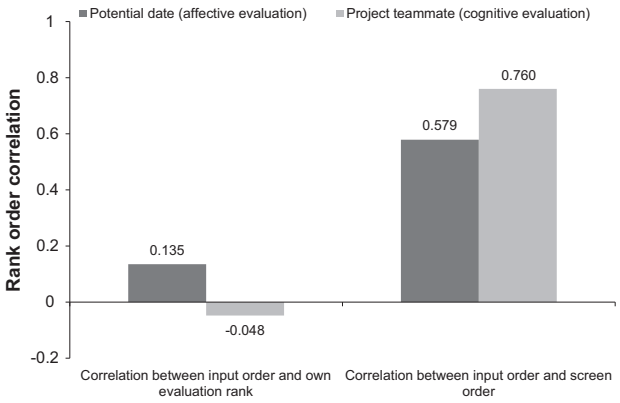

Fig. 2. Study 4: Correlations between input order and own evaluation rank and screen order as a function of type of evaluation.

7.2.4. 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.

7.3. 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 (project-teammate) condition, affective-evaluation (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.

8. The ordinality of affect as an explanation for well-known judgment phenomena

To recapitulate, the first four 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 remaining two studies aim to show that the proposition that the affective system is inherently more ordinal helps explain important judgment and decision-making phenomena that have been documented previously in the literature. Specifically, the two studies were designed to show that two well-known judgment phenomena—the scope-insensitivity and the reference-dependence of affective judgments—can be attributed in part to the greater ordinality of the affective system.

9. Study 5: Linking the ordinality of affect to scope-insensitivity of affective judgments

A well-documented judgment phenomenon is that, compared to cognitive evaluations, affective evaluations tend to be more scope-insensitive. That is, when people rely on feelings, they are sensitive to the mere presence or absence of the goal-relevant objects (i.e., the difference between 0 and some scope) but are largely insensitive to further variations in quantity (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.

We propose that the scope-insensitivity of affective evaluations is not an isolated judgment bias but is in fact linked to the inherent ordinality of the affective system. As an ordinal system of evaluation, the affective system is naturally less responsive to absolute magnitudes. Moreover, because the system was originally designed to rank alternative courses of action, it tends to focus on the presence or absence and quality of the to-be-evaluated objects rather than on their quantity. These built-in tendencies would promote scope-insensitivity even if the person is not explicitly required to make a choice or a relative comparison.

The purpose of Study 5 was to provide evidence that scope-insensitivity of affective evaluations is indeed linked to the ordinality of the affective system. The study used a "moderation-of-process" design strategy to substantiate this link.[2] As explained by Spencer, Zanna, and Fong (2005), one way to demonstrate that a process M mediates a relation between X and Y is to experimentally manipulate M independently of X to show that variation in M moderates the relation between X and Y. To implement such a strategy, the design of the study involved two stages, with the second stage intended to assess the degree of scope-insensitivity using a task adopted from Hsee and Rottenstreich (2004). The first stage was designed to prime both the reliance on affect versus cognition and the procedural accessibility of ranking versus rating, independently. This was done by having participants complete a series of evaluations that varied both in terms of evaluation dimensions (more affective vs. more cognitive) and response format (ranking vs. rating vs. control).

We expected that the primed reliance on affect versus cognition and the procedural accessibility of ranking versus rating versus control would interact to shape how participants made their judgments in the second stage. Specifically, we predicted that in the control response format condition, participants primed to rely on affect would exhibit greater scope-insensitivity than participants primed to rely on cognition, thus replicating prior findings on affect and scope-insensitivity. However, in the conditions where ranking and rating were made accessible, the effects of reliance on affect versus cognition would be significantly smaller, with participants in the ranking condition being more scope-insensitive than participants in the rating condition. This pattern of results would be consistent with the proposition that the effect of reliance on affect on scope-insensitivity is mediated in part by the greater ordinality of affective judgments.

9.1. Method

A total of 815 MTurk participants (42% female, mean age = 33, *SD* = 12.12) were randomly assigned to one of 12 conditions of a 2 (evaluation dimension: affective vs. cognitive) × 3 (evaluation mode: ranking vs. rating vs. control) × 2 (scope: 5 vs. 10 DVDs) between-subjects design. In the first stage of the study, participants were asked to evaluate three sets of pictured options: six individuals of the opposite sex, followed by six food dishes, and then six gadgets. In the affective condition, participants evaluated the individuals on attractiveness, the dishes on tastiness, and the gadgets on coolness, whereas in the cognitive condition, participants evaluated the individuals on intelligence, the dishes on ease of preparation, and the gadgets on usefulness. Independent of the evaluation dimensions that participants were asked to focus on, they were instructed to follow one of three evaluation modes. In the ranking condition, participants were asked to rank-order the six pictures in each set by dragging and dropping each picture to its desired rank-ordered position. In the rating condition, participants were instructed to rate each picture in each set on a 0–10 scale and enter their rating in a text box next to the picture. In the control condition, participants were instructed to perform the requested evaluations (attractiveness/tastiness/coolness or intelligence/ease of preparation/usefulness) only mentally (i.e., without any requirement to input their evaluations) and told that they would be asked "a few questions about [their] evaluations at the end of this session."

After completing the three sets of evaluations, participants were directed to the second stage of the study, in which they 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. Finally, as manipulation checks, participants rated their agreement with three sets of four statements (one set for each type of target), capturing the degree to which participants' evaluations in the first stage were primarily affective or cognitive, and ordinal or absolute. (These manipulation checks behaved as expected—showing large main effects of the corresponding factors—and are not detailed here due to space constraints.)

[2] We thank an anonymous reviewer for suggesting this particular design.

9.2. Results

Participants' WTP for the DVDs were submitted to a 2 (evaluation dimension) × 3 (evaluation mode) × 2 (scope) ANOVA. The cell means are reported in Table 2. For brevity, we focus on the results that are of substantive interest in this research. Unsurprisingly, there was a main effect of scope, indicating that WTP was higher for the 10-DVD set ($M = 44.48$, $SD = 29.85$) than for the 5-DVD set ($M = 25.24$, $SD = 16.00$; $F(1,803) = 135.87$, $p < .001$, $\eta^2 = .145$). More importantly, this effect was qualified by three separate interactions of substantive significance.

First, there was a scope × evaluation dimension interaction ($F(1,803) = 6.57$, $p < .02$, $\eta^2 = .008$), indicating that participants were significantly less scope-sensitive (more scope-insensitive) in the affective-evaluation condition ($M_5 = 24.97$, $SD = 15.52$ vs. $M_{10} = 40.45$, $SD = 26.26$; $F(1,803) = 42.03$, $p < .001$, $\eta^2 = .049$) than in the cognitive-evaluation condition ($M_5 = 25.48$, $SD = 16.42$ vs. $M_{10} = 48.64$, $SD = 32.71$; $F(1,803) = 99.49$, $p < .001$, $\eta^2 = .110$). This first interaction is consistent with prior results on scope-insensitivity.

Second, there was a scope × evaluation mode interaction ($F(2,803) = 3.37$, $p < .04$, $\eta^2 = .008$), showing that participants primed with ranking were more scope-insensitive ($M_5 = 27.41$, $SD = 16.60$ vs. $M_{10} = 41.10$, $SD = 26.99$; $F(1,803) = 23.28$, $p < .001$, $\eta^2 = .028$) than were participants primed with rating ($M_5 = 23.77$, $SD = 14.30$ vs. $M_{10} = 45.11$, $SD = 29.53$; $F(1,803) = 56.43$, $p < .001$, $\eta^2 = .066$) and participants in the control condition ($M_5 = 24.57$, $SD = 16.82$ vs. $M_{10} = 47.94$, $SD = 33.31$; $F(1,803) = 61.26$, $p < .001$, $\eta^2 = .071$). This second interaction is consistent with the proposition that the scope-insensitivity phenomenon may be due to ordinal processing in judgment.

Most importantly, there was a three-way interaction among scope, evaluation dimension, and evaluation mode ($F(2,803) = 3.128$, $p < .05$, $\eta^2 = .008$). To interpret this interaction we separately examined the simple two-way interaction between scope and evaluation dimension for each evaluation mode. In the control condition, the interaction between scope and evaluation dimension was significant ($F(1,803) = 11.83$, $p < .001$, $\eta^2 = .014$), again showing that participants were more scope-insensitive in the affective-evaluation condition ($M_5 = 24.16$, $SD = 15.13$ vs. $M_{10} = 37.45$, $SD = 26.60$; $F(1,803) = 9.49$, $p < .01$, $\eta^2 = .012$) than in the cognitive-evaluation condition ($M_5 = 24.91$, $SD = 18.17$ vs. $M_{10} = 58.79$, $SD = 36.18$; $F(1,803) = 66.67$, $p < .001$, $\eta^2 = .077$). This particular result suggests that when neither ranking nor rating was made particularly accessible, a reliance on affect increased participants' scope-insensitivity. In contrast, the interaction between scope and evaluation dimension was not significant in both the ranking condition and the rating condition (both $F < 1$). This result suggests that making either rating or ranking particularly accessible overrides the effects of reliance on affect (vs. cognition) on scope-insensitivity. An interaction contrast shows that in these two conditions scope-insensitivity was greater when ranking rather than rating was made more accessible ($F(1,803) = 3.84$, $p < .05$, $\eta^2 = .004$). In other words, the priming of ranking overrides the effects of reliance on affect in the direction of greater scope-insensitivity, whereas the priming of rating overrides the effects of reliance on affect in the direction of greater scope-sensitivity. This overall pattern of results is consistent with the proposition that the link between affect and ordinality mediates the previously documented effect of affect on scope-insensitivity.

9.3. Discussion

Three main results emerged from this study. First, it was found that the mere priming of affective (as opposed to cognitive) dimensions of judgment in one task made participants less sensitive to the scope of the to-be-evaluated object in an unrelated subsequent valuation task. This first result replicates previous findings linking affect to the scope-insensitivity phenomenon. Second, it was found that the mere priming of ranking (as opposed to rating) as a mode of evaluation also made participants less sensitive to the scope of the to-be-evaluated object in the subsequent valuation task. This second finding is novel, and points to a link between ordinal thinking and the scope-insensitivity phenomenon. This previously unrecognized link is consistent with our theorizing. Finally, it was found that evaluation mode interacted as predicted with the priming of affect (vs. cognition) in influencing scope-insensitivity. When neither ranking nor rating was made accessible (in the control-response-format condition), participants primed to rely on affect exhibited greater scope-insensitivity than participants primed to rely on cognition. However, in the conditions where ranking and rating were made accessible as evaluation modes, the effects of reliance on affect versus cognition were significantly smaller, with participants in the ranking conditions being more scope-insensitive than participants in the rating conditions. This moderation-of-process finding is consistent with the proposition that the link between affect and scope-insensitivity is at least partly mediated by the greater ordinality of thinking that the affective system promotes.

Table 2
Study 5. WTP as a function of scope, priming of affective vs. cognitive evaluation, and priming of evaluation mode (means, standard deviations in parentheses, and cell sizes).

	Affective evaluation		Cognitive evaluation	
	5 DVDs	10 DVDs	5 DVDs	10 DVDs
Control	24.16 (15.13) $n = 61$	37.45 (26.60) $n = 60$	24.91 (18.17) $n = 75$	58.79 (36.18) $n = 58$
Ranking	26.66 (15.96) $n = 68$	38.56 (24.62) $n = 70$	28.21 (17.35) $n = 64$	43.35 (28.89) $n = 79$
Rating	23.82 (15.51) $n = 57$	44.30 (27.21) $n = 81$	23.72 (13.42) $n = 75$	46.10 (32.29) $n = 67$

10. Study 6: Linking the ordinality of affect to reference-dependence of affective judgments

Another distinctive characteristic 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 sensitivity to outcome counterfactuals. According to decision affect theory (Mellers et al., 1997), emotional responses to gambling outcomes are not merely 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. We propose that this reference-dependence is also linked to the inherent ordinality of the affective system of evaluation. Given that rank-ordering naturally requires comparisons, reliance on the affective system triggers a built-in tendency to compare the objects of evaluation against available reference points, even when a comparison is not formally required.

Study 6 used an experimental strategy and a design similar to that of Study 5 to provide support for this proposition. As in Study 5, the study involved two stages, with the second stage intended to assess the degree of reference-dependence. The first stage used a method that was similar to the one used in Study 5 to prime both

the reliance on affect versus cognition and the procedural accessibility of ranking versus rating, independently. Parallel to the predictions of Study 5, we expected that in the control-response-format condition, participants primed to rely on affect would exhibit greater reference-dependence than participants primed to rely on cognition. This pattern of results would be consistent with the findings of prior research. However, in the conditions where ranking and rating were made accessible, the effects of reliance on affect versus cognition would be significantly smaller, with participants in the ranking condition being more reference-dependent than participants in the rating condition. This pattern of results would be consistent with the proposition that the effect of reliance on affect on reference-dependence is mediated by the greater ordinality of affective judgments.

10.1. Method

Another 1309 MTurk participants (52% female, mean age = 33.41, SD = 11.77) were randomly assigned to one of 12 conditions of a 2 (evaluation dimension: affective vs. cognitive) × 3 (evaluation mode: ranking vs. rating vs. control) × 2 (counterfactual: \$15 vs. \$50) between-subjects design. The first stage of the study was identical to the first stage of Study 5, with one exception: whereas in all conditions of Study 5 the items to be evaluated within each set (individuals, dishes, and gadgets) were presented together on a single page, in the rating condition of the present study each picture in each set was presented independently on a different page. We implemented this change to strengthen the rating manipulation by making it easier for participants in the rating condition to evaluate each target in isolation.

After completing the evaluations in the first stage, participants were directed to the second stage of the study, in which 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. This measure assessed participants’ degree of reference-dependence. Finally, participants completed a set of manipulation checks that were identical to the ones used in Study 5. As in Study 5, these manipulation checks behaved as expected and are not further discussed.

10.2. Results

Participants’ excitement with the outcome of the gamble were submitted to a 2 (evaluation dimension) × 3 (evaluation mode) × 2 (outcome counterfactual) ANOVA. The cell means are reported in Table 3. As expected, participants were less excited about the outcome of the gamble if the counterfactual was \$50 (M = 4.97, SD = 1.42) than if it was \$15 (M = 6.49, SD = 0.72; $F(1,1297) = 601.70$, $p < .001$, $\eta^2 = .317$). More importantly, this effect was qualified by three separate interactions of substantive interest.

First, there was a counterfactual × evaluation dimension interaction ($F(1,1297) = 3.81$, $p = .05$, $\eta^2 = .003$) indicating that, overall, participants were more reference-dependent in the affective condition ($M_{\$15} = 6.58$, $SD = .65$ vs. $M_{\$50} = 4.94$, $SD = 1.39$; $F(1,1297) = 353.49$, $p < .001$, $\eta^2 = .214$) than in the cognitive condition ($M_{\$15} = 6.40$, $SD = 0.77$ vs. $M_{\$50} = 4.99$, $SD = 1.44$; $F(1,1297) = 261.85$, $p < .001$, $\eta^2 = .168$). This first interaction is consistent with prior results on the stronger reference-dependence of affect-based judgments.

Second, there was a counterfactual × evaluation mode interaction ($F(2,1297) = 4.45$, $p < .02$, $\eta^2 = .007$). Participants who were primed with ranking ($M_{\$15} = 6.52$, $SD = 0.61$ vs. $M_{\$50} = 4.77$, $SD = 1.56$; $F(1,1297) = 282.49$, $p < .001$, $\eta^2 = .179$) were more reference-dependent than those primed with rating ($M_{\$15} = 6.45$, $SD = 0.81$ vs. $M_{\$50} = 5.15$, $SD = 1.08$; $F(1,1297) = 153.86$, $p < .001$, $\eta^2 = .106$), with participants in the control condition being in-between ($M_{\$15} = 6.51$, $SD = 0.54$ vs. $M_{\$50} = 4.99$, $SD = 1.40$; $F(1,1297) = 182.75$, $p < .001$, $\eta^2 = .123$). This second interaction is consistent with the proposition that the reference-dependence phenomenon may be due to ordinal processing in judgment.

Most importantly, there was a three-way interaction among outcome counterfactual, evaluation dimension, and evaluation mode ($F(2,1297) = 3.17$, $p < .05$, $\eta^2 = .005$). To interpret this interaction we separately examined the simple two-way interaction between counterfactual and evaluation dimension for each evaluation mode. In the control condition, the interaction between counterfactual and evaluation dimension was significant ($F(1,1297) = 7.49$, $p < .01$, $\eta^2 = .007$), again showing that participants were more reference-dependent in the affective evaluation condition ($M_{\$15} = 6.68$, $SD = .54$ vs. $M_{\$50} = 4.84$, $SD = 1.52$; $F(1,1297) = 139.27$, $p < .001$, $\eta^2 = .097$) than in the cognitive evaluation condition ($M_{\$15} = 6.31$, $SD = .85$ vs. $M_{\$50} = 5.15$, $SD = 1.27$; $F(1,1297) = 52.22$, $p < .001$, $\eta^2 = .039$). This particular result suggests that when neither ranking nor rating was made particularly accessible, a reliance on affect increased participants’ reference-dependence. In contrast, the interaction between counterfactual and evaluation dimension was not significant in either the ranking condition or the rating condition (both $F < 1$). This result suggests that making either rating or ranking particularly accessible overrides the effects of reliance on affect (vs. cognition) on reference-dependence. An interaction contrast shows that in these two conditions reference-dependence was greater when ranking rather than rating was made more accessible ($F(1,1297) = 8.86$, $p < .01$, $\eta^2 = .007$). In other words, the priming of ranking overrides the effects of reliance on affect in the direction of greater reference-dependence, whereas the priming of rating overrides the effects of reliance on affect in the direction of lower reference-dependence. This overall pattern of results is consistent with the proposition that the link between affect and ordinality mediates the previously documented effect of affect on reference-dependence.

10.3. Discussion

Paralleling the results of Study 5, three main results emerged from this study. First, the mere priming of affective (as opposed to cognitive) dimensions of judgment in one task made participants more reference-dependent in a subsequent valuation task. This first result is consistent with previous findings indicating a greater reference-dependence of affect-based judgments. Our finding extends these previous findings by showing that the phenomenon can arise even if reliance on affect is not driven by the evaluation task itself (as in previous studies) but is merely primed by a preceding task. Second, the mere priming of ranking (as opposed to rating) was also found to make participants more reference-dependent in the subsequent task. This second finding is consistent with recent research showing that comparative mindsets can carry over from task to task (see Xu & Wyer, 2008). Finally and more importantly, it was found that evaluation mode interacted as predicted with the priming of affect (vs. cognition) in influencing participants’ degree of reference-dependence. When neither ranking nor rating was made accessible (in the control condition), participants primed to rely on affect exhibited greater reference-dependence than participants primed to rely on cognition. However, when ranking and rating were made accessible, the effects of primed reliance on affect versus cognition were significantly smaller, with participants in the ranking conditions exhibiting more reference-dependence than participants in the

Table 3
Study 6. Excitement with gamble outcome as a function of outcome counterfactual, priming of affective vs. cognitive evaluation, and priming of evaluation mode (means, standard deviations in parentheses, and cell sizes).

	Affective evaluation		Cognitive evaluation	
	$15 Counterfactual	$50 Counterfactual	$15 Counterfactual	$50 Counterfactual
Control	6.68 (0.54) n = 106	4.84 (1.52) n = 99	6.32 (0.85) n = 93	5.15 (1.27) n = 100
Ranking	6.61 (0.52) n = 114	4.81 (1.51) n = 116	6.43 (0.68) n = 112	4.74 (1.62) n = 119
Rating	6.46 (0.83) n = 117	5.19 (1.08) n = 105	6.45 (0.79) n = 118	5.11 (1.36) n = 110

rating conditions. Again, this moderation-of-process finding is consistent with the proposition that the greater reference-dependence of affect-based judgments is at least partly mediated by the greater ordinality of thinking that the affective system promotes.

11. General discussion

11.1. Affect and the nature of value

A fundamental question about the psychology of value is whether perceived value is an absolute measurable 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.

Our 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 ordinal assessments only. 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 evaluations. 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. That the affective system is inherently ordinal may partly account for the strong discontinuities in utility functions that have been observed in affect-rich decision contexts (e.g., Loewenstein, 1996; Rottenstreich & Hsee, 2001). An ordinal system that strictly ranks states of the world or courses of action in terms of desirability is more likely to produce such discontinuities (e.g., when very thirsty, exhibiting a marked preference for a refreshing glass of beer right away over three glasses of beer a day later). Similarly, welfare analysis in affect-rich contexts may not lend itself to making tradeoffs between the absolute welfare of various constituencies. For example, whereas taxation systems that redistribute wealth across population sectors in order to increase the total welfare of the entire population are generally accepted, any redistribution that involves trading off one person's emotional well-being at the expense of another's is widely frowned upon (e.g., humiliating a person for another's amusement). Society's unwillingness to trade off emotional well-being across individuals is well illustrated by the almost universally severe legal treatment of strong moral transgressions such as rape, homicide, and child abuse. Finally, in affect-rich contexts, marketing research methods such as conjoint analysis may need to be adjusted to reflect the ordinality of preferences. For example, our research clearly suggests that in conjoint analysis choice- and ranking-based methods of utility assessment are more appropriate for affect-rich product categories (e.g., movies, perfume, vacation packages) than are (absolute) rating-based methods. Moreover, our research suggests that for affect-rich product categories, practitioners should exercise caution when making predictions or recommendations based on the magnitude of the estimated preferences (e.g., using the output of a conjoint analysis study to infer willingness to pay for features and/or to optimize prices).

11.2. 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 (Study 1). 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) (Study 2). Third, greater engagement of the overall affective system increases people's confidence in evaluative ranking but not in evaluative rating of targets (Study 3). 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 4). While none of these four sets of results, in isolation, can conclusively establish that affective evaluations are indeed more ordinal, *collectively* they converge in revealing a consistent pattern of greater ordinality under affective evaluations.

11.3. Why and how affect promotes ordinality

While we attribute the greater ordinality of affect-based evaluations to the evolutionary roots of the affective system—a system that was originally designed to guide ancestral behavioral choices rather than modern-day decisions—an obvious shortcoming of our research is that we are unable to provide direct evidence to support this evolutionary explanation. One may therefore wonder whether other explanations that are more proximal could account for our results. For example, it could be that the affective system undermines the efficient use of cognitive resources (e.g., Clark, Milberg, & Ross, 1983), thus making cardinal assessments more difficult to perform. In our studies we did not find much evidence for this alternative explanation. In this program of research we measured the amount of time that it took participants to complete the main evaluation task in a total of six studies. There were no differences between the high-affect and low-affect conditions in four of these studies, and marginally significant differences in the other two studies, with participants in the high-affect condition taking less time in one study and more time in the other. This suggests that across studies there were no consistent differences in difficulty of completing the evaluations between the high-affect and low-affect conditions.

Rather, our results collectively point to a different proximate explanation that is more congenial with our evolutionary account. We believe that the evolutionary tendency of the affective system to perform ordinal evaluations manifests itself in the form of a particular mindset that becomes automatically activated whenever the affective system is engaged. This mindset is a procedural mindset that favors comparative assessments and preference ordering (see Wyer & Xu, 2010, for related theorizing). This mindset account is consistent with the findings that (a) participants perceive a greater fit between affective evaluation and ranking than between affective evaluation and rating (Studies 1 and 2); (b) affect engagement increases confidence in ranking but not rating (Study 3); and (c) priming of an alternative procedural mindset (i.e., rating) effectively disrupts the effects of affect on scope-insensitivity and reference-dependence (Studies 5 and 6).

11.4. Ordinality of affect as a general explanation for judgment phenomena

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, the ordinality of the affective system 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, and therefore more sensitive to their presence or absence and identity than to their precise quantity. Consistent with the notion that the scope-insensitivity phenomenon is linked to the ordinality of affect, our findings show that the effects of affective evaluations on scope-insensitivity depend on the accessibility of ranking (vs. rating or control) as a dominant mode of evaluation (Study 5).

Second, our proposition also 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 the effects of affective evaluations on reference-dependence also depend on the accessibility of ranking (vs. rating or control) as a dominant mode of evaluation (Study 6).

We suspect that other judgment phenomena can similarly 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; Lee, Lee, Bertini, Zauberman, & Ariely, 2015). 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 4, 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.

11.5. Limitations and future research

One limitation of the research is that all studies involve hypothetical scenarios. It is therefore unclear whether the same pattern of results would be observed with more consequential evaluations. Although this is a common issue in judgment and decision-making research, it is a legitimate concern. However, in a field study that involved attendees of a commercial speed-dating event, we again found greater ordinality in affective judgments of attractiveness of potential dates compared to cognitive judgments of intelligence of the same dates. This finding suggests that the pattern of results documented by the present set of studies would extend to real-world judgments and decisions.

Another limitation is that in some of our studies, especially Studies 5 and 6, the effect sizes were clearly small. We attribute the small effect sizes in these two studies to two factors. The first is that the study was conducted online with the MTurk panel, which, while considered valid for research purposes (Buhrmester et al., 2011), is known to be quite heterogenous and "noisy" (Chandler, Mueller, & Paolacci, 2014). However, we believe that the more important reason has to do with the subtlety of the experimental manipulations that were used in these two studies. Recall that in these two studies (5 and 6), participants were primed to focus on affect versus cognition and ranking versus rating (vs. control) by completing an initial set of evaluations. The effects of these primes were expected to carry over and moderate how participants perform concrete judgments such as their WTP for a bundle of DVDs and their excitement about winning a particular gamble. Given the subtlety of the manipulations, it is not surprising that the observed effects were statistically small. However, as Prentice and Miller (1992) pointed out, even small effects can be "impressive" when the manipulations that produced them are minimal.

The above limitations notwithstanding, the notion that the overall affective system of evaluation is inherently more ordinal than the cognitive system offers a new perspective 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 judgment and decision making (Pham, 2007)—fundamental differences that research such as ours aims to understand.

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