The Devaluation Effect: Activating a Need Devalues Unrelated Objects

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It is commonly assumed that an object capable of satisfying a need will be perceived as subjectively more valuable as the need for it intensifies. For example, the more active the need to eat, the more valuable food will become. This outcome could be called a valuation effect. In this article, we suggest a second basic influence of needs on evaluations: that activating a focal need (e.g., to eat) makes objects unrelated to that need (e.g., shampoo) less valuable, an outcome we refer to as the devaluation effect. Two existing studies support the existence of a devaluation effect using manipulations of the need to eat and to smoke and measuring attractiveness of consumer products and willingness to purchase raffle tickets. Furthermore, the evidence suggests that consumers are not aware of the devaluation effect and its influence on their preferences.

In research on decision making, one of the core theoretical constructs relating to preference is utility. Models based on utility assume that people's preferences for an object or its properties depend on the degree to which the object or property can satisfy some active goal. The utility of an object will vary as people's goals relating to that object change in intensity. Thus utility (as well as common sense) is consistent with a valuation relation between goals and choice whereby an object is valued according to the extent that it is perceived as instrumental to satisfying an active goal. For example, food should be perceived as more valuable when people need to eat than when they do not (see Markman and Brendl [2000] for further discussion).

In order to select a goal and to maintain goal-directed behavior, however, the motivational system may have to rely on more than just the valuation of goal-relevant objects. For example, once selected, the motivational system must protect the active goal from tempting alternatives. One way to achieve this could be by reducing the attractiveness of potentially tempting objects that are not instrumental to satisfying the active goal. For example, a strong need to eat may make movie tickets less attractive. This outcome would be a devaluation of objects unrelated to a focal goal.

The purpose of this article is to establish the existence of the devaluation effect and its influence on preference formation. Although we will not directly investigate those mechanisms driving the devaluation effect, we discuss a range of possible causes at a later stage.

Valuation and Devaluation

Lewin (1935) established the relationship between the evaluation of objects and goals by suggesting that objects are perceived as positive or negative (i.e., they have a valence) to the extent that they support or hinder active goals. The capacity of an object to satisfy goals or needs is also called instrumentality (Rosenberg 1956; see also Lynch, Marmorstein, and Weigold [1988], from a perspective of diagnosticity). Models of goals and consumer choice have focused on the influence of activating goals on the attractiveness of objects related to these goals (Brendl and Higgins 1996; Ratneshwar, Mick, and Huffman 2000).

By devaluation of unrelated objects, we mean objects that are neither perceived as instrumental nor as disinstrumental (i.e., counterproductive) to the focal need or goal. By need we mean a state associated with a physiologically based

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outcome, whereas a goal is a state associated with a psychological outcome. Lewin also introduced the idea that psychological goals cause needlike states or "quasi needs" that can differ in activation. In support of the notion of quasi needs, subjects who were interrupted before they could complete a task were more likely to spontaneously take up the task again than were subjects who had not been interrupted. Presumably, a task goal is active until it is reached, making any activity that can help reach that goal momentarily more desirable. While this article focuses on needs, Lewin's work suggests that goals share important properties with needs.

Although valuation follows directly from the assumption that preference for an object is related to its utility, there have been surprisingly few demonstrations that activation of a focal goal increases the attractiveness of goal-related objects. There is clear evidence for valuation effects for some perceptual experiences, such as smell, taste, and thermal perception. For example, fasting subjects rated the pleasantness of tasting a sweet solution more highly than nonfasting subjects. Sniffing orange syrup was pleasant for fasting subjects but unpleasant after having ingested a glucose load. Subjects immersed in a warm bath found dipping their hand into cold and warm water respectively pleasant and unpleasant, whereas the reverse was true for subjects sitting in a cold bath (Cabanac 1971).

While the research of the Lewin group on quasi needs is consistent with valuation effects, it is equally consistent with devaluation effects. As an example, consider subjects whose goal is to finish a puzzle. Goal-related activities (solving a puzzle) are strongly preferred to goal-unrelated activities (e.g., magazine browsing, daydreaming) when the goal is active rather than passive. If the attractiveness of goal-unrelated activities decreases, then goal-related activities will become relatively more attractive. A similar argument could be made for "invigoration effects" (Klinger 1975), whereby putting barriers in a sequence of goal-directed animal behaviors increases the vigor of these behaviors. This view is also consistent with Ouellette and Wood's (1998) suggestion that past behavior predicts future behavior by strengthening the relationship between an active goal and an action.

There is substantial evidence that activating a goal or need affects perceptions and cognitions in a way that supports fulfillment of that need or goal (Klinger 1975). For instance, people pay more attention to goal-related than to goal-unrelated stimuli (Ratneshwar et al. 1997). People also interpret ambiguous stimuli in a need-consistent manner and judge goal-related objects to be larger and brighter than they are. In a classic study, coins were judged to be larger by poor children than rich children (Bruner and Goodman 1947). In this article we seek direct evidence for the influence of need activation on evaluations.

Few studies have examined the influence of goal activation on some form of evaluation. In two studies, normal-weight consumers have been shown to purchase more groceries than originally planned when hungry compared with when not hungry (Gilbert and Wilson 2000; Nisbett and Kanouse 1969). Other studies have shown that there is a greater preference for goal-related objects over goal-unrelated objects when a focal need is strong. In one study, the greater the subjects' hunger, the stronger their preference for candy over fruit (Read and van Leeuwen 1998). In another study, subjects were more likely to want answers to trivia questions than to want candy when they had actually attempted to answer the question as opposed to when they had not (cited in Loewenstein and Schkade 1999). In these studies, however, the preference for goal-related objects over goal-unrelated objects may reflect either a valuation effect (e.g., an increase in the evaluation of trivia answers) or a devaluation effect (e.g., a decrease in the evaluation of candy).

In sum, there is strong evidence that activating a need or goal increases the preference for need-related objects over need-unrelated objects. However, with the exception of perceptions (taste, smell, temperature), it is not clear whether this shift of preference is due to valuation of goal-related objects, devaluation of goal-unrelated objects, or both. Thus, to obtain evidence capable of separating valuation from devaluation effects, we need to explore people's preferences for individual objects rather than look at relative preferences for goal-related objects over goal-unrelated objects.

Preliminary Evidence and the Logic of Our Studies

To demonstrate the logic of our studies, we describe a previously published experiment (the Bursar Bill Study) that demonstrates a devaluation of a goal-unrelated object (Brendl, Markman, and Higgins 1998).[1] At the time the study was presented, we did not recognize the presence of a devaluation effect. Students were asked how much they would be willing to pay for a raffle ticket with a prize of either a $1,000 waiver on their university bill or $1,000 in cash. Participants were questioned either while queuing at the bursar's office to pay their bill or while sitting in a cafeteria on campus. The goal of paying university bills should have been more active at the bursar's office than at the cafeteria.

In support of a devaluation effect, students offered the raffle with the cash prize were willing to pay less for a ticket when approached at the bursar's office (high bill paying goal) (M = $0.93) than when approached at a cafeteria (low bill paying goal) (M = $1.73), $F(1, 101) = 12.82$, $p < .01$, $\eta = .34$.[2] In contrast, students offered the raffle with a bill waiver as prize were willing to pay only nonsignificantly more for a ticket when approached in the bursar's office (high bill paying goal) (M = $1.52) than when approached at a cafeteria (low bill paying goal) (M = $1.20), $F(1, 101) = 1.41$, $p = .24$, $\eta = .12$. To support the valu-

[1] An English translation of Brendl et al. 1998 is available from the first two authors of the current article.

[2] Due to an editing error, in Markman and Brendl (2000) we had stated slightly incorrect values for two of the four means reported here. Fortunately, even these incorrect means are consistent with the conclusions we are drawing in the present article.

ation effect this difference would need to be significant. Interestingly, the devaluation effect is significant.

Because this study is correlational, we cannot rule out that the two groups of subjects differed in dimensions other than the goal to pay or need to eat.[3] To address this problem we manipulated a physiological need (the need to smoke in study 1 and the need to eat in study 2). In addition, we do not know whether the measure of willingness to pay reflects what subjects would do if given actual choices. The following study elicited real choices from subjects.

STUDY 1: THE CIGARETTE STUDY

Smoke-deprived subjects participated in a study about smoking habits. Some subjects were permitted to smoke at the start of the study, and some were not, creating either a low or high need to smoke, respectively. Disguised as part of their remuneration, subjects were allowed to purchase raffle tickets that could win cash or cigarettes (manipulated between subjects). As they were told that the raffle would be held two weeks later, neither the cash nor cigarette prize could be used to satisfy any of their current goals.

If we observe a devaluation effect in this study, then participants who could win the cash prize and have not yet smoked (and thus have a high need to smoke) should buy fewer tickets than participants who have already smoked (and thus have a low need to smoke). This prediction follows from the assumption that high smoking need leads to a devaluation of cash.

Using cash in this study is a particularly conservative test of the devaluation effect because cash can be instrumental in satisfying a smoking need in that it can be used to purchase cigarettes. Obviously, cash cannot be smoked directly and thus might not be perceived as instrumental. Finding a devaluation effect for cash would suggest that objects that can be conceptualized as instrumental may not automatically be categorized as such.

The valuation effect should be obtained for those participants who can win a cigarette prize. Participants offered a cigarette raffle who have not yet smoked (and thus have a high need to smoke) should buy more tickets than those who have already smoked (and thus have a low smoking need). The valuation and devaluation predictions are independent so that one effect could be obtained without the other.

For exploratory purposes we introduced a third manipulation inspired by research on the "endowment effect" (Kahneman, Knetsch, and Thaler 1990), which implies that people evaluate choice options but not the means with which they pay for them. We varied the stake used by subjects to purchase tickets. Half of the subjects in each condition could purchase raffle tickets using cash. The other half could purchase tickets using cigarettes. The size of stake resulted only in a main effect (reported below) and is therefore not discussed further. In sum, we predicted a valuation effect for subjects given the raffle with the cigarette prize and a devaluation effect for subjects given the raffle with the cash prize.

[3]There is one alternative explanation that probably does not apply: that those with the goal of paying with cash in a cafeteria will value money more than those with the goal of paying with checks at the bursar's office. However, students at the cafeteria were interviewed after they had paid (hence when their goal was deactivated), and most of them did not pay with cash but instead with cash credits from their meal plan.

Method

Design and Overview. The design was a 2 × 2 × 2 between-subject factorial with smoking need (low vs. high), prize (cash vs. cigarettes), and stake (cash vs. cigarettes) as between-subject factors. Smoking need was manipulated by approaching deprived smokers in a lecture hall and either letting them smoke (low need) or not letting them smoke (high need). By buying raffle tickets subjects could win a prize two weeks later, either 100 DM in cash or two cartons of cigarettes. The stake consisted of buying these tickets either with cash or with cigarettes.

Subjects. Subjects were 270 students at a German university who were habitual smokers. They took part in exchange for a cup of coffee and the opportunity to participate in a raffle. The following subjects were excluded prior to the analysis: nine subjects who indicated that they rolled their own cigarettes (for whom the value of a carton of regular cigarettes was unclear), two subjects who participated in the study but did not take part in the previous class (hence their uncertain status as smoke deprived), and four subjects due to experimenter error. The data from the remaining 255 subjects were analyzed.

Procedure and Materials. An experimenter entered a classroom either in the middle or at the end of a 90-minute class. The experimenter announced a 10-minute survey and sought the participation of smokers in exchange for a cup of coffee and the possibility of participating in a raffle. If a class had been assigned to the high smoking need condition, the experimenter remained in the classroom. Smoking in classrooms was strictly prohibited and consequently participants had been deprived of smoking for at least the duration of their class. If a class had been assigned to the low smoking need condition, the experimenter asked the subjects to step out into the hallway. Two experimenters were involved; at any given time one ran the high need condition and the other ran the low need condition, alternating with each session. The experimenter began the study by serving the promised coffee to subjects. High need subjects were required to stay in the smoke-free classroom whereas low need subjects observed how the experimenter lit a cigarette and, if they had not started to smoke already, followed this example without exception. In each condition the experimenter waited until subjects had finished their coffee and then gave each a questionnaire and an envelope.

The first page of the questionnaire served as an unobtrusive check of the smoking need manipulation and was presented as an investigation of the perception of objects in daily use. Using a scale depicting 14 cigarettes ranging in

length from 80 mm to 90 mm, subjects were asked to circle the illustration that reflected the true length of a standard cigarette. In accordance with the aforementioned studies on estimating the sizes of coins (Bruner and Goodman 1947), we expected that subjects with a high need to smoke would judge the standard cigarette to be longer than those with a low need.

The second page was a consent form presenting the raffle, which explained that, instead of paying participants individually, the money had been pooled to buy raffle prizes for which only survey participants were eligible. It stated that participation was voluntary, that a maximum of 100 persons could participate, that three prizes would be drawn, and that participants could buy as many raffle tickets as they wished. It was made clear that the raffle prizes would be drawn publicly (at least) nine days later to ensure that instant need gratification would not affect subjects' choices. Winners would be notified by mail. Responses were collected using a scale showing the number of raffle tickets purchased, with values ranging from zero to 10, plus an additional box where the subject could enter a larger number of tickets. Depending on the condition, the scale title indicated the ticket price—25 pfennigs (about 14¢) or one cigarette. The cash raffle offered three prizes of DM 100, whereas the cigarette raffle offered three prizes of two cartons of cigarettes of the brand of the subject's choice. At the time the study was run, the retail value of a carton of cigarettes was DM 50. On a subsequent page, subjects rated their current need to smoke on an eight-point scale ranging from 1 (low need) to 8 (high need).

Other items followed—including a smoking addiction questionnaire—to enhance the credibility of the experiment but are irrelevant to the present analysis. Although subjects were under the impression that the survey would begin after completion of the consent form, the actual experiment was finished at this point. Finally, subjects put their payment for tickets into an envelope and returned it along with the questionnaire to the experimenter.

The drawing was held publicly at the conclusion of the study. All winners were given cash prizes (rather than cigarettes), and all stakes were returned to subjects.

Summary of Dependent Variables. Our main dependent measure was the number of raffle tickets bought. Cigarette length estimates and ratings of need to smoke served as manipulation checks on the need to smoke.

Results and Discussion

Manipulation Checks. The first task was to judge the length of a standard cigarette on a scale ranging from short (80 mm) to long (90 mm). Subjects low in smoking need judged the length of a cigarette to be shorter ($M = 83$ mm) than those high in smoking need ($M = 85$ mm), $t(252) = 4.15$, $p < .05$, $\eta = .25$, consistent with our assumption that these two groups differed in smoking need. In addition, after making their choice, subjects rated their need to smoke on a scale from 1 (low need) to 8 (high need). Subjects who had just smoked a cigarette judged their need to be lower ($M = 3.92$) than those who had not smoked during the study ($M = 5.05$), $t(249) = 3.57$, $p < .05$, $\eta = .22$. A few subjects failed to respond to the cigarette length rating ($n = 1$) or need to smoke ratings ($n = 4$).

Number of Raffle Tickets Bought.[4] The number of raffle tickets purchased was submitted to a 2 × 2 × 2 between-subjects ANOVA of smoking need (low vs. high) × prize (cash vs. cigarettes) × stake (cash vs. cigarettes). High need subjects had not been allowed to smoke, whereas low need subjects had been allowed to smoke before filling out the survey. There were only two significant effects, all other p's $\geq .18$. First, there was a main effect of stake, such that subjects bought more raffle tickets when they paid with cash ($M = 2.78$) than with cigarettes ($M = .88$), $F(1, 247) = 32.34$, $p < .05$, $\eta = .34$. This effect, which simply reflects a scale difference between cigarettes and cash, is not germane to our hypothesis.

Consistent with our predictions, however, there was a two-way interaction between smoking need and prize, $F(1, 247) = 4.08$, $p < .05$, $\eta = .13$. When the raffle prize was cash, subjects bought significantly more tickets when their need to smoke was low ($M = 2.40$) than when it was high ($M = 1.39$), $F(1, 251) = 4.02$, $p < .05$, $\eta = .13$.[5] In contrast, when the raffle prize was cigarettes, the number of raffle tickets purchased did not differ significantly between subjects high ($M = 1.84$) or low ($M = 1.71$) in need to smoke, $F < 1$, $\eta = .02$. Thus, the valuation effect represented by the two left bars in figure 1 (top panel) was not significant.

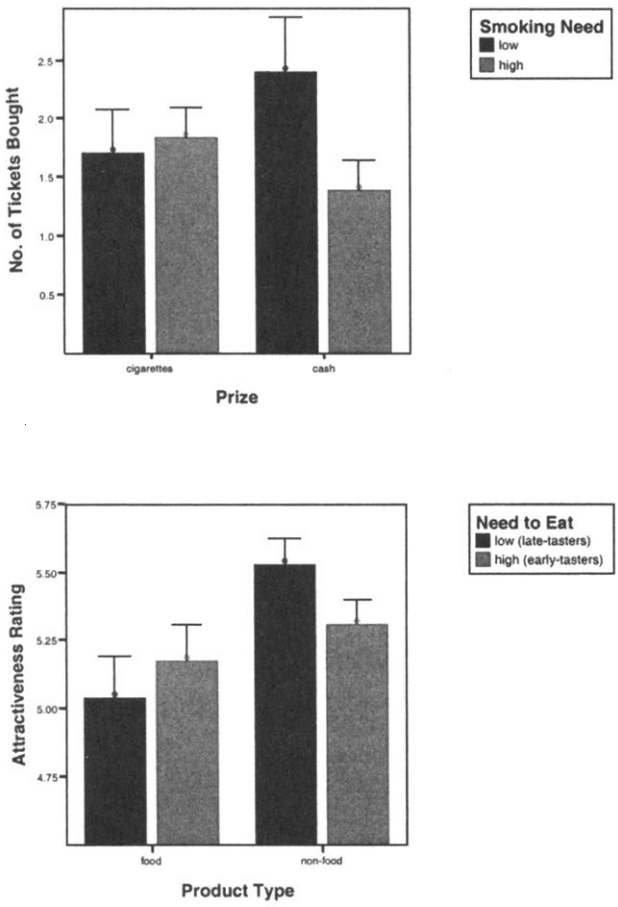
One potential locus of the devaluation effect is that subjects with a high need to smoke may be more likely than subjects in the low need condition to ignore the raffle task altogether. In this instance, we would expect that a greater proportion of subjects in the high need condition would purchase zero tickets than of those in the low need condition. In fact, the proportion of subjects who did not buy any raffle tickets was almost identical in both groups, $\chi^2 < 1$, that is, 44.1% ($n = 127$) of low need subjects and 47.7% ($n = 128$) for those high in need to smoke. Thus, the strong devaluation effect is a result of differences in the number of tickets bought between smoking need conditions, rather than a difference between smoking need conditions in the proportion of subjects who did not buy any tickets. A more complex version of this alternative interpretation of the results would be that while subjects in a high need condition would be unreceptive to raffles in general, they would be receptive to raffles that win cigarettes. For subjects high in need to smoke this hypothesis predicts more purchases of

[4]One subject in the "cash prize/low need" condition bought so many lottery tickets (40) that s/he can be considered an outlier. We recoded the bought tickets to the next lower level observed in the sample (20). Because we predict the maximal purchases of lottery tickets for this condition, this recoding is a conservative measure. In fact, without the recoding the devaluation effect reported in this section is slightly more reliable.

[5]These single degree of freedom contrasts were computed using a simple effects ANOVA with smoking need nested within prize type.

FIGURE 1

PREFERENCES AS A FUNCTION OF NEED ACTIVATION IN STUDIES 1 (TOP PANEL) AND 2 (BOTTOM PANEL)



NOTE.—Error bars represent standard errors of the mean.

raffle tickets that win cigarettes than win cash, a data pattern that was not reliable, $F(1, 251) = 1.91$, $p = .17$, $\eta = .09$. Further, this interpretation could not explain the results of study 2 (see below) and would be implausible for the Bursar Bill Study.

Study 1 is particularly related to research on the hot-cold empathy gap (Loewenstein and Schkade 1999). As in their earlier work, the present study demonstrates that subjects' choices are affected by their current motivational state even when they are likely to be in a different motivational state when the chosen outcome is obtained. Although intuition suggests that the hot-cold empathy gap results from an overvaluation of objects that can satisfy the current active motivational state, our results suggest that undervaluation of objects that are irrelevant to that state also contributes to hot-cold empathy gaps.

STUDY 2: THE POPCORN STUDY

So far, we have seen that the number of raffle tickets people purchased to win cash decreases in the presence of a strongly active need to pay a bill (Bursar Bill Study) or to smoke (study 1). This devaluation effect is interesting from the standpoint of utility theories, because although cash is instrumental for satisfying these goals, clearly subjects do not perceive it as such. One potential concern is that the devaluation effect only occurs with cash. To rule out this possibility, study 2 demonstrates a devaluation effect with a variety of consumer products. Further, to extend the construct validity of our need manipulation, the study employs a need-stimulation or appetizing manipulation instead of the need-deprivation manipulations used in the studies reported so far. Additionally, this study rules out conscious processes as causes of the devaluation effect by pitting the unconscious physiological need to eat against the conscious marker of that need (i.e., hunger). As explained below, physiological need states and their conscious markers are only very loosely correlated. Hence we were able to create an experimental group that felt hungry but had a low physiological need to eat and a second group that felt less hungry but had a higher physiological need to eat.

The manipulation in this study relies on well-established findings on the influences of eating on body function (understood intuitively by gourmets for hundreds of years). The physiological need to eat can be stimulated by first letting people taste a very small quantity of food (Cornell, Rodin, and Weingarten 1989; Rodin 1985) to prompt an appetizing effect. (To this end good French restaurants typically offer an amuse-bouche, or "mouth entertainment," to start the meal.) Research has clearly identified one important mediator of appetizing effects: the secretion of cephalic insulin, so called because it is triggered by psychological cues such as sight, smell, and taste (Powley 1977). Increased insulin levels in the blood lead in turn to increased eating behavior (Rodin 1985). Thus, a small amount of a food low in sugar (such as popcorn) should be particularly effective in stimulating the need to eat.

We differentially stimulated the need to eat by having one group taste test popcorn at the beginning of the session (early tasters) and another group at the end (late tasters). Subjects were asked to rate 43 consumer products in a putatively unrelated study that was described as collecting norms to prepare the materials for a later study. Of these, 11 were food products, and 32 were nonfood products. Thus, we first gave early tasters an appetizer followed by the rating task. In contrast, late tasters got the appetizer after the rating task. When making their ratings, early tasters should have a higher need to eat than late tasters, and the devaluation effect predicts that, on average, early tasters should give lower attractiveness ratings to nonfood products than late tasters.

This design also allows us to decouple the conscious experience of hunger from the physiological need to eat. Indeed, it has been shown that physiological processes do not necessarily map on to their conscious experiences. For example, in a typical "excitation transfer" experiment, subjects

engage in an arousing activity and some time later make a judgment. At that point, they are not conscious of the fact that the prior activity still arouses them, yet the arousal affects their judgment (Zillmann 1978). Thus, the physiological response, but not its source, affects judgment. As another example, heroin addicts offered a choice between different intravenous infusions whose contents were not specified, reliably preferred a very low dose of cocaine to a saline solution. They were unaware of this preference, as indicated by their belief that they had sampled each infusion equally often. They also felt that no solution contained a drug and rated each solution as equally unattractive (Berridge 1999).

Research on hunger and addiction has demonstrated that the conscious experience of hunger—like the subjective feeling of a drug craving—is not strongly correlated with physiological measures of need (Herman 1996; Kassel and Shiffman 1992; Pinel, Assanand, and Lehman 2000; Tiffany 1990). These consciously accessible feelings are not markers of the body's physiological needs but instead tend to occur when people are blocked from carrying out a consumption goal (Tiffany 1990). Hence it is possible to make the group with a lower physiological need feel more hungry than the group with the higher physiological need. To do so we exposed both groups to the smell of popcorn on entering the lab and told both groups that they would be given popcorn to taste, thereby increasing the physiological need to eat for both groups equally and prompting both groups to set a goal of eating popcorn.

The key difference between the groups is that early tasters ate some popcorn before making their ratings and thus have an additional physiological stimulation of their need to eat. Eating some popcorn allowed them to satisfy their eating goal. Late tasters, in contrast, did not receive the additional physiological stimulation. Thus, while both groups should be physiologically stimulated to eat by the smell, early tasters should be more stimulated by the prior taste cue. The late taster's goal of eating should be boosted by the knowledge that early tasters were already eating popcorn while they were doing the rating task, and thus they should experience more hunger because the pursuit of their goal has been blocked.

In sum, early tasters were more physiologically appetized than late tasters but the latter were blocked from pursuing their eating goal, which should result in greater hunger. We expect to observe a devaluation effect for nonfood products for the early tasters in accordance with the physiological need of the subjects but not their conscious experience of hunger. This pattern would further help to rule out the possibility that the devaluation effect occurs as a result of subjects' beliefs about how feelings of hunger influence the subjective value of nonfood products.

Method

Subjects. In exchange for course credits, 150 undergraduates at an American university were recruited. (One subject was excluded from all analyses for failing to follow instructions.)

Procedure and Materials. Subjects were put into groups of four to eight. Just before they entered the lab, a bag of microwave popcorn was popped to make the lab smell of popcorn. Subjects were told that they were taking part in a taste test and evaluation of a new brand of microwave popcorn. Half of them were given the taste test (early tasters), while the others were led into another room to perform the attractiveness ratings task (late tasters). On completion of their first task, subjects were given the other task.

At the beginning of the taste test, subjects drank a glass of water as a palate cleanser and tasted a handful of popcorn. They were then asked to indicate on a scale with five ratings the attractiveness of the popcorn they had just tasted and to answer questions about their popcorn consumption and the likelihood of purchasing the brand. The rating sheet invited subjects to eat more popcorn if they wanted, allowing them to satisfy their eating goals. In general, they did not eat more than another handful of popcorn. It is important to note that, as popcorn has few calories and is poorly digested, subjects would have to eat much more than offered to overcome the release of cephalic insulin.

The attractiveness ratings were introduced to help us norm stimuli for a future experiment. Subjects rated 43 consumer products on a scale of 1 (not very attractive) to 9 (very attractive). Of these, 11 were food products, and 32 were nonfood products. Some were generic products (e.g., DVD player), and some were specific brands (e.g., Nike sneakers). The order of the items as they appeared in the booklets was generated randomly subject to the restriction that two food products could not appear sequentially to minimize the possibility that subjects would see a connection between the parts of the study. Pages were randomly ordered for each subject. After completing their ratings, subjects were also asked to rate their level of hunger on a scale from 1 (not very hungry) to 9 (very hungry).

Results

Manipulation Check (Hunger Ratings). As expected, subjects who initially tasted the popcorn (early tasters) rated themselves as less hungry ($M = 4.11$) than did subjects who expected to taste their popcorn later (late tasters) ($M = 5.18$), $t(144) = 2.64$, $p < .01$, $\eta = .05$.[6] As indicated, the need to eat of early tasters is physiologically more stimulated than that of late tasters, even though early tasters rated themselves as less hungry. Thus, the need to eat was dissociated from feelings of hunger. One reason why hunger ratings were low for early tasters was that they could eat as much popcorn as they wanted after the taste test and thus were not conscious of any barrier to eating more food.[7]

Product Attractiveness Ratings. First, we computed

[6]Three subjects did not fill out the hunger rating.

[7]As mentioned above, subjects did not eat more than another handful of popcorn. Thus, they remained physiologically appetized.

separate arithmetic means of the attractiveness ratings of all food products and nonfood products. Subsequently, we submitted these means to a simple effects ANOVA with the factor time of tasting (early vs. late) nested within each level of the factor type of product (nonfood vs. food). Consistent with the predicted devaluation effect, early tasters evaluated nonfood products less favorably ($M = 5.31$) than did late tasters ($M = 5.53$), $F(1, 147) = 4.34$, $p < .05$, $\eta = .17$. Remember that early tasters were assumed to be physiologically appetized. In addition, as in previous studies, the valuation effect was not significant. Early tasters ($M = 5.17$) and late tasters ($M = 5.04$) evaluated food products similarly, $F(1, 147) = 1.52$, $p = .22$, $\eta = .10$ (see fig. 1, bottom panel). Not germane to our hypothesis, subjects rated nonfood products more favorably ($M = 5.41$) than food products, ($M = 5.11$), $F(1, 147) = 15.66$, $p < .05$, $\eta = .31$.

This result cannot be explained by assuming that people have a theory about how their preferences should be influenced by a need to eat. The subjective experience of hunger that is traditionally equated with the need to eat was diametrically opposed to the need to eat in this study. Thus, if people's ratings were influenced by hunger, we should have seen effects opposite to those observed. Instead, it is clear from the data that the popcorn tasting affected ratings of nonfood products.

It would further bolster our argument for a devaluation effect if we could provide independent evidence that the initial popcorn tasting stimulated the need to eat. Rating food products as more attractive after tasting popcorn would constitute such independent evidence because it would suggest a valuation effect consistent with the appetizing manipulation. However, in three studies, as well as in a meta-analysis, the valuation effects have been nonsignificant. As indicated earlier, the only domain where solid, unambiguous evidence for valuation effects exists is for certain perceptions (e.g., sweetness of taste). Although it may be possible to get a valuation effect for more abstract evaluations, they have been more difficult to obtain empirically.

In sum, study 2 provides strong evidence for a devaluation effect. Early tasters whose need to eat was stimulated by tasting popcorn rated nonfood products less favorably than did late tasters whose need to eat had not yet been stimulated. By exposing both early and late tasters to the smell of popcorn, all subjects were made aware that they would eventually eat popcorn. As a result, late tasters rated themselves as hungrier than early tasters, so it is unlikely that subjects were aware that their physiological need to eat led to a devaluation of nonfood products. Awareness should have produced the opposite effect. Finally, by extending the devaluation effect to a wide variety of consumer products, we rule out the idea that the devaluation effect is limited to the valuation of cash.

GENERAL DISCUSSION

In our studies we have consistently observed a devaluation effect. Activating a focal need decreased the evaluation of choice options unrelated to this need. In study 1, the more subjects needed to smoke, the less they paid for real raffle tickets that could win cash. In study 2, the more our subjects' physiological need to eat had been stimulated, the less attractive they rated nonfood consumer products. In a previously published study, subjects with a more active goal of paying a bill would have paid less for hypothetical raffle tickets that could have won cash than subjects with a less active goal of paying a bill (Brendl et al. 1998).

The consistency of the data across a variety of methods suggests that the devaluation effect is not an artifact of particular experimental methods. Specifically, we used both deprivation and appetizing manipulations of need, smoking and eating as needs, between-subject and within-subject measures of preference, ratings and actual choices as measures of preference, and cash and consumer products as need-unrelated objects.

Neither is the devaluation effect likely to be caused by experimenter demand effects. Both studies 1 and 2 used between-subject manipulations where subjects were not aware of the other conditions of the study. More important, in study 2, hunger—the consciously accessible marker of need to eat—was manipulated in a way that showed the opposite pattern from a need to eat. Thus, to the extent that people were relying on their theory of how hunger should influence their responses, their responses would have decreased the size of the devaluation effect.

Because our studies were designed to investigate the devaluation effect, it is difficult to draw conclusions from the nonreliable valuation effects in our data. As discussed in the introduction, valuation effects have reliably been found in the perceptual domain. It is possible that valuation effects are restricted to narrow perceptual categories and could therefore not be detected reliably in our studies. It is also conceivable that valuation effects can be more easily detected when need activation levels are considerably higher than in our studies. Our results call for a better understanding, not only of the devaluation effect, but also of the valuation effect.

Plausible but Unlikely Causes of the Devaluation Effect

The devaluation effect is an interesting phenomenon that begs further explanation. While the current research does not aim to distinguish among explanations, in the following section we consider mechanisms that have been posited for related phenomena, although none are likely candidates to explain the devaluation effect.

Implementation Intentions. Gollwitzer (1993) has demonstrated that simply committing to a goal is often not sufficient to drive behavior: people must also develop specific plans or "implementation intentions" to carry out goal-directed actions. The intention to pursue a particular action could devalue objects unrelated to that action. Implementation intentions cannot be the sole explanation for the devaluation effects reported here. If study 2 subjects focused

on their hunger—which is their consciously accessible marker of need activation— they would have exhibited a pattern opposite to that obtained.

Postchoice Dissonance. When people commit to an action, their evaluation of options to which they are not committed will decrease. One common example of this phenomenon is postchoice dissonance reduction where people devalue an option they did not select (Festinger 1957). This type of devaluation would not explain the effects of the present studies because devaluations occurred before subjects made choices.

Prechoice Devaluation of Related Choice Options. A related phenomenon has been demonstrated prior to commitment to choice by Russo and colleagues (e.g., Russo, Medvec, and Meloy 1996; Russo, Meloy, and Medvec 1998). In their research, subjects chose between two choice options such as buying one of two backpacks. Initially, they were provided with a reason to prefer one over the other that was unrelated to the product's features, for example, one backpack was produced by an alumnus of their alma mater. As decision makers subsequently received product information about the backpacks, they distorted the product information in favor of the initially endowed backpack (Russo et al. 1998), perhaps in an effort to maintain evaluative consistency between the initial endowment and subsequent product evaluations.

We believe that our work complements that of Russo and his colleagues whose hypothesis implies that people will both favor the endowed object and reduce the desirability of the nonendowed object. This reduced desirability is a type of devaluation effect. Like Russo et al., we suggest that an evaluative distortion can occur prior to committing to an action. Whereas their work has focused on precommitment distortions of related choice options, we focus on precommitment distortions of unrelated choice options. Our work suggests that the predecisional distortions they discovered extend to unrelated choice options.

Shifts of Attention toward Focal Needs. The devaluation effect could perhaps be explained as a shift in attentional resources to goal-related objects, leading to a devaluation of unattended objects. This process predicts stronger valuation than devaluation effects because limited attentional resources are shifted away from multiple goal-unrelated objects to just a few goal-related objects. Consequently, the increase in assigned resources to related objects ought be bigger than the decrease in resources from unrelated objects. The data pattern across all of our studies does not support this prediction.

Possible Causes of the Devaluation Effect

The existing data place some constraints on an explanation of the devaluation effect. An explanation must not require that subjects deliberately focus on some needs nor that they commit explicitly to an action or to a goal. Instead, the mechanism underlying the devaluation effect appears to function outside of awareness. Note, however, that our subjects always had the intention of evaluating something. Thus, we cannot (and do not wish to) conclude that devaluation is an uncontrollable response that occurs upon perceiving an object. It might involve goal-dependent automaticity (Bargh 1989), that is, automaticity that presupposes the goal of evaluating some object.

We see three types of processes that could satisfy the above constraints. First, motivational activation might be a limited resource so that activating a particular need draws activation away from unrelated needs and goals. Second, activation of one need or goal might inhibit unrelated needs and goals. In both cases, activation of one goal decreases the activation of unrelated goals, which in turn decreases the evaluation of objects associated with them. A third possibility is that the activation level of unrelated needs and goals does not change but their access to evaluative responses is blocked. We discuss each of these options in turn.

Drawing Activation Away from Unrelated Needs and Goals. Devaluation could be explained by assuming that motivational activation is a limited resource. In this view, activating one goal necessarily draws activation away from other goals. This proposal is consistent with Anderson, Reder, and Lebiere's (1996) suggestion that working memory reflects a cap on the total amount of activation that can flow through a semantic network. Thus, increasing the activation of one concept will decrease the activation of other concepts (see Alba and Chattopadhyay [1985, 1986], for related mechanisms).

While this hypothesis is quite plausible, its simplest version predicts that valuation effects would be larger than devaluation effects. In particular, when the activation of a specific goal increases, the combined activation of other goals must decrease by an equivalent amount. Assuming that there are many active goals, this decrease can be spread across many different products, so the valuation effect should be larger than the devaluation effect. Although this is not borne out by our findings, we nonetheless feel this view warrants further study.

Inhibition of Unrelated Needs and Goals. In many domains of psychology there is evidence for active inhibitory processes. For example, retrieving one item involves actively inhibiting competing items in memory (Anderson, Green, and McCulloch 2000Anderson and Spellman 1995). Similarly, when a word has many meanings, those that are irrelevant to a particular context are actively inhibited during comprehension (Gernsbacher and Faust 1991; Neely 1976). Synaptic inhibition is also a well-known neural mechanism (e.g., Kuffler, Nichols, and Martin 1984). Likewise, one possible explanation for the devaluation effect is that activating a focal need inhibits the activation level of unrelated needs and goals. Such a mechanism would not require the valuation effect to be larger than the devaluation effect and would even allow for valuation and devaluation effects to be governed by independent processes.

Although inhibition of unrelated goals is a promising

mechanism for explaining devaluation effects, it is inefficient for one active goal to inhibit all other goals in the motivational system. As an alternative, the motivational system may only inhibit goals and needs that are proximal to the focal need and thus may compete with it. Such a mechanism would be akin to the center-surround inhibitory mechanisms that are well known from perception (Kuffler et al. 1984). Consistent with this possibility, Brendl, Higgins, and Lemm (1995) explored subjects' sensitivity to gains and losses and found that subjects were particularly insensitive to events that were somewhat dissimilar to their chronic goals, but regained sensitivity to events that were very dissimilar to their chronic goals. These investigators posited an inhibitory mechanism to explain this phenomenon.

Note that the term "inhibition" is used in (at least) three different ways in psychology. Inhibition may describe behavior rather than process (e.g., a decline in performance) or a decrease in the overall activation or accessibility of a mental representation, or it may mean that a particular mental process is blocked from using a certain type of information. Our use of "inhibition" does not refer to behavior but to process. The studies in this section focus primarily on effects of decreasing the overall accessibility of a mental representation. In the next section we focus on inhibitory processes that interfere with the ability of a mental process to make use of evaluative information.

Blocked Access to Evaluative Responses. In demonstrations of negative priming the time to identify a probe stimulus is slowed when subjects are instructed to ignore that stimulus in a previous trial. Two processes contribute to this effect. One involves blocking the access of mental representations of previously ignored distractors to response mechanisms (Tipper and Cranston 1985); the other involves retrieving an episodic memory during the probe trial for the priming episode. That memory has a "do not respond" tag attached to the prime that then interferes with responding to the probe when the two are identical. Both mechanisms operate after the distractor has been selected by blocking access to response mechanisms (Neill, Valdes, and Terry 1995).

Similarly, in demonstrations of retrieval interference, cued recall of a target advertisement is weakened by presenting it in the context of distractor advertisements for competing brands. This inhibition of behavioral performance is caused by an increase in associations between the retrieval cue (e.g., the brand name) and other mental representations (e.g., distractor advertisements). It is not caused by an inhibition of the mental representation of the target advertisement itself (Burke and Srull 1988).

We must be clear that we do not think that the devaluation effect is an instance of negative priming, because this requires that subjects actively ignore distractors (Neill et al. 1995). Rather, explanations of negative priming focus on how access to information may be blocked without decreasing the activation of that information. Similarly, devaluation may occur when access to representations responsible for evaluative responses is blocked rather than being inhibited. Again, further research is required to explore this possibility.

Level of Need Activation as a Moderating Condition

The lack of evidence for valuation effects in our studies is counterintuitive. It is possible that our manipulations of need strength were not sufficient to lead to a valuation effect. Studies of valuation have not looked explicitly at the strength of the manipulated goal. A more explicit variation of goal or need strength might illuminate this issue. In this context it is noteworthy that the devaluation effect is detectable at the levels of need activation used in our studies. Furthermore, an increase in goal strength would likely increase the devaluation effect (in addition to any effects it has on valuation effects). This prediction accords with intuition, for example, that intense thirst would lead to a low level of interest in bargains on non-drink-related items such as jewelry. Furthermore, each of three hypothesized mediators discussed in the previous section predicts that stronger need activation will lead to a stronger devaluation effect. Activating a focal need more strongly should draw more activation away from other needs, inhibit unrelated needs more strongly, and block access to unrelated evaluative responses more strongly.

Implications for the Formation of Preferences

Utility models suggest that objects are valued to the extent that they can be used for satisfying a current goal. The present results place two constraints on this view. First, the value of objects decreases when the objects are perceived as unrelated to the active goal. Second, relatedness to a goal is a psychological measure, not a logical one. Thus, some objects that can be used to satisfy a goal (e.g., money) may not be perceived psychologically as instrumental. We now consider the implications of these constraints for theories of preference formation.

Prediction of Own Preferences. Loewenstein and colleague's work on the hot-cold empathy gap predicts that people's choices for future consumption are based on the activation level of their present goals and needs because they cannot mentally simulate future motivational states (Loewenstein 1996). Consumers do not seem to learn adequate theories about how preferences are affected by goals and needs even though these would improve their predictions. The devaluation effect might contribute to this learning difficulty because consumers would need to attend to irrelevant information to detect devaluation.

Instrumentality. Economists attribute special value to cash because of its fungibility. The system responsible for the devaluation effect does not seem to recognize this advantage. It devalues cash in the presence of goals that could be satisfied with cash. Loewenstein (2001) suggested that decisions are not driven by careful deliberations but by au-

tomatic pattern-matching and categorization processes that then trigger category-specific decision rules. We suspect that the devaluation of cash is the result of such a pattern-matching process. Cash is not likely to be categorized as smokable, although one can logically reason that cash can buy cigarettes. These results suggest that perceived instrumentality is not necessarily the result of logical reasoning but of fast perceptual processes. If people reason, they may be left with two conflicting and coexisting representations of the instrumentality of an object. This view would be consistent with advances in the psychology of reasoning (Sloman 1996) and in the psychology of attitudes (Wilson, Lindsey, and Schooler 2000).

The Structure of Needs and Goals. To date, researchers have focused on hierarchical means-ends relations and on relations of logically derived instrumentality (e.g., Bagozzi and Dholakia 1999; Carver and Scheier 1981; Miller, Galanter, and Pribram 1960; Ratneshwar et al. 2000). As discussed, means-ends relations are mental representations that result from reasoning about goals, but it is not clear that we have full conscious access to our needs and goals (Loewenstein 1996). To the degree that needs and goals are the representational structures of the motivational system, our findings suggest the intriguing possibility that the motivational system is structured differently than previously assumed. If conscious access to needs and goals is limited, then figuring out that structure is difficult. The devaluation effect could serve as a tool in mapping out the structure of needs and goals. In particular, to determine the breadth of a goal's end state, it should be possible to activate one goal and then see what objects are devalued as a result of that activation.

Where Do Our Conscious Goals Come From? Finally, we do consciously commit to goals, producing actions that turn these goals into reality. We know very little, however, about the processes that let us commit to a particular goal. Our choice of which goals to pursue cannot be driven solely by reasoning—there are simply too many goals and needs to be able to reason about all of them. Devaluation might be one principle involved in creating equilibrium in a system with so many components, serving the function of keeping the system focused.

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