Semantic Anchoring in Sequential Evaluations of Vices and Virtues

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Abstract

How do people evaluate sequentially presented items? Prior research suggests that sequential evaluations are subject to anchoring biases, such that the values of subsequently evaluated alternatives are assimilated toward the initially considered option. The present research argues, however, that sequential valuations often lead to contrast rather than assimilation effects, whereby values of the subsequently estimated alternatives are distanced from the initially evaluated option. These contrast effects are attributed to semantic anchoring, which stems from evaluating conceptually related options classified into opposing categories (e.g., vices and virtues).

Consumer decisions often involve numeric estimates. For example, evaluating the nutritional value of a meal involves estimating its calorie content, and bidding in online auctions involves estimating the monetary value of the target items. Such estimates are often derived in a sequential manner: Evaluating the healthiness of a meal might involve evaluating the caloric content of the appetizer, the entrée, and the dessert; estimating the monetary value of an item often occurs in the context of a series of similar estimates. The sequential manner in which many numeric estimates are derived raises the question of whether and how initially generated estimates influence subsequently generated ones.

Much research has argued that numeric judgments made under uncertainty are easily influenced by readily available anchors (Tversky and Kahneman 1974; Chapman and Johnson 1999). Thus, it has been shown that sequential evaluations typically result in assimilation of the numeric estimate toward initially generated values, such that smaller initial estimates are likely to produce smaller subsequent estimates and larger initial estimates are likely to lead to larger subsequent estimates (Ariely, Loewenstein, and Prelec 2003; Epley and Gilovich 2006; Wilson et al. 1996). To illustrate, consider two individuals deciding on a meal. Both order a burger; however, one orders a green salad as an appetizer, whereas the other orders a plate of fried cheese bites as an appetizer. Would these individuals vary in their evaluation of the calorie content of the burger? Most prior anchoring research will predict that individuals who think that the salad has fewer calories than the fried cheese bites will also think that the subsequently evaluated burger has fewer calories as well.

The research presented in this article argues, however, that this is not always the case and that sequential evaluations depend not only on the numeric value of the previously evaluated item but also on the semantic relationship between the evaluated items and whether these items are perceived as representing similar or opposing categories. In particular, this research predicts that for items classified into opposing categories (e.g., healthy and unhealthy), lower initial estimates can lead to higher (rather than lower) subsequent estimates, and vice versa. In the context of the above example, this implies that people are likely to believe that the burger has more calories when it is preceded by a low-calorie salad than when preceded by a high-calorie plate of fried cheese bites.

This research argues that evaluations of options classified into opposing categories will lead to a contrast effect stemming from the semantic relationship between these options. In particular, this research focuses on one specific case of such categorization that classifies options according to a good/bad dichotomy into vices or virtues. Building on the existing literature (Wertenbroch 1998; Khan and Dhar 2006; Scott et al. 2008), this research conceptualizes virtues as items that are consistent with long-term self-control goals (e.g., losing weight) but do not necessarily offer immediate gratification. On the other hand, vices are defined as items that are consistent with short-term goals of immediate gratification (e.g., eating a chocolate cake) but are inconsistent with longer term self-control goals (e.g., losing weight). To illustrate, fruits and vegetables are often considered as inherently healthy and, hence, classified as virtues. In contrast, “indulgent” foods such as chocolate cake, ice cream, and French fries are considered to be inherently unhealthy and, hence, classified as vices. In the same vein, options described by qualifiers such as light, fat-free, and low-fat tend to be classified as virtues, whereas options described by qualifiers such as rich, creamy, and decadent are more likely to be classified as vices.

In this context, this research posits that the anchoring effects in estimating the calorie content of sequentially presented items are a function of the semantic relationship between these items, such that sequences of options classified into opposing categories (i.e., a virtue and a vice) are

likely to produce a contrast rather than assimilation effect. The rationale for this prediction is described in more detail in the following sections.

THEORETICAL BACKGROUND

Anchoring Effects in Deriving Numeric Estimates

Normative theories predict that the value judgments derived by a "rational" individual should not be contingent on the decision context (Keeney and Raiffa 1976). With respect to sequentially evaluated options, this view implies that people's judgments of an option's value should not be influenced by the sequence in which they are generated (Tversky and Kahneman 1988).

The proposition that people's decisions are independent of the context in which the decision is made has been challenged by mounting evidence suggesting that numeric judgments made under uncertainty are easily influenced by readily available anchors (Tversky and Kahneman 1974; Chapman and Johnson 1999; Jacowitz and Kahneman 1995). Thus, it has been shown that sequential evaluations typically result in assimilation of numeric estimates toward initially generated values, such that smaller initial estimates are likely to produce smaller subsequent estimates and larger initial estimates are likely to lead to larger subsequent estimates (Ariely, Loewenstein, and Prelec 2003; 2006).

For example, in one of the classic illustrations of the anchoring effect, respondents were given a random number between 1 and 100 that was determined by spinning a wheel of fortune and were asked to indicate whether the percentage of African nations in the United Nations was higher or lower than that number. Next, respondents were asked to estimate the actual number of African nations in the United Nations. The results indicated that respondents' absolute estimates were significantly influenced by the magnitude of the initially provided anchor, such that those who received a higher number on the wheel gave higher absolute estimates (Tversky and Kahneman 1974).

Anchoring has been demonstrated by numerous studies in a broad array of decision domains, including probability judgments (Hogarth and Einhorn 1992; Jacowitz and Kahneman 1995), value judgments (Johnson and Schkade 1989), preference reversals (Lichtenstein and Slovic 1971), hindsight (Pohl and Hell 1996), causal attribution (Quattrone 1982), and behavior (Switzer and Sniezek 1991). Anchoring effects have been further recorded in decision tasks such as naming dates of historic events (Russo and Schoemaker 1990), purchase quantity decisions (Wansink, Kent, and Hoch 1998), real estate appraisals (Northcraft and Neale 1987), and price estimates (Ariely, Loewenstein, and Prelec 2003; Nunes and Boatwright 2004; Matthews and Stewart 2009). Anchoring has further been shown to occur for both externally provided (e.g., Tversky and Kahneman 1974) and self-generated (e.g., Epley and Gilovich 2001; 2006; Chandon and Wansink 2007a) anchors. Across these domains, studies document remarkable robustness of the basic finding that numeric estimates are assimilated toward a previously considered anchor (Wilson et al. 1996).

This research argues, however, that the assimilation effect predicted by the anchoring theories does not necessarily apply to evaluating conceptually related items. In such cases, individuals' estimates are likely to be determined not only by the numeric values of the initially considered options but also by their semantic relationship, and can result in assimilation as well as contrast

effects. The role of semantic anchoring in value judgments is discussed in more detail in the following section.

Semantic Anchoring in Deriving Sequential Estimates

This research argues that sequential value judgments are subject to anchoring effects that result from evaluations of the available information on two dimensions: numeric and semantic. The numeric evaluation involves estimating the quantitative aspect of the options and is typically expressed as a number. In contrast, the semantic evaluation involves value judgments based on the meaning of the options and is typically articulated in the form of qualitative judgments. For example, when estimating the calories in a meal, the numeric dimension is represented by judgments of the caloric content of the evaluated options, and the semantic dimension is represented by judgments of the meal's healthiness. The proposition that anchoring can involve both a numeric and a semantic component builds on prior research arguing that conceptual knowledge plays an important role in explaining the assimilation of a numeric estimate toward a previously considered anchor (Mussweiler and Strack 2001; Mussweiler 2003; Strack and Mussweiler 1997).

How do numeric and semantic anchors influence individuals' estimates of sequentially presented items? This research argues that estimates of sequentially presented items are a function of the nature of the conceptual relationship between these options and, in particular, whether these options are classified in the same or opposing categories. The numeric and semantic aspects of anchoring are discussed in more detail below.

First, consider a scenario in which individuals evaluate a sequence of two items classified into the same category (i.e., two vices or two virtues). Numeric estimations of such items are likely to produce an assimilation effect, such that individuals' estimates are assimilated toward the initially presented or derived anchor. For example, an item is likely to be judged as having more calories when preceded by a 500-calorie item than when preceded by a 100-calorie item. When both options belong to the same category, semantic evaluations are also likely to produce assimilation effects, such that the interpretation of the meaning of the subsequently evaluated option is assimilated toward the anchor (Herr, Sherman, and Fazio 1983; Mussweiler and Strack 2001; Schwarz and Bless 1992). For example, a cheeseburger is likely to be evaluated as less healthy when preceded by a chocolate dessert than when preceded by a hamburger. Thus, for sequences comprising either two virtues or two vices, both numeric and semantic anchoring are likely to lead to assimilation of the subsequently derived value toward the initially generated anchor.

Now, consider a scenario in which individuals are presented with a sequence of items classified into opposing categories (e.g., a vice and a virtue). Reliance purely on the numeric anchor in this case is likely to lead to the same assimilation effect as for options classified in the same category. The availability of a semantic anchor, however, is likely to produce a directionally opposite effect, leading to a contrast rather than an assimilation. For example, a cheeseburger following a green salad is likely to be judged as having more calories than the same cheeseburger preceded by a plate of fried cheese bites.

The proposition that sequential evaluations of vice/virtue combinations will lead to a contrast effect builds on prior research in the domain of social psychology arguing that classifying options into opposing categories is likely to polarize their meaning (Kenrick and Gutierres 1980; Schwarz and Bless 1992). Applied to anchoring, these findings imply that if the reference object is similar to the

target, it is likely to be used as a basis for judgments, resulting in an assimilation of the target toward the reference object. When the reference object is largely dissimilar from the target, however, it is likely to be used as a point of comparison, resulting in a contrast rather than assimilation effect (Mussweiler and Strack 2001; Strack and Mussweiler 1997; Yi-Wen et al. forthcoming). This argument is consistent with the finding that an object is likely to be judged as more extreme when following a dissimilar prime (Herr, Sherman, and Fazio 1983). For example, even though a fox is described as more ferocious following a similar semantic prime (wolf), it is described as less ferocious following a dissimilar prime (tiger). In the same vein, McFerran and colleagues (2010) have argued that the assimilation effect is attenuated when the anchor (obese or thin bystander) is different from the (thin) target.

The above discussion predicts that for options classified into opposing categories, numeric and semantic priming will lead to directionally inconsistent effects. Furthermore, this research argues that the contrast effect resulting from evaluating conceptually opposing options will overcome the assimilation effect stemming from numeric anchoring; as a result, for combinations of options classified into opposing categories, the net effect will be contrast rather than assimilation. The proposition that the semantic contrast dominates the numeric effects is consistent with prior research in social psychology suggesting that semantic anchoring effects can be more potent than purely numeric effects (Mussweiler and Strack 2000).

More generally, this research argues that sequential value judgments are a function of two types of anchoring effects: numeric and semantic. For sequences comprising same-category items (two vices or two virtues), both numeric and semantic evaluations will lead to assimilation toward the initially presented option. For sequences comprising items classified into opposing categories (a virtue and a vice), however, the assimilation effects associated with numeric anchoring will be countered by the contrast effects invoked by the semantic anchoring, resulting in a net contrast effect. These predictions are tested in a series of six empirical studies.

The experiments reported in this research examine semantic anchoring in the context of evaluating the calorie content of sequentially evaluated food items. This choice of context is driven by several considerations. Food consumption represents an important aspect of individuals' daily life; we are routinely exposed to sequences of products and, implicitly or explicitly, categorize them into vices and virtues. Moreover, most individuals are familiar with the concept of calories and are likely to view calorie estimation as a relevant task. People's ability to accurately evaluate a meal's calorie content also has important public policy implications, stemming from the fact that calorie overconsumption has been identified as one of the primary sources contributing to the obesity epidemic (Chandon 2009; Heini and Weinsier 1997; Olshansky et al. 2005). Accordingly, the six experiments reported in this research examine how people estimate the calorie content of sequentially evaluated food items and how initial evaluations influence subsequently generated estimates.

EXPERIMENT 1

This experiment examined whether and how the type of initially evaluated option influences subsequent value judgments. In particular, it tested the proposition that people are more likely to perceive a vice to have more calories when preceded by a virtue than when preceded by another vice. This experiment further examined whether the relative strength of this contrast effect is a

function of the degree to which the evaluated items are prototypical of the underlying categories. The more prototypical of a vice or virtue the evaluated options are, the greater the contrast effect stemming from semantic anchoring should be.

Method

Respondents were 264 undergraduates recruited to participate in an online survey on food preferences. They were randomly assigned to one of four experimental conditions and asked to evaluate different types of desserts. In some of the conditions the dessert was a fruit salad (virtue), and in the others it was a cake (vice). In addition, each of the two desserts was framed as either more or less prototypical of a virtue/vice. Thus, in some of the conditions, the fruit salad was described as an "organic fruit salad" (pure virtue), whereas in others it was described as a "fruit and bacon salad" (mixed virtue). Similarly, the cake was described as either a "decadent cheesecake" (pure vice) or as a "low-fat cheesecake" (mixed vice). Respondents were asked to evaluate the healthiness of the cake/salad using a 100-point ungraded scale (represented as a slider) with endpoints of "very healthy" and "very unhealthy." Following evaluation of the dessert, respondents in all conditions were shown a cheeseburger and asked to provide a numeric estimate of its calorie content.

The overall experimental design was a 2 (anchor type: virtue vs. vice) x 2 (anchor prototypicality: pure vice/virtue vs. mixed vice/virtue) between-subjects design. The stimuli included both verbal descriptions (e.g., "organic fruit salad," "decadent cheesecake," and "cheeseburger") and a pictorial representation. The design of the stimuli (a cake representing a vice and fruit salad representing a virtue) is consistent with prior research (Chandon and Wansink 2007b; Raghunathan, Naylor, and Hoyer 2006; Shiv and Fedorikhin 1999; Wertenbroch 1998).

Results and Discussion

This research argued that sequential numeric estimates are influenced by the presence of semantic anchors, such that combinations of items classified into opposing categories (e.g., a virtue and a vice) lead to a contrast effect, whereas combinations of options classified in the same category (e.g., two vices) lead to an assimilation effect. Furthermore, the assimilation and contrast effects were predicted to be more pronounced in the case of anchors perceived to be more prototypical of either a vice or a virtue.

The effectiveness of the framing of the vice/virtue anchors was examined by comparing respondents' ratings of the healthiness of these options. In this and the following experiments, the data were analyzed using a model in which calorie estimates were given as a function of the experimental design factors (e.g., anchor type and anchor prototypicality) and their interaction (Winer, Brown, and Michels 1991). The data show that the pure virtue was perceived to be significantly healthier than the mixed virtue ($M = 13.0$ vs. $M = 36.0$; $F(1,263) = 57.6$; $p < .001$), and that the pure vice was perceived to be significantly less healthy than the mixed vice ($M = 72.7$ vs. $M = 43.2$; $F(1,263) = 91.1$; $p < .001$). In addition, the mixed virtue was perceived to be significantly more healthy than the mixed vice ($M = 36.0$ vs. $M = 43.2$; $F(1,263) = 5.33$; $p < .01$). These data indicate that the virtue/vice framing manipulation was successful.

The data illustrated in Table 1 show that respondents in the pure virtue condition estimated the calorie content of the burger to be higher than those in the pure vice condition (M = 1041 vs. M = 780; $F(1,263) = 15.98$; $p < .001$). The data further indicate that the difference in evaluations following the virtue/vice anchor was eliminated when the anchor description was less prototypical (mixed virtue/vice: 891 vs. 896; $F < 1$, *NS*). These findings are consistent with the notion that the nature of the initially presented anchor (vice or virtue) is likely to influence the subsequent value judgments.

Table 1

More important, the data show that the impact of option type (vice vs. virtue) on the subsequent calorie estimates was a function of the option frame ($F(1,263) = 8.07$; $p < .005$). In particular, when the initially evaluated option was framed as a pure virtue (organic fruit salad), the subsequently evaluated vice was perceived to have more calories than when the initially evaluated option was framed as a mixed virtue (M = 1,041 vs. M = 891; $F(1,263) = 5.21$; $p < .01$). In the same vein, when the initially evaluated option was framed as a pure vice, the subsequently evaluated vice was perceived to have fewer calories than when the initially evaluated option was framed as a mixed vice (M = 780 vs. M = 896; $F(1,263) = 3.03$; $p < .05$). These data lend support to the proposition that observed estimation biases are moderated by the type (virtue or vice) and prototypicality (pure or mixed vice/virtue) of the anchor.

The data furnished by this experiment are consistent with the proposition that combinations of options classified into opposing categories are more likely to result in a contrast effect, whereas combinations of options classified in the same category (e.g., two vices) are more likely to lead to an assimilation effect. Thus, the data show that a vice is likely to be perceived as having a higher calorie content following a virtue rather than a vice—a finding contrary to predictions made by the traditional anchoring literature, which argues that lower calorie options (virtues) are likely to lead to lower, rather than higher, subsequent estimates. The data further show that the assimilation and contrast effects tend to level off in the case of virtues/vices perceived to be less prototypical (mixed)—a finding consistent with the proposition that numeric value judgments, such as calorie estimation, are a function of the semantic relationship between the evaluated options.

Overall, this experiment documented the impact of the type and prototypicality of the anchor on subsequent numeric estimates in a scenario in which respondents were not provided with a numeric value of the anchor. Because the availability of numeric estimates of the anchor is essential for the occurrence of assimilation effects reported by prior research (Chapman and Johnson 1999; Jacowitz and Kahneman 1995), it is also important to examine whether the observed semantic contrast effects exist in the presence of directionally opposite numeric assimilation effects. Therefore, the following experiment aimed to validate the semantic anchoring effects in the context of the traditional anchoring paradigm, which involved an externally provided numeric anchor and a subsequent comparison task (Tversky and Kahneman 1974).

EXPERIMENT 2

The goal of this experiment was to document that the semantic anchoring observed in the first experiment can occur even in the presence of numeric anchors. In particular, this experiment aimed to document that people tend to overestimate the calorie content of a vice following a virtue even when the numeric value (calorie content) of the initially considered option is readily available.

Method

Respondents were 150 undergraduates recruited to participate in an online survey on consumer food preferences. The overall design was conceptually similar to the traditional paradigm for testing the anchoring effect (Tversky and Kahneman 1974). Each of the respondents was first shown a dessert and asked to evaluate its healthiness using a binary response scale (very healthy vs. very unhealthy). Some of the respondents were presented with a dessert described as having 180 calories while the others were told that the dessert contained 360 calories. Respondents were then presented with a second option (a cheeseburger) and asked to evaluate whether it had more or fewer calories than the dessert they had just seen. Following this comparison task, respondents were asked to estimate the actual calorie content of the cheeseburger. Finally, respondents were asked to recall the calorie content of the initially shown dessert.

As in the first experiment, this study varied the framing of the dessert as either a vice or a virtue. Thus, for some of the respondents the dessert was described as a "decadent cheesecake," whereas for others it was described as an "organic fruit salad." The study involved a 2 (anchor value: 180 vs. 360) x 2 (anchor type: virtue vs. vice) between-subjects design. The stimuli included both verbal descriptions (e.g., "fruit salad," "decadent cheesecake," and "cheeseburger") and a pictorial representation.

Results and Discussion

This research theorized that the semantic contrast observed in the first experiment would occur even in the presence of numerical anchors. In particular, individuals were predicted to overestimate the calorie content of a vice following a virtue even when the numeric value (calorie content) of the initially considered option was readily available.

The data show a significant main effect of the calorie manipulation on the subsequently generated numeric estimate, whereby respondents evaluated the burger following a 180-calorie item to have fewer calories than a burger following a 360-calorie item ($F(1,149) = 8.09$; $p < .01$). This effect was significant for both virtue/vice and vice/vice conditions, indicating that in both cases lower numeric anchor values were associated with lower subsequent estimates ($M = 638$ vs. $M = 713$; $F(1,149) = 3.92$; $p < .05$ for the virtue/vice condition and $M = 473$ vs. $M = 550$; $F(1,149) = 4.18$; $p < .05$ for the vice/vice condition).

The data illustrated in Table 2 show that respondents estimated the cheeseburger to have more calories after evaluating a salad than after evaluating a cake, regardless of their calorie content. In particular, respondents evaluated the cheeseburger as having 638 calories when following a 180-calorie salad, but as having only 473 calories following a 180-calorie cake ($F(1,149) = 19.18$; $p < .001$). Similarly, the cheeseburger was perceived to have 713 calories following a 360-calorie salad but only 550 calories following a 360-calorie cake ($F(1,149) = 18.61$; $p < .001$). The observed

contrast effect was similar in magnitude across both calorie conditions (180 vs. 360), as indicated by the non-significant interaction ($F(1,149) < 1$; NS). These data lend support to the proposition that the vice/virtue categorization of the anchor is likely to influence subsequent value judgments. Moreover, because the calorie content was held constant in each of these conditions, the observed differences in the subsequently generated calorie estimates cannot be attributed to anchoring-and-adjustment effects derived from the numeric values of the available anchors.

Table 2

The data further show that respondents evaluated the cheeseburger as having more calories following a 180-calorie salad than following a 360-calorie cake ($M = 638$ vs. $M = 550$; $F(1,149) = 5.24$; $p < .001$). This finding offers more direct support for the proposition that the semantic relationship between decision options can influence sequential judgments in a way that is directionally opposite to that predicted by the anchoring-and-adjustment theory. Indeed, numeric anchoring predicts that the cheeseburger would be evaluated as having fewer calories when preceded by a lower rather than higher anchor. In contrast, the data show that sequential evaluations of combinations of vices and virtues can lead to contrast rather than assimilation effects.

The data furnished by this experiment offer more direct evidence for the impact of semantic anchoring on subsequent numeric estimates. In particular, this study shows that the contrast effect associated with semantic anchoring occurs even in the presence of a numeric anchor, such that a vice preceded by a virtue is believed to have more calories than when it is preceded by another vice. Experiment 2 examined this proposition in a scenario where the numeric estimate of the anchor's calorie content was made readily available to individuals. On many occasions, however, the calorie content of the initially evaluated item is not readily available and is likely to be inferred. This raises the question of whether people's decisions will be influenced by their self-generated estimates (rather than externally provided anchors) of the calorie content of the initially evaluated item. Therefore, the following experiment examined whether this contrast effect occurs in the presence of self-generated (rather than readily provided) numeric anchors.

EXPERIMENT 3

The goal of this experiment was to show that the contrast effect reported in the first two studies holds even in the presence of self-generated numeric anchors. In addition, this experiment aimed to document the contrast effect for both virtue-vice and vice-virtue sequences.

Method

Respondents were 134 participants in an executive business seminar asked to evaluate the calorie content of two sequentially presented items: a dessert and a cheesesteak. For some of the respondents the dessert was a vice (chocolate cake), whereas for the others the dessert was a virtue (fruit salad). In addition to varying anchor type (virtue vs. vice), some of the respondents were shown the cheesesteak first, whereas others were shown the dessert first. The purpose of

varying the order in which the two items were presented to respondents was to examine whether a vice/virtue sequence would lead to the same contrast effects as a virtue/vice sequence. In particular, semantic anchoring theory predicts that a vice followed by a virtue will produce the same type of contrast effects as a virtue followed by a vice.

The experimental procedure involved a 2 (anchor type: virtue vs. vice) x 2 (option sequence: dessert/cheesesteak vs. cheesesteak/dessert) between-subjects design. The stimuli included verbal descriptions (e.g., "cheesesteak") and a pictorial representation. The study involved a paper-and-pencil task completed individually by respondents at their own pace.

Results and Discussion

This research argued that the contrast effect reported in the first two experiments would hold even in the presence of self-generated numeric anchors. In particular, a vice was predicted to be perceived as having a higher caloric content when it was preceded by a virtue (salad/cheesesteak sequence) than when it was preceded by a vice (cake/cheesesteak sequence).

The data summarized in Table 3 reveal that respondents shown the salad/cheesesteak sequence estimated the calorie content of the cheesesteak to be higher than those shown the cake/cheesesteak sequence (M = 787 vs. M = 489; $F(1,133) = 19.57$; $p < .001$). Furthermore, respondents in the salad/cheesesteak condition also perceived the entire meal to have more calories than those in the cake/cheesesteak condition (M = 1,097 vs. M = 905; $F(1,133) = 3.25$; $p < .05$), even though they estimated the salad to have fewer calories than the cake (M = 311 vs. M = 416; $F(1,133) = 3.03$; $p < .05$). These findings lend support to the proposition that sequences of items classified into opposing categories will lead to a contrast effect, whereby a vice is perceived as having higher caloric content when it is preceded by a virtue than when it is preceded by a vice.

Table 3

An important question raised by these findings concerns the nature of the reported biases in sequential value judgments. The data reported so far did not offer clear evidence as to whether the differences in the calorie estimates were caused by overestimation of the calorie content of the cheesesteak in the salad/cheesesteak sequence, by underestimation bias of the cheesesteak in the cake/cheesesteak sequence, or by both. This was tested by comparing the calorie estimates of the cheesesteak in the salad/cheesesteak and cake/cheesesteak conditions to calorie estimates of the cheesesteak in the cheesesteak/salad and cheesesteak/cake conditions. Because in the latter two conditions respondents evaluated the cheesesteak before evaluating the dessert, they were combined (M = 578) and used as a control condition to evaluate the direction of the calorie estimation bias. The data show that the cheesesteak was perceived to have significantly more calories in the salad/cheesesteak condition than in the control condition (M = 787 vs. M = 578; $F(1,133) = 12.63$; $p < .001$). In contrast, the cheesesteak was perceived to have fewer calories when preceded by the cake than in the control condition (M = 489 vs. M = 578; $F(1,133) = 2.34$; $p < .10$). These findings suggest that individuals tend to overestimate the calorie content of the vice when it is preceded by a virtue.

Conceptually, this research argued that the sequential evaluation of a vice and a virtue is likely to produce a contrast effect leading to a bias in estimating the calorie content of the subsequently evaluated item. This implies that estimation biases should occur not only in virtue/vice sequences, but in vice/virtue sequences as well. The data show that respondents perceived the salad to have fewer calories when preceded by the cheesesteak than when it was evaluated first (M = 187 vs. M = 311; $F(1,133) = 4.41$; $p < .005$). These data offer further support for the notion of semantic anchoring, documenting that sequential evaluations of options classified in opposing categories are likely to produce contrast effects.

This research further argued that because contrast is not likely to occur for options classified in the same category (e.g., two vices), individuals are more likely to assimilate subsequently generated estimates toward the self-generated estimates of the initially presented option. The data were consistent with this prediction, showing that respondents perceived the cake to have more calories when it was preceded by the cheesesteak than when it was evaluated first (M = 591 vs. M = 416; $F(1,133) = 8.83$; $p < .001$). These data lend further support for the proposition that semantic anchoring can lead to contrast effects only for options classified in opposing categories.

The data reported in this experiment show that sequential evaluations of vices and virtues can lead to a systematic bias in estimating their calorie content, such that people tend to overestimate the calorie content of a vice when it is preceded by a virtue and underestimate the calorie content of a virtue when it is preceded by a vice. The data further show that this bias can lead to the paradoxical finding that a meal comprising a low-calorie salad and an entrée is perceived to have a greater amount of calories than a meal comprising the same entrée and a high-calorie dessert. These findings are attributed to a semantic anchoring stemming from categorizing foods according to a healthy/unhealthy dichotomy into virtues and vices, such that classifying items in opposing categories leads to a contrast effect, whereas classifying them in the same category leads to assimilation.

The first three experiments provided support for the semantic anchoring theory by varying the type of anchor (e.g., a virtue or a vice) and examining its impact on the subsequently evaluated item. An alternative approach to test the theory of semantic anchoring is to vary the categorization criterion such that a given pair of sequentially evaluated options can be classified either in the same or opposing categories. Thus, if our reasoning is correct, invoking a categorization using a criterion that does not necessarily place the available options in opposing categories should attenuate the observed effects. Following this line of reasoning, the next experiment varies the categorization criterion (healthiness vs. price) in a way that either places the vice and the virtue in opposite categories (in the case of healthiness-based categorization) or fosters an alternative categorization that does not call for a vice and a virtue to be classified in opposite categories (in the case of price-based categorization).

EXPERIMENT 4

The goal of this experiment was to examine the impact of categorization type (semantic vs. numeric) on the anchoring effects reported in the first three studies. In particular, it aimed to show that the semantic anchoring effects are attenuated in cases when an alternative means of categorization is invoked that does not place vices and virtues in opposing categories.

Method

Respondents were 148 undergraduates recruited to participate in a survey on food preferences. They were asked to estimate the calorie content of two sequentially presented items that varied in their perceived healthiness. As in the first three experiments, some of the respondents were presented with a sequence of a healthy (virtue) and an unhealthy (vice) item, whereas others were presented with a sequence of two unhealthy (vice) items. In particular, respondents given a virtue anchor were first asked to evaluate the calorie content of a broccoli salad and then the calorie content of a cheeseburger; in contrast, respondents given a vice anchor were asked to estimate the calorie content of chocolate fudge ice cream and then the calorie content of the same cheeseburger shown to respondents given the virtue anchor.

To examine the role of categorization type on semantic anchoring, prior to estimating the calorie content of the available options, respondents were given a categorization task in which they were asked to classify the option subsequently used as an anchor (broccoli salad in the virtue-vice condition and chocolate fudge ice cream in the vice-vice condition), based either on its healthiness or its price. Thus, some of the respondents were asked to rate the item in terms of its healthiness (very healthy vs. very unhealthy), whereas others were asked to estimate whether one pound of the item (broccoli or ice cream) is usually priced higher or lower than a gallon of milk in a typical grocery store.

The study involved a 2 (categorization criterion: vice/virtue vs. price) x 2 (anchor type: virtue vs. vice) between-subjects design, in which each respondent was given an initial categorization task, followed by two calorie-estimation tasks (broccoli salad and a cheeseburger, or ice cream and a cheeseburger). As in the previous studies, the stimuli included verbal descriptions (e.g., “chocolate fudge ice cream”) and a pictorial representation.

Results and Discussion

This research argued that the contrast effects in sequential estimation of vice/virtue combinations can be attributed to the categorization of items into opposing categories. In particular, the theory advanced in this research predicted that contrast effects would be more pronounced in cases in which respondents were first given a vice/virtue-based categorization task than in cases when they were initially given a price-based categorization task.

The data summarized in Table 4 show that the type of categorization had a significant impact on the nature of the anchoring effect ($F(1,147) = 4.42$; $p < .05$). In particular, respondents who were asked to classify the anchor according to its healthiness displayed a contrast effect in subsequent evaluations, whereby the burger was estimated to have significantly more calories when preceded by broccoli than when preceded by ice cream ($M = 923$ vs. $M = 786$; $F(1, 147) = 5.84$; $p < .01$). For respondents who were asked to classify the anchor based on price, no contrast effect was observed, and the burger was estimated to have fewer calories when preceded by broccoli than ice cream ($M = 705$ vs. $M = 736$; $F(1, 147) < 1$; NS).

Table 4

Furthermore, the contrast effect observed for virtue-vice sequences of items was more pronounced for respondents who were asked to classify the anchor according to its healthiness than for respondents who were asked to classify the anchor according to price (M = 923 vs. M = 705; $F(1, 147) = 15.13$; $p < .001$). These findings lend support to the proposition that the observed contrast effect is likely to be a function of the virtue/vice categorization of items.

The data provided by this experiment lend support to the proposition that the contrast effects reported in the first three experiments are a function of semantic categorization of items into vices and virtues. In particular, it shows that categorizing options using an unrelated numeric criterion, such as price, attenuates the contrast effect.

The experiments reported so far examined the semantic anchoring effect in a scenario in which individual options are presented in a sequential manner. From a conceptual standpoint, however, one can argue that semantic anchoring should occur even when individual items are presented simultaneously, as long as they are evaluated in a way that establishes one of the options as an anchor. This argument is consistent with prior research documenting that making one of the available options a focus of comparison is likely to make this option a reference point (anchor) against which the other available options are compared (Dhar and Simonson 1992; Houston, Sherman, and Baker 1989; Tversky 1977). Following this line of reasoning, one can argue that if the contrast effects observed in the first four experiments are indeed a function of semantic anchoring, they should also occur for options presented jointly but evaluated in a piecemeal fashion. This proposition is empirically tested in the following experiment.

EXPERIMENT 5

The goal of this experiment was to document the occurrence of the semantic anchoring effect beyond evaluating sequentially presented items. In particular, it aimed to show that semantic anchoring exists even for options presented side by side when they are evaluated in a piecemeal fashion.

Method

Respondents were 334 participants in a national online panel who were randomly assigned to one of five experimental conditions. Respondents in the first three conditions were shown a combination of a vice (burger) and a virtue (celery side salad); the only difference was the manner in which they were asked to estimate the calorie content of the items. Thus, respondents in the first (virtue/vice) condition were first asked to estimate the calorie content of the virtue and then the vice, respondents in the second (vice/virtue) condition were asked to first estimate the calorie content of the vice and then the virtue, and respondents in the third (virtue+vice) condition were asked to estimate the calorie content of the entire meal. Respondents in the remaining two conditions were shown a single item, which was either a vice (burger) or a virtue (salad).

Thus, the experimental design involved five conditions: virtue/vice piecemeal, vice/virtue piecemeal, vice+virtue joint, vice alone, and virtue alone. The latter three conditions were included in order to compare the calorie estimates derived in a piecemeal fashion with those derived by forming an overall evaluation, as well as to compare the contrast biases reported in this paper with the averaging bias reported in prior research. Indeed, prior research has argued that individuals tend to underestimate the calorie content of combinations of options classified

into opposite categories (e.g., a virtue and a vice) and that this effect disappears when the available options are evaluated in a piecemeal fashion (Chernev 2011; Chernev and Gal 2010). A prototypical example includes a scenario in which people think that a meal comprising a cheeseburger and a salad has 500 calories, even though they believe the cheeseburger alone to have 600 calories when they evaluate it separately. In this context, including piecemeal, joint, and individual evaluation conditions in the experimental design enables reconciling the current findings with those reported in prior research.

As in experiments 1-4, the stimuli were represented using verbal descriptions complemented by pictorial representations. The study was conducted online, with respondents answering the questions at their own pace.

Results and Discussion

This research argued that contrast effects in evaluating vice-virtue combinations can occur even when options are presented side by side, provided that the options are evaluated in a piecemeal fashion. The data summarized in Table 5 show that respondents in the virtue/vice condition, who were first asked to estimate the calorie content of the virtue, believed that the vice had significantly more calories than those in the vice/virtue condition, who evaluated the calorie content of the vice first (M = 770 vs. M = 692; $F(1, 267) = 4.72$; $p < .05$). Moreover, respondents who were asked to estimate the calorie content of the virtue first believed it to have more calories than those who estimated the calorie content of the virtue after estimating the calorie content of the vice (M = 101 vs. M = 71; $F(1, 196) = 13.83$; $p < .001$). These findings lend support to the semantic anchoring theory, documenting contrast effects resulting from manipulating respondents' focus of comparison.

Table 5

This research also argued that varying the sequence in which individual options are evaluated can lead to either an overestimation or underestimation of the calorie content of the entire meal. The data show that respondents who estimated the virtue prior to estimating the vice believed the combined meal to have 872 calories, significantly more than the sum of the individual estimates—794 calories ($z = 1.97$; $p < .05$). In contrast, respondents who estimated first the vice and then the virtue believed the entire meal to have 762 calories in total, slightly less than the sum of the individual estimates ($z = .77$; $p > .20$). These findings are consistent with the proposition that the order in which people are asked to estimate the individual components of the meal can influence its perceived calorie content, such that virtue/vice sequences lead to overestimation of a meal's calorie content, whereas vice/virtue sequences can lead to a directionally opposite effect.

The data also show that respondents who were asked to evaluate the calorie content of the vice/virtue combination believed it to have fewer calories than respondents who were asked to estimate the calorie content of the vice considered alone (M = 611 vs. M = 683; $F(1, 267) = 4.12$; $p < .05$)—a finding replicating the averaging bias reported in prior research (Chandon and Wansink 2007a; Chernev 2011; Chernev and Gal 2010). Piecemeal evaluation attenuated this underestimation effect in scenarios for both virtue/vice and vice/virtue sequences. In particular,

respondents who estimated first the vice and then the virtue believed the entire meal to have 762 calories in total, whereas respondents who estimated the virtue prior to estimating the vice believed the combined meal to have 872 calories. In both cases, however, the calorie content derived from sequential evaluations was significantly greater than the 611-calorie estimate of the two items considered together ($F(1, 333) = 18.94$; $p < .001$ and $F(1, 333) = 57.76$; $p < .001$).

These findings indicate that piecemeal evaluations can be used to reduce the underestimation bias reported in prior research and that the degree of correction is a function of the order in which people are asked to estimate the individual components of the meal. In particular, piecemeal evaluation of vice/virtue combinations anchored with a vice tends to attenuate the calorie underestimation effect that commonly occurs in joint evaluations of vice/virtue combinations. The data further show that piecemeal evaluation of vice/virtue combinations anchored with a virtue not only eliminates the underestimation effect, but also can "over-correct" it by as much as 10% (from 794 to 872 calories), resulting in overestimating the calorie content of virtue-vice combinations. These findings complement the results reported by prior research (Chernev 2011; Chernev and Gal 2010) by documenting that the order in which individuals evaluate vice-virtue combinations influences the degree to which piecemeal evaluation attenuates the calorie underestimation bias, such that virtue/vice sequences result in greater reduction of this bias than vice/virtue combinations.

The data reported in this experiment also show that the contrast effects reported in the first four experiments do not necessarily require that individual options be sequentially presented; they can also occur for simultaneously presented options evaluated in a piecemeal fashion. This finding lends further support to the proposition that the contrast effects reported in this research are a result of individuals using the semantic relations between the available options to derive numeric estimates of their calorie content.

The five experiments reported so far lend support to the proposition that in sequential evaluations vice-virtue combinations will lead to a contrast rather than assimilation effect on the estimated calorie content of these options. The persistence of the contrast effect across different scenarios raises the question of identifying factors that can reduce or even eliminate this effect. In this context, I argue that the contrast effect is likely to be attenuated when the available options are evaluated jointly prior to being evaluated sequentially. This prediction is based on the notion that joint evaluation is likely to lead to assimilation of the numeric estimates (e.g., Chernev 2011; Chernev and Gal 2010; see also Fishbach and Zhang 2008) which, in turn, will decrease the likelihood of contrast effects in subsequent evaluations of vice/virtue combinations.

EXPERIMENT 6

The goal of this experiment was to show that the contrast effect reported in the first five experiments can be attenuated and even reversed when the sequential evaluation is preceded by a joint evaluation of the available options.

Method

Respondents were 229 graduate students randomly assigned to one of four experimental conditions. The study involved estimating the calorie content of individual components of a

three-item meal. Some of the respondents were presented with a sequence of items anchored by a virtue (salad, steakburger, and fries), whereas the others were presented with a similar sequence anchored by a vice (cheesecake, steakburger, and fries). In addition, some of the respondents were first shown the three items together and were asked to evaluate the healthiness of the entire meal using a 10-point scale (1 = very unhealthy; 10 = very healthy); the remainder of the respondents was asked to evaluate the calorie content of the individual items without initially being shown the three items together.

The experimental manipulation involved a 2 (anchor type: vice vs. virtue) x 2 (initial overall evaluation: yes vs. no) between-subjects design. As in the previous experiments, the stimuli were represented using verbal descriptions complemented by pictorial representations. The study involved a paper-and-pencil task completed individually by respondents.

Results and Discussion

This research argued that the contrast effects in estimating the calorie content of virtue/vice combinations are attenuated when the sequential estimation is preceded by a joint evaluation of the available options. The data summarized in Table 6 show that respondents who were not initially asked to evaluate the healthiness of the entire meal estimated the calorie content of the steakburger and the fries to be higher when they were preceded by a virtue than when they were preceded by a vice (M = 1,719 vs. M = 1,274; $F(1, 228) = 11.16$; $p < .001$). This finding is consistent with the data from the first five studies showing that a vice is likely to be perceived as having a higher calorie content when preceded by a virtue than by another vice.

Table 6

More important, the data show that the joint presentation of the available options influenced the subsequent evaluations of the individual components for both virtue/vice and vice/vice sequences. Thus, respondents in the virtue/vice condition who were initially presented with all three items rated the burger and fries as having fewer calories than did respondents who were not given the overall evaluation task (M = 1,476 vs. M = 1,719; $F(1, 228) = 3.67$; $p < .05$). For respondents in the vice/vice condition, however, the effect was in the opposite direction: those who were initially presented with all the available options rated the burger and fries as having more calories than did respondents who were not given the overall evaluation task (M = 1,274 vs. M = 1,690; $F(1, 228) = 10.68$; $p < .001$).

The effect of initial overall evaluation of the available options on estimated calorie content of sequences of vices and virtues was significant, as indicated by the significant (option type) x (initial overall evaluation) interaction ($F(1,228) = 13.45$; $p < .001$). These findings are consistent with the proposition that simultaneous evaluations of combinations of vices and virtues attenuated the contrast effects observed in the first five experiments.

The data from this experiment show that the contrast effect reported in the first five studies is attenuated when individuals initially form an overall impression of the available options. Thus, forming an initial evaluation of vice-virtue combinations can be used to reduce the contrast effect stemming from semantic anchoring.

GENERAL DISCUSSION

This research argues that evaluating sequences of conceptually related options leads to anchoring effects that stem from the conceptual relationships among the evaluated items. In particular, sequences of items classified into the same category (e.g., two vices) lead to assimilation and convergence of the individual estimates, whereas sequences of items classified into opposing categories (e.g., a virtue and a vice) lead to contrast and polarization of the estimates.

The proposition that sequential evaluation can be influenced by semantic anchoring is supported by the data from six empirical studies. The first study documents the presence of contrast effects in sequential estimates by varying the type (vice/virtue) and the prototypicality of the anchor (pure/mixed). This study documents the contrast effects in a scenario in which individuals are presented with a semantic anchor and are not given any quantitative information (e.g., number of calories) about the initially evaluated option. The second experiment documents that contrast effects can occur even in the presence of readily available numeric anchors deemed likely by prior research to invoke directionally opposite assimilation effects. Building on the findings from the first two studies, the third experiment documents contrast effects in a scenario in which individuals use their initial estimates as self-generated anchors. This experiment also documents the contrast effect for both virtue/vice and vice/virtue combinations. Experiment 4 provides further evidence for semantic anchoring by documenting that the observed contrast effects are a function of the vice/virtue categorization of the available options and that the contrast effects are attenuated when options are categorized on a dimension that does not classify them in opposing categories. Experiment 5 generalizes the findings of the first four experiments, documenting that semantic anchoring can occur even for simultaneously presented options when they are evaluated in a piecemeal fashion. Finally, Experiment 6 establishes boundary conditions for the contrast effect observed in the first five studies and documents that the contrast effect is attenuated when the sequential evaluation is preceded by an overall evaluation of the available options.

This research examines anchoring effects in a scenario in which individuals make a series of evaluations, each followed by a numeric value estimate. This approach differs from the traditional research paradigm (e.g., Tversky and Kahneman 1974) in three key aspects: (1) it does not involve an explicit anchor-comparison task (i.e., asking respondents to indicate whether the correct estimate is higher or lower than the anchor); (2) it relies on self-generated rather than externally provided anchors; and (3) it involves evaluating items in the same domain, such that the anchor and the target are conceptually related. From a theoretical standpoint, these differences are important for several reasons. Most existing theories of anchoring are based on the notion that hypothesis testing is essential for occurrence of the anchoring effect (Strack and Mussweiler 1997; Mussweiler and Strack 2000). The fact that anchoring occurs even in the absence of a readily available anchor and an explicit anchor-comparison task suggests that semantic anchoring cannot be explained by the hypothesis-testing theory.

Furthermore, many anchoring-and-adjustment theories (Tversky and Kahneman 1974) include the assumption that the available anchor is more extreme than the acceptable values, which, in turn, leads to adjustment until a plausible value has been reached. The fact that anchoring occurs even in the presence of self-generated anchors with values typically representing plausible values points to the limitations of anchoring-and-adjustment theory in explaining semantic anchoring effects. In this context our findings add to the research on self-generated anchors in sequential judgments (Epley

and Gilovich 2001; 2006; Chandon and Wansink 2007a) by documenting that self-generated anchors can lead to both assimilation and contrast effects.

Most prior research has also focused on scenarios in which the anchor and the target are derived from different domains, an approach that concentrates individuals' attention exclusively on the numeric properties of the decision task (Jacowitz and Kahneman 1995; Epley and Gilovich 2001). Examining anchoring effects in estimating the value of conceptually related items (e.g., calorie content of different components of a meal) offers insight into the interplay of semantic and numeric anchoring effects, documenting outcomes inconsistent with the classic anchoring paradigm. In particular, this research identifies conditions when sequential evaluations can lead to a contrast rather than an assimilation bias, such that subsequent estimates are pushed further away from (rather than toward) the initially derived one(s).

This research further adds to the literature on semantic priming by demonstrating that semantic anchoring can lead to contrast effects even in the presence of numeric anchors. Indeed, most prior research has focused on scenarios in which numeric anchors are not readily available. The few studies that included numeric primes have demonstrated that dissimilar semantic anchors can attenuate or eliminate the assimilation effect but have not actually documented a significant contrast effect. For example, comparing the mean temperature in the Antarctic to either a high or a low numeric anchor has been shown to eliminate (but not reverse) the assimilation effect on estimates of temperatures in a dissimilar target—Hawaii (Strack and Mussweiler 1997). The studies presented in this research show not only that the assimilation effect can be eliminated but also that it can lead to a directionally opposite contrast effect and a polarization of the self-generated estimates.

This research also adds to the literature on task effects by documenting the differential impact of piecemeal and holistic processing on decision biases. Indeed, prior research has argued that piecemeal evaluation of the available options can lead to more accurate calorie estimates (Chandon and Wansink 2007a) and attenuate the calorie underestimation bias in evaluating vice-virtue combinations (Chandon and Wansink 2007a; Chernev 2011; Chernev and Gal 2010). The data reported in this research complement these findings by showing that piecemeal evaluations involving combinations of vices and virtues can themselves be subject to decision biases stemming from semantic anchoring. In particular, this research documents that piecemeal evaluations in which individuals first focus on a vice are likely to correct (at least partially) the underestimation bias, whereas piecemeal evaluations in which individuals first focus on a virtue might over-correct the underestimation bias, leading to overestimation of the calorie content of virtue-vice combinations.

An important aspect of examining assimilation and contrast effects in sequential valuations of vice/virtue combinations is investigating how these effects are influenced by the options' quantitative attributes, such as size. Size is important because prior research has shown that vices with extreme values on that dimension can be reclassified as virtues. To illustrate, snacks that in larger quantities are thought of as vices are likely to be considered virtues when offered in bite-size or 100-calorie pack quantities (Scott et al. 2008; do Vale, Pieters, and Zeelenberg 2008). For example, a bite-size Snickers snack might be considered as a virtue relative to a full serving of chocolate cake, which can lead to a contrast effect in sequential evaluations. Understanding the impact of quantitative characteristics on categorization of options into virtues or vices can shed light on understanding the contrast effects in sequential value estimates.

The theoretical rationale for the contrast effects reported in this paper is not constrained to the use of numeric estimates. The contrast effect also can be observed when estimating magnitude on non-numeric dimensions, such as drawing a line on a piece of paper or moving the knob of a slider. Thus, regardless of the domain on which estimates are generated (e.g., numeric or non-numeric), one should expect to observe the contrast effect resulting from semantic anchoring of options classified into opposing categories. Investigating the impact of semantic contrast in the context of non-numeric estimates of magnitude is a fruitful venue for future research.

The research presented in this article has important public policy implications. There is converging evidence that obesity among adults and children has increased significantly over the last two decades—a phenomenon commonly attributed to overconsumption (Chandon and Wansink 2007a; Wansink 2006; Wansink and Chandon 2006; Wadhwa, Shiv, and Nowlis 2008). This research addresses the obesity issue by examining biases in calorie estimation as one potential cause for overconsumption. The finding that sequential evaluations of virtue-vice sequences lead to overestimating a meal's calorie content is of particular importance in the context of the finding that individuals tend to underestimate the calorie content of a virtue and a vice presented simultaneously (Chernev 2011; Chernev and Gal 2010). Thus, whereas the underestimation of a meal's calorie content in simultaneous evaluations of virtue/vice combinations is likely to promote overconsumption, the overestimation of a meal's calorie content in sequential evaluations of virtue/vice combinations is likely to promote greater self-regulation of the consumption behavior. In this context, sequential valuations can be strategically used to manage a meal's perceived calorie content and individuals' consumption behavior.

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TABLE 1
SEMANTIC ANCHORING AS A FUNCTION OF THE TYPE AND PROTOTYPICALITY OF THE INITIALLY EVALUATED ITEM (EXPERIMENT 1)

Anchor	Target	Anchor prototypicality	*N*	Calorie estimate of the target
Virtue	Vice	Pure	70	1,041
		Mixed	64	891
Vice	Vice	Pure	65	780
		Mixed	65	896

NOTE.—Anchor type (virtue or vice) and prototypicality (pure vs. mixed) influence subsequent calorie estimates, such that a vice is estimated to have *more* calories when it follows a virtue than when it follows another vice. This effect is more pronounced for more prototypical anchors (pure vs. mixed virtues/vices).

TABLE 2
SEMANTIC ANCHORING AS A FUNCTION OF THE TYPE AND NUMERIC VALUE OF THE INITIALLY EVALUATED ITEM (EXPERIMENT 2)

Anchor	Target	Anchor value	*N*	Calorie estimate of the target
Virtue	Vice	Low (180)	36	638
		High (360)	39	713
Vice	Vice	Low (180)	39	473
		High (360)	36	550

NOTE.—The type of anchor (virtue or vice) influences subsequent calorie estimates, leading to decision biases even when calorie-content information is available. In particular, virtue/vice sequences lead to a contrast (rather than assimilation) bias and overestimation of the calorie content of the option following the anchor.

TABLE 3
SEMANTIC ANCHORING AS A FUNCTION OF ANCHOR TYPE AND EVALUATION SEQUENCE IN THE CASE OF SELF-GENERATED ANCHORS (EXPERIMENT 3)

			Calorie estimate		
Anchor	Target	*N*	Anchor	Target	Total
Virtue (salad)	Vice (cheesesteak)	34	311	787	1097
Vice (cheesesteak)	Virtue (salad)	33	570	187	757
Vice (cake)	Vice (cheesesteak)	34	416	489	905
Vice (cheesesteak)	Vice (cake)	33	587	591	1178

NOTE.—The type of anchor (virtue or vice) influences subsequent calorie estimates, leading to a contrast (rather than assimilation) bias in the case of evaluating sequences of options classified into opposing categories (vice/virtue and virtue/vice). Thus, a vice (cheesesteak) following a virtue (salad) is estimated to have more calories than when it follows another vice (cake). Moreover, in this case the combination of a virtue and a vice (a salad followed by a cheesesteak) is perceived to have *more* calories than the combination of two vices (cake and cheesesteak). In the case of two vices, however, an assimilation effect is observed (because the cake is estimated to have fewer calories than the cheesesteak, the cake/cheesesteak sequence logically is estimated to have fewer calories than the cheesesteak/cake).

TABLE 4
SEMANTIC ANCHORING AS A FUNCTION OF ANCHOR TYPE AND CATEGORIZATION TYPE (EXPERIMENT 4)

				Calorie estimate		
Anchor	Target	Categorization	*N*	Anchor	Target	Total
Virtue	Vice	Semantic (vice/virtue)	36	197	923	1,120
		Numeric (price)	39	226	705	931
Vice	Vice	Semantic (vice/virtue)	38	449	786	1,235
		Numeric (price)	35	424	736	1160

NOTE.—The type of anchor (virtue or vice) influences subsequent calorie estimates, leading to a contrast (rather than assimilation) bias in the case of evaluating sequences of options classified into opposing categories. This effect is a function of categorization type and is more pronounced in the case of vice/virtue-based categorization than in the case of an alternative (price-based) categorization.

TABLE 5
SEMANTIC ANCHORING AS A FUNCTION OF OPTION TYPE AND EVALUATION STRATEGY (EXPERIMENT 5)

				Calorie estimate		
Evaluation type	Anchor	Target	*N*	Anchor	Target	Total
Sequential	Virtue	Vice	67	101	770	872
Sequential	Vice	Virtue	64	692	71	762
Joint	NA	NA	68	–	–	611
Individual	NA	Virtue	66	–	111	111
Individual	NA	Vice	69	–	683	683

NOTE.—The type of anchor (virtue or vice) influences subsequent calorie estimates, leading to a contrast (rather than assimilation) bias in the case of evaluating sequences of vices and virtues. Piecemeal evaluation attenuates (in the case of vice-virtue sequences) or even reverses (in the case of virtue-vice sequences) the underestimation bias reported by prior research.

TABLE 6
SEMANTIC ANCHORING AS A FUNCTION OF ANCHOR TYPE AND EVALUATION STRATEGY (EXPERIMENT 6)

				Calorie estimate		
Anchor	Target	Joint evaluation	*N*	Anchor	Target	Total
Virtue	Vice	No	52	327	1,719	2,046
		Yes	63	257	1,476	1,734
Vice	Vice	No	51	650	1,274	1,924
		Yes	63	733	1,690	2,424

NOTE.—The type of anchor (virtue or vice) influences subsequent calorie estimates, leading to a contrast (rather than assimilation) bias in the case of evaluating sequences of vices and virtues. This effect is attenuated for respondents who initially form an overall evaluation of the available options. The discrepancy between the total value and the sum of the anchor and the target results from rounding.

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