

Vice-Virtue Bundles

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Abstract: We introduce a simple solution to help consumers manage choices between healthy and unhealthy food options: vice-virtue bundles. Vice-virtue bundles are item aggregates with varying proportions of both vice and virtue, holding overall quantity constant. Four studies compare choice and perceptions of differently composed vice-virtue bundles relative to one another and to pure vice and pure virtue options. Results suggest that people tend to prefer vice-virtue bundles with small ($\frac{1}{4}$) to medium ($\frac{1}{2}$) proportions of vice rather than large ($\frac{3}{4}$) proportions of vice. Moreover, people rate vice-virtue bundles with small vice proportions as healthier but equally tasty as bundles with larger vice proportions. For most individuals, choice patterns are different from those predicted by variety-seeking accounts alone. Instead, these findings provide evidence that bundle choice can be predicted by the identification of a *taste-health balance point*, determined based on consumers' perceptions of tastiness and healthiness as a function of the relative proportion of vice in an option.

Key words: choice-architecture; bundles; vices; virtues; self-control; health; taste

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1. Introduction

Increasing consumers' tendency to make healthy eating decisions is critical. Current estimates indicate that 68% of American adults are now overweight or obese (Flegal et al. 2010). In addition to obesity's physical and mental health consequences, it also has significant economic consequences. To illustrate, obesity is estimated to be responsible for almost 10% of total annual medical expenditures in the United States—approximately \$147 billion (Finkelstein et al. 2009). Additionally, for employers who contribute to their employees' healthcare costs, finding ways to prevent and reduce excess weight gain is critical (Chang and Marsh 2013; Finkelstein et al. 2010; Mello and Rosenthal 2008). Furthermore, many for-profit establishments in the food industry, such as restaurant chains, are also very interested in increasing healthy food sales, as they face criticism for the popularity of their traditionally indulgent offerings (Hastings 2013; Liu et al. 2014) and attempt to pursue nutrition initiatives as part of corporate social responsibility strategies (McDonald's 2013a; McWilliams et al. 2006).

In many ways though, the deck is stacked against the choice of healthy options. First, consumers have limited self-control (Baumeister et al. 1998) and they often find the immediate benefits of tasty indulgences to be more salient than their long-term negative consequences (O'Donoghue and Rabin 2000). In addition, cues that increase hunger and cravings permeate many choice contexts (Laibson 2001; Lambert et al. 1991; Stroebe et al. 2013), making it more difficult for consumers to resist choosing unhealthy foods (Shiv and Fedorikhin 2002). Moreover, many consumers prioritize taste goals over health goals in their food choices (Glanz et al. 1998; Stewart et al. 2006), such that health concerns only affect their food choices once they are confident that taste concerns will also be addressed.

In the present research, we consider the many daily choices that people face between unhealthy, but often tastier, options (such as fries) and unhealthy, but often less tasty, options (such as salad). We refer to these unhealthy and healthy options as vices and virtues, respectively, consistent with terminology used in other research on unhealthy and healthy foods (Hui, Bradlow, and Fader 2009; Mishra and Mishra 2011; Wertenbroch 1998). While much research has examined interventions aimed at shifting consumers from selecting vice to virtue options, in the present work we focus on simultaneously addressing both taste and health goals. Importantly, we find that a simple change in choice architecture can ultimately lead to meaningful shifts toward the healthier end of the spectrum for a large segment of consumers who would otherwise select vice.

We suggest that vice-virtue bundles represent an opportunity to address taste and health goals within a single choice (Dhar and Simonson 1999, Simonson 1989). Our analysis allows us to identify the

taste-health balance point—the *relative proportion of vice*¹ at which consumers perceive that both goals are addressed. Importantly, depending on consumers' prioritization of taste goals and beliefs about whether vice or virtue better address taste goals, they may need different amounts of vice in a bundle to feel that it will meet the taste goal. In general, results suggest that the mere presence of vice tends to drastically increase perceptions of an option's tastiness for many consumers, prompting them to select choices that include relatively less vice than virtue over choices that include relatively more virtue than vice. Thus, for consumers who would otherwise select vice in the absence of vice-virtue bundles, this choice architecture solution may lead to substantially healthier choices.

1.1. Existing Solutions to Promote Healthier Eating

Given the strong lure of indulgent foods, numerous strategies have been suggested to curb unhealthy consumption (Chandon and Wansink 2012). One strategy involves increasing access to healthy food options (Keohane 2008; Strom 2013). However, this strategy alone may not be sufficient to significantly increase healthy eating, unless accompanied by cues to increase health awareness (e.g., traffic light symbols) (Sonnenberg et al. 2013), as many consumers will have the option to choose unhealthy options (e.g., French fries) in the same situations in which healthy options (e.g., salads) are available. Another strategy for decreasing unhealthy eating has been to encourage consumers to use moderation—ordering the fries but only eating a few. Yet moderation often fails (Haws et al. 2011) because people do not appropriately monitor consumption quantity (Redden and Haws 2013) and because a variety of environmental factors inhibit consumption monitoring (Wansink 2004; Wansink et al. 2007). Thus, it may be very difficult to completely shift consumers away from vice consumption.

However, other work suggests that consumers may be responsive to external interventions that seek to alter the quantity of vice consumption rather than to eliminate it entirely (Cheema and Soman 2008; Schwartz et al. 2012). For example, research points to the potential for consumers to voluntarily limit vice quantity at the choice stage (Schwartz et al. 2012). Indeed, although consumers regularly consume large amounts of vices (Rolls et al. 2002; Schwartz et al. 2012; Sharpe et al. 2008; Wansink 2006; Wansink et al. 2005) and rarely self-ration by spontaneously requesting to downsize the quantity of vice (Schwartz et al. 2012), they sometimes choose to downsize when a server explicitly asks them if they want to downsize their order (Schwartz et al. 2012).

Further, other research also suggests that consumers sometimes embrace opportunities to increase virtue consumption quantity. For example, research suggests that people engage in more exercise if they can only listen to enjoyable audiobooks while exercising, rather than being able to listen at any time, and

¹ We define the taste-health balance point in terms of relative proportion of vice, but note that by definition, the relative proportion of vice is inherently linked to the relative proportion of virtue (i.e., $\frac{1}{4}$ -vice actually refers to $\frac{1}{4}$ -vice and $\frac{3}{4}$ -virtue).

are willing to pay for this restriction (Milkman et al. 2014); this restriction (termed “temptation bundling”) strategically combines the utility streams from a relative *want* (i.e., enjoyable audiobooks) and a relative *should* (i.e., exercising) (Milkman et al. 2014). In addition, offering quantity discounts increases consumption of virtuous food products, similar to effects on more indulgent products (Haws and Winterich 2013). Finally, offering a bonus pack is especially effective at increasing the purchase likelihood of virtuous foods (Mishra and Mishra 2011).

1.2. Vice-Virtue Bundles

We suggest a simple choice architecture solution that can help consumers who would otherwise choose vice over virtue to simultaneously increase consumption of healthy foods (virtues) and decrease consumption of unhealthy foods (vices) while still fulfilling taste goals—“vice-virtue bundles.” Vice-virtue bundles consist of non-zero proportions of both vice and virtue-related products. These proportions can vary, such that a vice-virtue bundle might contain relatively more virtue (e.g., three apple slices and one cookie), relatively equal proportions of virtue and vice (e.g., two apple slices and two cookies), or relatively more vice (e.g., one apple slice and three cookies).

Importantly, this solution is not equivalent to offering two snacks, as the overall portions provided through the bundles are visually and volumetrically equivalent to just one snack (i.e., proportion of pure vice option + proportion of pure virtue option = 1)—thereby carefully controlling overall portions. Prior research suggests that better health outcomes can be achieved if consumers both limit intake of indulgent foods (Schwartz et al. 2012; Wertenbroch 1998) and increase intake of healthy foods (Redden and Haws 2013). Vice-virtue bundles serve both functions, providing multifinal means for advancing two active goals (Kopetz et al. 2011).

To understand the effect of introducing vice-virtue bundles to a choice set, consider that consumers are likely to hold both taste and health goals², albeit to different degrees. We examine consumers’ perceptions and choices when they are presented with both pure options (virtue alone and vice alone) and a variety of vice-virtue bundles that vary in terms of the relative proportions of vice and virtue (e.g., $\frac{1}{4}$ vice and $\frac{3}{4}$ virtue; $\frac{1}{2}$ vice and $\frac{1}{2}$ virtue; or $\frac{3}{4}$ vice and $\frac{1}{4}$ virtue). We analyze this situation by introducing the idea of a taste-health balance point, which can vary based upon prioritization of taste and health goals and beliefs about whether vice or virtue better address taste goals. We then use this framework to predict the effect of adding virtue-vice bundles for three different segments of consumers. We note that whereas taste perceptions are inherently subjective, health perceptions can be fairly unambiguous for some foods (e.g., chips and cookies are unhealthy, whereas carrots and apples are

² We note that other goals may certainly come into play in making food decisions (e.g., reducing cost), but we focus on the trade-offs between health and taste, which are often thought to be in conflict (Raghunathan et al. 2006) and which people often seek to balance (Dhar and Simonson 1999).

healthy). It is these foods with unambiguous health perceptions (i.e., clear vice and virtue foods) that we focus on in the present research.

1.3. Theoretical Rationale for a Taste-Health Balance Point

We will begin with a consumer who tends to favor meeting a taste goal when both taste and health cannot be addressed simultaneously. We refer to such a consumer as a “vice-lover.” Vice-lovers display two common characteristics. First, these consumers perceive vices to be tastier than virtues, in keeping with the unhealthy = tasty intuition (Raghunathan et al. 2006). Thus, they believe that vices are more appropriate for satisfying taste goals. Second, although these consumers—like most consumers—may hold both health and taste goals and seek to balance attainment of the two (Dhar and Simonson 1999, Stewart et al. 1996), they tend to prioritize taste over health goals when they cannot simultaneously address both goals. Therefore, in the absence of vice-virtue bundles, they tend to select vices over virtues.

Given these characteristics, we depict vice-lovers’ functions for taste and health goals in Figure 1a. As the relative proportion of vice in an option increases from zero to one, we predict 1) an increasing concave function for the bundle’s perceived ability to meet a taste goal, and 2) a decreasing linear function for the bundle’s perceived ability to meet a health goal.

[Insert Figures 1a to 1c about here]

We predict these functional forms based on prior work on affect and cognition in valuation (Hsee and Rottenstreich 2004). This literature theorizes that if people rely more on feelings (or affect) than on calculation (or cognition) to make a judgment, then they will be more sensitive to the presence or absence of a stimulus than to the amount of stimulus (Hsee and Rottenstreich 2004). Because tastiness is a primarily affective (feelings-based) attribute (Shiv and Fedorikhin 1999), we anticipate that a vice-lover consumer will simply note whether vice is present or absent. If any vice is present, consumers’ perception that taste goals will be addressed will show an immediate increase, disproportionate to the actual proportion of the vice. Further, after this initial present/absent evaluation, returns for greater amounts of vice will diminish, consistent with satiation (Redden and Haws 2013). Thus, we propose an increasing concave pattern for an option’s ability to address taste goals as a function of the relative proportion of vice in an option.

In contrast, for healthiness, this literature leads us to predict a decreasing linear pattern (Hsee and Rottenstreich 2004). Healthiness is a primarily cognitive (calculations-based) attribute (Shiv and Fedorikhin 1999). As a result, when evaluating healthiness, people are more likely to use calculation than feelings (Hsee and Rottenstreich 2004), thus leading to a linear function of relative proportion of vice in an option. Therefore, we propose that the ability to meet a health goal decreases at a rate proportionate to the relative proportion of vice in an option.

Note that the increasing concave tastiness function and the decreasing linear healthiness function intersect at a point that we will refer to as the *taste-health balance point*. At proportions of vice above this intersection, further increasing the relative proportion of vice will produce little further boost in one's belief that they will meet their taste goals, but substantially decrease one's belief that they will meet their health goals. Thus, we hypothesize that consumers will attempt to address both taste and health goals by choosing an option that reaches their taste-health balance point.

This framework can also be used to predict the behavior of a second segment of consumers who tend to prioritize health over taste goals when they cannot simultaneously address both goals. Unlike vice-lovers, these individuals tend to select virtues over vices in the absence of vice-virtue bundles. We call this segment of consumers "virtue-acceptors." We depict the tastiness and healthiness functions that we would anticipate for these consumers in Figure 1b.

Note that past literature suggests that the tastiness function may be more concave for high (vs. low) self-control consumers, who would ordinarily possess the self-regulatory ability to choose pure virtue in the absence of a bundled option (Redden and Haws 2013). Therefore, assuming that those who prioritize health over taste goals when they cannot simultaneously address both goals (virtue-acceptors) tend to be relatively higher in self-control than those who prioritize taste over health goals (vice-lovers), the tastiness function we predict for virtue-acceptors (Figure 1b) is more concave than the tastiness function we predicted for vice-lovers (Figure 1a). Our theory therefore would predict that, compared to participants who would otherwise give priority to their taste goals (vice-lovers), virtue-acceptors' taste-health balance point will exist at a lower proportion of vice.

Finally, note that there may be a third segment of consumers ("virtue-lovers") who do not view a vice as tastier than a virtue and may actually, on average, view a virtue as tastier than a vice (Werle, Trendel, and Ardito 2013). That is, they simply love the taste of a virtue (e.g., salad). We depict the tastiness and healthiness functions that we would anticipate for these consumers in Figure 1c.

For virtue-lovers, pure virtue can meet both taste and health goals. Thus, increasing the proportion of vice from zero to one will tend to undermine both goals simultaneously. In other words, identification of a taste-health balance point is irrelevant for these consumers because both tastiness and healthiness are decreasing functions. Instead, when vice-virtue bundles are introduced, the only reason these consumers would introduce vice into their bundle would be to variety-seek (Inman 2001; Kahn and Wansink 2004). Moreover, virtue-lovers' chosen vice-virtue bundles will likely contain only a small proportion of vice, given that a small proportion of vice allows variety seeking without producing large decreases in health.

In Figures 1 and 2, we summarize our hypotheses about the tastiness and healthiness functions and the corresponding predictions about preference for vice-virtue bundles for each segment. These three

consumer segments consist of the two segments of consumers that believe vice tastes better than virtue (vice-lovers and virtue-acceptors in Figures 1a and 1b)—but who may differ in their prioritization of taste and health goals in the absence of a bundled option (see also Figure 2)—and one segment that does not believe vice tastes better than virtue (virtue-lovers in Figure 1c)—thereby removing the need to use vice-virtue bundles for balancing taste and health goals, but still allowing for variety seeking to operate (see also Figure 2).

[Insert Figure 2 about here]

Our theoretical framework thus suggests that adding vice-virtue bundles can have differential effects on consumers' caloric intake depending upon their consumer segment. Specifically, adding vice-virtue bundles should substantially decrease caloric intake for consumers who choose pure vice in the absence of vice-virtue bundles (vice-lovers). However, for consumers who choose pure virtue in the absence of vice-virtue bundles (virtue-acceptors and virtue-lovers), introducing vice-virtue bundles may slightly increase caloric intake.

1.4. Alternative Explanations for Vice-Virtue Bundle Preferences

Before shifting to discuss the present research, we briefly mention potential alternative explanations for preference for vice-virtue bundles: simple variety seeking and the effect of adding a virtue on calorie perceptions. First, whereas a simple variety seeking account can (and should) account for our predictions for virtue-lovers, a simple variety seeking account cannot explain our predictions for vice-lovers in particular, since it would not specifically predict preference for an option that approaches the taste-health balance point over an option that contains relatively more vice, for which vice-lovers indicate an initial preference.

Second, the existing finding that adding a small virtue (e.g., a tomato slice) to a larger vice (a hamburger) decreases perceptions of the calories in the meal (Chernev 2011; Chernev and Gal 2010) also cannot account for our predictions. This prior work focuses on adding smaller virtues to larger vices, which is most analogous to a vice-virtue bundle with relatively more vice than virtue, and thus would suggest the popularity of a vice-virtue bundle with relatively more vice than virtue. In contrast, we predict that a vice-virtue bundle with relatively more vice than virtue will be less popular than vice-virtue bundles with lower vice proportions.

2. Overview of Studies

First, in Studies 1 and 2, we tested the effects of vice-virtue bundles by first examining whether people select vice-virtue bundles, what proportions of vice and virtue people prefer in vice-virtue bundles ($\frac{1}{4}$ vice, $\frac{1}{2}$ vice, or $\frac{3}{4}$ vice), and whether people consume the options they select. We also checked

whether offering vice-virtue bundles changes subsequent consumption. Together, these studies yield the interesting conclusion that although choice share of pure vice and pure virtue are not different when only pure options are offered, offering vice-virtue bundles tends to lead consumers to choose options that offer $\frac{1}{2}$ -vice or $\frac{1}{4}$ -vice. In addition, Study 2 demonstrates that offering vice-virtue bundles appears to decrease subsequent caloric consumption.

Second, in Study 3, we directly tested the two accounts (taste-health balance point and variety seeking) that we proposed might underlie choices of vice virtue-bundles. We do this by measuring consumers' ratings of the tastiness and healthiness for different vice-virtue bundles and pure options. We examined these ratings, and relative preferences among vice-virtue bundles, separately by consumer segment.

Third, in Study 4, to demonstrate that the choice patterns that we predict for the vice-lover segment in particular cannot be explained by pure variety seeking, we tested the impact of removing the middle $\frac{1}{2}$ -vice option—the taste-health balance point option which tends to be chosen by the vice-lover segment when available—from the vice-virtue bundles offered. Our results indicate that in the absence of the $\frac{1}{2}$ -vice option, vice-lovers exhibit preference-shifts; consumers who would have selected a particular pure option (i.e., pure vice in the case of vice-lovers) in fact select a choice that contains less than 50% of that particular pure option when bundles are introduced. We compared the introduction of vice-virtue bundles to the introduction of vice-vice bundles, which also provide variety but do not provide an opportunity to balance goals. Our results indicate that in the absence of the middle vice-vice bundle option, preference-shifts are much less likely to occur. These findings suggest that when vice-virtue bundles are offered, the tendency to approach the taste-health goal balance point, not simply to variety-seek, clearly drives choice for vice-lovers.

It was also important to us to consider how the introduction of vice-virtue bundles affects caloric consumption. In Studies 1 and 2, our between-subjects design allows us only to observe a null effect in the aggregate. However, in Studies 3 and 4, we are able to test our predictions using a within-subjects design, such that we can observe differential changes in caloric consumption based on consumer segment. In the aggregate, changes in caloric consumption depend upon the relative proportions of the different consumer segments.

3.1. Study 1: Choice among Vice-Virtue Bundles

Study 1 uses a between-subjects design to compare actual choice when vice-virtue bundles are included versus not included in a choice-set. The main purpose of this study is to examine whether consumers choose vice-virtue bundles and, if so, which bundles they prefer.

3.1.1. Method

Participants and Design. Seventy participants (40.0% female) were recruited from a university’s annual weekend event in which graduate students camp out for college basketball tickets. The weekend event was held from Friday evening to Sunday morning. Data were collected on Saturday afternoon, ending at 6:15 PM when the basketball coach arrived to make a speech.

Participants were randomly assigned to one of two choice-sets: 1) “pure vice – pure virtue” (a two-option choice-set with pure virtue and pure vice) or 2) “vice-virtue” (a five-option choice-set with pure virtue, $\frac{1}{4}$ vice, $\frac{1}{2}$ vice, $\frac{3}{4}$ vice, and pure vice). Eight participants were excluded from analysis for the following reasons: two said they did not want a snack, and six observed another participant’s snack choice by inadvertently seeing or overhearing another participant’s snack choice.³

Procedure. Researchers approached participants who were alone or in relatively small groups and asked them to participate in a brief survey in exchange for a snack. Participants were told that we had two different sets of survey questions and that they needed to reach into an envelope and pick out a slip of paper that either had the number “1” or “2” printed on it; this number corresponded to the choice-set they received. Thus, though researchers selectively approached participants, this randomization ensured no systematic bias was generated across conditions.

Depending on condition, participants were shown a choice set consisting of two options or five options. The pure virtue and vice options were, respectively, baby carrots and potato chips. The mixed vice-virtue bundles included a $\frac{1}{4}$ -vice option ($\frac{3}{4}$ baby carrots and $\frac{1}{4}$ potato chips), a $\frac{1}{2}$ -vice option ($\frac{1}{2}$ baby carrots and $\frac{1}{2}$ potato chips), and a $\frac{3}{4}$ -vice option ($\frac{1}{4}$ baby carrots and $\frac{3}{4}$ potato chips). These choice options were presented pictorially (see Appendix Figure A1). For the precise food contents (i.e., grams of baby carrots and potato chips) and calories on each plate, see Appendix Figure A2.

Participants chose one option from their assigned choice set and received a voucher that allowed them to redeem it for their chosen snack from a researcher stationed next to a cooler of snacks.

3.1.2. Results and Discussion

Choice Share. Table 1 shows the percentage of participants who selected each snack in each condition. In the pure vice and pure virtue choice-set, the choice shares were not significantly different ($p = .163$, exact binomial test). In the vice-virtue bundle choice set, 24.1% chose pure virtue, 37.9% chose $\frac{1}{4}$ vice, 31.0% chose $\frac{1}{2}$ vice, 3.4% chose $\frac{3}{4}$ vice, and 3.4% chose pure vice.

[Insert Table 1 about here]

³ The choice patterns observed are largely robust to including the six participants who observed another participant’s snack choice. Additional details available from the authors.

Both the 1/4-vice option and the 1/2-vice option were significantly more likely to be chosen than the 3/4-vice option ($p = .006$ and $p = .022$, respectively, exact binomial tests). The 1/4-vice option and the 1/2-vice option drew similar choice shares (37.9% and 31.0%; $p = .824$, exact binomial test).⁴

Calories Ordered. We also calculated calories ordered (See Figure A2). Calories ordered was not significantly different when vice-virtue bundles were introduced ($M_{5\text{-option}} = 74$ calories, $M_{2\text{-option}} = 79$ calories; independent-samples t -test: $t(48) = .46$, $p = .648$ ⁵; non-parametric Mann-Whitney U test: $p = .346$).

Discussion. These results provide initial evidence that people select vice-virtue bundles when making actual food choices. We found choice shares among the vice-virtue bundles that were consistent with aggregate choice patterns predicted by a combination of addressing the taste-health balance point and variety-seeking, assuming taste-health balance points occurring at or before 1/2-vice for most consumers. Specifically, both the 1/4-vice and 1/2-vice options were more popular than the 3/4-vice option.

We note that, in the aggregate, we observe no decrease in the average number of calories ordered when vice-virtue bundles were introduced. However, our theory predicts that the effects of introducing vice-virtue bundles on calories ordered at the population level will depend upon the relative proportion of people in the population who would otherwise choose vice in the absence of vice-virtue bundles (vice-lovers) and those who would otherwise choose virtue in the absence of vice-virtue bundles (virtue-acceptors and virtue-lovers). As our between-subjects design in Study 1 does not allow us to observe participants' a priori preferences, we cannot test for this differential effect by consumer segment. We elaborate on this further in Study 2's discussion and test this prediction empirically in Studies 3 and 4.

We also note that in Study 1, we did not actually observe participants' consumption, either during or after the experiment. Therefore, it is possible that participants did not actually consume the options they selected. It is also possible that offering vice-virtue bundles might affect consumers' subsequent caloric intake. Examining this question is important because if offering vice-virtue bundles were to lead to higher subsequent caloric intake, then this intervention could in fact have perverse negative effects on healthy eating initiatives. We test these possibilities in Study 2.

⁴ We assume that the taste-health balance point may vary across consumers and stimuli (Redden and Haws 2013). Thus, for some consumers and for some stimuli, the taste-health balance point may be reached by the 1/4-vice, but for other consumers and for other stimuli, it may be reached by the 1/2-vice. This assumption is supported by Study 3, which shows that for the food stimuli used in Studies 3 and 4, the taste-health balance point is met by 1/4-vice for some consumers and 1/2-vice for other consumers. Thus, our two aggregate-level predictions for both Studies 1 and 2 are that the 1/4-vice option is more popular than the 3/4-vice option (due to variety seeking by virtue-lovers and potential seeking of the taste-health balance point by virtue-acceptors and/or vice-lovers) and that the 1/2-vice option is more popular than the 3/4-vice option (due to potential seeking of the taste-health balance point by vice-lovers and/or virtue-acceptors). We do not make an aggregate-level prediction about the relative popularity of the 1/4-vice option and the 1/2-vice options, as this should depend upon the taste-health balance points for vice-lovers and virtue-acceptors and the particular stimuli used, as well as on the relative proportions of each of the three consumer segments in the population.

⁵ The degrees of freedom were adjusted due to heterogeneity of variances.

3.2. Study 2: Choice and Consumption of Vice-Virtue Bundles

In Study 2, we aimed to replicate the choice share findings of Study 1 with a different set of snacks while also measuring whether people actually consume the snacks they select. In addition, we collected dietary recall data to examine whether offering vice-virtue bundles alters post-study caloric consumption.

3.2.1. Method

Participants and Design. One hundred participants ($M_{\text{age}} = 21.83$, 63.0% female) from a university participant pool took part in this study.⁶ This study contained two parts. Participants were eligible to complete part two if they completed part one on the previous day. Of the 100 participants who completed part one, 86 participants (86.0%) also completed part two the next day. Participants received \$5 if they only completed part one and \$15 if they completed both parts. Part one was administered in 20-minute sessions between 1:30 P.M. and 4:30 P.M. Part two was administered in 20-minute sessions between 9:00 A.M. and 1:00 P.M.

As in Study 1, participants were randomly assigned to one of two choice-sets: 1) “pure vice – pure virtue” (a two-option choice-set with pure virtue and pure vice) or 2) “vice-virtue” (a five-option choice-set with pure virtue, $\frac{1}{4}$ vice, $\frac{1}{2}$ vice, $\frac{3}{4}$ vice, and pure vice). Five participants were excluded from all analyses because of dietary restrictions (two participants reported an allergy to apples, the virtue product used in this study; one reported an allergy to wheat/gluten, an ingredient in the vice product used in this study; two reported that they do not eat chocolate, an ingredient in the vice product used in this study), thus leaving us with 95 participants for the analysis of snack choice and 81 participants for the dietary recall analysis.

Part One Procedure. Participants were told that part one would involve listening to an audio program and that they would be provided with a snack. Participants entered the lab in groups of up to eight, and each participant took a seat at an individual computer station. Dividers were placed between computer stations, to keep participants from observing other participants’ food choices and consumption.

Participants first selected one of two audio programs to listen to. In actuality, both audio programs were the same to ensure that all participants had the same listening experience, but the programs were labeled with different titles to facilitate the cover story that we were interested in their audio listening experience (rather than their food choices and consumption).

⁶ For Studies 2 to 4, we set target sample sizes prior to data collection and analysis (Simmons et al. 2011). For Study 2, we aimed for approximately the same number of participants as Study 1 but used a slightly larger sample size to account for potential attrition for the follow-up dietary recall part of the study. For Study 3, we aimed for approximately 100 participants, consistent with the number of participants in the Vice-Virtue 50/50-Included Choice 1 condition in Study 4. For Study 4, we aimed for 100 participants per between-subjects condition.

Based on condition, participants were shown a choice set with two or five options. The pure virtue and vice options were, respectively, apple slices and Oreo cookies. The vice-virtue bundle options were ¼-vice (3 apple slices and 1 Oreo), ½-vice (2 apple slices and 2 Oreos), and ¾-vice (1 apple slice and 3 Oreos). These choice options were presented pictorially (Appendix Figure A1). For the food contents (grams of apples and Oreos) and calories on each plate, see Appendix Figure A2.

Participants circled their selections on a sheet of paper and handed them to a researcher (hereafter “the main researcher”). The main researcher then instructed participants to complete a filler survey about headphone preferences and entertainment preferences. While participants completed the filler survey, researchers stationed in a second room prepared the snacks selected by participants. To allow us to keep track of how much each participant consumed, the bottom of each snack dish was discretely labeled to allow us to link each participant’s consumption with the rest of the data he or she provided. The main researcher then served participants their selected snacks. The main researcher told participants to begin watching the audio clip and that they could feel free to eat the snack until the researcher returned in approximately 10 minutes.

The main researcher returned after approximately 10 minutes and collected participants’ dishes and any leftovers. The researchers in the second room then recorded whether participants had any leftovers and if so, what the leftovers were.

Finally, participants provided demographic information and entered a unique ID to allow linking of their data across parts one and two of the study. Participants were reminded to return the following day for part two of the study. They were not told that they would be completing a dietary recall for part two because we did not want to alter their post-study consumption behavior.

Part Two Procedure. When participants returned the next day, they were told that the purpose of part two of the study was to gather information on what foods and drinks they had consumed yesterday from when they woke up to when they went to sleep. A three-step multiple-pass recall, adapted for group administration, was used to assess what participants had consumed (Guenther et al. 1997; Scott et al. 2007). During the first pass (quick list), participants listed all foods and beverages they consumed yesterday from when they woke up to when they went to sleep. During the second pass (detailed description), participants added detailed information about each food or beverage, including when they consumed it, the portion size consumed, and any brand names. Participants were provided with measurement estimation guides to help them estimate portion size, a folder of menus from local restaurants to help them recall exact dishes that they might have eaten, and a sheet of paper with seven questions to help participants add more detail to their dietary recalls (Scott et al. 2007). During the third and final pass (review), a researcher reviewed the participant’s dietary recall to check for completeness.

Of interest to the present research, this dietary recall included information on participants' food and beverage consumption in the afternoon and evening following the snack session.

Dietary Recall Coding. Calories consumed in the afternoon and evening following the snack session was calculated using the dietary recalls, online databases containing calorie information for different foods (e.g., www.calorie-count.com, www.fatsecret.com, www.myfitnesspal.com), and nutrition information on restaurant and product websites.

3.2.2. Results and Discussion

First, we examine the choice shares when vice-virtue bundles were introduced to the choice set. Second, we examine whether participants consumed their chosen snacks. Finally, we examine post-snack caloric consumption to examine whether introducing vice-virtue bundles alters subsequent consumption.

Choice Share. Table 1 shows the percentage of participants who selected each snack in each condition. In the pure vice and pure virtue choice-set, the choice shares were not significantly different ($p = .104$, exact binomial test). In the vice-virtue bundle choice set, 22.4% chose pure virtue, 22.4% chose $\frac{1}{4}$ vice, 40.8% chose $\frac{1}{2}$ vice, 4.1% chose $\frac{3}{4}$ vice, and 10.2% chose pure vice.

The $\frac{1}{4}$ -vice option was significantly more likely to be chosen than the $\frac{3}{4}$ -vice option (22.4% vs. 4.1%; $p = .023$, exact binomial test), and the $\frac{1}{2}$ -vice option was significantly more likely to be chosen than the $\frac{3}{4}$ -vice option (40.8% vs. 4.1% $p < .001$, exact binomial test). The $\frac{1}{4}$ -vice option and the $\frac{1}{2}$ -vice option drew similar choice shares (22.4% and 40.8%; $p = .150$, exact binomial test).

Consumption. The majority of participants (89.5%) consumed the entire snack they selected. The percentage consuming the entire snack did not differ across conditions; 87.0% of participants in the two-option choice set condition consumed the entire snack, and 91.8% of participants in the five-option choice set condition consumed the entire snack ($p = .441$, two-proportion Z-test). Of the six participants who did not consume the entire snack in the two-option choice set condition, two participants had some apple leftover, and four participants had some cookie leftover. Of the four participants who did not consume the entire snack in the five-option set condition, two participants had some apple leftover, and two participants had some apple and some cookie leftover.

Snack Caloric Consumption. We then calculated the calories consumed at the study snack session (See Figure A2). Calorie consumption during the snack session was not significantly different when vice-virtue bundles were introduced ($M_{5\text{-option}} = 103$ calories, $M_{2\text{-option}} = 91$ calories; independent-samples t -test: $t(79) = .85$, $p = .396^7$; non-parametric Mann-Whitney U test: $p = .063$).

Post-Snack Caloric Consumption. We then analyzed the dietary recall data to examine whether introducing vice-virtue bundles affected subsequent post-snack caloric consumption. The percentage of participants completing a dietary recall did not differ across conditions; 89.1% of participants in the two-

⁷ The degrees of freedom were adjusted due to heterogeneity of variances.

option choice set condition completed a recall, and 81.6% of participants in the five-option choice set condition completed a recall ($p = .303$, two-proportion Z-test). An independent-samples t -test indicated that post-study caloric intake was lower when vice-virtue bundles were introduced ($M_{5\text{-option}} = 886$ calories vs. $M_{2\text{-option}} = 1112$ calories; $t(79) = 2.03$, $p = .045$).

Discussion. Using a different set of stimuli with countable units, Study 2 replicated the choice share findings of Study 1. Specifically, we again find that when vice-virtue bundles are introduced, participants tended to choose vice-virtue bundles with proportions of vice that were $\frac{1}{2}$ or less. In addition, Study 2 demonstrated that most participants consumed the entire option they selected. Thus, it appears that participants' choices were well calibrated with their actual consumption and that offering vice-virtue bundles will not increase food waste (i.e., lead consumers to select but not consume virtues). Moreover, Study 2 found that offering vice-virtue bundles appears to lead consumers to decrease their subsequent caloric intake. We discuss this finding more in the General Discussion.

Finally, analogous to Study 1, no aggregate decrease in snack calories consumed occurred when vice-virtue bundles were introduced. However, our theory predicts that the aggregate-level effects of introducing vice-virtue bundles on calories ordered and consumed will depend heavily upon the relative proportions of the three consumer segments in the population. Thus, in Studies 3 and 4, we conduct a more precise examination of the impact of introducing vice-virtue bundles on calories ordered by examining the calorie implications separately for initial virtue-choosers and initial vice-choosers.

3.3. Study 3: Perceptions of Vice-Virtue Bundle Options

In Study 3, we test the theoretical predictions in Figures 1 and 2. All participants were asked to rate the perceived tastiness and healthiness of five options (pure virtue, pure vice, and three vice-virtue bundles). They then chose from a two-option choice set consisting of pure virtue and pure vice, allowing us to classify them as people who would otherwise choose pure vice (initial vice-choosers) and participants who would otherwise choose pure virtue (initial virtue-choosers) in the absence of vice-virtue bundles. Next, they chose from the five-option choice set containing vice-virtue bundles. Finally, they indicated whether they were in favor of the introduction of vice-virtue bundles.

This procedure allowed examination of four key outcomes (the tastiness and healthiness perceptions, most popular vice-virtue bundle, calories ordered as a result of the introduction of vice-virtue bundles, and favorability towards the introduction of vice-virtue bundles) separately for the three consumer segments outlined in Figure 2 (vice-lovers: initial vice-choosers who believe pure vice tastes better than pure virtue; virtue-acceptors: initial virtue-choosers who believe pure vice tastes better than pure virtue; virtue-lovers: initial virtue-choosers who do not believe pure vice tastes better than pure virtue).

3.3.1. Method

Participants and Design. One hundred and one participants ($M_{\text{age}} = 33.59$, 51.5% female) from Amazon’s Mechanical Turk panel completed this study. This study had a 3 (consumer segment: vice-lover, virtue-acceptor, virtue-lover) x 2 (ratings type: healthiness, tastiness) x 5 (rated option: pure virtue, $\frac{1}{4}$ vice, $\frac{1}{2}$ vice, $\frac{3}{4}$ vice, and pure vice) mixed design, where consumer segment was a between-subjects factor and ratings type and rated option were both within-subjects factors. One participant was excluded from analysis because s/he did not fit into any of the three consumer segments.⁸

Procedure. All participants were shown a choice set with five options: pure virtue, $\frac{1}{4}$ vice, $\frac{1}{2}$ vice, $\frac{3}{4}$ vice, and pure vice. In both this study and Study 4, the pure virtue and vice options were, respectively, a plate of salad and a plate of fries. The vice-virtue bundles included a $\frac{1}{4}$ -vice option (a plate of $\frac{3}{4}$ salad and $\frac{1}{4}$ fries), a $\frac{1}{2}$ -vice option (a plate of $\frac{1}{2}$ salad and $\frac{1}{2}$ fries), and a $\frac{3}{4}$ -vice option (a plate of $\frac{1}{4}$ salad and $\frac{3}{4}$ fries). We selected these stimuli because restaurants frequently offer these side dish choices. See Appendix Figure A1 for the pictures shown to participants, and see Appendix Figure A2 for the precise food contents (i.e., grams of salad and French fries) and calories on each plate.

After viewing the five options, participants then rated each option on healthiness (“How healthy do you think this side option is?”) and tastiness (“How tasty do you think this side option is?”), starting with the pure virtue option. Responses were on a scale anchored by 1 = *not at all* and 7 = *very much*.

Then, to classify participants as initial vice-choosers and initial virtue-choosers,⁹ we showed participants the pure vice and pure virtue options and asked them to imagine getting lunch from their workplace cafeteria and having to select one of the two side options.

Next, participants were told to imagine instead that they were now faced with the five options, including three vice-virtue bundles.¹⁰ They were again asked which side option they would choose. Participants were told that the overall quantity of the side dish was still the same in all options and that they could choose the same or a different side option as they previously chose.

Finally, to examine whether participants want vice-virtue bundles to be introduced, we asked participants: “Which set of side dish offerings would you prefer for your workplace cafeteria to offer?” (1

⁸ One participant was an initial vice-chooser who did not rate pure vice as tastier than pure virtue. Including this participant as a vice-lover (i.e., with all other initial vice-choosers) does not change any of the results.

⁹ To ensure that the classification of participants as initial vice-choosers and initial virtue-choosers was not affected by first rating the five options, we compared these participants’ choices from this two-option choice set with the choices made by a separate group of participants who chose from the same two-option choice set without first rating the five options. Using a two-proportion Z-test, we confirmed that the choice shares did not differ depending upon whether participants first rated the five options. Additional details are available from the authors.

¹⁰ To ensure that participants’ choice among the five options was not affected by first rating the five options and then selecting an option from the two-option choice set, we compared these participants’ choices from this five-option choice set with the choices made by a separate group of participants who chose from the same five-option choice set without first rating the five options and selecting from the two-option choice set. Using a Chi-squared test, we confirmed that the choice shares did not differ. Additional details are available from the authors.

= *definitely Option A* to 7 = *definitely Option B*). Option A referred to the 2-option choice set (pure virtue, pure vice), and Option B referred to the 5-option choice set (pure virtue, 1/4-vice, 1/2-vice, 3/4-vice, pure vice). The midpoint of the scale (4) was labeled “*not leaning either way*.”

3.3.2. Results and Discussion

First, we present tastiness and healthiness perceptions aggregated across all participants. Second, we examine tastiness and healthiness perceptions separately for the three consumer segments. Third, we identify the most popular vice-virtue bundle for each consumer segment. Fourth, we examine the impact of introducing vice-virtue bundles on calories ordered for each consumer segment. Finally, we examine whether each consumer segment favors the introduction of vice-virtue bundles.

Aggregated Tastiness and Healthiness Ratings. Past work (Raghunathan et al. 2006) examines participants in aggregate and would suggest that tastiness and healthiness ratings should be inversely related, such that as vice quantity increases, perceived healthiness decreases, and perceived tastiness increases. A two-way repeated-measures ANOVA of ratings type (healthiness, tastiness) and rated option (pure virtue, 1/4-vice, 1/2-vice, 3/4-vice, pure vice) on ratings revealed a significant interaction ($F(2, 243) = 260.63, p < .001$).¹¹

Follow-up tests were then conducted in the form of two separate one-way repeated-measures ANOVAs of rated option on healthiness and on tastiness. First, a repeated-measures ANOVA on healthiness was significant ($F(3, 331) = 501.86, p < .001$); follow-up Bonferroni-adjusted contrasts indicated that healthiness ratings consistently followed a “more vice = more unhealthy” rule, such that perceived healthiness decreased significantly with each increase in vice proportion (p 's $< .001$). Second, a repeated-measures ANOVA on tastiness was also significant ($F(2, 198) = 11.83, p < .001$). However, tastiness followed a different pattern: follow-up Bonferroni-adjusted contrasts indicated that the 1/4-vice option was rated as significantly higher in perceived tastiness than the pure virtue ($p < .001$), the 1/2-vice option was rated as marginally significantly tastier compared to the 1/4-vice option ($p = .074$), and the 1/2-vice option was rated as similarly tasty as the 3/4 vice option ($p = .359$), and the pure vice option ($p = 1.00$). Together, these ratings¹² show that the unhealthy = tasty intuitions that many people hold may weaken within vice-virtue combinations for this set of stimuli, reaching a plateau of 1/4-vice to 1/2-vice (i.e., higher vice proportion equals more unhealthy, but not always more tasty).

Disaggregated Tastiness and Healthiness Ratings. We then examined tastiness and healthiness ratings separately for each consumer segment. First, we verified that three distinct consumer segments

¹¹ Mauchley's Test of Sphericity was significant for the interaction test ($\chi^2(9) = 128.15, p < .001$), for the healthiness ratings ($\chi^2(9) = 58.08, p < .001$), and for the tastiness ratings ($\chi^2(9) = 194.18, p < .001$). Therefore, the Huynh-Feldt epsilon adjustment was made to the degrees of freedom for all three F -tests.

¹² In a separate study using a between-subjects design in which participants only rated one of the five options, we found similar aggregated tastiness and healthiness results. Additional details available from the authors.

exist (Figure 2): 43 participants were initial vice-choosers who rated pure vice as better tasting than pure virtue (vice-lovers), 21 participants were initial virtue-choosers who rated pure vice as better tasting than pure virtue (virtue-acceptors), and 36 participants were initial virtue-choosers who did not rate pure vice as better tasting than pure virtue (virtue-lovers). Only one participant was an initial vice-chooser who did not rate pure vice as better tasting than pure virtue, supporting our notion that this consumer segment should generally be non-existent (Figure 2). As noted earlier, we excluded this participant from all analyses.

We first conducted a three-way mixed ANOVA of consumer segment (vice-lover, virtue-acceptor, virtue-lover), ratings type (healthiness, tastiness), and rated option (pure virtue, 1/4-vice, 1/2-vice, 3/4-vice, pure vice) on ratings. Consumer segment was a between-subjects factor, and ratings type and rated option were both within-subjects factors. This analysis revealed a significant three-way interaction ($F(6, 315) = 19.26, p < .001$).¹³ Follow-up tests were then conducted in the form of three separate two-way repeated-measures ANOVAs, one for each consumer segment, of ratings type (healthiness, tastiness) and rated option (pure virtue, 1/4-vice, 1/2-vice, 3/4-vice, pure vice) on ratings.

For vice-lovers, a two-way repeated-measures ANOVA of ratings type (healthiness, tastiness) and rated option (pure virtue, 1/4-vice, 1/2-vice, 3/4-vice, pure vice) on ratings revealed a significant interaction ($F(3, 135) = 218.35, p < .001$). See Figure 3a. Follow-up tests were then conducted in the form of two separate one-way repeated-measures ANOVAs of rated option on healthiness and on tastiness. First, a repeated-measures ANOVA on healthiness was significant ($F(3, 124) = 192.98, p < .001$), and follow-up Bonferroni-adjusted contrasts indicated that healthiness ratings consistently followed a “more vice = more unhealthy” rule, such that perceived healthiness decreased significantly with each increase in vice proportion (p 's $< .001$). Second, a repeated-measures ANOVA on tastiness was also significant ($F(3, 130) = 71.80, p < .001$). However, tastiness did not follow a strictly linear pattern but rather appeared more similar to an increasing concave function: follow-up Bonferroni-adjusted contrasts indicated that the 1/4-vice option was rated as significantly more tasty than the pure virtue option ($p < .001$), and the 1/2-vice option was rated as significantly more tasty than the 1/4-vice option ($p < .001$), but tastiness ratings appeared to plateau at the 1/2-vice option, as the 3/4-vice option was rated as equally tasty as the 1/2-vice option ($p = 1.00$). The pure vice option was rated as significantly more tasty than the 1/2-vice option and the 3/4-vice option ($p = .001$ and $p < .001$, respectively), suggesting that a further increase in tastiness

¹³ Mauchley's Test of Sphericity was significant for the three-way interaction test ($\chi^2(9) = 67.79, p < .001$), for the two-way interaction test for vice-lovers ($\chi^2(9) = 33.24, p < .001$), for the two-way interaction test for virtue-acceptors ($\chi^2(9) = 13.92, p < .001$), for the two-way interaction test for virtue-lovers ($\chi^2(9) = 38.66, p < .001$), for the healthiness ratings for vice-lovers ($\chi^2(9) = 43.78, p < .001$), for the tastiness ratings for vice-lovers ($\chi^2(9) = 38.99, p < .001$), for the healthiness ratings for virtue-lovers ($\chi^2(9) = 31.63, p < .001$), and for the tastiness ratings for virtue-lovers ($\chi^2(9) = 40.22, p < .001$). Therefore, the Huynh-Feldt epsilon adjustment was made to the degrees of freedom for these F -tests.

occurred from removing all virtue, but altogether, these ratings show consistently that within vice-virtue bundles (consisting of non-zero proportions of both vice and virtue), tastiness plateaus at the 1/2-vice option for these stimuli. The increasing concave tastiness function and the decreasing linear healthiness function appear to intersect between the 1/4-vice and 1/2-vice options; thus, for vice-lovers, the taste-health balance point may be met by the 1/2-vice option. These findings are roughly consistent with our theoretical tastiness and healthiness functions presented in Figure 1a.

[Insert Figures 3a to 3c about here]

For virtue-acceptors, a two-way repeated-measures ANOVA of ratings type (healthiness, tastiness) and rated option (pure virtue, 1/4-vice, 1/2-vice, 3/4-vice, pure vice) on ratings also revealed a significant interaction ($F(4, 73) = 102.94, p < .001$). See Figure 3b. Follow-up tests were then conducted in the form of two separate one-way repeated-measures ANOVAs of rated option on healthiness and on tastiness. First, a repeated-measures ANOVA on healthiness was significant ($F(4, 80) = 145.14, p < .001$); follow-up Bonferroni-adjusted contrasts indicated that perceived healthiness decreased significantly with each increase in vice proportion (all p 's $< .001$ except $p = .002$ when shifting from 1/4-vice to 1/2-vice). Second, a repeated-measures ANOVA on tastiness was also significant ($F(4, 80) = 18.13, p < .001$). However, perceived tastiness did not increase linearly but rather in a concave manner: follow-up Bonferroni-adjusted tests indicated the 1/4-vice option was rated as significantly more tasty than the pure virtue option ($p < .001$), but tastiness ratings appeared to plateau at the 1/4-vice option, as the 1/2-vice, 3/4-vice, and pure vice options were all rated as similarly tasty compared to the 1/4-vice option (all three p 's = 1.00). These ratings show that tastiness plateaus at the 1/4-vice option for these stimuli. The increasing concave tastiness function and the decreasing linear healthiness function appear to intersect between the pure virtue and 1/4-vice options; thus, for virtue-acceptors, the taste-health balance point may be met by the 1/4-vice option. These findings are consistent with our theoretical tastiness and healthiness functions presented in Figure 1b.

For virtue-lovers, a two-way repeated-measures ANOVA of ratings type (healthiness, tastiness) and rated option (pure virtue, 1/4-vice, 1/2-vice, 3/4-vice, pure vice) on ratings revealed a significant interaction ($F(3, 102) = 51.98, p < .001$). See Figure 3c. Follow-up tests were then conducted in the form of two separate one-way repeated-measures ANOVAs of rated option on healthiness and on tastiness. First, a repeated-measures ANOVA on healthiness was significant ($F(3, 106) = 171.96, p < .001$), and follow-up Bonferroni-adjusted contrasts indicated that perceived healthiness decreased significantly with each increase in vice proportion (p 's $< .001$). Second, a repeated-measures ANOVA on tastiness was also significant ($F(3, 103) = 19.88, p < .001$). Tastiness, like healthiness, was a decreasing function for virtue-lovers, making goal balancing irrelevant. Tastiness exhibited a decreasing concave function: follow-up Bonferroni-adjusted contrasts indicated that both the 1/4-vice option and the 1/2-vice option were rated as

similarly tasty as the pure virtue option ($p = 1.00$ and $p = .483$, respectively), but tastiness dropped when increasing the vice proportion further, as the $\frac{3}{4}$ -vice option was rated as less tasty compared to the $\frac{1}{2}$ -vice option ($p = .006$), and the pure vice option was rated as less tasty compared to the $\frac{3}{4}$ -vice option ($p = .026$). These ratings show that tastiness exhibits a decreasing concave pattern, such that increasing the proportion of vice past $\frac{1}{2}$ leads to decreases in tastiness. These findings are consistent with our theoretical tastiness and healthiness functions presented in Figure 1c.

Choice Implications of Offering Vice-Virtue Bundles. When the vice-virtue bundles were added to the choice set, 22.0% chose pure virtue, 34.0% chose $\frac{1}{4}$ vice, 27.0% chose $\frac{1}{2}$ vice, 4.0% chose $\frac{3}{4}$ vice, and 13.0% chose pure vice. At the aggregate level, both the $\frac{1}{4}$ -vice option and the $\frac{1}{2}$ -vice option were again more frequently selected than the $\frac{3}{4}$ -vice option (p 's $< .001$, exact binomial tests).

We then assessed the most popular vice-virtue bundle for each consumer segment (see Table 1). As predicted, the most popular vice-virtue bundle for vice-lovers was the option that met their taste-health balance point: the $\frac{1}{2}$ -vice option (selected by 51.2% of participants; compared to 9.3% each for the $\frac{1}{4}$ -vice and $\frac{3}{4}$ -vice options, both p 's = .001, exact binomial tests). Also as predicted, the most popular vice-virtue bundle for virtue-acceptors was the option that met their taste-health balance point: the $\frac{1}{4}$ -vice option (selected by 71.4% of participants; compared to 9.5% for the $\frac{1}{2}$ -vice option, $p = .002$, and no participants for the $\frac{3}{4}$ -vice option, $p < .001$, exact binomial tests). Finally, as predicted by variety seeking, the most popular vice-virtue bundle for virtue-lovers was the vice-virtue bundle with the smallest proportion of vice: the $\frac{1}{4}$ -vice option (selected by 41.7% of participants; compared to 8.3% for the $\frac{1}{2}$ -vice option, $p = .008$, and no participants for the $\frac{3}{4}$ -vice option, $p < .001$, exact binomial tests).

Impact of Introducing Vice-Virtue Bundles on Calories Ordered. In Studies 3 and 4, we were able to examine changes in calories ordered when vice-virtue bundles were introduced separately for each consumer segment. As such, we calculated the calories chosen in each participant's two chosen options (See Figure A2).

First, at the aggregate level in this study, calories ordered was lower after the introduction of vice-virtue bundles ($M_{\text{before}} = 148$ calories, $M_{\text{after}} = 132$ calories). A paired-samples t -test was directional, although non-significant ($t(99) = 1.55$, $p = .125$), and a non-parametric related-samples Wilcoxon signed rank test was significant ($p = .005$), suggesting overall improvements in calorie profiles with the inclusion of vice-virtue bundles.

Our theory suggests, however, that this difference should be driven by differential changes in caloric consumption by consumer segment. Therefore, we examined how introducing vice-virtue bundles impacts calories ordered separately by consumer segment. We first calculated the change in calories ordered for each participant (calories ordered after vice-virtue bundles were introduced minus calories ordered prior to vice-virtue bundles being introduced). A one-way between-subjects ANOVA of

consumer segment on change in calories ordered revealed a significant main effect of consumer segment ($F(2, 97) = 81.48, p < .001$; non-parametric Kruskal-Wallis test: $p < .001$). Consistent with our theoretical argument, vice-lovers ordered on average 109 fewer calories when vice-virtue bundles were introduced, whereas virtue-acceptors ordered on average 70 more calories and virtue-lovers ordered on average 45 more calories. The change in calories for vice-lovers was significantly different from the change in calories for virtue-acceptors and virtue-lovers (Bonferroni-adjusted p 's $< .001$; Mann-Whitney U-test p 's $< .001$). Whether the change in calories for virtue-acceptors and virtue-lovers was significantly different differed depending upon whether a Bonferroni-adjusted follow-up test was used ($p = .478$) or a Mann-Whitney U-test was used ($p = .042$) but most importantly, the upward shift in calories for all initial virtue-choosers (virtue-acceptors and virtue-lovers) was less than the corresponding downward shift in calories for initial vice-choosers (vice-lovers), suggesting that introducing vice-virtue bundles may have population-level health benefits even if the population consists of similar proportions of initial vice-choosers and initial virtue-choosers.

Choice Set Preference. Both vice-lovers and virtue-lovers reported that they would prefer their workplace cafeteria to offer a choice-set with vice-virtue bundles (vice-lovers: $M = 5.81$, significantly $> 4, t(42) = 5.74, p < .001$; virtue-lovers: $M = 5.28$; significantly $> 4, t(35) = 3.60, p = .001$). Virtue-acceptors indicated a directional preference for their workplace cafeteria to offer a choice-set with vice-virtue bundles ($M = 4.90$, directionally $> 4, t(20) = 1.55, p = .138$).

Discussion. Study 3 demonstrated that tastiness perceptions of differently composed vice-virtue bundles, relative to other each other and to pure virtue or vice options, are different for the three consumer segments described in Figure 2. Vice-lovers and virtue-acceptors both exhibit an increasing concave tastiness function consistent with our predictions. Vice-lovers' tastiness function plateaus at a higher proportion of vice ($\frac{1}{2}$ -vice) than virtue-acceptors' tastiness function ($\frac{1}{4}$ -vice). This difference in concavity is consistent with research showing that people higher in self-control (presumably virtue-acceptors) tend to satiate more quickly on unhealthy foods (Redden and Haws 2013). In contrast, virtue-lovers exhibit a decreasing tastiness pattern that makes goal balancing irrelevant, as pure virtue is already able to address both taste and health goals. Unlike the tastiness perceptions, healthiness perceptions did not differ across consumer segments, indicating that these three consumer segments differ with respect to taste, but not health perceptions, which confirms that we selected vices and virtues that are rather unambiguous in their classification (i.e., we selected clearly unhealthy and healthy options for our vices and virtues).

As predicted, the most popular vice-virtue bundle for vice-lovers was the $\frac{1}{2}$ -vice option (consistent with meeting the taste-health balance point), and the most popular vice-virtue bundle for both virtue-acceptors and virtue-lovers was the $\frac{1}{4}$ -vice option (consistent with meeting the taste-health balance point for virtue-acceptors and variety-seeking for virtue-lovers). In general, these findings align with our

theoretical framework and our expectations about the shapes of the tastiness and healthiness functions for various segments.

These vice-virtue bundle preferences have the important practical implication that the introduction of vice-virtue bundles leads to a smaller increase in calories for initial virtue-choosers (virtue-acceptors and virtue-lovers) who shift from pure virtue to $\frac{1}{4}$ -vice than the corresponding decrease in calories for initial vice-choosers (vice-lovers) who shift from pure vice to $\frac{1}{2}$ -vice.

Finally, Study 3 demonstrated that introducing vice-virtue bundles is looked upon relatively favorably by all three consumer segments, suggesting that managers may better meet most consumers' preferences by altering their firms' product lines to include vice-virtue bundles.

3.4. Study 4: Expanding a Choice Set with Mixed Bundles

In the last study, we had several important objectives. First, Study 4 uses a within-subjects design to examine the choices that initial vice-choosers and initial virtue-choosers make when vice-virtue bundles, including and not including the $\frac{1}{2}$ -vice option (i.e., the option that met the taste-health balance point for vice-lovers), are offered.¹⁴

When the $\frac{1}{2}$ -vice option was included, we predicted that we would replicate the results from Study 3 since we were using the same participant pool and food stimuli as in Study 3. Specifically, we predicted that the most popular vice-virtue bundle for initial vice-choosers (i.e., vice-lovers) would be the $\frac{1}{2}$ -vice option (due to meeting the taste-health balance point), whereas the most popular vice-virtue bundle for initial virtue-choosers (i.e., virtue-acceptors and virtue-lovers) would be the $\frac{1}{4}$ -vice option (due to meeting the taste-health balance point by virtue-acceptors and variety seeking by virtue-lovers). From a policy perspective, replicating the finding that initial vice-choosers shift to a vice-virtue bundle (as opposed to remaining with a pure vice option) would be especially encouraging.

When the $\frac{1}{2}$ -vice option was not included, we predicted that initial vice-choosers would be more likely to choose a $\frac{1}{4}$ -vice option than a $\frac{3}{4}$ -vice option. The rationale for this hypothesis is that due to the pattern of the tastiness and healthiness functions, a vice-virtue bundle with a smaller proportion of vice than the taste-health balance point still substantially address taste while certainly addressing health, whereas a vice-virtue bundle with a larger proportion of vice than the taste-health balance point cannot substantially address health even though it can address taste. Note that although removing the $\frac{1}{2}$ -vice option may reduce external validity, this procedure allows a conservative test of our taste-health balance point account for initial vice-choosers and tests a hypothesis that a pure variety seeking account does not predict.

¹⁴ Study 4 does not separate initial virtue-choosers into those who do and do not believe vice tastes better than virtue (virtue-acceptors and virtue-lovers, respectively). This simplification seems appropriate given that Study 3 found that both consumer segments of initial virtue-choosers prefer $\frac{1}{4}$ -vice to other vice-virtue bundles.

Second, Study 4 examines how the introduction of vice-virtue bundles affects choice share differently from the introduction of vice-vice bundles, which should be appealing based on the variety offered, but which fail to provide the opportunity to address taste and health goals.

Finally, like Study 3, Study 4 provides an opportunity to examine shifts in calories ordered based upon the introduction of vice-virtue bundles, both in aggregate and separately for initial vice-choosers and initial virtue-choosers.

3.4.1. Method

Participants and Design. Three hundred and seventy-nine participants ($M_{\text{age}} = 33.33$, 56.2% female) from Amazon's Mechanical Turk panel completed this study. This study had a 2 (choice-set type: vice-virtue, vice-vice) x 2 (expanded choice-set: 5-options (50/50-option included), 4-options (50/50-option excluded)) x 2 (choice version: initial, expanded) mixed-design with choice-set type and expanded choice-set as between-subjects factors and choice version as a within-subjects factor. Thus, participants were randomly assigned to one of four conditions (vice-virtue 5-options, vice-virtue 4-options, vice-vice 5-options, or vice-vice 4-options), and all participants made two choices: one from a two-item (initial) choice set and one from a four-option or five-option (expanded) choice set.

Procedure. All participants were asked to imagine getting lunch from their workplace cafeteria and having to select a side option. Participants made two choices. First, they chose between pure versions of the two side options that would later be presented to them in mixed bundles. That is, participants who would see the vice-virtue bundles in the expanded set first chose either a plate of salad or a plate of French fries. Participants who would later see vice-vice bundles in the expanded choice set first chose either a plate of macaroni & cheese or a plate of French fries.¹⁵ See Appendix Figures A1 and A2 for pictures, food contents, and calorie content of each plate.

After participants chose one option from their assigned two-option choice set, they were then shown an expanded choice set consisting of either four or five options, depending upon their randomly assigned condition. Participants were then told to imagine that they were now faced with this expanded choice set and again asked which side option they would choose.¹⁶ Participants were told that the overall

¹⁵ Because salad and fries are very different in flavor and people are known to exhibit sensory-specific satiety along the flavor dimension (Inman 2001), we aimed to select a side dish that would be perceived as different in flavor from fries for the other vice in the vice-vice choice set. In a separate pre-test, participants ($N = 39$) saw a plate of macaroni & cheese and a plate of French fries and were asked "How similar or different are the flavors of the foods on these two plates?" from 1 = *very similar* to 7 = *very different*. Participants indicated that they consider macaroni & cheese to be very different in flavor from French fries ($M = 5.77$; significantly different from the scale midpoint of 4, according to a one-sample t -test, $t(38) = 8.87$, $p < .001$).

¹⁶ Because the potential for demand effects is generally stronger in within-subjects designs than in between-subject designs (Charness et al. 2011), we compared Study 4 participants' second choice from the vice-virtue four-option choice set and the vice-virtue five-option choice set with a separate group of participants' first (and only) choice from the vice-virtue four-option choice set and the vice-virtue five-option choice set. Using Chi-squared tests, we confirmed that the choice shares from the vice-virtue four-option choice set and the vice-virtue five-option choice

quantity of the side dish was still the same in all options and that they could choose the same side option or a different side option as they previously chose. Participants in the 5-options (50/50-option included) condition saw the two options they had already seen and three mixed bundles ($\frac{1}{4}$ vice, $\frac{1}{2}$ vice, and $\frac{3}{4}$ vice), and participants in the 4-options (50/50-option excluded) condition saw the two options they had already seen and two mixed bundles ($\frac{1}{4}$ vice and $\frac{3}{4}$ vice). The three mixed bundles in the vice-virtue condition were the same as those in Study 3 containing fries and salad. The three mixed bundles in the vice-vice condition included the same set of options, substituting macaroni & cheese for the salad (see Appendix Figures A1 and A2).

3.4.2. Results and Discussion

We first present the initial choice shares for each of the four conditions. Then, we present the main analyses. Specifically, we examine how consumers' choices change when vice-virtue and vice-vice bundles, including the $\frac{1}{2}$ -vice option, are introduced. Second, we examine how consumers' choices change when mixed vice-virtue and vice-vice bundles, dropping the $\frac{1}{2}$ -vice option, are introduced. Finally, we examine the impact of introducing vice-virtue bundles (including and dropping the $\frac{1}{2}$ -vice option) on calories ordered, separately for initial vice-choosers and initial virtue-choosers.

Initial Choice Shares. Table 1 shows the initial choice shares across all four conditions. Replicating choice share findings from Studies 1's and 2's pure vice – pure virtue condition and from Study 3, the initial choice shares of vice and virtue did not differ in either of the vice-virtue conditions ($p = .682$ in the vice-virtue 50/50-option included condition; $p = .121$ in the vice-virtue 50/50-option excluded condition, exact binomial tests). In the vice-vice conditions, the initial choice shares of the two vices differed in the vice-vice 50/50-option included condition ($p = .010$, exact binomial test)¹⁷ but not in the vice-vice 50/50-option excluded condition ($p = 1.000$, exact binomial test).

Introduction of Vice-Virtue and Vice-Vice Bundles, Including the Middle 50/50-Option. When the vice-virtue bundles were added to the choice set, 17.9% chose pure virtue, 41.1% chose $\frac{1}{4}$ vice, 29.5% chose $\frac{1}{2}$ vice, 5.3% chose $\frac{3}{4}$ vice, and 6.3% chose pure vice. Thus, at the aggregate level, both the $\frac{1}{4}$ -vice option and the $\frac{1}{2}$ -vice option were more frequently selected than the $\frac{3}{4}$ -vice option (p 's < .001, exact binomial test).

Next, we assessed how adding vice-virtue bundles shifted participants away from the choice they had made from the pure vice-pure virtue choice set. As shown in Table 1 and replicating Study 3, for initial virtue-choosers, the most popular vice-virtue bundle for them to shift to was a $\frac{1}{4}$ -vice option

set did not differ between the within-subjects and between-subjects designs. Thus, the second choice that Study 4 participants made does not seem to be driven by demand effects from using a within-subjects design. Additional details are available from the authors.

¹⁷ Although the initial choice shares of fries and macaroni & cheese happened to be significantly different in one of the vice-vice conditions, we are still able to examine the relative shifts in choice shares when the vice-vice bundles are introduced.

(selected by 64.0% of participants; compared to 4.0% for the 1/2-vice option, $p < .001$, and no participants for the 3/4-vice option, $p < .001$, exact binomial tests), and for initial vice-choosers, the most popular vice-virtue bundle for them to shift to was a 1/2-vice option (selected by 57.8% of participants; compared to 15.6% for the 1/4-vice option, $p = .001$, and 11.1% for the 3/4-vice option, $p < .001$, exact binomial tests).

We then examined how adding vice-vice bundles shifted participants away from their initial choice from the pure vice-pure vice set. We hypothesized that introducing vice-vice bundles would not have the same impact on choice as the introduction of vice-virtue bundles. When choosing from expanded vice-vice choice sets, consumers should be guided by variety seeking and their taste preferences rather than by seeking to simultaneously address health and taste goals. Therefore, we hypothesized that consumers choosing from expanded vice-vice choice sets would not exhibit the same systematic preferences for bundles with relatively small (1/4) to medium (1/2) proportions of one option as consumers choosing from expanded vice-virtue choice sets because they would be driven primarily by taste preferences and desire for variety, but not by balancing taste and health goals.

As shown in Table 1, movement to vice-vice bundles indeed did not follow the same pattern that characterized movement to vice-virtue bundles. If we consider salad (i.e., pure virtue in the vice-virtue set) and macaroni & cheese (i.e., vice A in the vice-vice set) to be comparable options within their respective choice sets, then whereas the most popular option for initial virtue-choosers was a 1/4-vice option (chosen by 64.0% of initial virtue participants), vice A choosers were equally likely to shift to 1/2 vice B as to shift to 1/4 vice B (31.1% chose 1/2 vice B and 44.3% chose 1/4 vice B; $p = .302$, exact binomial test). In addition, whereas the most popular option for initial vice-choosers in the vice-virtue condition was a 1/2-vice option (chosen by 57.8% of participants), initial vice B choosers were equally likely to shift to 3/4 vice B as to 1/2 vice B (37.1% chose 3/4 vice B and 28.6% chose 1/2 vice B; $p = .678$, exact binomial test).

Introduction of Vice-Virtue and Vice-Vice Bundles, Excluding the Middle 50/50-Option. We next examined the impact of introducing mixed bundles without the 1/2-vice bundle option.

First, we examined the impact of removing the 1/2-vice option on initial virtue-choosers and initial vice-choosers. The removal of the 1/2-vice option should not impact initial virtue-choosers; very few initial virtue-choosers (only 4.0%) selected that option when it was offered as their preferred vice-virtue bundle was the 1/4-vice option, due to meeting the taste-health balance point (virtue-acceptors) and variety seeking (virtue-lovers). Thus, we predicted that initial virtue-choosers would continue to choose the 1/4-vice option over the 3/4-vice option when the 1/2-vice option was removed. In contrast, the removal of the 1/2-vice option should impact initial vice-choosers, because many (57.8%) selected that option when it was offered. Importantly, given our taste-health balance point account, we predicted that initial vice-choosers

would gravitate toward the $\frac{1}{4}$ -vice option over the $\frac{3}{4}$ -vice option because taste and health goals can be more successfully addressed through a relatively large shift towards health.

As expected, initial virtue-choosers continued to choose the $\frac{1}{4}$ -vice option over the $\frac{3}{4}$ -vice option when the $\frac{1}{2}$ -vice option was excluded (58.2% chose the $\frac{1}{4}$ -vice option and 0.0% chose the $\frac{3}{4}$ -vice option; $p < .001$, exact binomial test). Recall that when the $\frac{1}{2}$ -vice option was included in the expanded choice set, 64.0% chose the $\frac{1}{4}$ -vice option and 0.0% chose the $\frac{3}{4}$ -vice option; essentially, removing the $\frac{1}{2}$ -vice option has no impact on initial virtue-choosers. Moreover, of particular interest, initial vice-choosers were more likely to shift to the $\frac{1}{4}$ -vice option than to the $\frac{3}{4}$ -vice option (48.7% chose the $\frac{1}{4}$ -vice option vs. 20.5% chose the $\frac{3}{4}$ -vice option; $p = .052$, exact binomial test). Recall that when the $\frac{1}{2}$ -vice option was included, 15.6% chose the $\frac{1}{4}$ -vice option and 11.1% chose the $\frac{3}{4}$ -vice option. In other words, a large percentage (48.7%) of initial vice-choosers exhibited preference-shifts, moving from a pure vice option to one with less than $\frac{1}{2}$ vice, providing strong support for our taste-health balance point account.

Second, we examined the impact of removing the 50/50 middle option on pure vice A and pure vice B choosers. The removal of the 50/50 middle option should impact both pure vice A and pure vice B choosers, as the 50/50 middle option was chosen by approximately one-third of participants (31.1% of pure vice A choosers; 28.6% of pure vice B choosers) when it was offered. However, given that vice-vice bundles do not offer the unique property of addressing both taste and health, we do not expect to see patterns of preference-shifts (i.e., situations in which a given individual who would have selected a given pure option in fact selects a choice that is less than 50% of that option when given the option of a bundle) in the presence of vice-vice bundles. Such a lack of preference-shifts would further support our theory, because among vice-vice bundles, tastes and variety-seeking alone are driving preferences. Therefore an initial choice of vice A should indicate a taste preference for vice A, such that initial vice A choosers should rarely switch to an option consisting of less than $\frac{1}{2}$ of vice A.

As expected, initial vice A choosers were indeed more likely to choose the $\frac{1}{4}$ vice B option than the $\frac{3}{4}$ vice B option (68.1% chose $\frac{1}{4}$ vice B vs. 8.5% chose $\frac{3}{4}$ vice B; $p < .001$, exact binomial test), and initial vice B choosers were directionally, although non-significantly, more likely to choose the $\frac{3}{4}$ vice B option than the $\frac{1}{4}$ vice B option (34.0% chose $\frac{3}{4}$ vice B vs. 19.1% chose $\frac{1}{4}$ vice B; $p = .230$, exact binomial test). Thus, preference-shifts happen more frequently among initial vice-choosers who are offered vice-virtue bundles than among initial vice-choosers who are offered vice-vice bundles.

Impact of Introducing Mixed Bundles on Calories Ordered in the Vice-Virtue Conditions. We then calculated the calories in each participant's two chosen options (See Figure A2).

First, we examined how introducing vice-virtue bundles impacts calories ordered at the aggregate level. In keeping with our overall study design, we conducted a 2 (expanded choice-set: 50/50-option included, 50/50-option excluded) x 2 (choice version: initial, expanded) mixed model ANOVA on

calories with expanded choice-set as a between-subjects factors and choice version as a within-subjects factor and found a significant main effect of choice version ($F(1, 187) = 15.64, p < .001$), but no significant interaction ($F(1, 187) = .39, p = .533$). This result suggests that the change in calories ordered did not differ depending upon whether the 50/50 option was included in the choice set or not. However, calories ordered was significantly lower after the introduction of vice-virtue bundles ($M_{\text{before}} = 152$ calories, $M_{\text{after}} = 119$ calories; paired-samples t -test: $t(188) = 3.96, p < .001$; non-parametric related-samples Wilcoxon signed rank test: $p < .001$), suggesting overall improvements in calorie profiles with the inclusion of vice-virtue bundles (with or without the ½-vice middle option).

Second, and more important for our theoretical account, we examined how introducing vice-virtue bundles impacts calories ordered differently for initial virtue-choosers versus initial vice-choosers. We first calculated the change in calories ordered for each participant (calories ordered after vice-virtue bundles were introduced minus calories ordered prior to vice-virtue bundles being introduced). A 2 (expanded choice-set: 50/50-option included, 50/50-option excluded) x 2 (initial choice: pure virtue, pure vice) between-subjects ANOVA on change in calories ordered revealed a significant main effect of initial choice ($F(1, 185) = 360.30, p < .001$) and no significant interaction ($F(1, 185) = 1.35, p = .247$).¹⁸ Consistent with Study 3, initial virtue-choosers ordered on average 50 more calories when vice-virtue bundles were introduced, whereas initial vice-choosers ordered on average 136 fewer calories. The lack of a significant interaction indicates that this effect was similar regardless of whether the second choice set included four or five options. Again, the upward shift in calories for initial virtue-choosers was less than the corresponding downward shift in calories for initial vice-choosers.

Discussion. Study 4 replicates the finding that people tend to select vice-virtue bundles with ¼-vice or ½-vice. As in Study 3, initial virtue-choosers frequently switched to a ¼-vice option, consistent with a combination of meeting the taste-health balance point (virtue-acceptors) and variety seeking (virtue-lovers) at play, and initial vice-choosers frequently switched to a ½-vice option, consistent with meeting the taste-health balance point (vice-lovers).

To further test our taste-health balance point account for initial vice-choosers, Study 4 also tested the impact of excluding the option that met the taste-health balance point (i.e., ½-vice) from the expanded choice set. In strong support of our theorizing, we found that in the absence of a ½-vice option, initial vice-choosers were more likely to choose a vice option with ¼ vice than one with ¾ vice.

Finally, on a practical level, Study 4 replicated the finding from Study 3 that introducing vice-virtue bundles can decrease calories ordered, especially if a large proportion of consumers otherwise

¹⁸ Because Levene's test of homogeneity of variances was violated for the change in calories ordered ($p < .001$), and we are not aware of a robust alternative procedure for a two-way ANOVA, we re-ran the two-way ANOVA as a one-way ANOVA with four-groups. We used the Brown-Forsythe procedure for the one-way ANOVA and then conducted follow-up contrasts using the Games-Howell procedure and came to the same conclusions.

choose pure vice options. This finding is important because the majority of patrons at many restaurants, including fast-food restaurants, tend to choose pure vice options in the absence of vice-virtue bundles (Wilcox et al. 2009).

4. General Discussion

Although a substantial amount of research has attempted to propose ways to shift consumers' choices from pure vice to pure virtue options, there are reasons to believe such efforts may often be unsuccessful. In the present research, we propose that introducing vice-virtue bundles may offer some means of nudging at least some consumers toward healthier consumption. Specifically, across four studies, we find that people consistently prefer vice-virtue bundles with small ($\frac{1}{4}$) to medium ($\frac{1}{2}$) proportions of vice to vice-virtue bundles with large ($\frac{3}{4}$) proportions of vice. We suggest that these choice patterns arise due to seeking the *taste-health balance point* by those who perceive pure vice as tastier than pure virtue (vice-lovers and virtue-acceptors) and due to variety seeking by those who do not perceive pure vice as tastier than pure virtue (virtue-lovers). We find tastiness and healthiness ratings as well as choice patterns that are consistent with this theoretical account of two different mechanisms at play for three different consumer segments. See Table 2 for a summary of key findings across studies.

[Insert Table 2 about here]

It would not be accurate to conclude that aggregate calorie consumption will necessarily be decreased by the introduction of vice-virtue bundles. Rather, our framework predicts differential effects on caloric consumption depending on consumers' a priori choice of virtue or vice. Indeed, both Studies 3 and 4 demonstrate that the aggregate impact of introducing vice-virtue bundles is likely to be a decrease in calories ordered when the proportion of initial vice-choosers in the population is high—a condition that may be predictable based on observable characteristics, such as dining context or prior sales data.

We note that although our studies focused on the food domain, we used the broader terms “vice” and “virtue,” respectively, to categorize food products. These broader terms were selected to be consistent with those used in past research on controlling food consumption quantity (Mishra and Mishra 2011; Wertenbroch 1998). Indeed, the definition of “vice” nicely captures the need to impose external controls on consumption: vices are defined as “goods that are likely to be consumed on impulse and that therefore may pose self-control problems” (Wertenbroch 1998).¹⁹ Our focus on understanding vice-virtue bundles in the food domain was for three main reasons. First, many consumers seek, yet often struggle, to balance taste and health goals (Dhar and Simonson 1999; Glanz et al. 1998; Stewart et al. 2006). Second, limiting

¹⁹ As Mishra and Mishra (2011) pointed out, however, researchers have used different, but related, terms to categorize products that vary in the extent to which they have short-term benefits versus long-term benefits. These terms including “wants” versus “shoulds” (Milkman, Rogers, and Bazerman 2008) and “hedonic products” versus “utilitarian products” (Dhar and Wertenbroch 2000).

consumption quantity of unhealthy foods (vices) is of concern to many stakeholders, including consumers, researchers, policy makers, and managers (Chandon and Wansink in press). Finally, many managers in the food industry are actively seeking out new, healthier options that consumers will voluntarily choose (Sifferlin 2013; Strom 2013; Wansink 2012)—vice-virtue bundles may be such an option.

Finally, although vice-virtue trade-offs exist outside of the food decision-making domain, the findings uncovered in our research may be specific to the characteristics of health and taste goals and to the functions presented in Figure 1. However, future research should explore contexts with similar trade-offs between affective and cognitive attributes, as the concepts of identifying functions for affective and cognitive attributes and of identifying affective-cognitive balancing points are quite valid in domains beyond that of food decision-making. We do note that research has shown that people do not always desire to balance competing affective and cognitive attributes when it comes to their choices in a single consumption episode (Dhar and Simonson 1999). For instance, whereas people often aim for balancing taste (affective attribute) and health (cognitive attribute), they may instead aim for highlighting either taste (affective attribute) or cost (cognitive attribute) (Dhar and Simonson 1999). Thus, the concept of an affective-cognitive balance point may be most relevant when applied to attributes that consumers desire to balance in a single consumption episode or when environmental triggers make balancing attributes particularly attractive.

4.1. Relationship and Contribution to Prior Research

From a theoretical perspective, research on balancing taste and health goals tends to focus on either the choice of food (Dhar and Simonson 1999; Laran 2010; Wilcox et al. 2009) or the quantity of consumption (Haws and Winterich 2013; Redden and Haws 2013; Schwartz et al. 2012), but less frequently on both of these. In contrast, in the present research, we focus on single-decision contexts that incorporate choices about the relative quantities of vice and virtue within food decision-making contexts. This approach allows us to propose and test for taste-health balance points, leading to our predictions about consumers' preferred proportions of vice and virtue.

Our concept of taste-health balance points is thus important because prior research on goal balancing is typically agnostic as to consumers' preferred proportions of vice and virtue (Dhar and Simonson 1999; Fishbach and Dhar 2005; Fishbach and Zhang 2008; Laran 2010). Further, work in licensing (Khan and Dhar 2006) tends to suggest that consumers alternate between virtue and vice choices over time. Our findings contribute to both of these literatures. We contribute to the literature on goal balancing by suggesting that a relatively small proportion of vice ($\frac{1}{4}$) is sufficient to address a taste goal, whereas a relatively large proportion of virtue ($\frac{1}{2}$) is needed to address a health goal. It may well be that

adding a small amount of vice to a food option provides a small, but powerful positive utility. This would be consistent with the notion of a silver-lining effect that takes advantage of the steep part of the gain function associated with prospect theory (Kahneman and Tversky 1979).

Indeed, consumers' perceptions of the healthiness and tastiness of vice-virtue bundles may make it relatively easy to restrict vice quantity because bundles with relatively small proportions of vice are perceived as healthier without being less tasty than vice-virtue bundles with larger proportions of vice. This notion is of particular theoretical and practical interest as it builds upon research on unhealthy = tasty intuitions (Raghunathan et al. 2006) and extends understanding of this intuition to evaluations of multiple food combinations varying in relative quantities. We show that the unhealthy = tasty pattern occurs for most consumers mainly when considering the anchors (pure virtue and pure vice) and that examining vice-virtue bundles reveals an asymptote, such that marginal increases in relative vice proportion produce little impact on perceived tastiness. This demonstrates an important boundary condition for these intuitions and suggests ways to promote healthy food choices that are also perceived as tasty (Glanz et al. 1998). Moreover, although we chose to focus on logical proportions of vices and virtues in all our studies, determining how far the boundaries could be pushed (e.g., would as low as 10% vice still be appealing?) and still maintain the present effects on choice could be examined in future research.

We also provide some insights into "licensing" effects whereby consumers use previous virtuous acts to justify subsequent indulgence (Khan and Dhar 2006). Such effects are often highlighted as a part of the goal balancing process. In a sense, our results might speak to "simultaneous licensing" as consumers may view the virtue within a vice-virtue bundle as licensing consumption of the vice, in that it allows consumers to rationalize their indulgent consumption (Bublitz et al. 2010). However, in addition to differences in sequential versus simultaneous decision making, we also deviate from licensing literature by finding that a small amount of virtue may not compensate for a larger amount of vice.

4.2. Practical Implications for Consumers and Managers

For consumers, there are important implications of shifting from pure vice options to vice-virtue bundles. First, the calorie savings can be clinically significant if such choice-shifts persist over repeated decisions. Take for instance the example of an average overweight adult consumer shifting from a medium fries at McDonald's (380 calories; McDonald's 2013b) to a McDonald's fries-salad bundle with half fries (190 calories) and half side-salad (10 calories). If this consumer visited McDonald's once per week and made this choice-shift every time for a year, she would eventually lose two to three pounds, with half that amount lost in one year and 95% of that amount lost in approximately three years, according to a dynamic simulation model of weight change (Hall et al. 2011). To put this into context, the average adult in the

United States gains about one to two pounds per year (Jeffery and French 1999), a gain that can translate into significant health consequences (Hubert et al. 1983; Williamson et al. 1991).

There are also implications for consumers shifting from pure virtue options to vice-virtue bundles. Our data show that introducing vice-virtue bundles leads some consumers who would otherwise choose pure virtue to shift to a vice-virtue bundle with a small proportion of vice, whether due to taste-health balance point seeking or due to variety seeking. That the introduction of vice-virtue bundles may lead to higher caloric intake for some consumers raises the important question of when introducing vice-virtue bundles is responsible from a consumer welfare perspective. We suggest that vice-virtue bundles should only be introduced when the population contains a large enough percentage of initial vice-choosers that there is still an aggregate savings in calories. We note that because a typical shift for initial virtue-choosers (i.e., from pure virtue to $\frac{1}{4}$ vice) is approximately twice as small in magnitude as a typical shift for initial vice-choosers (i.e., from pure vice to $\frac{1}{2}$ vice), substantial calorie savings would still occur at the population level if there were equal percentages of initial virtue-choosers and initial vice-choosers in the population. In addition, Study 2 demonstrates that offering vice-virtue bundles appears to decrease subsequent caloric intake, suggesting that offering vice-virtue bundles may actually have positive consequences for subsequent caloric consumption. Future research may examine whether offering vice-virtue bundles with a small amount of vice may satisfy some consumers' vice food cravings. Indeed, research has shown that depriving restrained eaters (who experience stronger food cravings) of vice foods can lead them to subsequently overeat these strongly desired foods (Polivy et al. 2005). Therefore, offering fixed vice-virtue bundles with small proportions of vice may allow these eaters to satisfy their cravings for vice foods and stem subsequent over-eating. Finally, although it does not mitigate the potential increase in caloric intake for initial virtue-choosers, Study 3 does indicate that most consumers are in favor of introducing vice-virtue bundles.

This research also has important implications for managers, who are under increasing pressure to promote healthier selections. In a recent commentary, Wansink (2012) highlighted the history of the food industry's response to the obesity epidemic, starting with denial of its role in obesity, shifting to appeals to consumer sovereignty via calls for moderation and increasing access to healthy choices, and finally shifting to development of "profitable win-win solutions to help consumers better control what and how much they eat." Vice-virtue bundles may fall squarely in this third category of profitable win-win solutions that many companies are now focusing on.

Given that consumers consistently find vice-virtue bundles to be attractive, managers should consider adding vice-virtue bundles to their product lines. For restaurants and food vendors that already offer pure vice and virtue options, vice-virtue bundles provide an opportunity for product line expansion through existing items rather than through development of completely new offerings. This provides a

potential opportunity for cost-savings, as many food establishments devote considerable resources to developing new product offerings (Sifferlin 2013; Strom 2013), which in turn can increase inventory or production costs.

In addition, if vice-virtue bundles are added to menu offerings, managers can consider whether to charge a price premium for them. In our studies, price is implicitly held constant across options to avoid activating any inferences that consumers might draw from different prices (Hamilton and Koukova 2008; Harris and Blair 2006) and to avoid consumers choosing based upon budget or monetary concerns. In this no-price-premium world, we found that most people favored the introduction of vice-virtue bundles. Thus, offering vice-virtue bundles potentially translates into more favorable attitudes towards the brand, increased long-term customer loyalty, and increased frequency of re-visiting the firm (Wansink 2012). Of course, some managers might decide to charge a price premium for vice-virtue bundles. In this case, introducing vice-virtue bundles may allow managers to extract consumer surplus via higher prices.

To conclude, our research presents a first look at a novel choice architecture solution—vice-virtue bundles—and examines its psychological underpinnings. To examine these psychological underpinnings, we did not use marketing messages nor did we deviate from choice-sets featuring two, four, or five options. However, in the real world, marketing messages could be added to explicitly promote preference for certain vice-virtue bundles (“You can get your cake and eat it too...especially if you have mostly fruit salad!”). Managers could also experiment with offering smaller choice sets while still promoting health and taste via vice-virtue bundles. For instance, a simple choice set might contain only three options (e.g., pure virtue, pure vice, and $\frac{1}{4}$ vice) or an even simpler choice set might contain only two options (e.g., $\frac{1}{4}$ vice and $\frac{3}{4}$ vice). Such smaller choice sets may be especially attractive to fast-food restaurants, for which speed and convenience, and hence a limited menu, are highly important for operations. With the right marketing and the right choice sets, we believe that vice-virtue bundles offer exciting directions for future research and practice aimed at maximizing health without compromising taste.

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Table 1. Percentage of Participants Choosing Each Choice Option Across Conditions and Studies

Study Condition	Choice Option (% Choosing)				
	Pure Virtue or Vice A	¼ Vice or Vice B	½ Vice or Vice B	¾ Vice or Vice B	Pure Vice or Vice B
Study 1					
Pure Virtue – Pure Vice (<i>n</i> = 33)	63.6	--	--	--	36.4
Vice-Virtue 50/50-Included (<i>n</i> = 29)	24.1	37.9	31.0	3.4	3.4
Study 2					
Pure Virtue – Pure Vice (<i>n</i> = 46)	63.0	--	--	--	37.0
Vice-Virtue 50/50-Included (<i>n</i> = 49)	22.4	22.4	40.8	4.1	10.2
Study 3					
Pure Virtue – Pure Vice – Choice 1 (<i>n</i> = 100)	57.0	--	--	--	43.0
Vice-Virtue Choice 2 (Vice-Lovers) (<i>n</i> = 43)	0.0	9.3	51.2	9.3	30.2
Vice-Virtue Choice 2 (Virtue-Acceptors) (<i>n</i> = 21)	19.0	71.4	9.5	0.0	0.0
Vice-Virtue Choice 2 (Virtue-Lovers) (<i>n</i> = 36)	50.0	41.7	8.3	0.0	0.0
Study 4					
Vice-Virtue 50/50-Included Choice 1 (<i>n</i> = 95)	52.6	--	--	--	47.4
Vice-Virtue 50/50-Included Choice 2 (Virtue Choosers) (<i>n</i> = 50)	32.0	64.0	4.0	0.0	0.0
Vice-Virtue 50/50-Included Choice 2 (Vice Choosers) (<i>n</i> = 45)	2.2	15.6	57.8	11.1	13.3
Vice-Vice 50/50-Included Choice 1 (<i>n</i> = 96)	63.5	--	--	--	36.5
Vice-Vice 50/50-Included Choice 2 (Vice A Choosers) (<i>n</i> = 61)	23.0	44.3	31.1	0.0	1.6
Vice-Vice 50/50-Included Choice 2 (Vice B Choosers) (<i>n</i> = 35)	0.0	5.7	28.6	37.1	28.6
Vice-Virtue 50/50-Excluded Choice 1 (<i>n</i> = 94)	58.5	--	--	--	41.5
Vice-Virtue 50/50-Excluded Choice 2 (Virtue Choosers) (<i>n</i> = 55)	41.8	58.2	--	0.0	0.0
Vice-Virtue 50/50-Excluded Choice 2 (Vice Choosers) (<i>n</i> = 39)	0.0	48.7	--	20.5	30.8
Vice-Vice 50/50-Excluded Choice 1 (<i>n</i> = 94)	50.0	--	--	--	50.0
Vice-Vice 50/50-Excluded Choice 2 (Vice A Choosers) (<i>n</i> = 47)	23.4	68.1	--	8.5	0.0
Vice-Vice 50/50-Excluded Choice 2 (Vice B Choosers) (<i>n</i> = 47)	0.0	19.1	--	34.0	46.8

Table 2. Summary of Key Findings across Studies

Study	Key Findings
1	<ul style="list-style-type: none"> • People were more likely to choose vice-virtue bundles with relatively small ($\frac{1}{4}$) or medium ($\frac{1}{2}$) vice proportions than vice-virtue bundles with relatively large ($\frac{3}{4}$) vice proportions when making actual choices.
2	<ul style="list-style-type: none"> • People were more likely to choose vice-virtue bundles with relatively small ($\frac{1}{4}$) or medium ($\frac{1}{2}$) vice proportions than vice-virtue bundles with relatively large ($\frac{3}{4}$) vice proportions when making actual choices. • The majority of participants consumed the entire option they selected, indicating that offering vice-virtue bundles does not increase food waste. • Offering vice-virtue bundles decreases subsequent post-study caloric intake.
3	<ul style="list-style-type: none"> • Vice-lovers (initial vice-choosers) exhibited tastiness and healthiness functions largely consistent with those predicted by our taste-health balance point account. The taste-health balance point occurred between $\frac{1}{4}$-vice and $\frac{1}{2}$-vice. When vice-virtue bundles were added to the choice set, the most popular vice-virtue bundle was the $\frac{1}{2}$-vice option, consistent with our prediction that people seek to meet the taste-health balance point. • Virtue-acceptors (initial virtue-choosers who believe pure vice tastes better than pure virtue) exhibited tastiness and healthiness functions consistent with those predicted by our taste-health balance point account. The taste-health balance point occurred between pure virtue and the $\frac{1}{4}$-vice option. When vice-virtue bundles were included in the choice set, the most popular vice-virtue bundle was the $\frac{1}{4}$-vice option, consistent with our prediction that people seek to meet the taste-health balance point. • Virtue-lovers (initial virtue-choosers who believe pure vice does not taste better than pure virtue) exhibited tastiness and healthiness functions that made goal balancing irrelevant because a pure virtue option could address both taste and health. When vice-virtue bundles were included in the choice set, the most popular vice-virtue bundle was the $\frac{1}{4}$-vice option, consistent with variety seeking. • Introduction of vice-virtue bundles decreased aggregate calories ordered, via decreases in calories ordered among vice-lovers. • Vice-lovers and virtue-lovers indicated a significant preference for vice-virtue bundles to be offered, and virtue-acceptors indicated a directional preference for vice-virtue bundles to be offered.
4	<ul style="list-style-type: none"> • Initial virtue-choosers (virtue-acceptors and virtue-lovers) frequently switched to vice-virtue bundles with a relatively small ($\frac{1}{4}$) vice proportion, and initial vice-choosers (vice-lovers) frequently switched to a vice-virtue bundle with a medium ($\frac{1}{2}$) vice proportion. • Further in support of the importance of choosing close to the taste-health balance point, in the absence of the middle bundle ($\frac{1}{2}$ vice), initial vice-choosers (vice-lovers) were more likely to choose an option with a relatively small ($\frac{1}{4}$) vice proportion than one with a relatively large ($\frac{3}{4}$) vice proportion. • Movement to vice-vice bundles did not follow the same pattern that characterized movement to vice-virtue bundles. • Introduction of vice-virtue bundles decreased aggregate calories ordered, via decreases in calories ordered among vice-lovers.

Figure 1a. Theoretical Tastiness and Healthiness Functions For Vice-Lovers

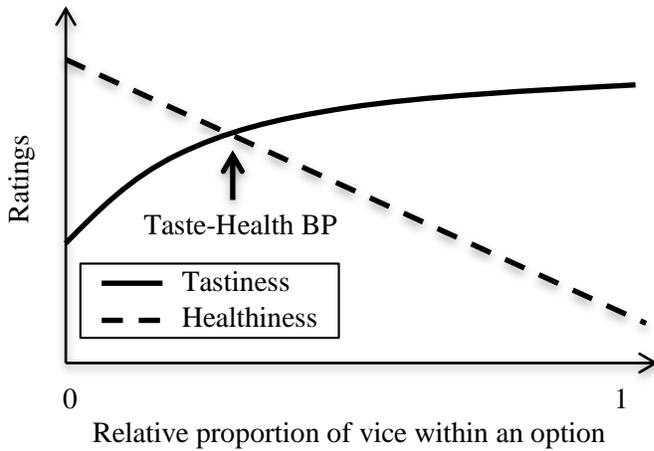


Figure 1b. Theoretical Tastiness and Healthiness Functions For Virtue-Acceptors

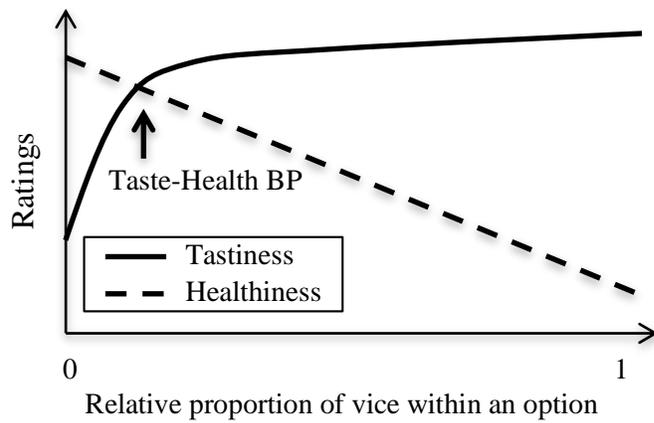
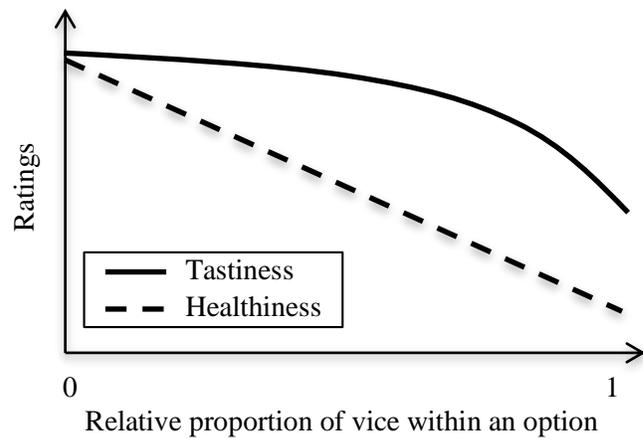


Figure 1c. Theoretical Tastiness and Healthiness Functions for Virtue-Lovers



Note. In Figures 1a and 1b, Taste-Health BP stands for taste-health balance point and depends on the concavity of the tastiness function, which can vary by stimuli and consumer segment (Redden and Haws 2013). In Study 3, we find that the taste-health balance point for the stimuli used in Studies 3 and 4 is between the $\frac{1}{4}$ -vice and $\frac{1}{2}$ -vice options for vice-lovers (Fig. 1a) and between the pure virtue and $\frac{1}{4}$ -vice options for virtue-acceptors (Fig. 1b). In Figure 1c, goal balancing is irrelevant because a pure virtue can address both taste and health; thus, preference among vice-virtue bundles is driven by variety seeking alone.

Figure 2. Summary of Theoretical Predictions for Three Distinct Consumer Segments

Choice and Motivations in the Absence of Vice-Virtue Bundles

“Vice-Lovers” (Prioritize Taste Goal in Absence of Vice-Virtue Bundles)	“Virtue-Acceptors” (Prioritize Health Goal in Absence of Vice-Virtue Bundles)	“Virtue-Lovers” (No Taste-Health Goal Conflict in the Absence of Vice-Virtue Bundles)
<u>Consumer Segment #1</u>	<u>Consumer Segment #2</u>	<u>Consumer Segment #3</u>
Goal Balancing via Vice-Virtue Bundles	Goal Balancing via Vice- Virtue Bundles	Goal Balancing via Vice- Virtue Bundles Irrelevant
Select pure vice in the absence of vice-virtue bundles, based on favoring taste goal when both taste and health cannot be addressed simultaneously	Select pure virtue in the absence of vice-virtue bundles, based on favoring health goal when both taste and health cannot be addressed simultaneously	Select pure virtue in the absence of vice-virtue bundles, based on being able to address both taste and health simultaneously via pure virtue
As relative vice proportion increases (Fig. 1a):	As relative vice proportion increases (Fig. 1b):	As relative vice proportion increases (Fig. 1c):
<ul style="list-style-type: none"> • Tastiness: Increasing concave function • Healthiness: Decreasing linear function 	<ul style="list-style-type: none"> • Tastiness: Increasing concave function • Healthiness: Decreasing linear function 	<ul style="list-style-type: none"> • Tastiness: Decreasing concave function • Healthiness: Decreasing linear function
When vice-virtue bundles are added:	When vice-virtue bundles are added:	When vice-virtue bundles are added:
<ul style="list-style-type: none"> • Vice-virtue bundle that meets <i>taste-health balance point</i> (identified as ½-vice option for stimuli and participant population used in Studies 3 and 4) is most popular vice-virtue bundle. 	<ul style="list-style-type: none"> • Vice-virtue bundle that meets <i>taste-health balance point</i> (identified as ¼-vice option for stimuli and participant population used in Studies 3 and 4) is most popular vice-virtue bundle. 	<ul style="list-style-type: none"> • Pure virtue option can still meet taste and health goals, but vice-virtue bundle with smallest proportion of vice (¼-vice option) is most popular vice-virtue bundle due to <i>variety seeking</i>.

Figure 3a. Tastiness and Healthiness Ratings of Each Option (Vice-Lovers: Initial Vice-Choosers Who Believe Vice is Tastier than Virtue; $n = 43$; Study 3)

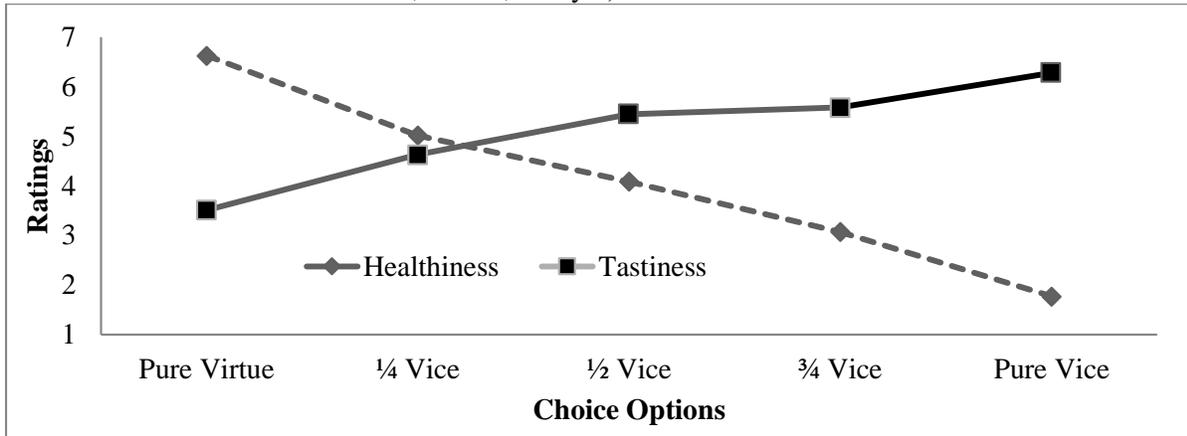


Figure 3b. Tastiness and Healthiness Ratings of Each Option (Virtue-Acceptors: Initial Virtue-Choosers Who Believe Vice is Tastier than Virtue; $n = 21$; Study 3)

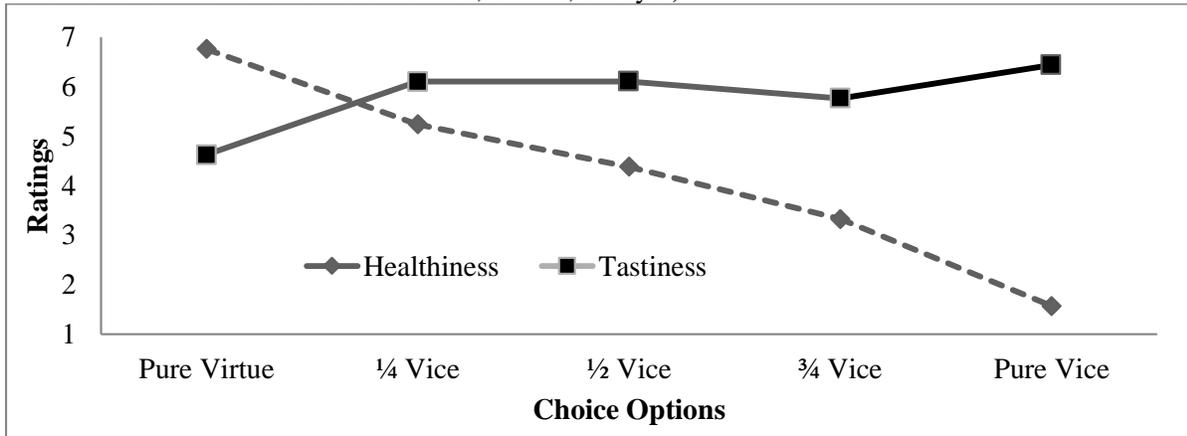


Figure 3c. Tastiness and Healthiness Ratings of Each Option (Virtue-Lovers: Initial Virtue-Choosers Who Do Not Believe Vice is Tastier than Virtue; $n = 36$; Study 3)

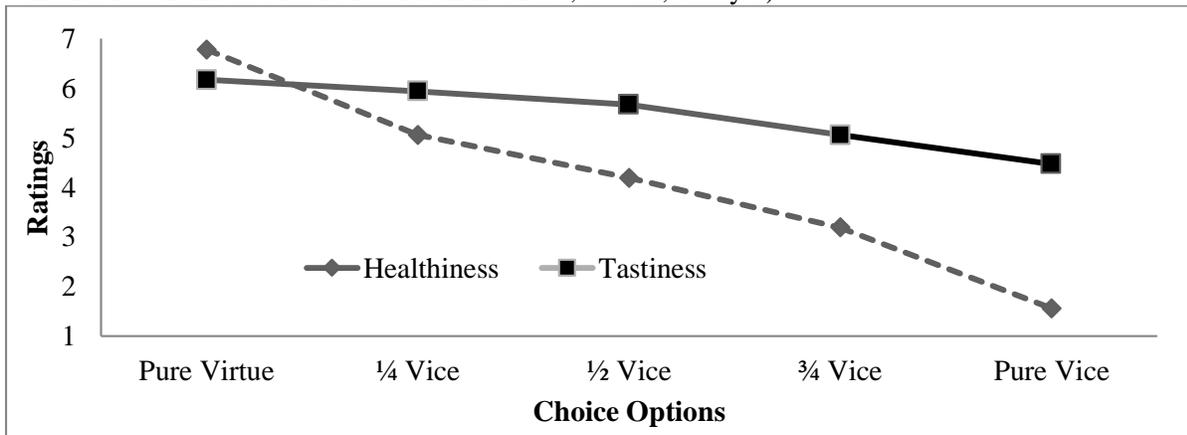


Figure A1. Study Stimuli

Menu		Study	Pure Virtue or Vice A	¼ Vice or ¼ Vice B	½ Vice or ½ Vice B	¾ Vice or ¾ Vice B	Pure Vice or Vice B
Vice-Virtue	Baby Carrots and Potato Chips	1					
	Apple Slices and Oreo Cookies	2					
	Salad and Fries	3 and 4					
Vice-Vice	Macaroni & Cheese and Fries	4					

Note: For all sets of stimuli except the apple slices and Oreo cookies stimuli set, color figures are available upon request from the authors.

Figure A2. Calories and Contents of Study Stimuli

Menu		Study	Pure Virtue or Vice A	¼ Vice or ¼ Vice B	½ Vice or ½ Vice B	¾ Vice or ¾ Vice B	Pure Vice or Vice B
Vice-Virtue	Baby Carrots and Potato Chips	1	Calories: 33 Contents: 12 baby carrots (91 g.)	Calories: 68 Contents: 9 baby carrots (63 g.), potato chips (8 g.)	Calories: 96 Contents: 6 baby carrots (45 g.), potato chips (14 g.)	Calories: 130 Contents: 3 baby carrots (27 g.), potato chips (21 g.)	Calories: 160 Contents: potato chips (28 g.)
	Apple Slices and Oreo Cookies	2	Calories: 36 Contents: 4 apple slices (69 g.)	Calories: 80 Contents: 3 apple slices (52 g.), 1 Oreo cookie (11 g.)	Calories: 125 Contents: 2 apple slices (35 g.), 2 Oreo cookies (23 g.)	Calories: 169 Contents: 1 apple slice (17.3 g.), 3 Oreo cookies (34 g.)	Calories: 213 Contents: 4 Oreo cookies (45 g.)
	Salad and Fries	3 and 4	Calories: 14 Contents: lettuce mix (30 g.), 4 tomato slices (38 g.)	Calories: 91 Contents: lettuce mix (22 g.), 3 tomato slices (25 grams), fries (25 g.)	Calories: 169 Contents: lettuce mix (15 g.), 2 tomato slices (18 grams), fries (50 g.)	Calories: 247 Contents: lettuce mix (8 g.), 1 tomato slice (10 grams), fries (75 g.)	Calories: 325 Contents: fries (100 g.)
Vice-Vice	Macaroni & Cheese and Fries	4	Calories: 400 Contents: macaroni & cheese (250 g.)	Calories: 377 Contents: macaroni & cheese (187 g.), fries (24 g.)	Calories: 359 Contents: macaroni & cheese (125 g.), fries (49 g.)	Calories: 346 Contents: macaroni & cheese (62 g.), fries (76 g.)	Calories: 325 Contents: fries (100 g.)

Note: For the sets of stimuli other than the apple slices and Oreo cookies stimuli set, the calories in this table were calculated based upon the actual grams of each food depicted in the photographs in Figure A1. For the apple slices and Oreo cookies stimuli set, the calories in this table were calculated based upon the following approximations (1 apple slice weighs approximately 17.31 grams and has 9 calories (fatsecret.com); 1 Oreo cookie weighs approximately 11.33 grams and has 53.33 calories (caloriecount.com)).