Restraint that Blinds:

Attention Narrowing and Consumers’ Response to Numerosity in Self-Control Decisions

KEITH WILCOX

SONJA PROKOPEC*

*Keith Wilcox is Barbara and Meyer Feldberg Associate Professor of Marketing at the Columbia Business School, 3022 Broadway, New York, NY 10027, USA, Tel: (212) 854 0357, E-mail: ktw2113@gsb.columbia.edu. Sonja Prokopec is Associate Professor of Marketing at the ESSEC Business School, 5 Nepal Park, Singapore 139408, E-mail: prokopec@essec.fr.
ABSTRACT

Research on numerosity demonstrates that consumers’ judgment can be influenced by the scale on which product benefit information is presented. However, only a limited amount of research has examined how consumers respond to the numerosity of cost information (e.g., prices, nutritional content) in decisions that involve self-control. The results of a pilot study and five experiments demonstrate that numerosity primarily influences self-control when consumers are high in restraint. Because restrained consumers regulate their behavior by anticipating negative emotions, they experience a narrowing of attention during self-control decisions that makes them more reliant on cues for judgment. As a result, consumers who are situationally primed and predisposed to be high in restraint display less self-control when cost information is presented on a contracted scale compared to an expanded scale. The same effect does not emerge when consumers are less focused on restraint because these consumers do not experience a similar narrowing of attention during self-control decisions.
Consumers use numerical product information to make a variety of decisions that involve self-control. They consider prices when deciding whether to make a purchase or limit their spending. They depend on nutritional content when determining which items to eat and which ones to avoid. Moreover, research on the numerosity heuristic finds that the scale on which product information is presented can have a considerable impact on judgment (Pelham, Sumarta and Myaskovsky 1994). For example, consumers prefer a rental service when the number of rentals is presented on an expanded scale with large numbers (e.g., 364 rentals per year) compared to a contracted scale with small numbers (7 rentals per week; Burson, Larrick and Lynch, 2009).

Despite a significant amount of research on numerosity (Burson et al. 2009, Bagchi and Li 2011; Monga and Bagchi 2011; Pandelaere et al. 2011), there is only a limited understanding of how the scale on which product information is presented affects self-control. Prior research has primarily focused on the numerosity of information related to the benefits of consumption and has largely ignored how consumers react to cost information (e.g., prices, nutritional content) that indicates the extent to which consumption undermines self-control. Moreover, the few studies directly examining consumers’ response to cost information offers mixed findings (Wertenbroch, Soman, and Chattopadhyay 2007), which suggests that other factors need to be considered.

The present research further examines how numerosity influences self-control. We extend previous research by introducing a theory that not only considers how consumers react to the numerosity of product information but one that accounts for how they make decisions involving self-control. We propose that numerosity primarily influences self-control when consumers are highly focused on restraining their consumption (e.g., eating and spending). When consumers are highly focused on restraint they make self-control decisions by anticipating the negative emotions they will experience from failing at self-
control. The threat posed by such situations, however, results in a narrowing of attention that limits restrained consumers’ ability to engage in extensive deliberation, which makes them more reliant on cues (e.g., the size of numbers) for judgment. As a result, restrained consumers’ anticipated emotional response and their self-control are more biased by numerosity.

This theory is tested in a series of studies demonstrating that consumers who are predisposed or situationally primed to be highly focused on restraint display lower self-control when cost information is presented on a contracted scale with small numbers compared to an expanded scale with large numbers. The same findings do not emerge when consumers are less focused on restraint because these consumers do not experience a similar narrowing of attention in response to self-control decisions. Finally, we show that inducing restrained consumers to experience positive emotions, which broadens attention (Fredrickson and Branigan 2005), attenuates the effect of numerosity on self-control.

In addition to demonstrating the process by which numerosity influences self-control, these findings extend prior research by identifying both emotional and motivational factors that determine consumers’ propensity to be biased by numerosity, as previous studies have primarily focused on cognitive factors that moderate the numerosity effect (Monga and Bagchi 2011; Pandelaere et al. 2011; Pelham et al. 1994; Shen and Urminsky 2013). This research also contributes to the literature on self-control by suggesting that attention narrowing in response to threats may explain why some restrained consumers (e.g., dieters) have been shown to be more susceptible to external cues for judgment (Irmak, Vallen and Robinson 2011).

In the sections that follow, we review prior research on numerosity before introducing a theory that explains how restrained consumers are more susceptible to the numerosity of cost information. We then report the results of a pilot study and five
experiments supporting our theory. Finally, we discuss the implications of our findings for marketing practice, policymaking, and consumer welfare.

**NUMEROSITY**

Individuals often rely on the number of distinct elements in stimuli as a cue for judgment without fully considering other relevant information (Monga and Bagchi 2011). As a result, they evaluate a stimulus based on the number of units into which it is divided independent of the meaning or value of the units. Because more pieces of something suggests a greater magnitude (Pelham et al. 1994), people judge targets to be larger when they are described in larger numbers; so a week seems longer when it is described as seven days and a yard seems bigger when it is described as thirty-six inches. This tendency to make judgments based on numerosity occurs because people often fail to engage in the extensive deliberation necessary to determine the meaning of information.

A considerable amount of research finds that consumers’ judgment can be influenced by the numerosity of attribute information (Burson et al. 2009, Bagchi and Li 2011; Monga and Bagchi 2011; Pandelaere, Briers, and Lembregts 2011). For instance, distances to redeem rewards in loyalty programs seem larger when the distances are presented on an expanded scale (e.g., 10 points per dollar with a reward at 1,000 points) compared to a contracted scale (1 point per dollar with a reward at 100 points; Bagchi and Li 2011). Additionally, the difference in quality between two options is perceived to be larger when the quality differences are presented on an expanded scale (200 out of 1,000) compared to a contracted scale (2 out of 10; Pandelaere, Briers, and Lembregts 2011). Consequently, consumers prefer higher quality options when quality differences are presented on an expanded scale compared to a contracted scale (Burson et al. 2009).
Prior research examining how the numerosity of cost information influences decisions that involve self-control has primarily focused on the “face value” effect whereby consumers’ willingness to spend money is biased by the nominal value of the currency used for payment. Raghubir and Srivastava (2002) found that consumers are willing to pay more for products when making purchases in a currency that has a smaller nominal value relative to their home currency (i.e., a more contracted scale), but spend less when the currency is in a larger nominal value (i.e., a more expansive scale). However, research conducted at around the time of the introduction of the Euro found that the “face value” effect did not occur in many countries (Desmet 2002; Gamble et al. 2002) and may have had a different effect in some others (European Central Bank 2003).

Wertenbroch and colleagues (2007) suggest these inconsistencies can be explained by differences in the reference values that are salient at the time of judgment. They demonstrate that the effect of a currency’s nominal value on spending primarily emerges when consumers have a small budget. They contend that budget size moderates the numerosity effect because price information has a greater impact when it is compared to a smaller budget. However, because people are also more likely to be focused on restraining their spending when they have a small (vs. large) budget it is possible that differences in restraint may have played a role in the findings. We expand on this possibility in the next section.

**SELF-CONTROL AND NUMEROSITY**

Self-Control and Deliberation

Consumers frequently face consumption decisions that conflict with their goals. Although they may want to act consistently with their long-term objectives, such as by eating healthy foods or limiting their spending, they often find themselves considering
options that undermine their goals. Numerous models of self-regulation propose a similar conceptualization of self-control. When consumers are faced with tempting alternatives that may undermine their goals, they exercise self-control through an effortful, deliberative and conscious process. This conceptualization is evident in the ego depletion model (Baumeister and Heatherton 1996), the hot and cool systems (Metcalfe and Mischel 1999) and the impulsive versus reflective systems (Hofmann, Friese and Strack 2009).

It is likely due to the deliberative nature of self-control that consumers tend to be more effective at interpreting cost information in situations that may undermine self-control. For example, consumers are better at estimating the caloric content of a meal when situational factors suggest the meal is unhealthy compared to healthy (Chandon and Wansink 2007). They are also more accurate at estimating the caloric content of a meal when the meal is comprised of only unhealthy items compared to when it contains at least one healthy option (Chernev and Gal 2010). Moreover, consumers are more accurate at estimating the portion sizes of unhealthy foods compared to healthy foods (Cornil et al. 2014).

One implication suggested by these findings is that consumers may be less likely to be biased by numerosity during self-control decisions. If consumers are more likely to deliberate during self-control decisions, they should be more effective at determining the meaning of cost information and thus be less likely to rely on the size of numbers as a cue for judgment. While this may be true in many situations, we contend that consumers will be less likely to deliberate on cost information when they are highly focused on restraint.

Restraint and Numerosity

When people engage in an action that undermines their goals, they often experience negative emotions from failing to behave consistently with their objectives (Hoch and Loewenstein 1991; Kivetz and Simonson 2002; Okada 2005). For some, failing at self-
control may lead them to experience only a minor twinge of guilt. For consumers highly focused on restraint, however, giving into temptation often leads them to experience intense negative emotions. For example, tightwads, who are highly focused on limiting their spending, often experience intense pain from spending money (Rick, Cryder and Loewenstein 2008; Raghubir and Srivastava 2009). Similarly, restrained eaters experience strong negative emotions, such as guilt and shame, after eating unhealthy foods (Macht and Dettmer 2006; Macht, Gerer and Ellgring 2003).

The threat of experiencing negative emotions serves an important self-regulatory function for restrained consumers. They have experienced these emotions so frequently in response to violations of their goals that they have learned to regulate their behavior by anticipating the negative emotions they might experience from failing to exercise restraint (Baumeister et al. 2007; Rick et al. 2008). As a result, restrained consumers often make self-control decisions by assessing the threat posed by the situation (i.e., how bad they will feel) to determine how to respond (i.e., whether to exercise self-control).

When individuals are exposed to potentially threatening or aversive situations, they experience a narrowing of their perceptual and cognitive attention as they attempt to find a solution to the problem at hand (Derryberry and Tucker 1994; Wichary, Mata and Riekamp 2016). Attention narrowing is an adaptive mechanism derived from the fight or flight response (Najmi, Kuckertz and Amir 2012) that allows individuals to quickly process information relevant to threats and ignore irrelevant information (Gorn, Pham and Sin 2001). As a result, when people are exposed to threats, they display greater visual and cognitive selectivity as their attention narrows to allow them to efficiently assess the situation. This suggests that the threat posed by self-control decisions may lead restrained consumers to narrow their attention toward cost information.
However, while attention narrowing increases focus on threat-relevant information, individuals do not necessarily process information in a deliberative manner. Several studies demonstrate that when individuals are exposed to potential threats, they consider only a limited amount of information because their narrow attentional scope impairs their ability to assimilate all available information (Sieber 1974; Keinan 1987). For example, when individuals believe they may receive a painful shock while making a series of decisions, they fail to consider all of the options and are more likely to scan for information in a nonsystematic fashion (Keinan 1987). Additionally, narrowing individuals’ attention by exposing them to aversive pictures leads them to use simple decision strategies and makes them more reliant on cues for judgment (Wichary, Mata and Riekamp 2016). Thus, while attention narrowing may lead restrained consumers to attend to cost information, they may be less likely to deliberate on the information, which will make them more reliant on numerosity as a cue for judgment.

Integrating these lines of research, we predict that when restrained consumers face self-control decisions, they will exercise self-control by anticipating the negative emotions they will experience from failing to exercise restraint. The threat posed by the situation, however, will result in a narrowing of attention that will make them more reliant on numerosity as a cue for judgment. Consequently, restrained consumers’ anticipated emotional response, as well as their self-control, will be biased by the numerosity of cost information. Specifically, we posit that restrained consumers will anticipate feeling less intense negative emotions from consumption (e.g., eating and spending) and, therefore, will display less self-control when cost information is presented on a contracted scale with smaller numbers compared to an expanded scale with larger numbers. Because unrestrained consumers do not experience a similar narrowing of attention in response to self-control decisions, they should be less likely to use numerosity as a cue for judgment.
OVERVIEW OF STUDIES

We tested our theory in a pilot study and five experiments examining consumers’ response to numerosity of cost information in the spending and eating domains. The pilot study demonstrates that when consumers are highly focused on restraining their spending, they perceive a spending decision to be a greater threat and display a more narrow scope of attention compared to consumers less focused on restraint. Study 1 shows that consumers are more willing to spend money when using a currency with a small nominal value (i.e., a contracted scale) compared to a large nominal value (i.e., an expanded scale). However, this effect primarily emerges when consumers are situationally primed to focus on restraining their spending. Study 2 replicates the findings of study 1 in the eating domain using the nutritional content in food to manipulate the numerosity of cost information. Study 3 demonstrates that consumers who are predisposed to focus on restraining their spending (i.e., tightwads) are more likely to be biased by the nominal value of a currency used for payment compared to those who are less focused on restraining their spending. Study 4 replicates these findings on restrained eaters while also showing that anticipated negative emotions mediate the effect of numerosity on judgment. Finally, study 5 demonstrates that inducing restrained consumers to experience positive emotions at the time of judgment, which broadens attention (Fredrickson and Branigan 2005), attenuates the effect of the numerosity on judgment.

PILOT STUDY

We propose that the anticipated emotional response and self-control of consumers high (vs. low) in restraint are more likely to be biased by numerosity. However, this prediction is based on two assumptions. The first is that consumers high (vs. low) in restraint
perceive self-control decisions as a greater threat. The second is that restrained consumers experience a narrowing of attention toward information associated with the threat. The pilot study sought to provide evidence for these assumptions by exploring whether participants situationally primed to be highly focused on restraining their spending would perceive a spending decision to be a greater threat and display a narrower scope of attention toward threat-relevant information compared to those less focused on restraint.

Method

*Participants and design.* One hundred-two participants from Amazon Mechanical Turk participated in the study in exchange for a small payment. The study was a (restraint: high vs. low) between subjects design.

*Procedure.* Participants were told that the purpose of the study was to understand consumers’ spending decisions. In the low restraint condition, respondents were instructed that they had recently moved to a new city and needed to make purchases for their new apartment. They were then told that they were considering purchasing a new 55” Samsung television for $580. The instructions for the high restraint condition were similar except participants were told that they would be making their purchase using money from their savings account. We expected this to increase respondents’ spending restraint because consumers often mentally label money set aside for savings as “off limits” in order to avoid spending the money (Thaler 1999).

Participants were then asked to think about the decision to spend money on the television and to write down everything that comes to their mind. Having them write about the decision allowed us to analyze their response to the situation using structured text analysis. Structured text analysis is a method that matches words in written content to a number of predefined categories that are associated with individuals’ momentary
psychological states. It has been shown to be effective at capturing emotions, thinking styles and attentional focus (see Pennebaker, Francis, and Booth 2001 for further discussion). We used the text analysis to assess the extent to which participants viewed the situation as a threat and to examine whether their attention was narrowed toward threat-relevant information. Finally, participants completed a three-item focus on restraint manipulation check that asked them the extent to which the situation would make them concerned about “controlling” their spending, “restricting” their spending and “restraining” their spending (1 = “not at all” and 7 = “very much”; α = .97).

Results

Manipulation check. We confirmed the validity of our restraint manipulation using ANOVA. As expected, participants indicated that they would be more focused on restraining their spending in the high restraint condition (M = 5.80) compared to the low restraint condition (M = 5.01; F(1, 100) = 6.68; p = .01).

Perceived threat. When participants are exposed to threats they often use tentative language to describe the situation (McGlone and Pfiester 2015). Thus, we assessed the extent to which participants viewed the spending decision as a threat by analyzing their written content to determine whether they displayed a tentative writing style. Specifically, we submitted participants’ open-ended responses to the structured text analysis program Linguistic Inquiry and Word Count (LIWC; Pennebaker et al., 2015). LIWC computes two measures that capture the tentativeness of writing. The first is a summary score (referred to as clout) that uses an algorithm to determine the extent to which people write in a confident, authoritative manner (higher numbers) versus a more tentative, anxious manner (lower numbers). As expected, high restraint participants wrote in a more tentative style (M = 9.59) compared to low restraint participants (M = 16.24; F(1, 100) = 6.31; p = .01). The second
measure was the percentage of words used that are associated with tentativeness. Because the measure was comprised of percent data with a high number of zeroes, we analyzed the measure using binomial regression (we get the same findings using linear regression). Participants high in restraint used a higher percentage of tentative words than those low in restraint ($\beta = .29, \chi^2 = 4.34; p = .04$). Thus, both measures support our assumption that restrained consumers perceive self-control decisions to be a greater threat than those who are less focused on restraint.

Attention narrowing. To assess the extent to which participants’ attention was narrowed toward threat-relevant information, we analyzed the percentage of words used that were associated with money (e.g., words such as price, expensive and spend). Participants high in restraint used a greater percentage of words associated with money compared to those low in restraint ($\beta = .26, \chi^2 = 4.79; p = .03$).

While the previous analysis offers insight into participants’ attentional focus (i.e., money, spending), it does not necessarily demonstrate that participants’ scope of attention was narrowed. Attention narrowing entails focusing processing resources toward information associated with the threat and inhibiting information that is unrelated to the threat. As a result, individuals not only experience a narrowing of their conceptual focus, but also their visual field, which leads them to process less visual information in their environment (Najmi, Kuckertz and Amir 2012). To assess whether individuals were processing less visual information, we examined the percentage of words used that are associated with visual processing (e.g., red, vivid and view). Consistent with attention narrowing, participants high in restraint used a lower percentage of words associated with visual processing compared to those low in restraint ($\beta = -.47, \chi^2 = 3.95; p < .05$). Moreover, the correlation between visual processing words and money words was negative ($r = -.23, p = .02$), indicating that as thoughts about money increased, visual processing decreased.
Together, the findings support two assumptions underlying our theoretical framework. Specifically, when restrained consumers are exposed to self-control decisions they 1) perceive the situation as a greater threat and 2) display a narrower attentional scope towards threat-relevant information compared to those less focused on restraint. We provide further evidence for attention narrowing in study 5.

**STUDY 1**

The primary purpose of study 1 was to demonstrate that consumers high in restraint are more susceptible to the numerosity of cost information during self-control decisions. We manipulated the extent to which consumers were focused on restraining their spending prior to making a purchasing decision using a currency with a small nominal value (i.e., a contracted scale) or a large nominal value (i.e., an expanded scale). We expected the nominal value of the currency to have a stronger effect on spending for consumers who were high in restraint compared to those who were less focused on restraint. A second objective was to show that situationally priming consumers to be high in restraint would make them more focused on negative emotions during self-control decisions. We sought to demonstrate this to expand on previous research examining the relationship between restraint and negative emotions, which has primarily focused on consumers who are predisposed to be focused on restraint (e.g., Rick et al. 2008).

**Method**

*Participants and design.* One hundred thirty-seven undergraduates from a large Northeastern university participated in the study in exchange for a small payment. The study was a 2 (currency: small nominal value vs. large nominal value) x 2 (restraint: high vs. low) between subjects design.
Procedure. Participants were instructed that the purpose of the study was to understand consumers’ spending decisions. In the low restraint condition, respondents were told that they had recently moved to a new country where the local currency was the KEN and were considering purchasing a new television. In the small nominal value condition, participants were told that 100 KEN was equal to $1,000 whereas those in the large nominal value condition were told that 10,000 KEN was equal to $1,000. Participants were then instructed that they were considering purchasing a 55” Samsung television. The price of the television was 58 KEN in the small nominal value condition and 5,800 KEN in the large nominal value condition. Thus, the price was equivalent to $580 dollars in both conditions, which was the price of the television in the pilot study. Participants then indicated how likely they would be to purchase the television on a seven-item scale (1 = “not at all likely” and 7 = “very likely”). The instructions for the high restraint condition were identical to that of the low restraint condition except that before evaluating their likelihood to purchase the television, participants were told that they would be making their purchase using money from their savings account.

Afterwards, participants indicated the extent to which they were focused on negative emotions while making their purchasing decision (1 = “not at all” and 7 = “very much”). They then completed a three-item manipulation check asking them how focused they were on restraint during the decision: “how focused were you on controlling your spending?”,” “how focused were you on restricting your spending?” and “how focused were you on restraining your spending?” (1 = “not at all” and 7 = “very much”; α = .87).

Results

Manipulation check. Confirming the restraint manipulation, an ANOVA with currency and restraint as the factors found a main effect of restraint such that participants in
the high restraint condition were more focused on restraining their spending (M = 5.88) compared to those in the low restraint condition (M = 5.32; F(1, 132) = 11.33; p < .001).

*Focus on negative emotions.* We examined the participants’ focus on negative emotions using ANOVA with currency and restraint as the factors. As predicted, there was a main effect of restraint such that participants high in restraint (M = 4.73) were more focused on negative emotions during their decision compared to those low in restraint (M = 3.86; F(1, 132) = 9.00; p < .01).

*Spending.* An analysis of spending found a significant main effect of restraint, such that participants were less likely to purchase the television in the high restraint condition (M = 2.56) compared to the low restraint condition (M = 3.28; F(1, 132) = 6.51; p = .01). Additionally, the main effect of currency was significant. Participants were more likely to make a purchase when the nominal value was small (M = 3.22) versus large (M = 2.64; F(1, 132) = 6.51; p < .05). Importantly, the predicted currency by restraint interaction was significant (F(1, 132) = 3.99; p < .05; see figure 1). As expected, high restraint participants were more likely to purchase the television when the price was in a currency with a small nominal value (M = 3.15) compared to a large nominal value (M = 1.97; F(1, 132) = 10.50; p < .01). For low restraint participants, there was no significant difference in purchase intent between the small (M = 3.30) and large nominal value conditions (M = 3.25; F(1, 132) = .15; p = .70).
Discussion

The findings of study 1 support our prediction that consumers high in restraint are more likely to be biased by the numerosity of cost information during self-control decisions. Specifically, priming individuals to be focused on restraining their spending made them more likely to make a spending decision by focusing on negative emotions and led them to display less spending control when the nominal value of the currency was small versus large. The nominal value of the currency did not influence consumers who were less focused on restraint.

**STUDY 2**

The second study had two primarily objectives. The first, was to replicate the results of study 1 in the food domain. The second was to demonstrate our findings in a context that involved having participants make a consequential decision. Specifically, participants were primed (vs. not primed) to be highly focused on restraining their eating. They then made an actual decision involving an unhealthy food item when nutritional information was presented on a contracted scale or an expanded scale. We expected participants highly focused on
restraint to be more likely to eat the unhealthy food item when nutritional information was presented on a contracted scale compared to an expanded scale.

Method

Participants and design. One hundred forty-six undergraduates participated in the study for a small payment. The study was a 2 (nutritional information: contracted scale vs. expanded scale) by 2 (restraint: high vs. low) between-subjects design.

Procedure. Respondents were instructed that they were participating in two unrelated studies. The first study manipulated eating restraint. Participants in the high restraint condition were given five sentences to unscramble where the words in the sentence were associated with eating restraint (fit, thin, healthy, diet, restraint). Participants in the low restraint condition were given five sentences to unscramble where the words in the sentence were not associated with eating restraint (see Appendix A for the manipulation).

The second, purportedly unrelated, study examined how people respond to a new food scoring system called FSCORE. The system was described as a scoring system that takes into account the various aspects of a food item (e.g., calories, fat) to create an FSCORE, with larger scores indicating that the item is unhealthier. Participants in the contracted scale condition were told that based on a national sample, the average person consumes 420 FSCORE points per day, whereas in the expanded scale condition they were told the average person consumes 42,000 FSCORE points per day. They were then shown a picture of a Snickers bar and given its FSCORE, which was 55 points in the contracted scale condition and 5,500 points in the expanded scale condition. Participants were then instructed to choose between a Snickers bar and a granola bar as a gift for participating.

After completing some unrelated scales asking them to evaluate the scoring system, participants indicated the extent to which they made their decision by anticipating the
negative emotions they would feel from eating the Snickers bar (1 = “not at all” and 7 = “very much”). They then completed a three-item manipulation check asking them how focused they were on restraint: “how focused were you on controlling your eating?”, “how focused were you on restricting your eating?” and “how focused were you on restraining your eating?” (1 = “not at all” and 7 = “very much”; α = .88).

Results

**Manipulation check.** Confirming the restraint manipulation, participants in the high restraint condition were more focused on restraining their eating (M = 5.88) compared to those in the low restraint condition (M = 4.38; F(1, 142) = 16.33; p < .001).

**Focus on negative emotions.** As predicted, there was a main effect of restraint on negative emotions such that participants high in restraint (M = 4.64) were more focused on negative emotions during their decision compared to those low in restraint (M = 3.93; F(1, 142) = 7.76; p < .01).

**Unhealthy choice.** We examined the likelihood of making an unhealthy choice using logistic regression. The dependent variable was unhealthy choice, coded as 1 if a participant selected the Snickers and 0 if they selected the granola bar. The independent variables were restraint, nutritional information and their interaction. The predicted restraint by nutritional information interaction was significant (z = 1.95, p = .05; see figure 2). As predicted, in the high restraint condition, participants were more likely to select the Snickers when the nutritional content was presented on a contracted scale (36.1%) compared to an expanded scale (14.7%; z = 1.99, p < .05). Additionally, in the low restraint condition, there was no difference in participants’ preference for the Snickers when the nutritional content was presented in a contracted scale (28.2%) compared to an expanded scale (35.1%; z = -.64, p = .52).
Discussion

The findings of study 2 provide additional support our theory that restrained consumers are more likely to be biased by the numerosity of cost information during self-control decisions. Specifically, priming individuals to be focused on restraining their eating made them more focused on negative emotions during a self-control decision and led them to display less self-control when the nutritional information was presented on a contracted scale with small numbers compared to an expanded scale with large numbers. The numerosity of nutritional information did not influence consumers who were less focused on restraining their eating.

**STUDY 3**

Although situational factors may increase consumers’ focus on restraint, there are also individual differences in consumers’ propensity to focus on restraint. The objective of the third study was to demonstrate that consumers who are predisposed to be highly focused on restraining their spending (i.e., tightwads), who tend to regulate their spending by focusing on negative emotions (Rick et al. 2008), will be more biased by the nominal value
of a currency compared to those who are less focused on restraining their spending (i.e., non-tightwads). Demonstrating this would also rule out the possibility that our situational manipulations in previous studies may have influenced other factors beyond restraint.

Method

Participants and design. Two hundred twenty-nine respondents from Amazon Mechanical Turk participated in the study in exchange for a small payment. The study was a 2 (currency: small nominal value vs. large nominal value) x 2 (restraint: high vs. low) with currency manipulated and restraint as a measured variable.

Procedure. Respondents were told that the purpose of the study was to test a new auction web site and that they would be making bids on different products using a new currency called TRICOIN. They were further instructed that they would be making actual bids on the products. If their bid was above the reserve price and they were the highest bidder in the auction, they would get the chance to purchase the product at the value of their winning bid (with payments made in US dollars). Participating in the auction was voluntary and if respondents declined to participate they received their full payment and were given another task to perform. Those who agreed to participate were reminded that they would be making their bids in TRICOINS and given the exchange rates of the currencies relative to the US dollar. In the small nominal value condition one TRICOIN was equal to ten US dollars, but in the large nominal value condition ten TRICOINS was equal to one US dollar.

The first product in the auction was a GoPro video camera. Participants were shown a picture and description of the camera. In the expanded scale condition, participants submitted bids using a slider that ranged from 0 to 2,000 TRICOINS without the option to submit bids below one TRICOIN. In the contracted scale condition, participants submitted bids using a slider that ranged from 0 to 20 TRICOINS that allowed participants to submit
bids in hundredths of TRICOINS. We allowed bids in hundredths of TRICOINS in this condition so that respondents could make equivalent bids in US dollars compared to the large nominal value condition. Thus, in each condition the maximum bid was the equivalent of $200 and the bidding increment was $.10. After submitting their bid on the camera, participants were shown a picture and description of the second product, a Fitbit Charge wireless wristband, and asked to submit their bid using the same slider as the camera.

Respondents who participated in the auction and those who opted out completed the four-item Tightwad-Spendthrift scale (Rick et al. 2008; α = .64), which served as a measure of restraint. The scale classifies people as spendthrifts (i.e., unrestrained spenders) at the high end of the scale and as tightwads (i.e., restrained spenders) at the low end of the scale.

Results

Sixty-four respondents declined to participate in the auction leaving us with a final sample of one hundred sixty-five respondents for our analysis of spending. To ensure that there were no differences in opt out rates for those high versus low in restraint, we ran an ANOVA with opted out (vs. not) as the factor and restraint as the dependent variable. There was no difference in restraint between those who did (M = 13.42) and did not opt out (M = 13.21; F(1, 227) = .10; p = .76).

We created a measure of spending by combining respondents’ bids on both products and then converting the bids to US dollars. Because this variable was not normally distributed, we transformed the responses using a square root transformation. We analyzed spending using regression with currency, restraint and their interaction as the independent variables. The predicted currency by restraint interaction was significant (t(161) = 1.95; p = .05). To decompose the interaction, we used the Johnson-Neyman technique— or “floodlight” analysis Spiller et al. (2013) –to identify the regions on the tightwad-spendthrift scale where
the simple effect of the nominal value of the currency was significant. We found that for any tightwad-spendthrift score of 5.82 or below (lower numbers indicate a high focus on restraint), participants spent more when the nominal value of currency was small rather than large (β = 2.50, p = .05). The nominal value of the currency did not significantly affect spending for any score above this threshold. It should be noted that two participants did not submit a bid on any item, which may due to them clicking the submit button without considering a bid since the default value was set at zero. When we analyze the data without these participants the interaction remains significant (t(159) = 2.05; p < .05) and the threshold below which the nominal value of the currency has a significant effect on spending increases to 10.19 (β = 1.51, p = .05), which is a value that would still classify someone as a restrained spender (i.e., a tightwad; Rick et al. 2008).

Discussion

The results of this study provide additional evidence that the numerosity of cost information has the strongest effect on self-control when consumers are highly focused on restraint. Specifically, tightwads, who are predisposed to focus on negative emotions while making spending decisions, spent more money when the nominal value of the currency used for payment was small compared to when it was large. The same effect was not observed for non-tightwads who are less focus on restraining their spending. The purpose of the next study was to provide evidence for the process.

STUDY 4

Our theory argues that restrained consumers display less (more) self-control when cost information is presented on a contracted (expanded) scale because numerosity biases their anticipated negative emotions from engaging in consumption. The primary objective of
study 4 was to demonstrate this process on restrained eaters who typically experience guilt from eating unhealthy foods. Specifically, we sought to demonstrate that restrained eaters would anticipate experiencing less guilt from eating an unhealthy food item when nutritional information is presented on a contracted scale (vs. expanded scale). As a result, they would be more likely to eat the unhealthy food items when nutritional information is presented on a contracted scale (vs. expanded).

In addition to demonstrating this process, we sought to show that our findings would hold when we used actual cost information. Specifically, we manipulated the numerosity of nutritional information by having participants make a food decision with either the caloric content or the number of grams of fat in the food as the cost information. Thus, this study is consistent with the growing trend in the United States of restaurants adding both caloric content and fat content to their menus.

Method

Participants and design. One hundred sixty-two respondents from Amazon Mechanical Turk participated in the study in exchange for a small payment. The study was a 2 (nutritional information: contracted scale vs. expanded scale) x 2 (restraint: high vs. low) with nutritional information manipulated and restraint as a measured variable.

Procedure. Respondents were instructed that the purpose of the study was to understand consumption decisions. They were told to imagine that they were considering eating a slice of pizza for lunch and to take a moment to consider their decision. As they were considering their decision, they were shown a picture of a slice of pizza and given nutritional information. In the contracted scale condition, respondents were instructed that the slice of pizza has 15 grams of fat and in the expanded condition they were told that the slice of pizza has 400 calories. Participants then indicated how likely they would be to eat
pizza for lunch (1 = “not at all” and 7 = “very likely”).

Afterwards, we measured anticipated guilt by having participants indicate how intensely they expected to experience a range of positive and negative emotions from eating the pizza (1 = “not intense at all” and 7 = “very intense”), including guilt and shame (r = .80). Finally, participants completed the 10-item Restraint scale (Polivy, Herman and Warsh 1978; α = .76), which served as a measure of restraint. Higher numbers on this scale indicate a greater focus on restraint.

Results

Pretest. We conducted a pretest on ninety-nine participants from the same pool as the main study to ensure that providing consumers high (vs. low) in restraint with the grams of fat versus the caloric content of pizza did not differentially affect their beliefs about the pizza. Participants were told that the purpose of this study was to understand how people evaluate different foods. We did not mention anything about consumption so that we could assess participants’ beliefs as opposed to their reaction to food in potentially threatening situations. They were then shown a picture of a slice of pizza with either the grams of fat (15) or calories (400). Participants were asked to indicate how healthy (1 = “not at all” and 7 = “very much”) and tasty they expected the pizza to be (1 = “not tasty at all and 7 = “very tasty”).

An analysis of perceived healthfulness found no significant effects of nutritional information (t(95) = .87; p = .38), restraint (t(95) = 1.09; p = .28) or their interaction (t(95) = 1.32; p = .19). Similarly, nutritional information (t(95) = .73; p = .47), restraint (t(95) = 1.19; p = .24) and their interaction (t(95) = 1.22; p = .23) did not significantly affect perceived tastiness. Thus, the results indicate that consumers high (vs. low) in restraint do
not hold different beliefs about the healthfulness and/or tastiness of pizza depending on the type of nutritional information provided.

Unhealthy eating. We examined unhealthy eating using regression with nutritional information, restraint and their interaction as the independent variables. The predicted nutritional information by restraint interaction was significant (t(158) = 2.09; p = .04). We decomposed this interaction using floodlight analysis to identify the regions on the restraint scale where the simple effect of the nutritional information was significant. We found that for restraint scores of 14.40 or above, participants were more likely to eat the pizza when the nutritional information was presented on a contracted scale compared to an expanded scale (β = .30, p = .05). Notably, research typically classifies someone as a restrained eater when they score 15 or above on this scale (e.g., McFarlane, Urbszat and Olmsted 2011). The scale on which nutritional information was presented did not significantly affect the likelihood of eating the pizza for any score below this threshold.

Anticipated guilt. A regression with nutritional information, restraint and their interaction as the independent variables found that the nutritional information by restraint interaction on anticipated guilt was significant (t(158) = 2.45; p = .02). A floodlight analysis found that participants expected to feel less guilty about eating the pizza when nutritional information was presented on a contracted scale compared to an expanded scale for restraint scores of 15.32 or above (β = -.23, p = .05). However, the nutritional information scale did not significant effect guilt for scores below this threshold.

Mediation. We tested whether anticipated guilt mediated the effect of nutritional information on unhealthy eating for respondents high versus low in restraint using conditional process modeling (Hayes 2013; model 8). For participants high in restraint, the indirect effect of nutritional information through anticipated guilt was significant with a confidence interval that did not include zero (indirect effect = -.20, 95% CI [-.4368, -.0533]),
which supports mediation. For participants low in restraint, the indirect effect of nutritional information through anticipated guilt was not significant with a confidence interval that included zero (indirect effect = .06, 95% CI [-.0520, .2207]), which does not support mediation.

Discussion

The results of study 4 demonstrate the process underlying the effect of the numerosity of cost information on self-control. The numerosity of cost information (e.g., fat vs. calories) biases restrained consumers’ anticipated negative emotions (e.g., guilt), which leads them to make unhealthier food decisions when cost information is presented on a contracted scale compared to an expanded scale. As in previous studies, the numerosity of cost information did not influence those who were less focused on restraining their eating.

STUDY 5

The previous study demonstrates that restrained consumer’s anticipated negative emotions and self-control are biased by the numerosity of cost information. However, our theory assumes that restrained consumers rely on numerosity as a cue for judgment because their attention narrows during self-control decisions. Although the pilot study supported this assumption, study 5 sought to provide additional evidence that the findings are the result of attention narrowing. If attention narrowing leads restrained consumers to be more susceptible to numerosity, then broadening their scope of attention should make them less likely to use numerosity as a cue for judgment. Accordingly, based on previous research finding that positive emotions broaden people’s thoughts and increase the breadth of their attentional scope (see Fredrickson and Branigan 2005 for a review), we induced (did not induce) restrained consumers to experience positive emotions during a self-control decision.
When restrained did not experience positive emotions, we expected to replicate the findings in previous studies. However, we predicted that the experience of positive emotions would attenuate the effect of numerosity on anticipated guilt and self-control.

Method

Participants and design. Two hundred respondents from Amazon Mechanical Turk participated in the study in exchange for a small payment. The study was a 2 (nutritional information: contracted scale vs. expanded scale) x 2 (emotions: positive vs. neutral) between subjects design.

Procedure. Respondents were instructed that they were participating in two unrelated studies. The first study induced participants to be highly focused on restraining their eating by having them unscramble the same five sentences from the high restraint conditions in study 2. The second, purportedly unrelated, study examined how people respond to the FSCORE food scoring system. The description of the system was the same as study 2. After the description of the FSCORE, participants in the positive emotions condition were told that the study was being conducted by a company called Happy Burger and shown a logo for the company that depicted a cartoon burger with a smile on its face. In the neutral emotion condition, participants were told that the study was being conducted by a company called Burger Ranch and shown a logo for the company that had a graphic burger, without a smiling face (see Appendix B for logos).

On the next screen, participants were shown the same company logo. Then they were instructed to imagine that they were deciding what to eat for lunch and were considering having a Happy Burger [Ranch Burger]. Below the name of the burger was its FSCORE, which was 90 points in the contacted scale condition and 9,000 points in the expanded scale condition. Participants were then asked to indicate how likely they would be to eat the
burger for lunch (1 = “not at all” and 7 = “very much”).

Afterwards, we measured anticipated guilt using the same scales as study 4 (r = .81). As a manipulation check for the positive emotions manipulation, participants indicated how pleasant they found the company’s logo to be and the extent to which the logo made them feel positive emotions (r = .77).

Results

Pretest. We conducted a pretest on ninety-nine respondents from the same panel as the main study to ensure that exposing individuals to the logo at the time of making a self-control decision increased positive emotions and also broadened their attentional scope. Participants were given the same restraint manipulation as the main study. They were then given the same lunch scenario from the main study with two key differences. First, instead of FSCORE points, caloric information was used as the cost information (400 calories). Second, instead of actually deciding whether to eat the burger for lunch, participants were instructed to write about all of the things that come to their mind when they consider the decision. This allowed us to analyze the content of their text for emotionality as well as attentional scope. Participants then answered several questions to ensure that the logos did not differentially affect beliefs about the burger. Specifically, participants indicated how healthy they perceived the burger to be (1 = “not at all” and 7 = “very much”), the expected quality of the burger (1 = “low quality” and 7 = “high quality”) and how tasty they expected the burger to be (1 = “not tasty at all and 7 = “very tasty”). Finally, to ensure that exposing participants to the happier logo did not lower restraint, we asked them to indicate the extent to which they were focused on restraint (1 = “not at all” and 7 = “very much”). No significant differences were observed between conditions in terms of perceived healthfulness and taste, or focus on restraint (all F’s < 1).
We submitted participants’ open-ended responses to LIWC (Pennebaker et al., 2015) to assess whether there were differences in participants’ emotional response to the decision based on whether they saw the positive, Happy Burger logo or the neutral, Ranch Burger logo. LIWC computes a summary score (referred to as tone) that uses an algorithm to determine the extent to which people write in a manner conveying positive emotions (higher numbers) versus negative emotions (lower numbers). As expected, participants who viewed the positive logo wrote in a more positive emotional tone ($M = 74.95$) compared to those who saw the neutral logo ($M = 56.78$; $F(1, 97) = 6.94$; $p = .01$). To rule out the possibility that the differences in tone could be the result of people mentioning the burger or the company (e.g., Happy Burger) in their written text, we conducted a second analysis that eliminated mentions of the company or the burger (see Web Appendix for details). The results of this second analysis were consistent with the analysis of emotional tone, which suggests that the findings are not explained by mentions of the burger or company name.

Previous research finds that positive emotions broaden visual attention (Wadlinger and Isaacowitz 2006). Consequently, to show that our manipulation broadened attention, we analyzed the percent of words associated with visual processing. Participants who viewed the positive logo used more words associated with visual processing, which is consistent with a broader attention scope, compared to those who saw the neutral logo ($\beta = 1.83, \chi^2 = 14.67; p < .001$). Additionally, the correlation between positive tone and visual processing words was significantly positive ($r = .32, p = .001$), which suggests that as positivity increased, attention broadened. Finally, a mediation analysis found that positive tone mediated with the effect of emotion on visual processing words. Specifically, the indirect effect of emotion through tone was significant with a confident interval that did not include zero (indirect effect = .08, 95% CI [.0277, .1888]).
Manipulation checks. Confirming the emotion manipulation, an ANOVA with nutritional information and emotions as the factors found a main effect of emotions such that participants in the positive emotion condition indicated that the company’s logo made them feel more positive emotions (M = 4.56) compared to those in the neutral emotion condition (M = 4.11; F(1, 132) = 5.16; p < .02).

Unhealthy eating. The predicted nutritional information by restraint interaction on the unhealthy eating was significant (F(1, 196) = 4.48; p = .04; see figure 3). Consistent with previous studies, in the neutral emotion condition, restrained consumers were more likely to eat the burger when nutritional content was presented on a contracted scale (M = 4.60) compared to an expanded scale (M = 3.72; F(1, 196) = 5.62; p = .02). As expected, the effect of numerosity in the positive emotion condition was attenuated. There was no significant difference in restrained consumers’ likelihood of eating the burger when nutritional content was presented on a contracted scale (M = 4.04) compared to an expanded scale (M = 4.27; F(1, 196) = .39; p = .53).

Figure 3

Anticipated guilt. As expected, the nutritional information by restraint interaction on consumers anticipated guilt was significant (F(1, 196) = 4.84; p = .03; see figure 4). In the neutral emotion condition, restrained consumers anticipated feeling less guilty when
nutritional content was presented on a contracted scale (M = 2.18) compared to an expanded scale (M = 3.00; F(1, 196) = 5.49; p = .02). In the positive emotions condition, there was no significant difference in restrained consumers’ anticipated guilt when nutritional content was presented on a contracted scale (M = 3.02) compared to an expanded scale (M = 2.75; F(1, 196) = .59; p = .44).

**Figure 4**

*Mediation.* We tested whether anticipated guilt mediated the effect of nutritional information on unhealthy eating in the positive and neutral emotion conditions using conditional process modeling (Hayes 2013; model 8). In the neutral emotion condition, the indirect effect of nutritional information through anticipated guilt was significant with a confidence interval that did not include zero (indirect effect = -.21, 95% CI [-.3920, -.0502]), which supports mediation. In the positive emotions condition, the indirect effect of nutritional information through anticipated guilt was not significant with a confidence interval that included zero (indirect effect = .07, 95% CI [-.1073, .2659]), which does not support mediation.

Discussion
The results of study 5 provide additional support for our theory that numerosity biases restrained consumers’ anticipated guilt and self-control because the threat posed by self-control decisions result in a narrowing of attention. Specifically, the results show that broadening consumers’ attention as the time of judgment, by inducing them to experience positive emotions, makes restrained consumers less likely to rely on the numerosity of cost information as a cue for judgment.

**GENERAL DISCUSSION**

This research examines how consumers’ focus on restraint affects their propensity to be biased by the numerosity of cost information. We show that consumers high in restraint, who focus on negative emotions to make self-control decisions, are more susceptible to the numerosity of cost information (studies 1 – 5). This occurs because the threat posed by self-control decisions narrows their attention toward threat-relevant information (pilot study and study 5), which makes them more likely to rely on numerosity as cue for judgment. As a result, restrained consumers anticipate feeling less intense negative emotions from consumption and display less self-control when cost information is presented on a contracted scale compared to an expanded scale (Studies 4 and 5). The same findings do not emerge for consumers who are less focused on restraint because they do not experience a similar narrowing of attention in response to self-control decisions. Furthermore, we find that this effect is mitigated when restrained consumers experience positive emotions because positive emotions broaden attentional scope (study 5).

Our research contributes to extant research investigating the relationship between numerosity and self-control. Although previous research (Pandelaere, Briers, and Lembregts 2011; Raghurir and Srivastava 2002) has demonstrated that the scale on which cost information is presented can bias self-control decisions, these studies did not consider how
the process through which consumers make such decisions affects their propensity to be biased by numerosity. The current research extends this research by demonstrating that the influence of numerosity on consumption decisions is contingent on whether consumers are focused on restraining their consumption. In doing so, we show that individual differences that make people more focused on restraining their behavior makes them more susceptible to the heuristic. To the best of our knowledge, this research is the first to demonstrate individual differences in consumers’ propensity to be biased by numerosity.

These findings also contribute to research examining how consumers who are high (vs. low) in restraint respond to situations involving self-control. In particular, several studies find that dieters tend to be more susceptible to external cues compared to non-dieters (Carels, Konrad, and Harper 2007; Heatherton, Polivy, and Herman 1989), including packaging and serving sizes (Coelho do Vale et al. 2008; Scott et al. 2008), and the name of food (Irmak et al. 2011). Consistent with these studies, we find that restrained consumers are more susceptible to external cues (i.e., the numerosity of cost information). However, we extend this research by demonstrating that this propensity is not limited to dieters. Participants situationally primed to be highly focused on restraint, as well as those predisposed to exercise restraint in others domains (e.g., tightwads), are also shown to be more reliant on cues for judgment. Importantly, our findings suggest that attention narrowing may explain why restrained consumers are more susceptible to external cues and that broadening restrained consumers’ attention may make them less reliant on external cues. Thus, nudges designed to increase positive affect may be an effective way to improve the decision-making of restrained consumers.

Our findings have other implications for consumer welfare as they suggest that policies and initiatives designed to make nutritional information more available to consumers can encourage healthier (or unhealthier) eating depending on the scale on which
this information is presented. Whereas the results suggest that requiring caloric content on restaurant menus may be effective because caloric information is represented on an expansive scale, the findings also suggest using caution when making information represented on a contracted scale more available, such as grams of fat. If the number of calories are the default scale on which consumers evaluate the extent to which they should exert self-control, presenting the fat content of a food an item in isolation could actually lead consumers to make unhealthier decisions compared to when no nutritional information is provided. Since the current set of studies do not directly test this possibility, future research is necessary to examine how presenting nutritional information on contracted scales influences eating behavior relative to when no nutritional information is provided.

This research also has implications for financial decision-making, as the findings extend into the spending domain. These implications are especially relevant given the introduction of different forms of digital and virtual currencies such as BitCoin. Consumers predisposed to anticipating negative emotions (i.e., tightwads) might be more likely to make unsound spending or investing decisions when using BitCoin as it operates on a contracted scale. Another example is the virtual currency of Second Life, called Linden dollars. Linden dollars are exchangeable for real currency and currently trades on Second Life at 250 Linden dollars for 1US dollar. Our findings suggest that consumers are more likely to make more effective spending decisions when using Linden dollars as opposed to Bitcoin, especially if they are prone to relying on their feelings during decision-making.

While some issues regarding generalizability remain following this research, these limitations provide a starting point for future research. Our results are generalizable in terms of conceptual replicability because the predicted effects emerge across two domains (eating and spending), employing different independent and dependent variables. As an issue of robustness, we should note that we focused only on laboratory settings in order to control
extraneous influences and more closely examine the process. However, we expect our effects to replicate in more natural settings (e.g., field study) because similar lab interventions have yielded robust results many times in the past.

Future research could examine how unit sizes differ in terms of whether they encourage abstract thinking and a consideration of available cues. For instance, larger numbers might induce abstract construal, naturally facilitating deliberative thinking and increase openness to alternative possibilities that might not be consistent with the individual’s self-control goal. On the other hand, smaller numbers might induce concrete construal, narrowing the individual’s attention to focus on the new spending opportunity in light of the self-control goal. The unique psychology of tightwads versus spendthrifts parallels this notion that tightwads tend to think about every consumption opportunity concretely, making them spend less, and even under-consume. Spendthrifts, on the other hand, think about consumption opportunities more broadly (abstractly), allowing distracting thoughts in (i.e., focus on pleasure of consuming the product, etc.), making them spend more and consequently over-consume. As a result, it might be interesting to observe whether tightwads and spendthrifts (or restrained consumers in general) naturally construe consumption opportunities at different levels and are thus differentially able to make self-control decisions.
REFERENCES


----------------------------------------------- (2009), ”The Denomination Effect,” Journal of Consumer Research, 36 (4), 701-713.


APPENDIX A

Sentences used in the high restraint condition in studies 2 and 5:

- very fit they are.
- he thin wanted to be.
- he healthy desired to be.
- she a is diet on.
- she restraint tried show to.

Sentences used in the low restraint condition in study 2:

- look those will shoes nice.
- poem it an was interesting.
- suit wore a black she.
- the mall works at she.
- zoo they visited the.
APPENDIX B

Logos used in study 5:

Positive emotions condition

Neutral Emotions condition
WEB APPENDIX

Additional Analysis for Pretest in Study 5

To rule the possibility that mentions of the company’s logo or the name of the burger may have led to the differences in emotional tone, we created a variable that captured the relatively positivity of participants writing while accounting for mentions of the company’s logo and the name of the burger. Specifically, we recalculated the percentage of words used that were associated with both positive emotions and negative emotions after eliminating instances where the logo or company’s name was mentioned in the text. We then created a measure that captured the relative positivity or participants writing (similar to the summary measure tone) by subtracting the percentage of negative words used from the percentage of positive words used. Consistent with the analysis of tone, participants who viewed the positive logo used relatively more positive words (M = 4.73) compared to those who saw the neutral logo (M = 2.42; F(1, 97) = 5.94; p = .02).