Curiosity Tempts Indulgence

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Given curiosity's characterization as a motivational drive for knowledge, prior research has primarily focused on curiosity's positive effects on knowledge exploration, information acquisition, and learning. Once the desired knowledge has been acquired, curiosity is said to be satisfied. But what happens if curiosity is left unsatisfied? Across five experiments, spanning four domains of indulgence-related decisions and relying on different methods of curiosity elicitation, the present research sheds light on an unexpected yet crucial consequence of curiosity—that unsatisfied curiosity tempts indulgent consumption in domains unrelated to the source of the curiosity. This effect is explained by a generalized desire for rewards. Experiments 1–3 establish and replicate the proposed mediation model of curiosity → desire for rewards → indulgence, employing manipulation-of-process, moderation-of-process, and measurement-of-process experimental designs. Experiment 4 utilizes neurophysiological data to indicate brain activation in the insular cortex for unsatisfied (vs. satisfied) curiosity. Experiment 5 addresses the role of cognitive depletion as a possible alternative mechanism. In summary, this article demonstrates that the hunger for information that accompanies unsatisfied curiosity is converted into a generalized desire for rewards, which in turn tempts indulgence.

Keywords: curiosity, desire for rewards, indulgent consumption, consumer neuroscience, fMRI, insula, multimethod mediation

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Extant work in both consumer research and general psychology has built on the widespread idea that curiosity—a motivational drive—produces a desire for knowledge that can be satiated through the acquisition of new knowledge (Berlyne 1954, 1960, 1966; Loewenstein 1994). After all, curiosity is said to be superficial, easily pleased, and fleeting (Burke 1757/1958; Loewenstein 1994). As a result of this conceptualization of curiosity, much of the prior research has focused on curiosity's effects on the exploration of new knowledge (Berlyne 1966; Kashdan, Rose, and Fincham 2004; Litman, Hutchins, and Russon 2005), the acquisition and evaluation of information (Kruger and Evans 2009; Noseworthy et al. 2014), and learning (Gruber, Gelman, and Ranganath 2014; Jepma et al. 2012; Kang et al. 2009; Menon and Soman 2002).

The present work poses the question: What may be some consequences if one's curiosity is left unsatisfied? We think this is an important question to investigate, because in numerous daily instances it is simply impossible to quench one's curiosity. For example, nosy people are often

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unable to acquire details about other people's affairs, curious students may fail to find solutions to thought problems, and inquisitive researchers are still powerless to tackle many burning questions in science and technology. Further, consumers' curiosity is frequently activated through teaser advertisements for novel products but left unsatisfied because crucial details (e.g., product features, price) are deliberately left out. And, more often than not, consumers explore the web for product-related information in a seemingly endless and unsatisfactory attempt to satiate their curiosity.

In an effort to shed novel light on the effects unsatisfied curiosity can have, this research reinforces the idea of a minimally explored but crucial notion that unsatisfied curiosity tempts indulgence in domains unrelated to the source of curiosity. To our knowledge, the first proposal and empirical test of the curiosity → desire for rewards → indulgence model was reported by Wiggin, Jain, and Reimann (2014). This model has been subsequently replicated in an investigation by Wang and Huang (2018), which appears in this journal. Wang and Huang (2018) seem to endorse a largely cognitive basis to the effects of curiosity on indulgence and provide experimental tests of the model. As we elaborate below, our theory rests on recent conceptualizations of curiosity as having cognitive as well as hedonic underpinnings. In addition, we document robust tests of the model—experimental, psychometric, as well as neuroimaging—using manipulation-of-process, moderation-of-process, and measurement-of-process tests.

Indulgent consumption (hereinafter simply "indulgence"), a behavior that standard dictionaries describe as "yielding to unnecessary or 'sinful' inclinations" (Merriam-Webster 2017), has been associated with the consumption of luxuries, hedonics, and other temptations (Baumeister 2002; Kivetz and Simonson 2002b; Mukhopadhyay and Johar 2009). To understand the reasons why many consumers yield to indulgences remains an ongoing quest in consumer research, psychology, and the health sciences not only because the sale of indulgent products is central to marketing, but also because (over-) indulgence can lead to obesity, debt, and addiction (Xu and Schwarz 2009). Additionally, recent correlational work has provided initial glimpses into a possible association between curiosity and a justification to indulge (Taylor, Webb, and Sheeran 2014). Against this background, and considering the pervasive nature of unsatisfied curiosity in our lives, an investigation of curiosity's causal effect on indulgence seems warranted. Across five experiments, we will assess indulgence in a variety of ways in order to generalize curiosity's effect to a host of different indulgent consumption behaviors, such as the number of chocolate candies consumed (experiments 1 and 4), the willingness to pay for a luxury vacation (experiments 2 and 5), and the choice of an indulgent over a nonindulgent reward (experiment 3).

In addition to uncovering the effect of curiosity on indulgence, this research also asks: Why is the effect of unsatisfied curiosity on indulgence prone to occur? Classic curiosity research has long argued and shown that the desire for knowledge is physiologically arousing in the sense that the information gap between what one knows and what one wants to know makes the curious individual "thirsty" and "hungry" to know more (Berlyne 1954, 1960, 1966; Loewenstein 1994). More recently, scholars have started to "operationalize curiosity as anticipation of reward, where the reward is information" (Marvin and Shohamy 2016, 270). Above and beyond these conceptualizations and operationalizations of curiosity, we will argue and show that—if left unsatisfied—curiosity produces a more generalized motivation to seek rewarding outcomes, which we call *desire for rewards* and define as motivational urges or cravings to obtain a rewarding stimulus when someone feels physiologically aroused. In support of our theorizing, we will show that unsatisfied curiosity leads to a desire for rewards, which can be satiated with a rewarding stimulus unrelated to the source of curiosity (experiment 1), is sensitive to individual differences in the responsiveness to rewards (experiment 2), is indicated in people's thoughts (experiment 3), and is associated with the very core of the neurophysiology that seems to provide a feeling-based account of desires: the insula (experiment 4). We will continue to argue and show that the curiosity-induced desire for rewards triggers indulgence because many indulgent (vs. nonindulgent) rewards offer greater reward potency such as greater short-term gratification (Mukhopadhyay and Johar 2009), especially in situations where someone exerts effort and is motivated to obtain something, and thus represent a fast and efficient way of rewarding oneself (Kivetz and Simonson 2002a; Wadhwa and Kim 2015; Wadhwa, Shiv, and Nowlis 2008).

In addition to providing evidence for the proposed mediation model, this work will report the investigation of a theoretically plausible mechanism that may also explain the effect of curiosity on indulgence: the cognitive depletion that results from being curious (experiment 5).

THEORETICAL BACKGROUND

Curiosity

The state of curiosity has been defined in multiple distinct but related ways throughout the centuries (Loewenstein 1994). Many curiosity theorists agree that curiosity is a motivational drive characterized by elevated levels of physiological arousal (Berlyne 1954, 1960, 1966; Loewenstein 1994; Noseworthy et al. 2014). While some drive theories view curiosity as internally stimulated (Fowler 1965), other drive theories view it as externally

stimulated, arising when there is conflict in the environment (e.g., doubt, perplexity, contradiction, or conceptual incongruity in stimuli or situations; Berlyne 1954, 1966). While it is acknowledged that all drives are influenced by both internal states and external stimuli (Loewenstein 1994), the present work focuses on curiosity as an externally stimulated drive, based on Berlyne's (1954, 1960, 1966) seminal understanding of curiosity.

Once externally stimulated, curiosity manifests as an appetite to obtain missing information, which is brought about by the recognition of an "information gap" between one's current knowledge and what one wants to know (Loewenstein 1994). In other words, a curious individual is driven to seek closure in his or her state of knowledge (Jepma et al. 2012; Kang et al. 2009). It follows that once such closure in knowledge has been achieved, curiosity should be satiated, just as hunger is satiated after sufficient food intake. If left unsatisfied, however, curiosity produces a strong craving for information (Litman 2005; Loewenstein 1994) that intensifies over time (Lee and Qiu 2009), to the extent that one feels physiologically deprived (Blumenberg 1985).

This understanding of curiosity is in line with many definitions across past centuries. Early philosophers described curiosity in terms of love, passion (Cicero 45BC/1914; Hume 1738/2017), longing, lust (Augustine 397–400AD/2017), or appetite (Bentham 1780/2007; Loewenstein 1994) for knowledge. Psychologists such as Sigmund Freud and Daniel Berlyne built on this philosophical understanding of curiosity, describing it as a thirst for (Freud 1909) and a drive to acquire (Berlyne 1954) knowledge. In aggregate, we conceptualize curiosity as a motivational drive stemming from an externally stimulated information gap between what one knows and what one wants to know (Berlyne 1954, 1960, 1966; Loewenstein 1994).

Curiosity and Desire for Rewards

Central to the present work are the questions of what happens if curiosity is left unsatisfied and why. Given our definition of curiosity as a motivational drive for knowledge, we hypothesize that, if left unsatisfied, curiosity triggers a generalized desire for rewards. In that sense, we expect that curiosity fosters a desire for rewards that is not exclusive to the desire for rewards that comes from knowledge. Instead, we expect that the desire for knowledge converts to other reward-based domains.

Curious consumers have been found to exhibit a tendency to seek out information regardless of whether the outcome of doing so is positive or negative (Kruger and Evans 2009). One possible explanation that has been suggested for this finding is that curiosity produces a state that may be considered rewarding in and of itself. Indeed, curiosity can lead to feelings of interest and joy related to the anticipation of learning something new (Litman et al. 2005), and these feelings can be inherently rewarding. Moreover, neuroimaging studies have shown that when a state of doubt or the perplexing nature of seeing an incongruent object activates curiosity, areas of the brain's reward center are active during both the arousal (Kang et al. 2009) and the satiation (Jepma et al. 2012) of curiosity. However, this prior research indicated only that the reward stems from the anticipation and realization of new knowledge directly related to the object of curiosity; it did not show that curiosity can also extend to a generalized desire for rewards.

More direct support for our theorizing comes from personality psychology, which has shown that consumers with naturally higher (vs. lower) levels of curiosity report higher scores on the reward responsiveness subscale of the behavioral activation system (BAS) (Carver and White 1994; Kashdan et al. 2004). Adding to this line of support, consumers with a higher disposition for curiosity were found to perceive risky behaviors as more desirable in terms of providing emotional, social, and physical rewards (Maner and Gerend 2007). However, while this prior research showed that *trait* curiosity is associated with a sensitivity toward reward cues, causal evidence for a relationship between *state* curiosity and desire for rewards is lacking from this line of work.

Preliminary causal evidence for a possible conversion of curiosity's desire for knowledge into a generalized desire for rewards also comes from outside curiosity research. Investigators have gathered evidence for the notion of a generalized desire for rewards—one that is independent of specific domains. For example, consumers can be "hungry for money" in the sense that the desire for caloric rewards increases the desire for financial rewards (Briers et al. 2006). Consumers' desire for material rewards is also similar to their desire for food rewards, as demonstrated by the evidence of actual salivation for material goods (Gal 2012) and money (Wadhwa and Kim 2015).

Curiosity, Desire for Rewards, and Indulgence

We also hypothesize that the curiosity-induced desire for rewards tempts indulgence. But why would a generalized desire for rewards trigger indulgence to a greater extent than other rewarding behaviors? We argue that the answer to this question may have three parts: (1) the nature of unsatisfied curiosity being the root cause of the desire for rewards; (2) the nature of indulgence and its high reward potency; and (3) the emerging understanding of curiosity as a fundamental aspect of human existence, which may have both cognitive and hedonic components.

First, if the generalized desire for rewards is indeed rooted in the motivational drive of curiosity (as defined and argued above), then this drive can be expressed in the effort one invests to close the information gap, such as devoting precious cognitive resources to think about the

solution or devoting behavioral resources to go somewhere to find out the answer (Loewenstein 1994). Prior research has shown that exerting effort increases the chance of indulgence. For example, when asked to join one of two different loyalty programs, consumers were more likely to choose programs offering luxury rewards (e.g., a vacation in Hawaii) over programs offering necessity rewards (e.g., credit toward gasoline purchases) of equal value when program requirements were high versus low (Kivetz and Simonson 2002a). Thus, unsatisfied curiosity may lead to indulgence because consumers feel they have earned a right to desire something rewarding for their effort. Additional support for our argument comes from recent work, which has shown that consumers who failed to obtain a reward they worked to get (e.g., uncovering diamonds in a phone game app) subsequently exerted more effort to obtain an unrelated indulgent reward (e.g., walked faster to obtain a chocolate bar) (Wadhwa and Kim 2015). Moreover, because unsatisfied curiosity leaves one "hungry," it is possible that such desire provides a "glimpse" or "taste" of the experience of receiving a reward. In support of this notion, prior work found that the mere taste of something sweet (e.g., a sip of a flavored beverage) increases the tendency to indulge in categories other than flavored beverages (e.g., eating chocolate or choosing a massage) (Wadhwa et al. 2008). Additionally, stimulating brain regions associated with the reward circuitry causes consumers to desire more of stimuli that are often considered indulgent (e.g., food or sex) (Berridge and Kringelbach 2008).

Second, another part of the answer as to why a generalized desire for rewards leads to indulgence lies in the nature of indulgence itself. In Western societies, indulgent products (e.g., sweet and fatty foods, luxury items) are abundantly available, and thus their consumption serves as a quick and effective way to reward oneself. Indeed, indulgent products are said to offer ample reward gratification in the short term (Mukhopadhyay and Johar 2009). Along similar lines, indulgent consumption has been associated with the consumption of addictive substances (e.g., alcohol), which are known to provide faster and more direct reward gratification compared to the slower, indirect gratification of natural rewards (e.g., water) (Bechara 2005). We acknowledge the possibility that the generalized desire for rewards stemming from unsatisfied curiosity can trigger rewarding behaviors other than indulgence. However, more often than not, indulgences possess greater reward potency than other rewarding products.

Third, recent research provides deeper insights into the meaning of the curiosity construct. Earlier conceptualizations of curiosity, and even several current ones, treat it as a cognitive drive whereby the perceiver is motivated toward information closure in a somewhat utilitarian sense. However, other contemporary conceptualizations suggest that curiosity may be a more complex construct than previously understood. For example, a confirmatory factor analysis on five curiosity measures by Reio et al. (2006) suggested that curiosity may be best construed in terms of its cognitive, physical thrill-seeking, and social thrill-seeking underpinnings. This perspective leads us to think that curiosity serves as a drive, not only in the interest of cognitive closure but also in pursuit of hedonic motives. At a higher level, among other conceptualizations, curiosity has been construed as a state of deprivation. When human beings are deprived, they often take action toward a state of lower deprivation, and such actions are not always based on deliberate and thoughtful processing. For example, Kirk and Logue (1997) showed that individuals who experienced tomato soup deprivation chose a more immediate but smaller portion of apple juice than those who did not experience such deprivation. It can be implied that even though the alternative was a larger (but more delayed) portion of apple juice, the more immediate gratification of sweet juice was more indulgent than the delayed version. Further, deprivation, which is often experienced viscerally, can take an individual away from his or her primary pursuit (Loewenstein 1996).

All these perspectives subsume the reasons that led us to think that a desire for rewards channels one's urges and cravings specifically (though not necessarily) onto indulgent products.

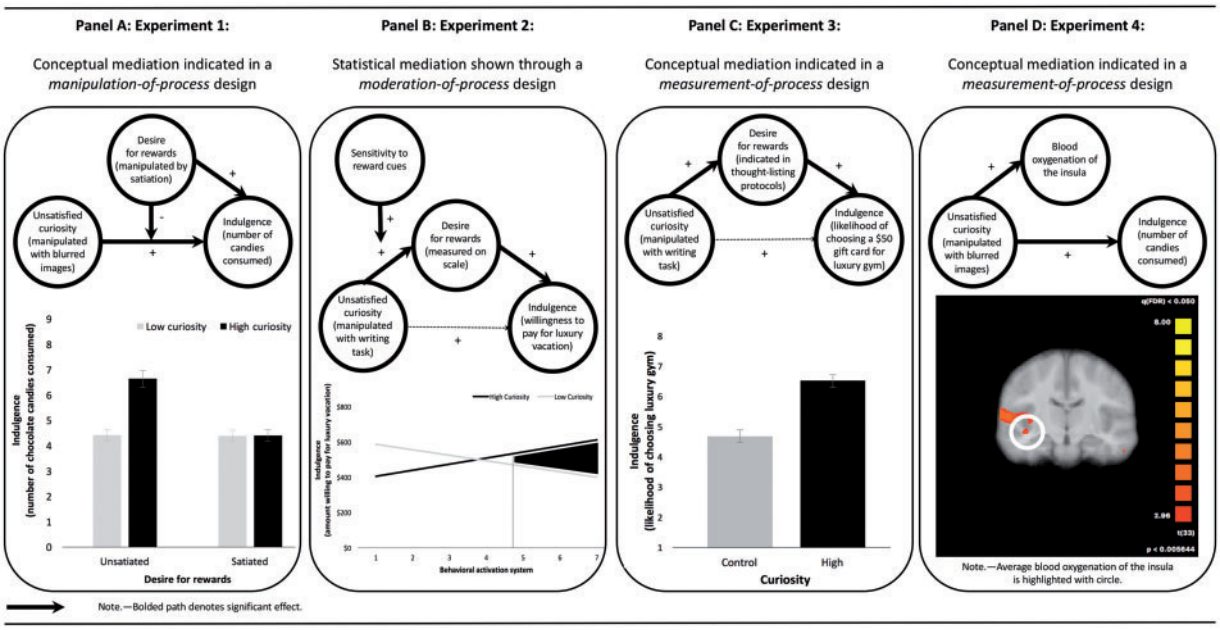
OVERVIEW OF STUDIES

Across five experiments, the present work employed a multimethod approach to study our proposed account. The present work tested for mediation in various ways (Spencer, Zanna, and Fong 2005), including *conceptual* tests for mediation (through a manipulation of the proposed process in experiment 1, a thought-listing protocol in experiment 3, and measurement of brain activation in experiment 4) and *statistical* tests for mediation (through a scale measurement in experiments 2 and 5). This research also employed different manipulations of curiosity and different assessments of indulgence. Figure 1 provides an overview of the first four experiments.

Based on the obtained effect sizes of the curiosity manipulation from several pilot studies, we aimed for sample sizes of at least 70 per condition to yield an alpha (Type I error rate) of .05 and power of .80. Data collection for these experiments was cut off after a fixed number of laboratory sessions or after the requested sample size had been reached, and always prior to data analyses, which resulted in fewer or more participants depending on the laboratory turnouts rates or typical response rates from Amazon Mechanical Turk (MTurk). The exception from our target sample size was the neuroimaging experiment, due to budgetary constraints. Participants in all studies provided informed consent to a protocol approved by an institutional

FIGURE 1

EXPERIMENTS 1–4: CONVERGING EVIDENCE FOR THE MEDIATING ROLE OF DESIRE FOR REWARDS IN THE EFFECT OF UNSATISFIED CURIOSITY ON INDULGENCE



NOTE.—See online version of this article for color neuroimage.

review board. Participants in the neuroimaging experiment were also screened for medical eligibility. Unless stated otherwise, all complete, useable observations were included in the data analyses.

EXPERIMENT 1

Overview and Method

Design and Participants. Experiment 1 aimed to provide initial support for the proposed mediation model, using a test for conceptual mediation through a manipulation-of-process design (Spencer et al. 2005) in which both the independent variable (curiosity) and the proposed mediator (desire for rewards) are manipulated. Experiment 1 employed a 2 (curiosity: high vs. low) × 2 (desire for rewards: satiated vs. unsatiated) between-subjects design with curiosity and desire for rewards as between-subjects independent variables and indulgence as a continuous dependent variable. Indulgence was operationalized as the number of chocolate candies consumed. One hundred ninety-three participants were recruited from an undergraduate subject pool in exchange for course credit.

Procedures and Materials. Experiment 1 was divided into three parts. The first part consisted of a manipulation of curiosity. Participants were randomly assigned to one of two curiosity conditions. Participants in both conditions were sequentially exposed to 15 blurred images and, for each image, were asked to guess what the actual, unblurred image was. After making a guess, participants in the low-curiosity condition were shown the corresponding unblurred image, while participants in the high-curiosity condition were not shown the unblurred image but were instead asked to indicate how curious they were to find out the answer, on a seven-point Likert-type scale (1 = not at all curious; 7 = very curious) (Jepma et al. 2012). Web appendix A shows example stimuli. To check the effectiveness of the manipulation, we then asked participants in both conditions to respond to the 10-item state curiosity scale of the State-Trait Personality Inventory (STPI) developed by Spielberger and Reheiser (2009). This scale measures the intensity of feelings and cognitions related to curiosity. Sample items include "I am in a questioning mood" and "I feel curious" (1 = not at all; 4 = very much so). Items were averaged to form a curiosity index (α = .88). The second part consisted of a manipulation of desire for rewards. Participants were told that they would be shown actual movie trailers in order to help clear their minds before continuing. Participants were randomly assigned to one of two desire-for-reward conditions.

Participants in the satiated-desire-for-rewards condition were shown a 2-minute trailer from *Ocean's Eleven* (a highly desire-satisfying movie featuring George Clooney, Julia Roberts, and Brad Pitt in Las Vegas), while participants in the unsatiated-desire-for-rewards condition were shown a 2-minute trailer from *Schindler's List* (a highly desire-unsatisfying movie). To check the effectiveness of the manipulation, we then asked participants in both conditions to respond to a desire-for-rewards scale. Desire for rewards was assessed on a 10-item scale, which we had established for our purposes based on the work by Tiffany and Drobes (1991). Sample items are "I have a desire for something rewarding right now" and "I would like to get something rewarding as soon as possible" (1 = strongly disagree; 7 = strongly agree). Web appendix B summarizes the full list of items, which were averaged to form a desire-for-rewards index ($\alpha = .90$). The third part consisted of an assessment of indulgence. Participants were informed that they would be participating in a taste test of chocolate candies. Participants were instructed to raise their hand, at which time a lab assistant gave them a white plastic cup containing 10 generic chocolate candies resembling M&Ms. Participants were told that they could consume as many of the chocolates as they would like but would not be allowed to take any outside the lab. Once finished, they were instructed to raise their hand again, at which point a lab assistant collected each cup and discreetly recorded the number of chocolate candies remaining. The total number of chocolate candies consumed served as a proxy for the dependent variable, where a higher number of candies consumed indicated more indulgence.

Results

Manipulation Checks. The manipulation of curiosity was successful. Participants in the high-curiosity condition were significantly more curious ($M_{High} = 2.42$, SD = .60) than were participants in the low-curiosity condition ($M_{Low} = 2.23$, SD = .63), $t(191) = 2.06$, $p < .05$, $d = .30$. There was no significant difference in desire for rewards between the high- ($M_{High} = 4.57$, SD = 1.08) and low-curiosity conditions ($M_{Low} = 4.43$, SD = .98), $t(191) = .98$, NS. The manipulation of desire for rewards was also successful. Participants in the satiated-desire-for-rewards condition reported a significantly lower desire for rewards ($M_{Satiated} = 4.35$, SD = 1.05) than did participants in the unsatiated-desire-for-rewards condition ($M_{Unsatiated} = 4.65$, SD = 1.00), $t(191) = 2.06$, $p < .05$, $d = .30$. There was no significant difference in curiosity between the satiated- ($M_{Satiated} = 2.33$, SD = .60) and unsatiated-desire-for-rewards conditions ($M_{Unsatiated} = 2.31$, SD = .65), $t(191) = .22$, NS. In summary, the independence between the curiosity and desire-for-rewards manipulations on the manipulation-check measures is supported by the finding that there was no difference between the high- and low-curiosity conditions on reported desire for rewards and that there was no difference between the satiated- and unsatiated-desire-for-rewards conditions on the curiosity measures. In support of this finding, two univariate analyses of variance further revealed nonsignificant interactions effects of curiosity and desire for rewards on the curiosity manipulation-check scale ($p = .99$) and the desire-for-rewards manipulation-check scale ($p = .85$).

The Satiation of Desire for Rewards Attenuates the Effect of Curiosity on Indulgence. To test whether satiating the desire for rewards attenuates the effect of curiosity on indulgence, the data were subjected to an ANOVA with curiosity and desire for rewards as the independent variables and the number of chocolate candies consumed as the dependent variable. Results confirmed the predicted simple effect of curiosity on indulgence, $F(1, 189) = 4.38$, $p < .05$, and a simple effect of desire for rewards, $F(1, 189) = 4.47$, $p < .05$. These simple effects were qualified by a significant curiosity × desire for rewards interaction effect on indulgence, $F(1, 189) = 4.25$, $p < .05$. As shown in figure 1 (panel A), when the desire for rewards had not been satiated, curiosity further increased desire for rewards and thus increased indulgence in the form of participants in the high-curiosity condition consuming a larger number of chocolates ($M_{High} = 6.63$, SD = 3.59) than participants in the low-curiosity condition ($M_{Low} = 4.42$, SD = 3.76), $t(95) = 2.97$, $p < .01$, $d = .60$. In other words, when curiosity is high, an unsatiated desire for rewards can escalate the effect of curiosity further and, thus, increase indulgence. Conversely, when the desire for rewards had been satiated, participants in the high-curiosity condition consumed a similar number of chocolates ($M_{High} = 4.40$, SD = 4.18) as did participants in the low-curiosity condition ($M_{Low} = 4.39$, SD = 3.26), $t(94) = .02$, NS.

Discussion

Experiment 1 provided initial support for our theoretical account, demonstrating that when the desire for rewards had not been satiated, curiosity increased indulgence. However, when the desire for rewards had been satiated by a curiosity-unrelated reward (i.e., seeing Julia Roberts in *Ocean's Eleven*), curiosity did not significantly increase indulgence. Employing a test for conceptual mediation through a manipulation-of-process design, experiment 1 thus added preliminary credibility to our hypothesis that curiosity produces a desire for rewards, which in turn tempts indulgence.

Experiment 2 was designed to manipulate curiosity and to measure participants' sensitivity to reward cues, the latter of which has been used in recent consumer research as a moderator of desire for rewards (Wadhwa et al. 2008). Social psychology research on the behavioral activation system (BAS) has shown that people vary in their

sensitivity to reward cues, such that people who report a high BAS exhibit a stronger motivation to seek out rewards (Carver and White 1994; Gray 1990). If desire for rewards truly underlies the effect of curiosity on indulgence, then this effect should be more prevalent among consumers who exhibit reward-seeking tendencies than among those who do not. We predicted that high BAS consumers will indulge more when their curiosity is high (vs. low), while low BAS consumers will show no difference in indulgence regardless of their level of curiosity.

EXPERIMENT 2

Overview and Method

Design and Participants. Experiment 2 aimed to provide additional support for the proposed mediation model, using a test for statistical mediation through a moderation-of-process design (Spencer et al. 2005), in which the independent variable (curiosity) is manipulated and both the proposed mediator (desire for rewards) and the proposed moderator (sensitivity to reward cues) are measured. Experiment 2 employed a two-level, single-factor (curiosity: high vs. low) between-subjects design with curiosity as a between-subjects independent variable, sensitivity to reward cues as a continuous independent variable, and indulgence as a continuous dependent variable. Indulgence was operationalized as the amount participants were willing to pay to make a vacation luxurious, building on extant research suggesting that one salient way consumers indulge is through the consumption of luxury products and the spending that goes along with it (Dzhogleva and Lamberton 2014; Kivetz and Simonson 2002b; Mukhopadhyay and Johar 2009). Three hundred two participants were recruited from an undergraduate subject pool in exchange for course credit.

Procedures and Materials. Experiment 2 was divided into four parts. The first part consisted of a measure of the participants' sensitivity to reward cues. Participants were asked to complete Carver and White's (1994) 16-item BAS measure on a seven-point Likert-type scale (1 = strongly disagree; 7 = strongly agree). Sample items included "When I want something, I usually go all out to get it" and "When I see an opportunity for something I like, I get excited right away" ($\alpha = .91$). The second part consisted of a manipulation of curiosity. A curiosity induction task was adapted from Lerner and Keltner (2001), who demonstrated that writing about an affective state can intensify the experience of that state. Participants were randomly assigned to one of two conditions. Participants in the curiosity condition read the following definition of curiosity: "Curiosity is often described as a state of high arousal that motivates exploratory behavior in order to acquire new knowledge or experiences" (Berlyne 1960). Participants were then asked to list three to five things that had made them feel most curious and about which their curiosity had not been satisfied (i.e., they still did not know the answer). Participants were then instructed to select one of the things that they had listed and to write a paragraph describing what they remembered about the situation in such a way that someone reading the paragraph might experience the same curiosity they had felt. Participants in the low-curiosity condition were shown the definition as well but were then instructed to list things that they were no longer curious about. To check the effectiveness of the manipulation, we asked participants in both conditions to respond to the curiosity scale ($\alpha = .85$), as described in experiment 1. The third part consisted of a measure of desire for rewards ($\alpha = .93$), as described in experiment 1. The fourth part consisted of the assessment of indulgence. Participants were asked to imagine that they were planning to go on a three-day vacation to the Bahamas. They were told that they had saved $1,000 but that the price of the trip ranged from $1,200 to $2,200, depending on how luxurious they wanted it to be. Participants were then asked how much more they would be willing to pay (from $200 to $1,200) (Dzhogleva and Lamberton 2014).

Results

Manipulation Check. The manipulation of curiosity was successful. Participants in the high-curiosity condition were significantly more curious ($M_{High} = 2.45$, SD = .58) than were participants in the low-curiosity condition ($M_{Low} = 2.31$, SD = .61), $t(300) = 2.01$, $p < .05$, $d = .23$.

Curiosity Increases Indulgence. Participants in the high-curiosity condition were willing to pay significantly more for an indulgent luxury vacation ($M_{High} = \$543$, SD = $265) than were participants in the low-curiosity condition ($M_{Low} = \$456$, SD = $238), $t(300) = 3.00$, $p < .01$, $d = .34$.

Curiosity Increases Desire for Rewards. Participants in the high-curiosity condition also experienced a significantly greater desire for rewards ($M_{High} = 4.80$, SD = 1.26) than did participants in the low-curiosity condition ($M_{Low} = 4.45$, SD = 1.18), $t(300) = 2.47$, $p < .05$, $d = .29$.

Desire for Rewards Mediates the Effect of Curiosity on Indulgence. To test whether desire for rewards mediates the increase in indulgence when curiosity is high, the data were subjected to a standard mediation analysis (PROCESS model 4) with 5,000 bootstrapped samples (Hayes 2013). Results showed that, as predicted, the desire for rewards mediated the effect of curiosity on the amount participants were willing to pay for a luxury vacation (the estimated coefficient of the indirect effect was 10.01, with a 95% CI exclusive of 0 [1.47, 27.36]).

A Greater Sensitivity to Reward Cues Moderates the Mediating Effect of Desire for Rewards. To test for moderated mediation by sensitivity to reward cues (abbreviated "BAS" for "sensitivity to the behavioral activation system"), the data were subjected to a standard moderated-mediation analysis (model 7) with 1,000 bootstrapped samples (Hayes 2013). Results showed that the effect of curiosity on desire for rewards was moderated for those participants with high (vs. low) BAS sensitivity and that the effect of curiosity on indulgence was mediated by desire for rewards (index = 10.69, SE = 8.37, 95% CI [.34, 34.33]). Figure 1 (panel B) illustrates this finding.

A Greater Sensitivity to Reward Cues Moderates the Effect of Curiosity on Indulgence. To further test whether BAS moderates the effect of curiosity on indulgence, the data were subjected to a multiple regression analysis with the amount participants were willing to pay as the dependent variable and curiosity, BAS (mean-centered, measured as a continuous variable), and their interaction term as the predictors. Results confirmed the predicted effect of curiosity on indulgence ($B = 87.10$, SE = 28.95, $t = 3.00$, $p < .01$) as well as a significant curiosity × BAS interaction effect ($B = 59.62$, SE = 29.16, $t = 2.05$, $p < .05$). To facilitate the interpretation of this interaction effect, spotlight analyses were performed at 1 SD above and 1 SD below the mean BAS score (Fitzsimons 2008). Simple slope analyses revealed that at 1 SD above the mean BAS score, arousing curiosity increased the amount participants were willing to pay for a luxury vacation ($B = 146.72$, SE = 40.92, $t = 3.59$, $p < .001$). In contrast, at 1 SD below the mean BAS score, participants showed no difference in their willingness to pay when their curiosity was (vs. was not) aroused ($B = 27.48$, SE = 41.26, t = .05, NS). Additionally, to identify the range of BAS scores for which the simple effect of curiosity was significant, we conducted a floodlight analysis using the Johnson-Neyman technique (Spiller et al. 2013). Results showed that high curiosity increased the amount participants were willing to pay when BAS scores were greater than 4.71 (b_{JN} = 62.05, SE = 31.53, p = .05) but not when they were lower than 4.71, NS. At the lowest level of BAS, the effect was also nonsignificant ($b_{JN} = -181.49$, SE = 134.75, NS).

Discussion

Experiment 2 provided further support for our theoretical account by demonstrating that, for curious consumers, the desire for rewards becomes stronger for those who are more (vs. less) sensitive to reward cues. In turn, curious high (vs. low) BAS consumers indulge more. Conversely, in the case of low curiosity, individual differences in sensitivity to reward cues no longer affect indulgence. Employing a test for statistical mediation through a moderation-of-process design, experiment 2 thus provided additional support for our hypothesis that curiosity produces a desire for rewards, which tempts indulgence. Experiment 2 also generalized our account to a different manipulation of curiosity (writing task).

Experiment 3 was designed to answer the question of whether curiosity is more likely to predict a specific effect toward an indulgent consumption option than to predict a broader effect to any stimulus with reward value. To do so, the dependent variable in experiment 3 kept the rewarding properties of two choice options constant, while varying the level of indulgence of these two options. A follow-up experiment further tested the effect of curiosity on a single consumption option that was nonindulgent but rewarding. Further, experiment 3 was designed to avoid demand effects by measuring desire for rewards after the dependent variable.

EXPERIMENT 3

Overview and Method

Design and Participants. Experiment 3 aimed to provide further support for the proposed mediation model, using a test for conceptual mediation through a measurement-of-process design (Spencer et al. 2005) in which the independent variable (curiosity) is manipulated and the proposed mediator (desire for rewards) is measured. Experiment 3 employed a two-level, single-factor (curiosity: high vs. control) between-subjects design with curiosity as a between-subjects independent variable, desire for rewards as an independent variable, and indulgence as an ordinal dependent variable. Indulgence was operationalized as the choice of an indulgent reward ($50 gift card for a one-month trial membership at a luxury gym) over a nonindulgent reward ($50 gift card for a one-month trial membership at a regular gym with $15 cash back). Two hundred participants were recruited from MTurk in exchange for monetary compensation. Three cases were removed from the dataset because participants had not complied with instructions (e.g., had typed in a number where they were asked to write an essay).

Procedures and Materials. Experiment 3 was divided into three parts. The first part consisted of a manipulation of curiosity. Participants were randomly assigned to one of two curiosity conditions. The writing task described in experiment 2 was used, with the only modification being that participants either wrote about something that they were curious about (high curiosity) or were not told the definition of curiosity and asked to write something normal they had done the previous day (control). To check the effectiveness of the manipulation, we asked participants in both conditions to respond to the curiosity scale ($\alpha = .87$), as described in experiment 1. The second part consisted of the assessment of choice of an indulgent over a nonindulgent reward. Participants were first asked which credit

card they used most often (i.e., American Express, Discover, MasterCard, or Visa). On the next screen, participants were shown the name of the credit card they had just chosen and were told that this card gave them points every time they used it. Participants were also informed that the points are good for gift card offers, which the credit card automatically sends once enough points have been accumulated. Participants were then told that they had accumulated enough points to be eligible for a gift card offer and were asked to click a button to see the offer. Participants were shown an offer of a gift card good for a one-month trial membership at a gym, valued at $50. Participants were then asked to imagine that they had become interested in this offer and had toured the two available gyms in their area in order to compare them and make a decision. The descriptions of the two gyms (counterbalanced) were shown next. One of the two gyms was described as a luxury gym that offered, in addition to the standard workout equipment, many features that are unexpected and somewhat unnecessary for a gym, such as a relaxation area with a dipping pool, Scandinavian wood sauna, and an indulgent rain shower. Participants were further told that the gym costs $50 per month and that their gift card would cover the first month of membership for free. The other gym was described as a regular fitness gym that offered the standard workout equipment. Participants were also told that the gym was 5 minutes from their home/work, so they could use it often and achieve their fitness goals. Participants were further told that the gym costs $35 per month, that their card would cover the first month of membership for free, and that, in addition, the gym would send them a $15 check in the mail for signing up. An independent pretest ($n = 50$) confirmed that the gift card for the luxury gym ($M = 4.94$, SD = 1.85) was similarly rewarding when compared to the gift card for the regular gym ($M = 4.60$, SD = 1.76; 1 = not at all rewarding; 7 = very much rewarding), $t(49) = .86$, NS. However, the gift card for the luxury gym ($M = 6.08$, SD = 1.21) was viewed to be more indulgent than the gift card for the regular gym ($M = 3.80$, SD = 1.87; 1 = more of a necessity; 7 = more of an indulgence), $t(49) = 6.63$, $p < .001$. Finally, participants were asked to indicate which gym they would be more likely to choose on an 11-point semantic differential rating scale (highly likely to choose regular gym/highly likely to choose luxury gym). The third part consisted of a measure of desire for rewards. Participants completed a thought-listing protocol in which they were asked to recall the situation (curious, normal) they had written about earlier and describe, in their own words, the feelings they had when they thought about the situation. The listed thoughts of each participant were rated by two judges on a four-point scale assessing the strength of indicating desire-related thoughts (1 = weak indication; 4 = strong indication). Based on Tiffany and Drobes' (1991) definition of desire, the judges rated the thoughts in terms of the degree to which the thoughts expressed urgent and strong needs or wants. Inconsistencies were resolved through discussion, and interrater reliability was high ($r = .81$). The average of the judges' ratings served as the measure of desire for rewards.

Results

Manipulation Check. The manipulation of curiosity was successful. Participants in the high-curiosity condition were significantly more curious ($M_{High} = 3.11$, SD = .53) than were participants in the control condition ($M_{Control} = 2.72$, SD = .59), $t(195) = 4.91$, $p < .001$, $d = .70$.

Curiosity Increases Indulgence. Participants in the high-curiosity condition were significantly more likely to choose the indulgent reward option ($M_{High} = 6.52$, SD = 3.92) than were participants in the control condition ($M_{Control} = 4.69$, SD = 3.86), $t(194) = 3.28$, $p < .01$, $d = .47$.

Curiosity Increases Desire for Rewards. Participants in the high-curiosity condition also experienced a greater desire for rewards ($M_{High} = 2.74$, SD = 1.02) than did participants in the control condition ($M_{Control} = 1.30$, SD = .35), $t(195) = 13.66$, $p < .001$, $d = 1.89$.

Desire for Rewards Mediates the Effect of Curiosity on Indulgence. To test whether desire for rewards mediates the increase in indulgence when curiosity is high, the data were subjected to a standard mediation analysis (PROCESS model 4) with 5,000 bootstrapped samples (Hayes 2013). Results showed that, as predicted, the desire for rewards mediated the effect of curiosity on choice of the indulgent option (the estimated coefficient of the indirect effect was 1.98, with a 95% confidence interval [CI] exclusive of 0 [.92, 3.20]). Figure 1 (panel C) illustrates this finding.

Discussion

Experiment 3 provided additional support for our theoretical account, indicating that curiosity increases indulgence through a heightened desire for rewards. Experiment 3 also demonstrated that, compared to a control, curious consumers were more likely to choose the more indulgent reward option and to have more desire-related thoughts underlying their choice. While both choice options were similar in their reward value (i.e., both rewards came in the form of a $50 gift card), one option was described as more indulgent than the other. Thus, it seems that desire for rewards channels consumers' choices specifically onto indulgent (vs. nonindulgent) rewards. Experiment 3 further served as a conservative test of our account by comparing high curiosity to a control condition with no mention of curiosity. Experiment 3 also successfully dealt with concerns about demand effects by measuring the proposed mediator after the dependent variable.

While these results are promising, the design of experiment 3 leaves open the question as to whether curiosity would predict the choice of a *single* rewarding option (i.e., a coupon of a regular, nonindulgent gym). For this reason, we conducted another experiment among an independent sample of 204 MTurk panel members. This study was identical to experiment 3, except that the likelihood of choosing a single option was being evaluated (i.e., the regular gym membership, as described above). In other words, in this experiment, participants did not choose between a luxury and a regular gym, but just stated their likelihood of choosing the regular gym (10-point scale). Results revealed that the manipulation of curiosity was again successful: participants in the high-curiosity condition were more curious ($M_{High} = 3.21$, SD = .61) than were participants in the control condition ($M_{Control} = 2.63$, SD = .70), $t(202) = 6.30$, $p < .001$, $d = .88$. Importantly, however, participants were approximately equally likely to choose or not choose the coupon: $M_{High} = 5.20$, SD = 3.43 vs. $M_{Control} = 5.16$, SD = 3.21), $t(202) = .07$, NS. These results lend further support to the notion that curiosity predicts a specific effect toward indulgent consumption, as experiment 3 has shown.

But why might this be the case? As we had predicted, one reason why desire for rewards channels consumers toward indulgences might be the reward potency that indulgences offer. For this reason, we conducted yet another follow-up study to test whether the indulgent gym offers more *reward potency* than the nonindulgent gym, despite having the same objective *reward value* of $50. An independent post-test ($n = 62$) confirmed that the $50 gift card for the luxury gym ($M = 5.65$, SD = 1.44) was indeed perceived to offer greater reward potency than the $50 gift card for the regular gym ($M = 4.15$, SD = 1.71; "How much power does this gym have to make an impression on people?" 1 = low potency; 7 = high potency), $t(61) = 5.44$, $p < .001$. This finding suggests that a more complex process may be at work in which curiosity excites desire for rewards, followed by a focus on rewards that are especially reward-potent, followed by indulgent consumption.

Experiment 4 was designed to manipulate curiosity and to test for the underlying process by using a neurophysiological measure. In particular, experiment 4 employed functional magnetic resonance imaging (fMRI) to measure blood oxygenation in participants' brains. Blood oxygenation has been used in consumer research as a process measure (Hedgcock, Vohs, and Rao 2012; Yoon et al. 2006), including reward-related processes (Reimann, MacInnis, and Bechara 2016). In short, greater blood oxygenation is highly and positively correlated with greater brain activation (Huettel, Song, and McCarthy 2008). Applying this logic, we had hypothesized that, if desire for rewards truly underlies the effect of curiosity on indulgence, then this effect should be associated with blood oxygenation of the *insula*. The insula receives sensory inputs from the body, such as thirst and hunger, and provides a feeling-based account of desire (Craig 2002). For example, in situations in which the body senses the feeling of thirst, a desire for water arises (Cannon 1929, 1932/1963) because the appetitive and survival value in liquid and solid foods is psychologically rewarding (Schultz 2006). However, the desire for rewards should not be limited to the thirst and hunger for foods (Naqvi and Bechara 2009). For example, causal evidence comes from smokers who, after experiencing a stroke with damage to the insula, stopped feeling a desire to smoke cigarettes (vs. smokers with brain damage not involving the insula) (Naqvi et al. 2007). Further, in healthy consumers, the insula was found to be a common structure underlying both the desire for food rewards and the desire for monetary rewards (Reimann et al. 2016). We expect that curiosity is associated with blood oxygenation of the insula, which in turn explains indulgence. Initial support for this notion comes from a recent neuroimaging study suggesting that curiosity (stemming from seeing an incongruent object) is correlated with insula activation (Jepma et al. 2012). It is important to note here that the function of the insula differs from the function of other brain structures known to be associated with rewarding stimuli (e.g., the striatum), in that the insula processes the visceral *desire* for something rewarding as opposed to the *anticipation of receiving* a reward or *actually receiving* a reward (Naqvi and Bechara 2009).

EXPERIMENT 4

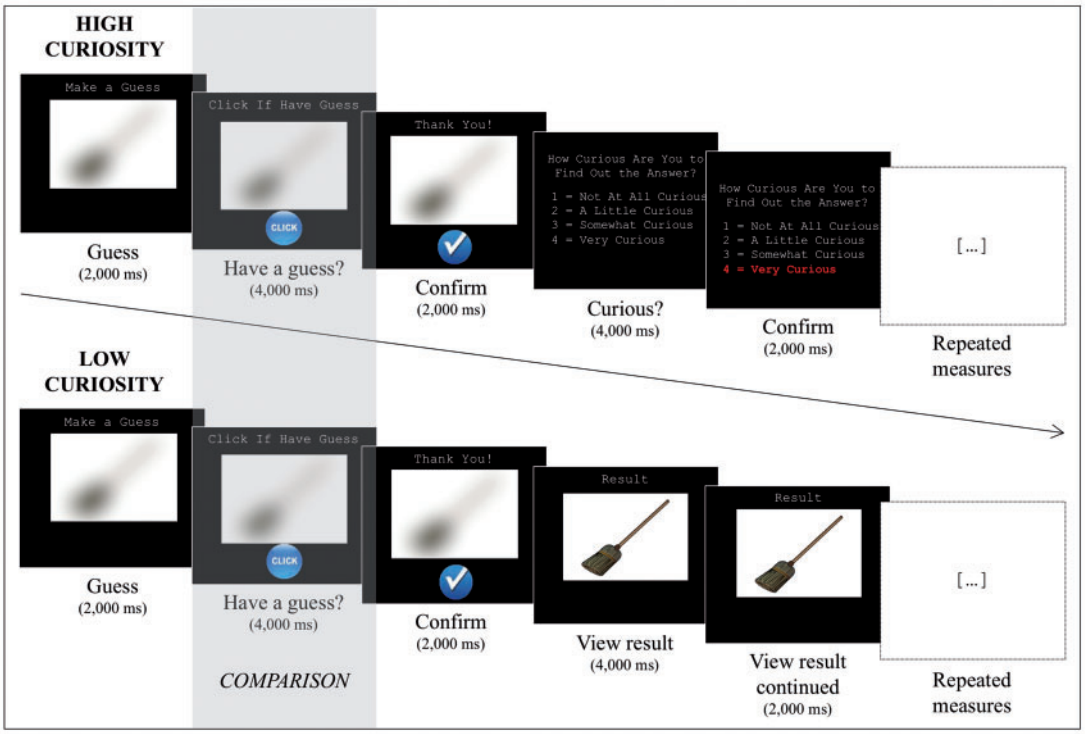
Overview and Methods

Design and Participants. Experiment 4 aimed to provide additional support for the proposed mediation model using a test for conceptual mediation through a measurement-of-process design, in which the independent variable (curiosity) is manipulated and the proposed mediator (blood oxygenation of the insula) is measured. Experiment 4 employed a two-level, single-factor (curiosity: high vs. low) between-subjects design with curiosity as a between-subjects independent variable, blood oxygenation of the insula as an independent variable, and indulgence as a continuous dependent variable. Indulgence was operationalized as the number of chocolate candies consumed. Thirty-six participants were recruited from an undergraduate subject pool in exchange for course credit. One participant's neuroimaging data was unusable for analysis due to excessive head movement; however, this participant's choice data was retained in the dataset.

Procedures and Materials. Upon arrival at the neuroimaging lab, participants were placed inside a Siemens Skyra 3 Tesla fMRI scanner and underwent a brain scan. Web appendix C summarizes the neuroimaging data collection and analyses.

FIGURE 2

EXPERIMENT 4: PARTICIPANTS WERE ENGAGED IN A BLURRED IMAGES TASK DURING FUNCTIONAL NEUROIMAGING



Experiment 4 was divided into four parts. Participants were randomly assigned to one of two curiosity conditions. The first part consisted of a two-step manipulation of curiosity to maintain the efficacy of the manipulation. Outside the scanner, participants were engaged in the writing task, as described in experiment 2. Inside the scanner, participants were exposed to blurred images, as described in experiment 1. Figure 2 illustrates the in-scanner manipulation. The second part consisted of a measurement of blood oxygenation of the insula. Figure 2 and web appendix C detail the exact phases of this part. We expected that insula activation would be greater for participants in the high (vs. low) curiosity condition during the "Have a guess?" phase (see figure 2, highlighted in grey) because this phase most likely represents the stage in which curiosity arises and, thus, the desire for rewards should be greatest. The third part consisted of a measure of curiosity, which was administered immediately after participants exited the scanner. To check the effectiveness of the manipulation, participants in both conditions were asked how curious they were (1 = not at all; 7 = very much so). The fourth part of the experiment consisted of the assessment of indulgence. Outside the scanner, participants then chose how much candy to consume, as described in experiment 1.

Results

Manipulation Check. The manipulation of curiosity was successful. Participants in the high-curiosity condition were significantly more curious ($M_{\text{High}} = 4.78$, SD = 1.96) than were participants in the low-curiosity condition ($M_{\text{Low}} = 3.39$, SD = 1.75), $t(34) = 2.24$, $p < .05$, $d = .75$.

Curiosity Increases Indulgence. Participants in the high-curiosity condition consumed a significantly larger number of chocolates ($M = 6.44$, SD = 3.07) than did participants in the low-curiosity condition ($M = 4.22$, SD = 3.26), $t(34) = 2.10$, $p < .05$, $d = .70$.

Curiosity Increases Blood Oxygenation in the Insula. Participants in the high-curiosity condition were also found to have greater blood oxygenation of the insula during the "Have a guess?" phase, averaged across 45 trials, as compared to participants in the low-curiosity condition ($p < .005644$, q(FDR) $< .05$, cluster-corrected for multiple comparisons). Figure 1 (panel D) illustrates this finding (marked with a circle). Table 1 in web appendix C summarizes all brain areas for which differences in blood oxygenation were found between high and low curiosity.

Discussion

Experiment 4 provided additional support for our theoretical account by demonstrating that curiosity is associated with greater blood oxygenation of the insula for more (vs. less) curious participants. Taken together, experiments 1–4 provide converging support by highlighting the phenomenon from multiple angles.

Beside the desire for rewards, curiosity might also lead to cognitive depletion. Given mounting evidence that cognitive depletion can lead to indulgence (Cools, Schotte, and McNally 1992; Fedorikhin and Patrick 2010; Kacen and Lee 2002), it seems warranted to investigate this alternate process further. The extant literature offers two competing accounts as to whether curiosity may lead to the depletion of regulatory resources. One account suggests that being curious creates a feeling of frustration from not knowing (Litman and Jimerson 2004; Loewenstein 1994) that could deplete consumers cognitively. Indeed, tolerance for frustration and cognitive depletion have been said to be closely interconnected (Baumeister et al. 1998). Additionally, correlational studies have suggested that curiosity is associated with the self-regulation of attentional resources (Kashdan et al. 2004) and the self-regulation of emotional resources (Lauriola et al. 2015). In line with these correlational findings, addiction researchers have included curiosity subscales in their measurements of maladaptive temptations (e.g., smoking) (McGee et al. 2012).

However, another account offers a contrasting position. More recently, many consumers have been increasingly observed to "binge" on social media and video-on-demand shows (Jenner 2017) in a seemingly endless attempt to satisfy their curiosity. This phenomenon seems to suggest that there are situations in which curiosity leads to little or no depletion because binging on a Netflix series requires cognitive resources such as attention and memory. Experiment 5 was designed to investigate these two accounts in the context of indulgence. We used a well-established manipulation of restoration of cognitive resources as a way to test whether it is likely for curiosity to lead to cognitive depletion.

EXPERIMENT 5

Overview and Method

Design and Participants. Experiment 5 aimed to test the alternative explanation of cognitive depletion, which suggests that unsatisfied curiosity could be cognitively depleting, thus leading to indulgence. We hypothesized that if our manipulation of curiosity indeed induces a state of cognitive depletion, then—in line with extant work on the restoration of cognitive resources (Schmeichel and Vohs 2009)—high (vs. low) self-affirmation would restore curious participants' cognitive resources (vs. control) and, in turn, lower the chances of indulgence. Along similar lines, prior research has also shown that because self-affirmation counteracts cognitive depletion, when participants' cognitive resources appeared to be replenished after affirming (vs. not affirming) a cherished value, they exercised better self-control in another task (Schmeichel and Vohs 2009). Experiment 5 employed a 2 (curiosity: high vs. low) × 2 (self-affirmation: high vs. low) between-subjects design with curiosity and self-affirmation as between-subjects independent variables and indulgence as a continuous dependent variable. Indulgence was operationalized as the amount participants were willing to pay for a vacation. Two hundred ten participants were recruited from MTurk in exchange for monetary compensation. Seven cases were removed from the dataset because participants had not complied with instructions (i.e., had typed "yes" or "nice study" instead of providing an essay). In one case, the same essay was provided twice; in another case, one duplicate was removed, while the other was kept.

Procedures and Materials. Experiment 5 was divided into four parts. The first part consisted of a manipulation of curiosity, as described in experiment 2. To check the effectiveness of the manipulation, we asked participants in both conditions to respond to the curiosity scale ($\alpha = .92$) described in experiment 1. The second part consisted of a manipulation of self-affirmation using a well-established value essay self-affirmation task (cf. McQueen and Klein 2006 for an extensive review) adapted from Schmeichel and Vohs (2009). All participants were presented with a list of 11 personal characteristics and values and were asked to rank them in order of personal importance. The list included business/managerial skills, relationships with friends/family, and romantic values (Cohen, Aronson, and Steele 2000). Participants were then randomly assigned to one of two self-affirmation conditions. Participants in the high self-affirmation condition were asked to write an essay explaining why their top-ranked value was important to them and describe a time in their lives when it had been particularly important. Participants in the low self-affirmation condition were asked to write an essay explaining when the value they had ranked seventh in importance might be important to the average MTurk panelist (Schmeichel and Vohs 2009). The third part of the experiment consisted of a measure of desire for rewards ($\alpha = .95$), as described in experiment 1. The fourth part consisted of an assessment of indulgence, as described in experiment 2.

Results

Manipulation Checks. The manipulation of curiosity was successful. Participants in the high-curiosity condition were significantly more curious ($M_{High} = 3.23$, SD = .70) than were participants in the low-curiosity condition ($M_{Low} = 2.62$, SD = .69), $t(200) = 6.29$, $p < .001$, $d = .88$. There

was no significant difference in curiosity between the high- (M_{High} = 2.86, SD = .72) and low-self-affirmation conditions (M_{Low} = 2.98, SD = .79), $t(200) = 1.12$, NS.

Curiosity Increases Indulgence, Even after Restoring Cognitive Resources. To test whether self-affirmation would restore the cognitive resources of more curious participants (vs. less), thus in turn lowering the chances of indulgence, we subjected the data to a univariate analysis of variance with curiosity and self-affirmation as independent variables and indulgence as the dependent variable. Results revealed a significant effect of curiosity on indulgence, $F(1, 198) = 14.45$, $p < .001$. Participants in the high-curiosity condition were willing to pay significantly more for an indulgent vacation (M_{High} = \$573, SD = \$364) than were participants in the low-curiosity condition (M_{Low} = \$406, SD = \$248), $t(200) = 3.83$, $p < .001$, $d = .54$. Both the effect of self-affirmation on indulgence and the interaction effect of curiosity and self-affirmation on indulgence were nonsignificant (*p*s > .50). Curious participants were actually willing to pay *more* in the high-self-affirmation condition ($M_{High\ curiosity,\ high\ self\text{-}affirmation}$ = \$586) than were participants in both the low-self-affirmation condition ($M_{High\ curiosity,\ low\ self\text{-}affirmation}$ = \$562, NS) and the low-curiosity condition ($M_{Low\ curiosity}$ = \$406, $p < .001$). If curiosity was indeed cognitively depleting, then we would have expected curious participants who affirmed a cherished value to be willing to pay *less* than curious participants without such self-affirmation and to pay nonsignificantly more than participants with low curiosity. However, this was not the case in this dataset.

Curiosity Increases Desire for Rewards. A univariate analysis of variance with curiosity and self-affirmation as independent variables and desire for rewards as the dependent variable revealed a significant effect of curiosity on desire for rewards, $F(1, 198) = 4.43$, $p < .05$. Participants in the high-curiosity condition also experienced a greater desire for rewards (M_{High} = 4.96, SD = 1.41) than did participants in the low-curiosity condition (M_{Low} = 4.56, SD = 1.44), $t(200) = 2.03$, $p < .05$, $d = .28$. Both the effect of self-affirmation on desire for rewards and the interaction effect of curiosity and self-affirmation on desire for rewards were nonsignificant (*p*s > .30).

Desire for Rewards Mediates the Effect of Curiosity on Indulgence. To test whether desire for rewards mediates the increase in indulgence when curiosity is high, the data were subjected to a standard mediation analysis (PROCESS model 4) with 5,000 bootstrapped samples (Hayes 2013). Results showed that, as predicted, the desire for rewards mediated the effect of curiosity on the amount participants were willing to pay for a vacation (the estimated coefficient of the indirect effect was 29.22, with a 95% CI exclusive of 0 [1.90, 69.48]).

Discussion

Experiment 5 showed that cognitive depletion is less likely to be an explanation for why curiosity tempts indulgence. Instead, experiment 5 affirmed that desire for rewards is an explanation for this effect.

GENERAL DISCUSSION

In a multimethod approach to understanding the effect of curiosity on indulgence, we provided converging evidence that unsatisfied curiosity leads to a generalized desire for rewards, which in turn, tempts indulgence. Accordingly, in order to understand curiosity's consequences, researchers must consider not only that curiosity creates the motivation to attain knowledge but also that the state of unsatisfied curiosity translates to a desire to pursue unrelated rewards. Five experiments led to a novel comprehension of curiosity with important theoretical contributions to several literatures.

Core Theoretical Contributions

On the Unexpected Consequences of Curiosity. This research advances our understanding of state-derived curiosity and its incidental effects on both consumption attitudes and behaviors. Previous research has primarily focused on curiosity's integral role in fostering a desire for knowledge, which spurs information search and exploratory behaviors (Berlyne 1966; Litman et al. 2005; Menon and Soman 2002; Noseworthy et al. 2014). The present work furthers this understanding by demonstrating that the experience of curiosity can also produce a generalized desire for unrelated rewards, thus tempting indulgence. This finding is novel and surprising given the longstanding categorization of curiosity as superficial, easily satisfiable, and fleeting (Burke 1757/1958; Loewenstein 1994). In contrast to this venerable notion, the present research found that curiosity can be left unsatisfied, which converts the desire for knowledge into a desire for rewards. This effect, in turn, has profound consequences for a variety of downstream consumer attitudes and behaviors, such as people's willingness to pay for luxurious products as well as their reward choices and indulgent food consumption.

As discussed in the front end, Wang and Huang (2018) also explore the link between curiosity and indulgent choices. There are some key conceptual differences between Wang and Huang (2018) and our investigation. Wang and Huang (2018) conceptualize their process mechanism as a reward-seeking goal, which is primed by a desire to obtain the information one is curious about, and in turn tempts indulgence. This idea is conceptually close to what we had termed the "desire for rewards" in our earlier article (Wiggin et al. 2014). A key difference is that while we speak more broadly of a generalized desire for rewards

that is motivational and possibly homeostatic, Wang and Huang (2018) base their theorizing in the priming literature and argue that the desire for information primes an associated higher-order reward-seeking goal. In particular, they suggest that curiosity motivates a drive for closure due to missing information, which led to curiosity in the first place. This drive for closure translates into a reward-seeking goal. In this sense, Wang and Huang's framework appears to implicate a cognitive basis to the link between curiosity and indulgence. Our theory rests on curiosity as indeed being a drive, but one that can have both cognitive and hedonic underpinnings. This novel thrust is aligned with Reio et al. (2006), who treat curiosity multimodally—as a cognitive, a physical, and a social thrill-seeking drive. Our investigation also departs from Wang and Huang (2018) in that the evidence in support of our theory includes robust behavioral, psychometric, and neuroimaging data, all of which converge toward a cognitive and hedonic basis of the curiosity–indulgence association. We also uniquely recognize that one of the reasons why curiosity can lead to indulgent consumption is because of the latter's greater reward potency. Importantly, our investigation relies on multiple testing designs—manipulation of process, moderation of process, and measurement of process. Lastly, our use of the BAS measure is in line with Carver and White's (1994) conceptualization of BAS as an individual difference measure, while Wang and Huang (2018) used BAS as a measure of reward seeking.

Marvin and Shohamy (2016) investigated factors that enhance learning and conceptualized "curiosity as the anticipation of reward, where the reward is information" (270). On the surface, our focus on desire for reward appears similar to this conceptualization. However, beyond terminology, there are significant differences. First, Marvin and Shohamy (2016) reframe curiosity "as the motivation to obtain reward" (266), treating them as synonymous. Herein, we created a separation between curiosity and desire for rewards and treat the latter as a consequence of the former, not as its synonym. Thus, we treat desire for rewards as a construct distinct from curiosity, which is theoretically different from and much more than a reframe. This separation permits an empirical testing of mediation, which appears to be robust across our studies. Such compartmentalization also enables a more micro-level and theoretically richer examination of curiosity and its consequences. Second, in Marvin and Shohamy's (2016) terminology, "reward is information" (270). In other words, the authors suggest that curiosity is the motivation to obtain information, which is well known. Our consideration of the reward is in terms of indulgence and not information.

Taylor et al. (2014) found that people consider indulgences to be deserved based on several justifications, one of them being curiosity. The specific parts of Taylor and colleagues' investigation involving curiosity (studies 1 and 2) are based on correlational and idiosyncratic interpretation of the evidence. For example, the justifications were obtained via focus groups and were later subjected to a principal component analysis to determine the factor structure. The factor labeled curiosity appears to be conflated with persuasive/vivid messaging as well as message exposure. Furthermore, the authors were unable to rule out the possibility that the same findings could also be obtained for healthy consumption (there was no healthy consumption condition in the article across any of the three studies). Our investigation provides causal as well as correlational evidence—in the lab, with online respondents, and using fMRI data— that relied on clean constructs rooted in literature. We provided compelling evidence that the effect is robust across settings and specifically in the domain of indulgent consumption. Also, to our knowledge, no preceding research has tested the full model of desire for rewards mediating the causal effect of curiosity on indulgence.

Faraji-Rad and Pham (2017) examine the effect of uncertainty on choices that are affectively- or functionally-superior. If we consider curiosity to be a state of uncertainty and indulgences as being always affectively-superior, then it can be argued that there are conceptual similarities between their and our work (also see Wiggin et al. 2014). Specifically, their conceptualization of uncertainty and our conceptualization of curiosity are akin in that both focus on an information gap that underlies uncertainty (Faraji-Rad and Pham 2017) or curiosity (Wiggin et al. 2014). Despite these similarities, there is a surprising lack of convergence in these two literatures and future work bringing uncertainty and curiosity closer together may be particularly insightful. For instance, it is unknown whether and the extent to which uncertainty and curiosity move in the same direction. It is possible that for some types of uncertainty (e.g., when uncertainty evokes an avoidance response), people are less curious than when uncertainty evokes an approach response (Golman and Loewenstein 2015). It is also possible that for some types of curiosity (e.g., interest-based curiosity; see discussion of curiosity types below), people experience lower uncertainty than when curiosity is deprivation-based. An effort to integrate the notions of uncertainty and curiosity may shed light on these interesting speculations and might make an important contribution to the field.

On How Desire for Rewards Channels One's Choice onto Indulgent Rewards. Another contribution of the present research to the consumer literature is that indulgent products carry a specifically high reward potency. As shown in experiment 3 and its follow-up studies, curious consumers are more likely to choose indulgent over functional rewards, even if the reward value of both options is kept constant. Indulgent products thus seem to provide faster and more direct reward gratification compared to utilitarian rewards. In other words, consumers receive a

bigger "psychological bang for their buck" when choosing indulgences over necessities, even if both have the same objective value. It thus seems that the desire for reward channels consumers' judgment and decision making onto indulgences. Thus, indulgences possess greater reward potency—that is, the power to impress consumers.

On the Dark Side of Curiosity. Curiosity has often been characterized as a positive affective state (Litman et al. 2005; Noseworthy et al. 2014). However, a pilot study (not reported here) showed that curiosity correlated with both positive affect ($r = .75$, $p < .001$) *and* negative affect ($r = -.15$, $p < .05$). Given these findings, there is clearly something to learn from the negativity that may be inherent in curiosity. Being curious often implies *deprivation* of knowledge, an *uncomfortable* desire to find closure, and the potentially *destructive* consequence of doing so—all of which are highly negative associations of curiosity. Researchers have just recently begun to view curiosity as a potential "curse," as it can lead people to expose themselves to aversive stimuli (Hsee and Ruan 2016). The present work contributes to this emerging literature on the "dark side" of curiosity by implying possible negative consequences of the effect of curiosity on indulgence such as overspending or even food addiction.

On the Inhibition of Regulatory Resources by Curiosity. One of our key contributions rests in the notion that curiosity can lead to unexpected and unrelated negative consequences, a result not documented in the extant literature. In accord, we asked how likely it might be that the effect of curiosity on indulgence is explained by cognitive depletion. Indeed, if cognitive depletion is at play, an intriguing and unanswered question is why curiosity would inhibit regulatory resources. Some recent work suggested that incidental curiosity (i.e., a curiosity-evoking stimulus that is incidental to the focal task) diverts attention away from the focal task (Isikman et al. 2016). In other words, a desire to indulge may indeed be the process, but what makes this process so profound in an unrelated domain is that there is an underallocation of focal attention to regulate that domain. Thus, it may not be the more cognizant notion that consumers have "earned the right to indulge," but rather that consumers are not consciously regulating whether they "should indulge."

However, in the present work, we did not find support for cognitive depletion. While curiosity may tax cognitive resources (e.g., a researcher trying to solve a scientific puzzle), in many other cases people can engage in their curiosity at length without experiencing cognitive depletion (e.g., reading a novel from beginning to end or binge-watching). In this sense, we extend literature that found that cognitive depletion triggers indulgence by way of elevated arousal (Cools et al. 1992; Fedorikhin and Patrick 2010; Kacen and Lee 2002). Herein, we illustrated that curiosity stands apart from the norm of other affective-motivational constructs that may trigger indulgence. Second, we bring more clarity to recent correlational studies, which have associated curiosity with the self-regulation of attentional (Kashdan et al. 2004) and emotional resources (Lauriola et al. 2015). We add to this work by arguing that, yes, curiosity can help regulate attentional and emotional resources toward the source of curiosity and this regulation process can be maintained for a long time, but more importantly, without necessarily getting cognitively depleted.

On the Role of the Insula in the Effect of Curiosity on Indulgence. Our work adds new insights to recent neuroimaging research on curiosity. Previous neuroimaging work has found initial correlational evidence between satiated curiosity and dopaminergic regions in the brain that have long been associated with anticipated reward (Kang et al. 2009). Our research extends this important work by highlighting insula activation as an underlying mechanism of curiosity. The differentiation of the insula and its association with curiosity from structures of the dopamine system (e.g., the dorsal striatum) is an important one to make, because it hints at the possible existence of different psychological processes: while the striatal regions have often been associated with the anticipation or actual experience of receiving a reward (Kang et al. 2009), the insula seems to process a bodily desire for something rewarding without the surety of receiving the reward (Naqvi and Bechara 2009; Preuschoff, Quartz, and Bossaerts 2008; Vartanian, Mandel, and Duncan 2011).

Directions for Future Research

Curiosity as a Means for "Better" Goal Pursuit? This research provides a foundation for exploring the incidental effects of curiosity on consumer behavior: indulgence. Although the findings of this research suggest that curiosity influences consumers' preferences for short-term indulgences, other research suggested that curiosity may also motivate the pursuit of long-term goals (Maner and Gerend 2007). These paradoxical findings suggest that curiosity may facilitate goal pursuit when a future goal offers a temptation. Future work should explore how the effect is influenced by differences in short- and long-term goals.

Reward Potency. The present work argued that indulgences often possess greater reward potency than other rewarding products, and experiment 3 and its follow-up studies supported this notion. This finding offers an important characteristic of indulgent products (their reward potency) that helps explain the motivational quality of a generalized reward-seeking tendency (from curiosity) toward indulgent products. Future work on the intricacies of the concept of reward potency is warranted. For example, reward potency can refer to the temporal distance of

reward gratification: Mukhopadhyay and Johar (2009) suggested that indulgent (vs. nonindulgent) products offer gratification in the short term.

D-Type versus I-Type Curiosity. There has been discussion in the literature around deprivation- versus interest-based curiosity (Lauriola et al. 2015; Litman 2010; Litman and Silvia 2006). It is important to note that the present work likely manipulated D-type curiosity, a type that is appetitive and can be negative if unable to be satiated. Future research could study these different types of curiosity to see whether I-type (vs. D-type) curiosity impacts indulgence in different ways.

Using Neuroimaging in Consumer Research. Over the past decade, a growing number of fMRI studies have been published in marketing and consumer research journals and have associated brain *function* with attitudinal and behavioral measures as well as market-level data. For example, neuroimaging has been used to associate self-control depletion with frontal lobe functioning (Hedgcock et al. 2012) and to relate liking of television ads with amygdala and prefrontal cortex activation (Venkatraman et al. 2015). Other work has associated brain *structure* with individual difference measures (Plassmann and Weber 2015). The growing body of neuroimaging in consumer research begins to paint a cohesive picture of how brain function and structure are correlated with consumption. By doing so, this literature has (intentionally or not) started to provide congregating support for a longstanding but sometimes overlooked neuropsychological scaffold of judgment and decision making: the somatic marker framework (Bechara and Damasio 2005; Reimann and Bechara 2010). This framework, which is rooted in observations of judgment and decision making in brain lesion patients, offers testable predictions for consumer researchers on the role of the prefrontal cortex, amygdala, and insula, as well as these structures' implications for self-control, affect, and memory. The present work attempted to develop and test a priori hypotheses based on this framework. An additional way to interpret neuroimaging data is to reverse-infer psychological function from brain activity using meta-analyses (Poldrack 2006; Yarkoni et al. 2011); we did not apply this approach here, but have done so previously (Reimann et al. 2016, 2018). Because inferences based on meta-analyses are only as good as the data that have been entered into the meta-analyses, the involvement of some psychological processes can be overlooked and others overstated. Besides focusing only on a priori hypotheses testing or focusing only on exploratory reverse-inferring, a third approach emerged, which is compatible with experimental consumer research: multimethod triangulation across a series of studies. The present research serves as an illustration: while each study in isolation only indicated the involvement of desire for rewards, together they converge into a more comprehensive story about a possible underlying process. Thus, our neuroimaging study complements the behavioral (experiment 1), psychometric (experiments 2, 5), and qualitative assessments (experiment 3) of desire for rewards by building on and testing an externally-validated neuropsychological framework of choice.

DATA COLLECTION INFORMATION

The authors equally designed the experiments, collected and analyzed the data, and wrote the work. Data reported in experiments 1 and 2 were collected at the University of Washington in 2014. Data reported in experiment 4 were collected at the University of Arizona in 2015. Data reported in experiments 3 and 5 were collected via Amazon Mechanical Turk in 2017 and 2018.

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