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The Teasing Effect: An Underappreciated Benefit of Creating and Resolving an Uncertainty

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ABSTRACT

Seven studies covering diverse contexts show an underappreciated benefit of teasing in information acquisition: first creating and then resolving an uncertainty can generate a net positive experience, yet laypeople do not seek out this process. For example, trivia readers report better hedonic experiences if they are first teased with some missing information and then given that information than if they receive all the information at the same time, but when given a choice, readers prefer to receive all information at the same time. The authors further show that teasing is hedonically beneficial because that uncertainty engenders curiosity and thereby *builds a potential* for a positive experience, whereas uncertainty resolution resolves the curiosity and thereby *realizes that potential*. This research yields practical implications by demonstrating that imbuing an ad with an uncertainty-creation-resolution process improves the viewer's attitude toward and increases the viewer's willingness to try the advertised product.

Keywords: curiosity, uncertainty, hedonic experience, affective forecasting, teasing, desire, happiness

Uncertainty is generally regarded as aversive (e.g., Buhr and Dugas 2002; Castaño et al. 2008; Gordon 2003; Gneezy, List, and Wu 2006; Hsee and Ruan 2016; Van den Bos 2001). When delivering a message, marketers often avoid uncertainty and tend to give all information directly. “Use the name within the first ten seconds,” suggested David Ogilvy (1983), known as the father of advertising. Indeed, most ads reveal the name of a brand/product up front and involve no uncertainty (Armstrong 2010; Stewart and Furse 1986).

Is it hedonically beneficial to incorporate uncertainty in the delivery of information? To illustrate, consider two versions of a smartphone “animal cool facts” app: in one version (the control version, which directly delivers all the information), the user clicks a button and a piece of trivia appears on the screen in its entirety (e.g., “Only one type of mammal can fly. It is the bat.”); in the other version (the treatment version, which incorporates uncertainty in the delivery of information), the user clicks a button and only the first part of the trivia appears, along with a question (e.g., “Only one type of mammal can fly. Do you know what it is?”), then after a short delay, the rest of the trivia appears (e.g., “It is the bat.”). Does the treatment version create a better hedonic experience than that of the control version? We believe so. In this research, we show that first creating and then resolving an uncertainty can generate a net positive hedonic experience. Furthermore, we show that most laypeople underappreciate the hedonic benefit of this process and do not seek it out.

In practical terms, our research highlights the importance of using uncertainty in marketing, especially advertising. The usage of uncertainty, both within and outside of marketing, is still scant. Table 1 shows a few companies that do intentionally incorporate uncertainty in information delivery. Apple, a well-known example, often unveils no information about a new product until its actual release to create a cliffhanger and fuel speculation. However, these

companies primarily use uncertainty to pique curiosity and capitalize on consumers' desire to resolve curiosity. Prior research has shown that curiosity can attract attention (Isikman et al. 2016), facilitate learning (Kupor and Tormala 2015; Marvin and Shohamy 2016; Menon and Soman 2002), and encourage purchases (Hill, Fombelle, and Sirianni 2016; Laran and Tsiros 2013; Polman, Ruttan, and Peck 2017). It is unclear, however, what happens when curiosity is resolved. This research focuses on hedonic experiences, studying how people feel both when they are curious (i.e., they experience uncertainty) and when their curiosity is resolved (i.e., they receive the information that resolves the uncertainty). We show that when watching an ad, consumers feel better and like the advertised brand more if they first experience an uncertainty about the identity of the brand and then resolve that uncertainty than if they experience no uncertainty. Our research provides an additional reason for the usage of uncertainty in information delivery and highlights the importance of uncertainty resolution.

*** *Insert Table 1 about Here* ***

This research also carries practical implications for everyday life. Hedonic experiences are an important component of subjective wellbeing (Kahneman, Wakker, and Sarin 1997), and positive hedonic experiences often reside in seemingly insignificant events such as receiving a greeting card from a friend or seeing a rainbow in the sky (Kahneman et al. 2004). The positive hedonic experience gained from uncertainty-creation-resolution, as studied in the present research, is one example of an apparently insignificant event that can affect one's momentary hedonic experience and, potentially, one's subjective wellbeing. This research is an example of *hedonomics*, which studies how to increase happiness by improving the presentation of and choices among external outcomes (such as external information) without changing the objective levels of the external outcomes (Hsee, Hastie and Chen 2008; Tu and Hsee 2017).

Theoretically, this research contributes to our understanding of the effects of uncertainty and uncertainty resolution. Most extant research on uncertainty studies how uncertainty affects judgement and decision making, and views uncertainty as aversive. We nevertheless study the hedonic consequence of uncertainty and show that uncertainty can generate positive experiences, thus joining a growing body of literature documenting positive effects of uncertainty (e.g., Lee and Qiu 2009; Shen, Fishbach, and Hsee 2015; Whitchurch, Wilson, and Gilbert 2011). Our research also complements the literature on curiosity. Prior research has focused predominantly on the very state of curiosity, examining its nature (e.g., Dashiell 1925; Fowler 1965; Litman 2005), determinants (e.g., Berlyne 1954a, 1954b), and consequences (e.g., Hsee and Ruan 2016; Isikman et al. 2016; Menon and Soman 2002). In contrast, the current research studies the hedonic experiences of both *curiosity* and *curiosity resolution* and intends to show that, controlling for everything else, the entire process is hedonically net positive.

Notably, we study only uncertainty about non-negative consequences. When uncertainty involves potentially negative consequences (e.g., “will my medical test turn out to be positive?”), it likely causes negative feelings such as anxiety and worry (Buhr and Dugas 2002; Chew and Ho 1994; Gordon 2003; Mandel and Nowlis 2008; Van den Bos 2001; Wu 1999). Hence, it is unlikely that an uncertainty-creation-resolution process that contains potentially negative consequences would engender a net positive hedonic experience.

THEORETICAL FRAMEWORK

Uncertainty Creation and Resolution

Recall the aforementioned cool-fact app. Unlike users of the control version, who experience no uncertainty, users of the treatment version undergo two distinctive phases: first,

uncertainty creation, and then, uncertainty resolution.

Will users of the two versions feel differently? To answer this question, we examine the uncertainty-creation phase and the uncertainty-resolution phase in turn. In the uncertainty-creation phase, users of the treatment version experience an uncertainty that represents an information gap, and information gaps induce curiosity (Loewenstein 1994). As summarized in Table 2, curiosity may cause both positive and negative feelings. On one hand, curiosity is a state of information deprivation (Litman and Jimerson 2004; Loewenstein 1994) and thus may cause discomfort and displeasure (Berlyne 1954a, 1966b; Litman and Jimerson 2004). On the other hand, curiosity is an arousal state (Berlyne 1966a; Jepma et al. 2012; Litman 2005). Because we study only uncertainty about non-negative information (e.g., trivia), the associated arousal is likely to be mild, and mild arousal can be pleasurable (Berlyne 1960; Leuba 1955; Spielberger and Starr 1994). This analysis is consistent with prior research that viewed curiosity as a feeling of interest, which fits in the larger scheme of positive emotions (Kashdan and Silvia 2009; Silvia 2008). Moreover, because users of the treatment version know that the uncertainty will resolve soon, curiosity may be associated with a positive feeling of anticipation (Kang et al. 2009; Lee and Qiu 2009; Noordewier and van Dijk 2015; Nowlis, Mandel, and McCabe 2004).

*** *Insert Table 2 about Here* ***

In the uncertainty-resolution phase, users of the treatment condition receive the missing information that resolves the uncertainty they experience. Because the users have been curious, receiving the missing information satisfies their curiosity. Although theorists disagree on whether curiosity is an internally stimulated homeostatic state (Dashiehl 1925; Fowler 1965) or an externally stimulated deprivation state (Berlyne 1960), it is generally acknowledged that curiosity possesses many of the features of primary deprivation states (Loewenstein 1994).

Extensive research has found that people experience a sense of joyful relief when their deprivation is resolved (Brown 1955; Cabanac 1971; Melis and Argiolas 1995). Thus, people experiencing curiosity—a state of information deprivation—also enjoy a positive hedonic experience when receiving the missing information that resolves their curiosity (Berlyne 1960; Golman and Loewenstein 2015; Litman 2005; Loewenstein 1994; Marvin and Shohamy 2016). This proposition is consistent with neurological evidence that curiosity resolution activates brain regions responsible for reward processing (Jepma et al. 2012).

The above analysis suggests that uncertainty creation is *unlikely* to induce an overall negative experience, while uncertainty resolution induces an overall positive experience. Even if uncertainty creation induces a negative experience, it is likely to be mild and outweighed by the positive experience of uncertainty resolution. Therefore, the entire uncertainty-creation-resolution process will produce a net positive experience. This constitutes our main hypothesis:

Hypothesis 1: When receiving information, people will enjoy a better overall experience if they first experience some uncertainty about the information and then resolve that uncertainty than if they receive the information directly with no uncertainty.

We refer to the proposed phenomenon as the *teasing effect*. Hypothesis 1 is reminiscent of the finding in Ge, Häubl, and Elrod (2012) that while delaying the presentation of some favorable information about an option reduces the option's chance of surviving the screening stage, the delay can actually increase the likelihood of that option ultimately being chosen.

We are not the first to study the effects of uncertainty on feelings. However, the uncertainty studied in most prior research has involved valenced outcomes such as winning a gamble (positive valence) or losing a gamble (negative valence). For this type of uncertainty, the

hedonic experience of uncertainty resolution depended primarily on the valence of the outcome (e.g., Andrade and Iyer 2009; Chew and Ho 1994; Yang, Gu, and Galak 2017). In contrast, we study the hedonic experience generated by the uncertainty-creation-resolution process, over and above the hedonic experience generated by the valence of the outcome. Therefore, in our studies, we try to hold constant the valences of the alternative outcomes of an uncertain prospect.

Some existing studies have also investigated the effects of uncertainty without involving valenced outcomes, but as Table 2 shows, most of the existing studies on the topic have explored only the effect of uncertainty creation (i.e., how people feel when they experience uncertainty), and not the effect of uncertainty resolution (i.e., how people feel when the uncertainty is resolved). For example, Wilson et al. (2005) showed that gift recipients remained happy for longer if they did not know the identity of the gift giver than if they knew.

A few studies have examined the overall effect of uncertainty and uncertainty resolution without distinguishing between the two (e.g., Knobloch et al. 2004). One exception was the Knobloch-Westerwick and Keplinger (2006) study on mystery novels. Those authors manipulated the degree of uncertainty early in a story and the way the uncertainty was resolved later in the story to examine readers' reactions during both the uncertainty-creation and uncertainty-resolution phases. However, such manipulation also changed the content of the story, making it difficult to tell whether the difference between the uncertainty-creation-resolution condition and other conditions was due to uncertainty-creation-resolution or due to the difference in the content of the information (the story) delivered.

The present research distinguishes between the uncertainty-creation phase and the uncertainty-resolution phase, and shows that while controlling everything else, an uncertainty-creation-resolution manipulation can create a net positive hedonic experience, compared to a

baseline of delivering information with no uncertainty.

Attitude and Behavior toward Associated Stimuli

Prior research on advertising has demonstrated that ad-evoked feelings impact brand attitudes (Batra and Ray 1986), with a .35 average correlation between ad-evoked feelings and brand evaluations (Brown, Homer, and Inman 1998; Pham, Geuens, and Pelsmacker 2013). Due to evaluative conditioning, the mere pairing of a brand with the feelings induced by an ad may even lead to a change in brand evaluation (Gorn 1982). Based on these findings, we propose that the positive experience of uncertainty-creation-resolution will spill over to the associated stimuli:

Hypothesis 2: People who undergo an uncertainty-creation-resolution process about the information of a stimulus have a more positive attitude and a more favorable behavioral tendency toward the stimulus than people who do not undergo the process.

The effect hypothesized above echoes existing research studying the positive effect of uncertainty on marketing. Whereas the majority of existing research concerns people's learning (Fazio, Herr, and Powell 1992; Menon and Soman 2002; Swasy and Arno 1986) and behavior (Bernard and Schulze 2005; Goldsmith and Amir 2010; Hill, Fombelle, and Sirianni 2016; Laran and Tsiros 2013; Shen, Fishbach, and Hsee 2015) before uncertainty is resolved and capitalizes on people's desire to resolve uncertainty, the present research demonstrates that even after uncertainty is resolved, people who have experienced uncertainty treat the associated items more favorably than do people who have not experienced uncertainty.

Will People Seek the Uncertainty-Creation-Resolution Process?

Given that an uncertainty-creation-resolution process generates a net positive experience, will laypeople appreciate this positive teasing effect and voluntarily seek out this process? For example, if consumers are given a choice between the previously mentioned two versions of the cool-fact app, will they choose the treatment version, which first withholds some information and then delivers the missing information, or the control version, which directly delivers all the information? While this question is largely exploratory, we offer our speculations below.

Notably, this question is about whether people actively seek uncertainty in the first place, and not about whether they seek to resolve an uncertainty when they are already experiencing it and feeling curious. Ample extant literature indicates that if people are already experiencing curiosity, they endeavor to resolve it (Berlyne 1960; Loewenstein 1994; Litman and Jimerson 2004; Van Dijk and Zeelenberg 2007). In fact, the desire to resolve an already-induced curiosity can be so powerful that people seek the missing information even if doing so may lead to predictably miserable consequences (Hsee and Ruan 2016; Kruger and Evans 2009).

Returning to the question of whether trivia readers will choose the control version or the treatment version before they experience any uncertainty, we predict that people will choose the control version, because we speculate that they heuristically dread uncertainty (“being in the dark”), even when the uncertainty causes no harm. The uncertainty people encounter in real life often involves potential negative consequences (Kruger and Evans 2009; Shani, Tykocinski and Zeelenberg 2008; Sieff et al. 1999; Perry et al. 1990), such as “will the reviewers reject my paper?” or “will my test result turn out to be positive?” Such uncertainties likely evoke worries and anxieties. In situations where uncertainty indeed undermines wellbeing, people may overlearn the association between uncertainty and negative feelings and carry it over to situations in which that association does not apply (Amir and Ariely 2007; Arkes and Ayton 1999; Hsee,

Yang, and Ruan 2015). This analysis concurs with Wilson et al.'s (2005) finding that people mistakenly predicted that gift recipients would be happier if the recipients knew the identity of the gift giver than if they did not. People may predict the happiness of uncertainty resolution. However, because people are myopic (e.g., Frederick, Loewenstein, and O'donoghue 2002; Strotz 1955; Thaler et al. 1997), when deciding whether to undergo an uncertainty-creation-resolution process, they may focus more on the impending uncertainty-creation phase, which, they believe, is aversive, than on the ensuing uncertainty-resolution phase.

Some people do seek uncertainty, for example, reading mysteries and working on puzzles. These people are likely to choose the treatment version of the cool-fact app. However, they may constitute only a minority of the general population, just like risk-seeking individuals are only a minority of the general population. Also note that in most cases where people seek uncertainty, people have control over when they receive the missing information (e.g., when to read the end of a mystery and when to learn the solution of a puzzle). When such control is absent (as is the case in our studies), we doubt that those who seek uncertainty under other circumstances will still do so here. Based on the speculations above, we suspect that when given a choice between undergoing an uncertainty-creation-resolution process and directly receiving the information, most people will choose the latter.

We next report seven studies, all conducted on MTurk. Unlike many MTurk studies which use hypothetical scenarios, our studies involved real experiences.

STUDY 1 (TRIVIA)

Method

Study 1 mimicked the cool-fact app example mentioned earlier to test Hypothesis 1 and

examine people's choice. The stimuli were 11 animal-related cool facts. For each fact, we created a control version and a treatment version.

The control version consisted of two statements, one general (e.g., "Three types of mammals undergo menopause") and one specific (e.g., "They are killer whales, pilot whales, and humans"). When participants clicked the button, both statements appeared on the screen simultaneously and stayed there for 20s. The treatment version was identical to the control version except that when participants clicked the button, the general statement appeared on the screen along with a question (e.g., "Do you know what they are?"); after 12s, the specific statement replaced the question and stayed for another 8s. Thus, for both the control and the treatment versions, the total display time for each trial was held constant at 20s. In none of our studies did we ask participants in the treatment condition to answer the questions, because we did not want them to suspect others might judge their performance.

Participants were 229 adults (116 women; $M_{\text{age}} = 39.60$ years) recruited on MTurk for a fixed nominal payment. They were told they would first complete an animal-related survey, then take a break, and then complete a second animal-related survey. The animal-related surveys were a pretext; each survey asked participants to rate a list of animals on traits such as friendliness and aggressiveness. After they completed the first survey, participants were informed that there would be a break before the second survey began, and they could read some animal-related cool facts during the break to kill time. Participants could view as few or as many of these facts as they wanted. To view a fact, they clicked a button on the computer screen. If participants no longer wanted to view more cool facts, they could sit back and wait until the break was over.

Unbeknownst to the participants, the actual experiment took place during this break. Participants were assigned to one of three conditions: control, treatment, and choice. Those in the

treatment condition viewed the treatment version of the trivia, and those in the control condition viewed the control version. Participants in the choice condition were given a choice between the two versions for every fact. Specifically, before a fact appeared on the screen, they were told they had two viewing options, each taking 20s. To make a choice, they clicked one of two buttons on the screen, one labeled, “First read a question about the cool fact and then read the cool fact that answers the question,” and the other labeled, “Directly read the cool fact.” Once they clicked a button, participants viewed their chosen version of the fact.

Four minutes into the break, participants were told that the break was about to end, and were asked, “Are you having a good time during the break?” They rated their experience on a 5-point scale anchored by “not at all” (left) and “very much” (right).

Results and Discussion

We first report the hedonic-experience result from the treatment and the control conditions, and then report the choice result from the choice condition. Due to space constraints, we report the main statistics of all studies in Table 3 rather than in the text.

*** *Insert Table 3 about Here* ***

Hedonic experience. To test our primary hypothesis about the positive effect of uncertainty-creation-resolution, we compared the hedonic-experience ratings between the treatment condition and the control condition. In support of Hypothesis 1, participants in the treatment condition felt significantly better. The two conditions did not differ in the number of cool facts participants read ($M_s = 10.15$ and 10.29 , $SD_s = 1.47$ and 1.11 ; $t(153) = -.66$, $p = .512$).

Choice. To see whether participants voluntarily chose to undergo an uncertainty-creation-resolution process, we examined the choice distribution of the two versions. Supporting our

speculation, across all the facts viewed, fewer than 50% were in the treatment version.

The results of Study 1 were susceptible to some alternative explanations. Instead of our curiosity-based explanation, an alternative explanation for the happiness result was the joy of guessing correctly: Participants in the treatment condition might think they had guessed most of the answers correctly, and thus felt happier. An alternative explanation for the choice result was misunderstanding. Some participants in the choice condition never tried the treatment version; they might have mistakenly believed they would have to answer the questions if they chose the treatment version, and therefore avoided it. Study 2 addresses these alternative explanations.

STUDY 2 (CITIES)

Study 2 replicated Study 1 in the context of viewing a slideshow, and extended Study 1 in several ways. First, to test the joy-from-guessing-right alternative explanation, Study 2 asked participants in the treatment condition to report the number of correct guesses they had made. Second, to minimize misunderstanding, Study 2 required participants in the choice condition to sample both the treatment and the control versions of the stimuli before they made their choice. Third, unlike Study 1, which measured hedonic experience only at the end, Study 2 measured hedonic experience multiple times throughout the process. Finally, to see whether our manipulation had any behavioral consequence, Study 2 gave participants the opportunity to view more slides after they had viewed the main slideshow, and examined whether those in the treatment condition were more willing to view the additional slides.

Method

The stimulus for the study was a slideshow of 24 color pictures of city scenes. The cities

were all well-known places, such as Philadelphia, Tokyo, and Paris, but it was not obvious from the picture which city was depicted. We compiled a treatment version and a control version for the slideshow. In both versions, each picture stayed on the screen for 12s before switching to the next picture. In the control version, the name of the city stayed above the picture for the entire display duration. In the treatment version, a question mark stayed above the picture for the first 6s of the display period, after which the name of the city replaced the question mark and stayed for the remaining 6s. In short, the two display versions were identical except that in the treatment version, the name of the city was concealed during the first half of each picture's display period.

Participants were 293 adults (151 women; $M_{\text{age}} = 36.84$ years) recruited on MTurk for a fixed nominal payment. They were told they would enjoy a slideshow of city scenes and report on their experience. Study 2 consisted of three conditions: treatment, control, and choice. Participants in the treatment and the control conditions viewed the treatment and the control versions of the slideshow, respectively. Participants in the choice condition were told that the slideshow had two versions, and viewed four sample slides, two in the treatment version and two in the control version, in a counterbalanced order. The participants were then asked to choose the version they preferred, and viewed the remaining slides in their chosen version.

We measured hedonic experiences six times during the slideshow, once after every four pictures (i.e., after the 4th, 8th, ...). On each occasion, participants saw the question, "Are you having a good time?" and gave their answer on a 5-point scale anchored by "not at all" (left) and "very much" (right). After viewing all 24 pictures in the slideshow, participants were asked whether they were willing to view six more similar pictures without extra compensation. Those who said yes viewed the additional pictures. At the end, we asked participants in the treatment condition how many cities they had figured out correctly before seeing the city names.

Results and Discussion

Hedonic experience. A 2 (condition) $\times$ 6 (time) mixed analysis of variance (ANOVA) found a main effect of condition. Replicating the teasing effect, participants in the treatment condition felt significantly better than participants felt in the control condition ($F(1, 192) = 5.59, p = .019$). The ANOVA also found a main effect of time ($F(5, 960) = 23.56, p < .001$), and a condition $\times$ time interaction effect ($F(5, 960) = 3.72, p = .002$).

An additional analysis using a linear mixed-effects model (which treated time as a continuous variable, and included by-participant random intercept and random slope) compared the temporal slopes of the two conditions, and revealed a significant effect of time ($F(1, 192) = 44.28, p < .001$) and a significant condition $\times$ time interaction effect ($F(1, 192) = 6.10, p = .014$). As Figure 1 shows, although the average hedonic experience declined over time, the difference between the treatment and the control conditions increased over time, suggesting that the teasing effect was not transient and slowed hedonic adaptation to the slideshow.

Notably, our results could not be attributed to boredom, because even toward the end of the slideshow, participants in the control condition did not feel negative ($t(94) = -.23, p = .816$, relative to the midpoint). Our results could not be attributed to the joy of guessing correctly, either, because we found no correlation between self-reported correct guesses and hedonic experience ($r = .08; t(97) = .78, p = .437$).

*** *Insert Figure 1 about Here* ***

Willingness to continue. Compared with the control condition, more participants in the treatment condition volunteered to view the additional slides at the end of the main study, suggesting our manipulation influenced not only experience but also behavior.

Choice. Replicating the choice result of Study 1, more than half of the participants in the

choice condition chose to view the control version of the slideshow, in which they would know the identity of the city from the very beginning. Notably, the choice result could not be attributed to misunderstanding or fear of answering questions, because before making their choices, the participants had sampled both the treatment and the control versions of the slideshow, and knew they did not need to answer the questions in the treatment version.

At first glance, the finding that most participants in the choice condition preferred the control version of the slideshow seems at odds with the finding that more participants in the treatment condition than in the control condition volunteered to continue. However, this ostensible inconsistency is actually consistent with our theory: Participants in the choice condition saw both the treatment and the control versions of the stimulus, could easily tell the difference between the two versions, and, perhaps because of myopia and aversion to uncertainty, they chose the control version. In contrast, participants in the treatment condition and in the control condition encountered only their own version, and, because those in the treatment condition had a better experience, they were more willing to continue.

In all the studies that had a choice condition, we also measured the hedonic experiences of the participants in the choice condition while they went through the study in their chosen version. These results are not highly informative because (a) the participants were aware of both versions and self-selected the treatment or the control version, and (b) the numbers of participants choosing the two versions were unbalanced (fewer chose the treatment version). We report these results in Table 3 and Web Appendix B.

STUDY 3 (BIOGRAPHY)

To test our theory further, Study 3 separated the uncertainty-creation phase from the

uncertainty-resolution phase, and measured participants' hedonic experiences in each of the two phases separately. This deviates from the first two studies, in which participants in the treatment condition repeatedly underwent many brief uncertainty-creation-resolution cycles; for example, in Study 2, they underwent an uncertainty-creation-resolution cycle first on the first slide, then on the second slide, and so on. Because of the brevity of each cycle, we were unable to assess participants' hedonic experiences in the uncertainty-creation phase and in the uncertainty-resolution phase separately. Unlike the first two studies, Study 3 involved only one uncertainty-creation-resolution cycle. The cycle comprised two distinct phases: uncertainty creation (Phase 1) and uncertainty resolution (Phase 2); each phase was relatively long. Specifically, participants in the treatment condition first read a series of questions about Einstein (Phase 1), and then read a biography of Einstein (Phase 2), whereas participants in the control condition first viewed a series of pictures of Einstein (Phase 1), and then read the same biography of Einstein (Phase 2). At the end of each phase, we measured participants' experiences. According to our theory, the positive effect of an uncertainty-creation-resolution process is not realized until uncertainty resolution. Thus, in Study 3, we expected to observe not only a main effect of condition, but also an interaction effect between condition and phase, such that the difference in hedonic experience between the treatment and the control conditions would be greater in Phase 2 than in Phase 1.

Another noteworthy feature of Study 3 was that, in the choice condition, we asked the participants not only to choose their condition (control or treatment), but also to predict which condition they would feel better in. Because we attribute the unwillingness to choose the treatment condition to participants' underappreciation of the hedonic benefit of that condition, we expected the prediction results to match the choice results.

Method

The Einstein biography used in the study was adapted from Biography.com, and was divided into 10 paragraphs of similar length, each about 200 words. The 10 questions were all about Einstein, for example “According to Einstein, which two events had a marked effect on his childhood?” and “What insight led Einstein to develop his theory of relativity?” The 10 pictures all depicted Einstein in black and white and were available in the public domain. See Web Appendix C for examples.

Participants in the study were 305 adults (165 women; $M_{\text{age}} = 36.94$ years) recruited on MTurk for a fixed nominal payment. They were assigned to one of three conditions: treatment, control, and choice. Participants in the treatment condition went through two phases. In Phase 1, they viewed the 10 Einstein questions one by one, with each question staying on the screen for 10s before participants could move to the next question; participants were told they needed only to read, not to answer, the questions. In Phase 2, participants viewed the 10 paragraphs of the Einstein biography one by one, with each paragraph staying on the screen for 10s before participants could move to the next paragraph. Participants in the control condition followed the same procedure, except that in Phase 1, they viewed the Einstein pictures instead of the Einstein questions. Participants in the choice condition were first told about the procedures of the treatment and the control conditions, including the facts that the two conditions took the same amount of time, that they needed only to read, and not to answer, the questions in the treatment condition, and that they could find the correct answers to those questions in the biography. The participants then viewed two sample Einstein questions and two sample Einstein pictures. After that, the participants were asked, in a counterbalanced order, 1) to choose their preferred condition, and, on a separate screen, 2) to predict the condition in which they would have a better

time. Finally, the participants went through their chosen condition as described above.

We measured participants' hedonic experiences twice, once at the end of Phase 1 and once at the end of Phase 2. At the end of Phase 1, we asked, "Did you have a good time reading the questions (viewing the pictures)?" and at the end of Phase 2, we asked, "Did you have a good time reading the biography?" Participants answered each question on a 5-point scale anchored by "not at all" (left) and "very much" (right). We also asked participants about their curiosity after surveying their hedonic experiences. At the end of Phase 1, we asked, "Do you feel curious about Einstein now?" and at the end of Phase 2, we asked, "Did the biography satisfy your curiosity about Einstein?" Participants answered each question on the same 5-point scale.

Results and Discussion

Curiosity. As expected, during Phase 1, participants in the treatment condition experienced more curiosity than did those in the control condition ($M_s = 4.56$ and 4.00 , $SD_s = .69$ and 1.02 ; $t(202) = 4.56$, $p < .001$), and during Phase 2, those in the treatment condition also experienced greater satisfaction of curiosity than did those in the control condition ($M_s = 4.56$ and 4.07 , $SD_s = .72$ and 1.12 ; $t(202) = 3.74$, $p < .001$).

Hedonic experience. To analyze hedonic experience, we performed a 2 (condition) $\times$ 2 (phase) mixed ANOVA. Replicating the previous findings, the analysis found a main effect of treatment ($F(1, 202) = 7.27$, $p = .008$), a main effect of phase ($F(1, 202) = 9.65$, $p = .002$), and a condition $\times$ phase interaction effect ($F(1, 202) = 11.33$, $p = .001$). As Figure 1 shows, the Phase 1 hedonic experiences were similar between participants in the treatment condition and in the control condition, but the Phase 2 hedonic experiences were more positive in the treatment condition than in the control condition. These results reinforced our proposition that the effect of

uncertainty creation (Phase 1) manifests itself in uncertainty resolution (Phase 2).

Choice and prediction. Of the participants in the choice condition, fewer than 50% opted into the treatment condition, and fewer than 50% predicted a better experience in the treatment condition. The two results were highly consistent (Exact McNemar's test: $p = .625$). Even when we analyzed choices and predictions between-participants by examining only the choices of those who answered the choice question first and the predictions of those who answered the prediction question first, the choice and the prediction results were still consistent (18.0% versus 21.6%; $z = .45$, $p = .653$). Thus, the consistency between choice and prediction was not a within-participants carryover effect. It suggested that the participants based their decisions on predicted experience and that their unwillingness to seek the uncertainty-creation-resolution process reflected their underappreciation of the hedonic advantage of that process.

Study 3 replicated the positive effect of uncertainty creation and resolution, and showed that the effect arises in uncertainty resolution rather than in creation. In other words, uncertainty creation induces a “potential” for happiness and uncertainty resolution realizes that potential. Furthermore, the choice and prediction results suggest that the laypeople’s failure to seek the uncertainty-creation-resolution process stems from their failure to predict its hedonic advantage.

STUDY 4 (TARGET CARD)

Study 4 sought to replicate the findings of the above studies using a marketing relevant stimulus (a gift card). It also tested Hypothesis 2—that an uncertainty-creation-resolution process will make consumers like the associated stimulus (product) more.

Method

We conducted the study on MTurk as an add-on to an unrelated experiment. After participants completed the unrelated experiment, they were asked whether they were willing to participate in an extra study about sound evaluation, for which they would not get paid but instead would get a small chance to win a \$50 gift card. Participants then learned that, in order to proceed, they had to have speakers or earphones attached to their computer. We administered an audio test and dismissed those who chose to do the extra study but failed the test. Out of 632 participants who completed the unrelated study, 259 (151 women; $M_{age} = 35.85$ years) agreed to do the extra study and passed the audio test.

Upon entering the study, participants first read that their task was to listen to a sound for about two minutes and report their feelings. While listening to the sound (repeated piano tones), participants saw, at the top of the computer screen, “Below is the gift card you may actually receive. It can be used at...” and, below the words, a 100s animation of the \$50 gift card. During the animation, the gift card gradually moved from the left side to the right side of the screen.

The study consisted of three between-participants conditions—control, treatment, and choice. In the control condition, participants immediately saw the entire gift card and learned that it could be used at Target. In the treatment condition, the gift card was initially inside an envelope. During the animation, the gift card gradually emerged from the envelope. Because participants could not tell where the gift card could be used until the second half of the animation, the first half of the animation represented the uncertainty-creation phase and the second half represented the uncertainty-resolution phase. In the choice condition, participants were asked to choose, before the animation began, whether they wanted to find out where the gift card could be used right away or 60s later. After making their choice, the participants then watched the animation and went through the study in their chosen condition.

We measured hedonic experience twice, once at the end of the first half of the animation and once at the end of the second half, using the question “Overall, how good do you feel now?”; participants answered the question on an 11-point scale, anchored by “very bad” (left), “neutral” (middle), and “very good” (right). At the end of the entire study, participants answered two questions about their attitudes toward Target, one asking “How do you feel about Target (the store)?” and the other asking “How much do you like Target (the store)?” The first question used a 7-point scale anchored by “very bad” (left), “neutral” (middle), and “very good” (right), and the second question used a 7-point scale anchored by “not at all” (left) and “very much” (right).

Unlike the previous studies, in which we assigned an equal number of participants to the choice condition as to each of the other conditions, in this study we assigned twice as many participants to the choice condition as to each of the other conditions. We did so because we were curious whether those in the choice condition who opted into the treatment condition were happier than those in the choice condition who opted into the control condition. The previous studies were unable to address this question because the sample size in the choice condition was small, and thus rendered insufficient power for the comparison.

Results and Discussion

Hedonic experiences. The results, presented in Figure 1, replicated the previous findings: A 2 (condition) $\times$ 2 (phase) mixed ANOVA found a main effect of uncertainty ($F(1, 126) = 5.34$, $p = .023$), a main effect of phase ($F(1, 126) = 19.57$, $p < .001$), and a condition $\times$ phase interaction effect ($F(1, 126) = 48.54$, $p < .001$). Relative to participants in the control condition, participants in the treatment condition felt similarly during the uncertainty-creation phase, and felt significantly better during the uncertainty-resolution phase. The results suggest that

uncertainty creation induces a potential for a positive hedonic experience, which is not realized until the uncertainty is resolved.

Choice. More than 50% of participants in the choice condition chose to find out where the gift card could be used right away rather than to wait 60s before finding out the information. This result replicated the findings of our previous studies and parallels Galak, Kruger, and Loewenstein's (2013) finding about eating: people tend to eat quickly rather than slowly, even though eating slowly is more pleasurable.

Attitude. As noted earlier, we asked two questions about attitude toward Target. Because responses to the two questions were highly correlated ($r = .91$; $t(128) = 24.57$, $p < .001$), we averaged them to create a composite attitude score, and found that participants in the treatment condition had a more positive average attitude toward Target than did participants in the control condition. In support of Hypothesis 2, the result suggests that an uncertainty-creation-reduction process not only makes people happier, but also makes them like the associated brand more.

To show that uncertainty-creation-resolution is vital to producing the teasing effect, and to rule out a mere-stimulus-change account and a mere-uncertainty account, we conducted Study 7 and manipulated uncertainty in both Phase 1 and Phase 2. The results were consistent with our theory and ruled out the two alternative accounts. See Web Appendix A for details.

STUDY 5 (ADS)

We designed Studies 5 and 6 primarily to test Hypothesis 2 and show the implication of our research for ads. Study 5 comprised a treatment condition and a control condition. Participants viewed four ads and reported their overall hedonic experience, their attitudes toward the advertised brands/products, and their willingness to try the brands/products. Each ad had two

versions, which were identical except that one revealed the identity of the brand/product at the beginning (the control version) while the other revealed the identity at the end (the treatment version). We predicted that viewers of the treatment version would feel better, would like the brand/product more, and would be more willing to try it.

Method

This study showed ads for four rather diverse brands/products: Burberry, Toyota Corolla, Windex, and IBM. Each ad consisted of an animated PowerPoint slideshow. Each slideshow had two versions: treatment and control. The treatment version first prompted viewers to guess what the brand/product was, then provided descriptions of the brand/product, and finally displayed the image of the brand/product along with its name. The control version was identical except that the identity of the brand/product was revealed at the beginning. Take the slideshow for Burberry as an example: The treatment and the control versions differed only in the first slide. In the treatment version, the first slide read, “Guess what the brand to be described is.” In the control version, the first slide read, “Introducing Burberry.” Then, both versions provided several lines of descriptions about Burberry (see Web Appendix C), with each line gradually appearing on the screen and then gradually giving way to the next line. On the final slide, both versions presented a picture of Burberry’s brand logo along with the brand name, “Burberry.” The logo and the brand name stayed on the screen for 5s before they disappeared, marking the end of the slideshow. The ads for the other three brands/products followed the same structure.

Participants were 199 adults (100 women; $M_{\text{age}} = 37.33$ years) recruited from MTurk for a nominal payment. They were assigned randomly to one of two conditions: treatment or control. In each condition, participants viewed, in a random order, the four ads in their respective

versions. At the end of each slideshow, they first were asked, “Did you feel curious when viewing the ad?” After that, they were asked, (i) “Overall, did you have a good time when viewing the ad?”, (ii) “How do you feel about the brand/product in the ad?”, and (iii) “Would you like to try the brand/product if you have never tried it?” The participants answered each question on a 5-point scale anchored by “not at all” (left) and “very much” (right). In addition, participants in the treatment condition were asked if they had guessed the identity of the brand/product correctly before it was revealed in each ad.

Results and Discussion

Curiosity. As expected, participants in the treatment condition reported greater curiosity for each ad ($M_s = 3.68, 3.92, 3.60$ and 3.66 , $SD_s = 1.07, .91, 1.00$ and 1.00) than participants in the control condition reported ($M_s = 2.42, 2.15, 2.25$ and 2.17 , $SD_s = 1.08, 1.11, 1.07$ and $.97$; all $t_s > 8.27$, $p_s < .001$).

Hedonic experience. A 2 (condition) $\times$ 4 (brand/product) mixed ANOVA on participants’ overall hedonic-experience ratings generated a significant effect of condition ($F(1, 186) = 70.08$, $p < .001$), a main effect of brand/product ($F(3, 558) = 3.07$, $p = .027$), and no interaction effect ($F(3, 558) = 1.44$, $p = .232$). Participants in the treatment condition were significantly happier than were participants in the control condition, replicating the teasing effect. As in Study 2, we found no correlation in the treatment condition between self-reported correct guesses and hedonic experience ($r = -.05$; $t(102) = -.52$, $p = .603$), further ruling out joy-from-guessing-right as an alternative explanation for the teasing effect.

Attitude and willingness-to-try. Because attitude and willingness-to-try were highly correlated ($r_s > .71$, $p_s < .001$ across different brands/products), we conducted a 2 (condition) $\times$

4 (brand/product) mixed multivariate analysis of variance (MANOVA) on these two measures. The results, based on Wilks' lambda, revealed a significant effect of condition ($F(2, 190) = 7.14$, $p = .001$), a significant effect of brand/product ($F(6, 186) = 11.90$, $p < .001$), and no significant interaction effect ($F(6, 186) = 1.43$, $p = .204$), suggesting that our manipulation yields positive effects even on a brand/product.

Our results may appear contrary to Baker, Honea, and Russell's (2004) finding that participants had better associative learning of and thus more favorable attitudes toward a brand in an ad if the identity of that brand was revealed at the beginning than at the end of the ad. However, a closer look suggests a major difference between the two streams of research: whereas we studied well-known brands, Baker et al. investigated unknown brands. Based on prior research showing that curiosity is positively related to one's prior knowledge in a domain (Berlyne 1954b; Jones 1979; Loewenstein 1994), we suspect that imbuing the ad of an unknown brand with an uncertainty-creation-resolution process did not induce much curiosity from the viewer, and therefore did not generate a net positive experience.

STUDY 6 (STARBUCKS CARD)

Study 6 replicated Study 5 with real consequences to participants. In Study 5, we asked participants about their curiosity and attitudes before measuring their behavioral tendency (willingness to try), possibly biasing the behavioral-tendency response. In Study 6, we directly asked participants about their choice without first asking them about psychological variables.

Method

Participants in the study were 106 adults (54 women; $M_{age} = 35.46$ years) recruited from

MTurk for a nominal payment. We embedded this study in an unrelated survey. At the end of the unrelated survey, participants were told that beyond the promised payment for completing the survey, they had a chance to win a gift.

Participants were assigned to either a treatment or a control condition. Participants in the treatment condition were first asked, “Wanna know what the gift is?” They were then presented, line by line, with some descriptions about the gift (see Web Appendix C). At the end, participants were informed, “It is a \$15 Starbucks gift card,” and shown the image of the card. Participants in the control condition were first informed, “It is a \$15 Starbucks gift card,” and then saw the same descriptions and image as did those in the treatment condition.

After the above steps, participants in both conditions were asked whether they would prefer the \$15 Starbucks gift card or a \$5 Amazon gift card instead; they were told they would actually receive the card of their choice if they won. The Amazon gift card served as a common alternative option and enabled us to assess participants’ relative preferences for the Starbucks gift card (the focal stimulus) between the treatment and the control conditions. Upon completion of the study, we indeed sent the winners the gift cards of their choice.

Results and Discussion

Because we wanted to keep this study as natural as possible and minimize the influence of question-asking per se, we asked participants only to indicate their preferences for the Starbucks card relative to the Amazon card and did not ask them to report their feelings. In support of Hypothesis 2 and replicating the behavioral results of Study 5, more participants in the treatment condition chose the Starbucks card than did participants in the control condition.

A subtle uncertainty manipulation can influence even real choices: *ceteris paribus*, people

who first experience uncertainty about the identity of a product and then resolve that uncertainty are more likely to choose the product than are people who learn the product's identity directly.

GENERAL DISCUSSION

We are living in an epoch of abundant information, yet we have limited knowledge of how we can deliver and receive information better. The present research enriches our understanding of the topic and makes multiple contributions: We propose and identify a positive hedonic effect of teasing—that first creating and then resolving an uncertainty engenders a net gain in happiness. This effect exemplifies the hedonomics approach to happiness, increasing happiness by improving the presentation of and choices among external stimuli without changing their objective levels (Hsee, Hastie and Chen 2008; Tu and Hsee 2017). Furthermore, we find that laypeople underappreciate the hedonic benefit of such a process and do not seek it out. Finally, we show that imbuing an ad with such a process enhances consumers' attitudes toward, their willingness to try, and their choice of the advertised product.

To test the reliability of the teasing effect, we conducted a single-paper meta-analysis (SPM; McShane and Böckenholt 2017) including all the studies except for Study 6, which did not measure hedonic experience. The SPM estimates the teasing effect at .55 (95% confidence interval: .26-.85), demonstrating the robustness of the effect. We also submitted key statistical results into a p-curve analysis (Simonsohn, Nelson, and Simmons 2014). Both the half p-curve test ($z = -10.80, p < .001$) and the full p-curve test ($z = -11.27, p < .001$) are right-skewed, providing strong support for the presence of evidential value.

Applied Implications

This research carries applied implications for marketing and beyond. First, as demonstrated in Studies 5 and 6, it has implications for designing ads that are both more pleasurable to watch and more effective. In real life, many ads are displayed in situations that involve waiting; for example, waiting for a bus, riding an elevator or subway, waiting for a website or video to load, etc. In these situations, our research is helpful from the perspectives of both consumer wellbeing and advertising effectiveness. Another implication regards the design of software and smartphone apps, as we alluded to in our opening example. Consider two versions of a “word a day” app, an example similar to the cool-fact-app example introduced earlier. Every morning, one version of the app delivers an esoteric word along with its definition (e.g., “‘Brogue’ means an Irish accent.”). The other version first teases the reader with a question (e.g., “Does the word ‘Brogue’ mean (a) an American accent, (b) a British accent, or (c) an Irish accent?”) and, after a delay, delivers the answer. Most existing apps resemble the first version. But we predict that the second version is better at brightening one’s day.

A third implication concerns the design of information guides (booklets and websites). Consider two versions of an art museum pamphlet that museum visitors receive when purchasing their tickets. One version directly relays facts about the artwork in the museum, whereas the other version simply poses questions about the artwork and lets the visitors find out the answers themselves while visiting the museum. We predict that visitors receiving the second version will have a better time in the museum.

Fourth, this research also suggests that ads that interrupt a television program can enhance viewers’ enjoyment. In fact, Nelson, Meyvis, and Galak (2009) have already documented this effect and explained it in terms of adaptation, positing that the ads disrupt the viewers’ adaption of the program. Our research offers an additional (though not necessarily

alternative) explanation: The presence of an ad creates uncertainty about the upcoming content of the program, which is later resolved when the program resumes after the ad. The viewers thus experience an uncertainty-creation-resolution process and, therefore, a net gain in happiness.

Fifth, our findings carry implications for teaching and interpersonal communications. Some teachers and speakers already take advantage of uncertainty by first asking questions and then giving answers (Gaylen 1998), but many still do not. Even those who do primarily use uncertainty to help the audience learn better (Hawes 2004). Our research suggests that doing so has the additional benefit of making the audience feel happier. We further speculate that if teachers routinely create uncertainty about some knowledge and later resolve the uncertainty, students will learn to enjoy the process (Csikszentmihalyi 1990; Kapp 2012), develop long-lasting habits of knowledge-seeking (Kashdan and Silvia 2009; Silvia 2008; Silvia and Kashdan 2009), and live a happier life for years to come (Kashdan and Steger 2007).

Finally, our research provides insights about gamification. Uncertainty and curiosity are important components of a game (Seaborn and Fels 2015). Our research suggests that the uncertainty-creation-resolution manipulation can make a non-game activity, such as reading a biography or watching an ad, enjoyable and game-like. Shen, Hsee, and Talloen (2017) recently documented a robust reinforcing uncertainty effect: people repeated a boring task more when the incentive for the activity was uncertain *a priori* (e.g., either \$1 or \$2) than if it was certain and larger *a priori* (e.g., \$2 for sure). Although this finding is counter-normative, it agrees with our current theory. Every time a person in the uncertain-incentive condition repeated the activity, she underwent an uncertainty-creation-resolution cycle. This process made the otherwise boring task enjoyable and game-like. Also consistent with our theory, this counter-normative reinforcing uncertainty effect occurred only when people in the uncertain-incentive condition could find out

the incentive immediately and resolve the uncertainty every time they repeated the activity, and disappeared when the uncertainty was not resolved immediately (Shen, Hsee, and Talloen 2017).

Remaining Questions

What role does curiosity play? According to our theory, curiosity is vital in producing the teasing effect. Indeed, in all studies where we asked participants to rate their curiosity, the ratings not only differed between the treatment and the control conditions, but also fully mediated the effect of our uncertainty-creation-resolution manipulation on hedonic experience (see Web Appendix B), which attested to the importance of curiosity in the process.

Is curiosity good or bad? Curiosity carries both risk and potential. Hsee and Ruan (2016) found that people experiencing curiosity acted to resolve it even if the outcome was expectedly aversive, such as receiving electric shocks. Dubbed the Pandora effect, this result divulges the risk of curiosity. On the other hand, the present research reveals the potential of curiosity. Notably, the Pandora-effect research focused on uncertainty about potentially negative outcomes (e.g., electric shocks), and showed that after curiosity was induced, people could not resist the temptation to resolve their curiosity despite the negative consequences. In contrast, the present research concerns uncertainty about non-negative outcomes, and demonstrates that before curiosity is induced, people do not seek out curiosity despite its positive potential.

What roles do specific feelings (such as engagement and relief) play? Like much of the existing research on hedonic experience (e.g., Galak, Kruger, and Loewenstein 2013; Mandel and Nowlis 2008; Wilson et al. 2005), the present research focuses on overall experience, as measured by questions such as “Are you having a good time now?” rather than on the specific feelings (besides curiosity) involved in the overall experience. However, we speculate that

participants in the treatment conditions of our studies may have experienced different specific feelings during uncertainty creation and uncertainty resolution—tension and engagement during uncertainty creation, and relief and satisfaction during uncertainty resolution. Although they are beyond the scope of the present research, such specific feelings can shed light on what constitutes overall hedonic experience, and they deserve future research.

Does the length of the uncertainty-creation phase matter? We suspect that for uncertainty-creation-resolution to yield a positive effect, the length of the uncertainty-creation phase should be neither too brief nor too long. Too brief a phase is insufficient to evoke curiosity, and too long a phase may cause anxiety or lose the interest of the person (Noordewier and van Dijka 2015).

Can evaluation mode explain the choice-experience discrepancy? In studies that included a choice condition, the experiencers (i.e., participants in the treatment and the control conditions) favored the treatment condition, while the choosers (i.e., participants in the choice condition) favored the control condition. A potential explanation for the inconsistency is that the choosers were in the joint evaluation mode—they knew both the treatment and the control conditions and could compare the two—whereas the experiencers were in the single evaluation mode, exposed to one condition only. (See Hsee 1996 for further discussions on joint versus single evaluations.) Given the studies in this research, we cannot tell whether this is an alternative explanation or part of our explanation (e.g., that joint evaluation mode highlights the initial information deficiency in the treatment condition), and look forward to further research on this issue.

Would choosers learn? We speculate people have learned from their life-long experience that uncertainty is generally aversive, and thus do not actively seek uncertainty. However, if people experience a benign learning environment (e.g., one in which uncertainty is always about

innocuous outcomes and is always resolved) with repeated trials, they will learn to appreciate the benefit of temporary uncertainty and will seek it out.

Broader Implications

Besides the aforementioned specific implications, this research also holds broader implications about desire in general. The overarching theme of this research is to use a desire-creation-resolution process to distill happiness. This theme is more important today than ever before. For most of human history, our ancestors lacked the resources to satisfy even their most basic desires (Newman 1990). In those times, one of the most effective ways to gain pleasure was to satisfy a basic desire. Historically, this is probably why it is popular in many cultures to treat friends by cooking them a meal. Relative to our ancestors, we are living in a world of abundance. For many people, there is too much to eat, not too little. With the advances of technology and the accumulation of wealth, more and more of us face a “ceiling effect.” To generate additional happiness, we need additional desires. Thus, the key to happiness is not to satisfy existing desires, but to induce new desires. But most basic desires cannot easily be induced, and even if they could, inducing such desires would entail costs and side effects. Curiosity—at least the type of curiosity studied in this research—is a desire that is readily induced and can be satisfied with little to no cost. This research shows the potential of using curiosity induction and resolution to boost happiness.

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TABLE 1. EXAMPLES OF COMPANIES USING UNCERTAINTY IN MARKETING

Tactic	Company	Example
Withholding information about a new product to attract attention and fuel buzz	Sony Ericsson	A countdown for something "smarter is coming" (Xperia X10) on its website
	Apple	Teaser trailer for Mac Pro 2013
	Nike	Teaser ads for Air Max 360 launched on January 21, 2006
Offering a mystery bonus or discount to encourage purchases or other behaviors	Alaska Airlines	A mystery bonus of up to 35%, 40%, or even 50% more miles
	American Airlines	"Mystery Miles": "like" the AAdvantage program on Facebook and earn 100–100,000 miles.
	United Airlines	"Mystery Sale": buy MileagePlus miles at up to an 80% bonus (account specific).
	InterContinental Hotels Group	"Surprise—it's a mystery bonus! Reveal up to 100% more on your points purchase now."
	Banana Republic	"Mystery Money": play a game online and find out the prize in the store.
	Starwood Preferred Guest	"Save up to 50% on starpoints. Buy now and see what you will save."
	Macy's	"Receive a FREE Mystery Gift with any \$50 online beauty purchase."
Selling mystery products at a relatively low price	Groupon	"Goods Midsummer Mystery Deal: \$10 for a Mystery Product Ranging from Watches to TVs"
	Funjet Vacations	"Deals so good we can't reveal the hotel name"
	That Daily Deal	"Mystery Box of Awesome" at \$24.99 per month

TABLE 2. REVIEW OF RELEVANT RESEARCH

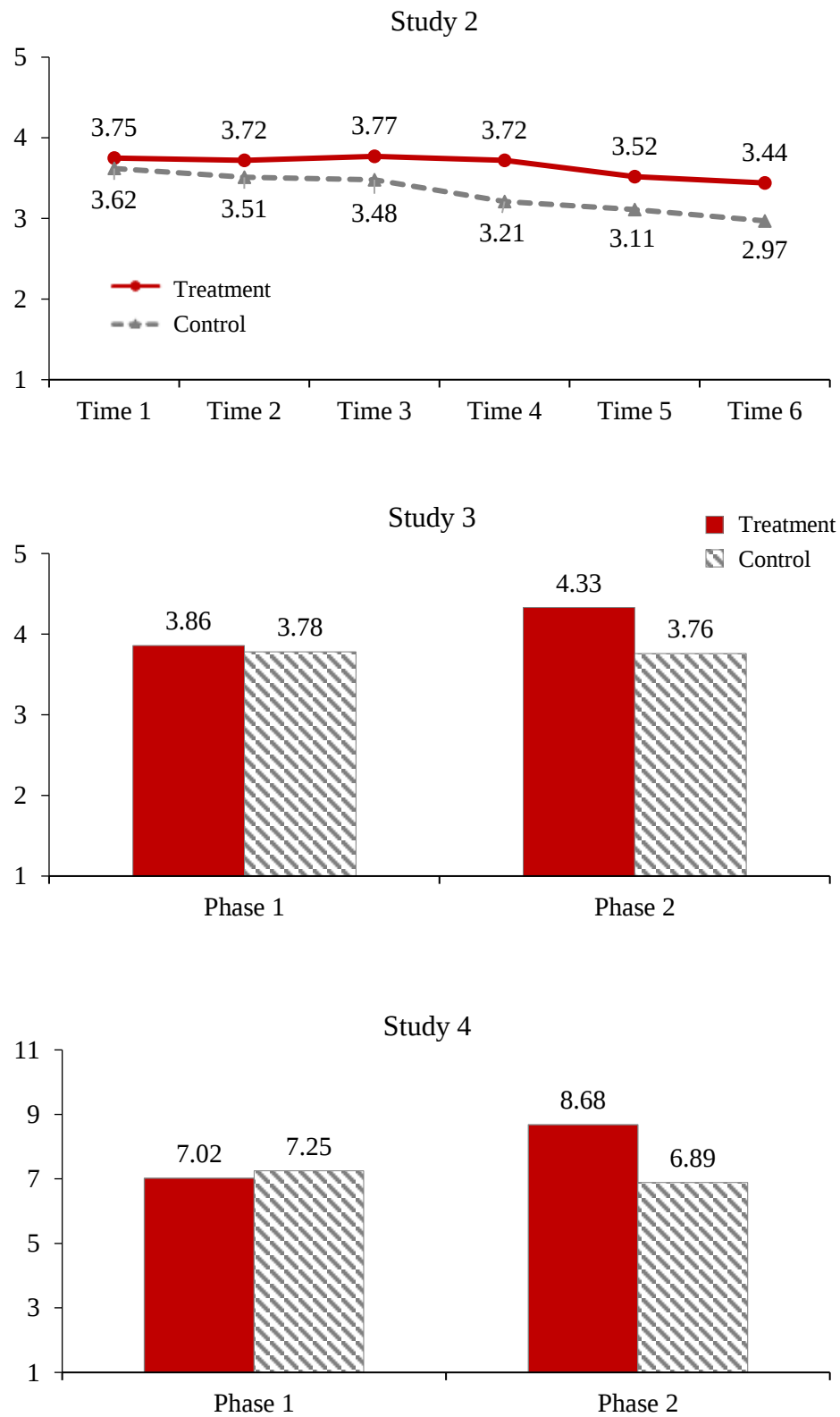
Category	Paper(s)	Relevant Conclusion(s)/Finding(s)
Curiosity as a Deprivation State	Berlyne 1950; Dashiell 1925; Dember 1956; Harlow, Harlow, and Meyer 1950; Welker 1956	When presented with novel, complex, or ambiguous (curiosity-evoking) stimuli, animals engaged in exploration without additional incentives or even at the cost of enduring other deprivations.
	Berlyne 1954a, 1966b; Loewenstein 1994; Litman and Jimerson 2004	Curiosity could be viewed as a state of information/knowledge deprivation.
Negative	Han et al. 2013	Participants who were made curious showed less positive brain activities than did those who were not made curious.
	Jepma et al. 2012	The induction of curiosity activated brain regions sensitive to conflict and arousal.
	Shani and Zeelenberg 2007; Shani, Tykocinski and Zeelenberg 2008	People experienced emotional discomfort when they were uncertain whether an unfavorable decision had been made.
	Perry et al. 1990; Sieff, Dawes, and Loewenstein 1999	People felt worse when waiting for the result of an HIV test than after they learned their test result was positive.
Positive	Hill, Fombelle, and Sirianni 2016	Curiosity was a state of high activation and positive valence.
	Kang et al. 2009	The level of curiosity when reading trivia questions correlated with activity in brain regions involved in anticipated reward.
	Kashdan and Silvia 2009; Kashdan and Steger 2007; Silvia 2008; Silvia and Kashdan 2009	Curiosity induction was rewarding and involved positive feelings of interest.
	Knobloch-Westerwick and Keplinger 2006	Participants liked the first part of a mystery more if it involved greater uncertainty and induced more curiosity.
	Leavitt and Christenfeld 2011	Story spoilers might enhance reading enjoyment by increasing readers' curiosity about a story.
	Lee and Qiu 2009	Uncertainty associated with a positive event induced greater and longer-lasting positive feelings.
	Maner and Gerend 2007	Curiosity was more strongly associated with judgments of positive (vs. negative) outcomes.
	Wilson et al. 2005	Uncertainty about a positive experience prolonged the pleasure it caused.
	Berlyne 1960, 1966a; Spielberg and Starr 1994	Curiosity/uncertainty induced positive (negative) feelings when the associated arousal was low (high).
	Berlyne 1966b	Exploratory behavior could be associated with the condition of discomfort due to the inadequacy of information and an optimal amount of stimulation (e.g., excitement).
Mixed	Elsen, Pieters, and Wedel 2016	Viewers initially responded negatively toward mystery ads, but responded more positively over time.
	Litman 2005; Litman and Jimerson 2004; Litman and Silvia 2006	Curiosity represents both a negative feeling of deprivation and a positive feeling of interest.
	Loewenstein 1994	Curiosity could involve both the pleasant anticipation of acquiring information and the unpleasant

		deprivation of not having access to information.
Valence of Curiosity Resolution	Noordewier and van Dijk 2015	As people got closer to resolving their curiosity, they experienced more positive affect, less discomfort, and less annoyance with the lack of information.
	Jepma et al. 2012	The resolution of curiosity activated brain regions related to reward processing and memory.
	Knobloch-Westerwick and Keplinger 2006	Participants liked a mystery more if the first half of the mystery induced more curiosity, and this curiosity was resolved in the second half of the mystery.
	Marvin and Shohamy 2016	The information that resolved curiosity was a reward. It had value in and of itself.
	Yang, Gu, and Galak 2017	Favorable uncertainty resolution of the mere possibility of negative experiences slowed hedonic adaptation of positive experiences.

TABLE 3. RESULTS OF ALL THE STUDIES

Study	Condition	N	Dependent Variables	Key Test Statistics
1	Treatment	79	E = 3.61 (1.17)	$t(153) = 2.22, p = .028^*$
	Control	76	E = 3.18 (1.21)	
	Choice	74	E = 3.22 (1.29)	$\chi^2(1) = 49.59, p < .001^*$
			% choosing Treatment = 37.0%	
2	Treatment	99	E = 3.65 (.99); % continuing = 69.7%	E: $F(1, 192) = 5.59, p = .019^*$
	Control	95	E = 3.32 (.99); % continuing = 52.6%	% continuing: $z = 2.43, p = .015^*$
	Choice	99	% choosing Treatment = 37.4%	$\chi^2(1) = 6.31, p = .012^*$
	Treatment	37	E = 3.64 (1.01)	$F(1, 97) < .01, p = .968$
	Control	62	E = 3.63 (1.08)	
3	Treatment	98	E1 = 3.86 (.92); E2 = 4.33 (.81)	Interaction: $F(1, 202) = 11.33, p = .001^*$; E1: $F(1, 202) = .29, p = .590$; E2: $F(1, 202) = 16.21, p < .001$
	Control	106	E1 = 3.78 (1.03); E2 = 3.76 (1.14)	
	Choice	101	% choosing Treatment = 19.8%	$\chi^2(1) = 36.84, p < .001^*$
			% predicting Treatment = 21.8%	$\chi^2(1) = 32.17, p < .001^*$
	Treatment	20	E1 = 3.95 (.95); E2 = 4.15 (1.23)	Interaction: $F(1, 99) = 5.08, p = .026$; E1: $F(1, 99) = .03, p = .869$; E2: $F(1, 99) = 1.00, p = .320$
	Control	81	E1 = 4.27 (.91); E2 = 3.75 (1.30)	
4	Treatment	66	E1 = 7.02 (1.98); E2 = 8.68 (2.10); A = 5.73 (1.21)	Interaction: $F(1, 126) = 48.54, p < .001^*$; E1: $F(1, 126) = .39, p = .533$; E2: $F(1, 126) = 22.33, p < .001$; A: $F(1, 128) = 7.48, p = .007^*$
	Control	64	E1 = 7.25 (1.97); E2 = 6.89 (2.09); A = 5.09 (1.42)	
	Choice	129	% choosing Treatment = 39.5%	$\chi^2(1) = 5.65, p = .017^*$
	Treatment	51	E1 = 7.55 (2.27); E2 = 9.02 (1.98)	Interaction: $F(1, 127) = 28.73, p < .001$; E1: $F(1, 127) = .36, p = .548$; E2: $F(1, 127) = 14.12, p < .001$
	Control	78	E1 = 7.79 (2.26); E2 = 7.50 (2.40)	
5	Treatment	104	E = 3.35 (.94); A = 3.98 (.61); T = 3.44 (.83)	E: $F(1, 186) = 70.08, p < .001^*$
	Control	95	E = 2.17 (.88); A = 3.65 (.59); T = 3.01 (.83)	A and T: $F(2, 190) = 7.14, p = .001^*$
6	Treatment	53	% choosing the stimulus = 66.0%	$z = 2.15, p = .032^*$
	Control	53	% choosing the stimulus = 45.3%	
7	Treatment (M-F)	66	E1 = 2.62 (.63); E2 = 3.12 (.69)	Treatment vs. Controls
	Control (M-M)	53	E1 = 2.75 (.65); E2 = 2.26 (.81)	Interaction: $F(1, 218) = 66.62, p < .001^*$; E1: $F(1, 218) = .54, p = .462$; E2: $F(1, 218) = 40.66, p < .001$;
	Control (F-F)	49	E1 = 2.63 (.60); E2 = 2.39 (.79)	
	Control (F-M)	54	E1 = 2.69 (.70); E2 = 2.59 (.74)	

Notes: 1) E=Overall Experience, E1=Experience in Phase 1, E2=Experience in Phase 2, A=Attitude, T=Willingness to try. 2) In the Dependent Variables column, the parenthetical numbers are standard deviations. 3) Because some participants skipped some questions, the degrees of freedom of some tests are smaller than they would be otherwise. 4) * denotes test statistics included in the p-curve analysis.

FIGURE 1. HEDONIC-EXPERIENCE RESULTS OF STUDIES 2-4

The Teasing Effect:

An Underappreciated Benefit of Creating and Resolving an Uncertainty

Bowen Ruan, Christopher K. Hsee, Zoe Y. Lu

WEB APPENDIX A

STUDY 7 (WORDS)

We found in Studies 3 and 4 that the difference in hedonic experiences between the treatment and the control conditions occurred only in the uncertainty-resolution phase. We attributed the effect to the joy of curiosity resolution. However, there are two alternative explanations. One is a mere-stimulus-change account—that any change in the stimulus can increase happiness. The other is a mere-uncertainty account—that any uncertainty can boost happiness. We sought to rule out these alternative explanations in this study.

The study also explored the moderating role of individual differences in need for cognition and need for closure. The effect of our manipulation might be stronger for both individuals high in need for cognition, who tend to engage in effortful cognitive activities, and/or for individuals high in need for closure, who tend to avoid ambiguity.

Method

The stimuli in the study were a series of 11-letter English words, such as PUBLICATION and DEMONSTRATE. For each word, we created two versions: a missing-letter version in which 5 of the 11 letters were missing, and a full-letter version with no missing letters.

The study consisted of four conditions—one treatment condition and three (not one)

control conditions—each consisting of two phases. In the missing-to-full (i.e., treatment) condition, Phase 1 displayed five words in their missing-letter versions, and Phase 2 displayed these words in their full-letter versions. In the full-to-full condition, both Phase 1 and Phase 2 displayed five words in their full-letter versions. In the full-to-missing condition, Phase 1 displayed five words in their full-letter versions, and Phase 2 displayed these words in their missing-letter versions. In the missing-to-missing condition, both Phase 1 and Phase 2 displayed five words in their missing-letter versions. In all cases, the words appeared one after another on the screen, with an 8s delay between the appearance of one word and the appearance of the next.

This design allowed us to distinguish our theory from the two alternative accounts. If the mere-stimulus-change account held, participants in both the missing-to-full and the full-to-missing conditions would be happier than participants in the other two conditions would be, because the stimuli (words) in the former two conditions changed from Phase 1 to Phase 2. If the mere-uncertainty account held, participants in both the missing-to-full and the missing-to-missing conditions would be happier than participants in the other two conditions would be, because the former two conditions involved uncertainty in Phase 1. But according to our theory, participants in the missing-to-full condition (the treatment condition) would be happier than participants in all the other conditions (the three control conditions) would be. Furthermore, there would be an interaction between condition and phase, such that the difference in hedonic experience between the treatment condition and the control conditions would emerge in Phase 2 rather than in Phase 1.

Participants were 222 adults (131 women; $M_{\text{age}} = 35.40$ years) recruited from MTurk for a nominal payment. They were assigned randomly to one of the four conditions. After they completed their respective assigned conditions, the participants also went through the other three

conditions, in random order. Across different conditions, no participant would encounter the same word more than once.

The main dependent variable was hedonic experience, measured twice in every condition, once at the end of Phase 1 and once at the end of Phase 2. Each time, participants were asked to rate how good of a time they had during that phase on a 4-point scale, anchored by “very good” (left) and “not good at all” (right). We also asked participants about their curiosity. At the end of Phase 1, we asked participants to choose between the following statements: “The words in Phase 1 induced my curiosity,” and “The words in Phase 1 did not induce my curiosity.” Similarly, at the end of Phase 2, we asked participants to choose among the following statements: “The words in Phase 2 resolved the curiosity I had in Phase 1,” “The words in Phase 2 did not resolve the curiosity I had in Phase 1,” and “Neither of the above, because I had no curiosity in Phase 1.” Finally, we asked participants to fill out an individual-difference survey at the end of the study, which included an 18-item Need for Cognition scale (Cacioppo, Petty, and Kao 1984) and a 15-item Need for Cognitive Closure scale (Roets and Van Hiel 2011).

Results and Discussion

Curiosity. The curiosity results agreed with our predictions. When asked whether the words in Phase 1 induced curiosity, more participants said yes in the missing-to-full condition (88%) and in the missing-to-missing condition (87%) than in the full-to-full condition (37%) and the full-to-missing condition (39%, $\chi^2(1) = 61.82, p < .001$, comparing the first two with the last two conditions). When asked whether the words in Phase 2 resolved their curiosity, more participants said yes in the missing-to-full condition (88%) than in any of the other conditions (missing-to-missing: 19%; full-to-full: 22%; full-to-missing: 24%; $\chi^2(1) = 88.97, p < .001$,

comparing the first with the last three conditions).

Hedonic experience. Because each participant went through all four conditions in random order, we could analyze the results both between participants (examining their responses in the first condition only) and within participants (examining their responses in all four conditions). The results presented below are based on between-participants analyses. Within-participants analyses yielded highly consistent results.

Figure B1 shows the results. A 4 (condition) $\times$ 2 (phase) mixed ANOVA found a main effect of condition ($F(3, 218) = 4.52, p = .004$), a marginally significant main effect of phase ($F(1, 218) = 3.52, p = .062$), and a condition $\times$ phase interaction effect ($F(3, 218) = 25.62, p < .001$). Planned orthogonal contrasts offered more insights. Overall, participants in the treatment condition were happier than were participants in all the control conditions ($F(1, 218) = 12.14, p < .001$), and this difference was greater in Phase 2 than in Phase 1 ($F(1, 218) = 66.62, p < .001$). In fact, during Phase 1, participants in the treatment condition did not feel differently from those in the control conditions, but they were significantly happier during Phase 2.

Mediation. We ran a mediation analysis to test the mediating role of curiosity (Preacher and Hayes 2008). In the analysis, we computed a curiosity score (by coding the answer “The words in Phase 1 induced my curiosity” of the first curiosity question and the answer “The words in Phase 2 resolved the curiosity I had in Phase 1” of the second curiosity question both as 1, the remaining answers of the two questions all as 0, and then averaging the two questions) and pooled the three control conditions. Results showed that our uncertainty-creation-resolution manipulation increased both the curiosity score ($B = .50, SE = .05; t(220) = 9.84, p < .001$) and hedonic experience ($B = .32, SE = .09; t(220) = 3.47, p < .001$). More importantly, when controlling for curiosity, the effect of our manipulation on hedonic experience became non-

significant ($B = -.07$, $SE = .10$; $t(219) = -.75$, $p = .456$). The indirect effect (.39) of our manipulation on hedonic experience differed from zero at the 95% CI, [.28, .52], suggesting that curiosity fully mediated the effect.

Need for cognition and need for cognitive closure. We found a main effect of need for cognition, with individuals higher in need for cognition feeling better ($F(1, 214) = 5.92$, $p = .016$), but no interaction effect between need for cognition and our manipulation ($F(1, 214) = 2.02$, $p = .157$). Our manipulation influenced even participants low (at one standard deviation below the mean) in need for cognition ($F(1, 214) = 13.40$, $p < .001$). Need for cognitive closure had neither a main effect ($F(1, 214) = 2.40$, $p = .123$) nor an interaction effect ($F(1, 214) = .32$, $p = .572$). It seems that these individual differences did not play a moderating role.

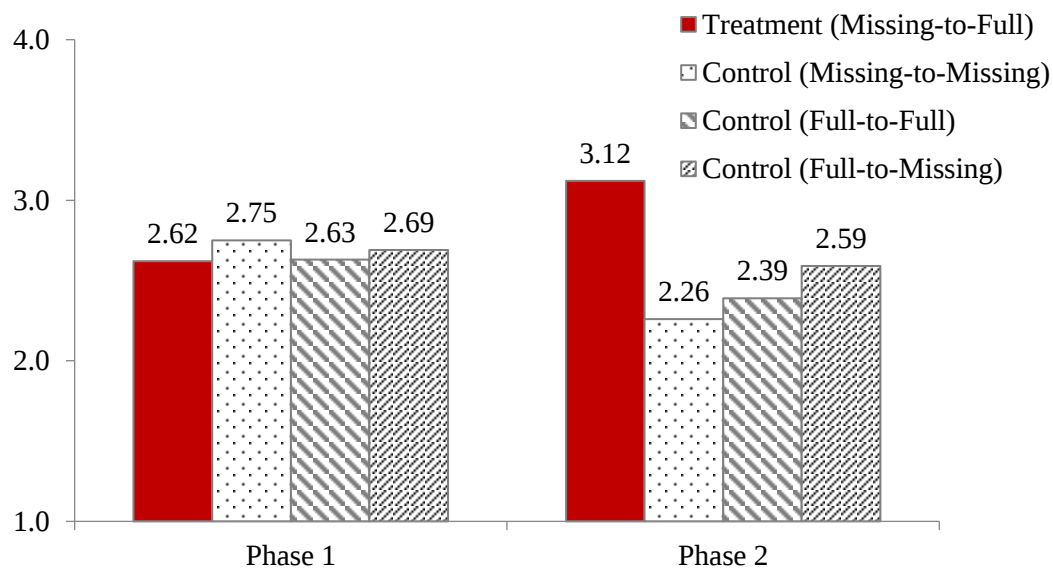
Using a minimalistic design, Study 7 replicated the positive effect of uncertainty-creation-resolution, supported our theory, and cast doubts on the mere-stimulus-change account and the mere-uncertainty account.

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FIGURE A1: HEDONIC EXPERIENCE RESULTS OF STUDY 7

Participants in the treatment condition were happier than were participants in the control conditions, and the difference occurred not in Phase 1 (uncertainty creation) but in Phase 2 (uncertainty resolution).



WEB APPENDIX B

ADDITIONAL RESULTS

Hedonic Experience in the Choice Condition

Study 1 (Trivia). Of the participants in the control condition, 45.9% chose the control version for all the cool facts, 17.6% chose the treatment version for all the cool facts, 9.5% chose the treatment version for the first fact or first few cool facts and switched to the control version for the remaining ones, 6.8% chose the control version for the first fact or first few cool facts and switched to the treatment version for the remaining ones, and 20.3% showed no systematic pattern. Overall, the more cool facts participants chose to view in the treatment version, the better they felt ($r = .37$; $t(72) = 3.43$, $p = .001$).

Study 2 (Cities). A 2 (choice) $\times$ 6 (time) mixed ANOVA found no main effect of choice ($F(1, 97) < .01$, $p = .968$), a main effect of time ($F(5, 485) = 6.58$, $p < .001$), and no interaction effect ($F(5, 485) = 1.00$, $p = .416$). Independent from which version of the slideshow participants chose to view, their hedonic experience declined over time.

Study 3 (Biography). A 2 (choice) $\times$ 2 (phase) mixed ANOVA found a main effect of choice ($F(1, 99) = .03$, $p = .869$), no main effect of phase ($F(1, 99) = 1.00$, $p = .320$), and an interaction effect ($F(1, 99) = 5.08$, $p = .026$). Participants who chose the treatment condition felt similarly in Phases 1 and 2 ($F(1, 99) = .49$, $p = .485$), whereas participants who chose the control condition felt worse in Phase 2 than in Phase 1 ($F(1, 99) = 13.36$, $p < .001$).

Study 4 (Target Card). A 2 (choice) $\times$ 2 (phase) mixed ANOVA revealed a main effect of phase ($F(1, 127) = 12.74$, $p = .001$), a marginally significant main effect of uncertainty ($F(1, 127) = 2.94$, $p = .089$), and a choice $\times$ phase interaction effect ($F(1, 127) = 28.73$, $p < .001$). The difference in hedonic experience between participants who chose the treatment condition and those who chose the control condition occurred only in Phase 1 but not in Phase 2. These results

were highly consistent with the results in the treatment and the control conditions.

Discussion. Note that in most of the studies, participants in the choice condition did not report worse experiences on average than did participants assigned to the treatment condition. It is possible they did not feel worse because they made the choice themselves, leading them either to feel good and/or to feel the need to justify their choice. The results may also suggest that people have heterogeneous preferences for uncertainty, and the choice condition allowed those who would enjoy the treatment (control) condition to choose the treatment (control) condition.

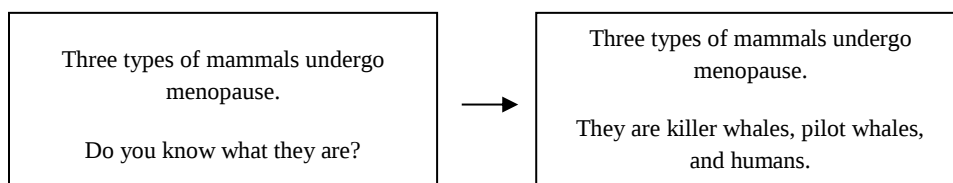
Mediation Analysis

To provide support for our curiosity-based explanation, we conducted mediation analyses (Preacher and Hayes 2008) in Studies 3 and 5, with hedonic experience as the dependent variable and curiosity as the mediator. The analyses revealed significant effects of our manipulation on both curiosity ($B = .53$, $SE = .11$; $t(202) = 4.72$, $p < .001$ in Study 3; $B = 1.45$, $SE = .12$; $t(195) = 12.21$, $p < .001$ in Study 5) and hedonic experience ($B = .32$, $SE = .12$; $t(202) = 2.70$, $p = .008$ in Study 3; $B = 1.12$, $SE = .13$; $t(186) = 8.37$, $p < .001$ in Study 5). More importantly, when controlling for curiosity, the effect of our manipulation on hedonic experience became non-significant ($B = -.08$, $SE = .09$; $t(201) = -.93$, $p = .355$ in Study 3; $B = -.09$, $SE = .11$; $t(183) = -.82$, $p = .413$ in Study 5), whereas the effect of the curiosity remained ($B = .76$, $SE = .05$; $t(201) = 14.54$, $p < .001$ in Study 3; $B = .85$, $SE = .05$; $t(183) = 17.05$, $p < .001$ in Study 5). Bootstrap estimates indicated that curiosity fully mediated the effect of our manipulation on hedonic experience (indirect effect = .40, 95% confidence interval [CI]: [.22, .59] in Study 3; indirect effect = 1.20, 95% CI: [.96, 1.46] in Study 5).

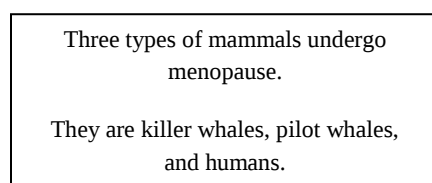
WEB APPENDIX C: SAMPLE STIMULI

STUDY 1 (TRIVIA)

Treatment condition



Control condition



STUDY 2 (CITIES)

Treatment condition

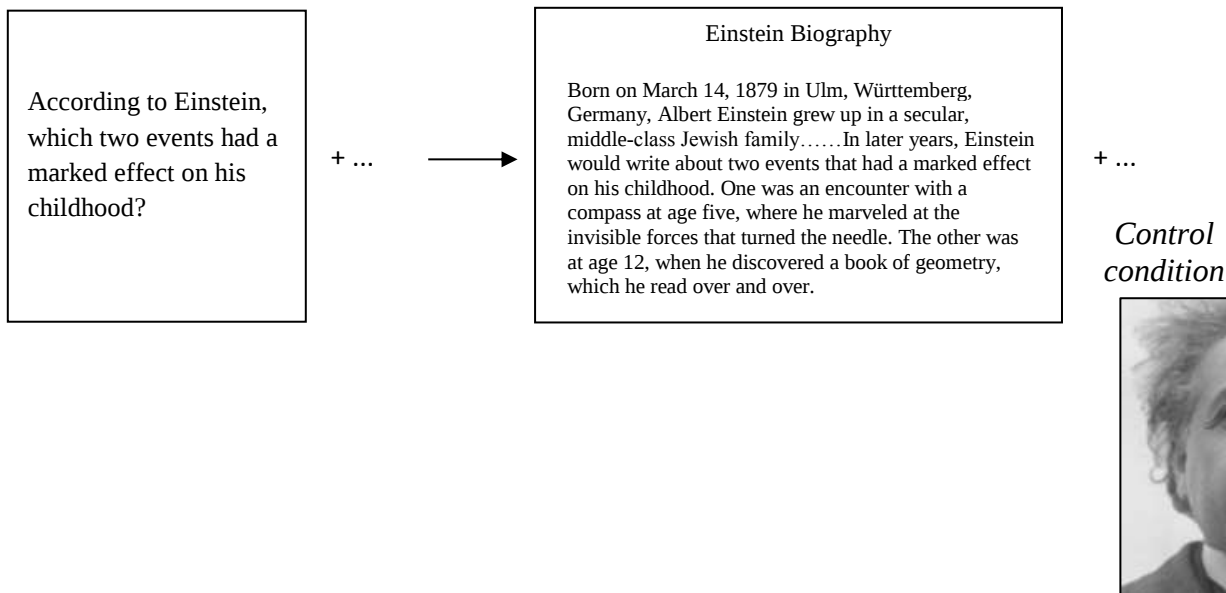


Control condition



STUDY 3 (BIOGRAPHY)

Treatment condition



STUDY 4 (TARGET CARD)

Treatment condition



Control condition



STUDY 5 (ADS)

Treatment condition

Guess what the brand to be described is.
It was founded in 1856 in Hampshire, England.
Its logo contained the Latin word "Prorsum" meaning forwards.
It has more than 500 stores in over 50 countries.
It is well known for using British celebrities in its advertisements.
Queen Elizabeth II and the Prince of Wales have granted the brand Royal Warrants.
It is a luxury fashion brand.
Burberry.

Control condition

Introducing Burberry.
It was founded in 1856 in Hampshire, England.
Its logo contained the Latin word "Prorsum" meaning forwards.
It has more than 500 stores in over 50 countries.
It is well known for using British celebrities in its advertisements.
Queen Elizabeth II and the Prince of Wales have granted the brand Royal Warrants.
It is a luxury fashion brand.
Burberry.

STUDY 6 (STARBUCKS CARD)

Treatment condition

Wanna know what the gift is?
Wherever you go, you can bring it with you, easily and effortlessly.
You can use it at more than 12,000 locations in the U.S. alone.
In the summer, you can trade it for fun and freedom.
In the winter, you can trade it for warmth and energy.
It is not only the perfect way to treat yourself, but also your friend.
It is a \$15 Starbucks gift card.

Control condition

It is a \$15 Starbucks gift card.
Wherever you go, you can bring it with you, easily and effortlessly.
You can use it at more than 12,000 locations in the U.S. alone.
In the summer, you can trade it for fun and freedom.
In the winter, you can trade it for warmth and energy.
It is not only the perfect way to treat yourself, but also your friend.
It is a \$15 Starbucks gift card.