The Effects of Numerical Divisibility on Loneliness Perceptions and Consumer Preferences

DENGFENG YAN
JAIDEEP SENGUPTA

This research seeks to examine, first, whether and why consumers perceive divisible versus indivisible numbers differently and, second, how such divergent perceptions influence consumer preferences for marketer-created entities associated with divisible versus indivisible numbers. Integrating insights from two different literatures—numerical cognition and loneliness—we propose and find that numbers perceived to be divisible (vs. indivisible) are viewed as having more "connections" and are therefore deemed to be less lonely. Building on these findings and the literature on compensatory consumption, we then propose and demonstrate that a temporary feeling of loneliness increases participants' relative preference for various targets—products, attributes, and prices—associated with divisible (vs. indivisible) numbers, which are perceived to be relatively more connected and less lonely. It merits mention that our findings are triangulated across a wide variety of numbers, different product categories, and multiple operationalizations of loneliness.

Keywords: numerical cognition, divisibility, loneliness

While the idea that consumers might associate products and brands with human-like traits is now relatively well-accepted (Aaker 1997; Aggarwal and McGill 2007; Johar, Sengupta and Aaker 2005), do we also endow numbers with personalities? Much less is known with regard to this question. However, some anecdotal evidence suggests that this might indeed be the case. As early as in 1880, the mathematician Francis Galton's paper on visualized numerals quotes the experience of a correspondent, who says, "The numerals 1, 2, 3, 4, &c., from the part they play in the multiplication table, have been personified by me from childhood. 9 is a wonderful being of whom I felt almost afraid, 8 I took for his wife …. 6, of no particular sex but gentle and straightforward; 3, a feeble edition of 9, and generally mean; 2, young and sprightly; 1, a commonplace drudge." In his book on mental calculation, Smith (1983) described another example, "the horny-handed, rough-and-tough bully 8 or the sinister 64 or the arrogant, smug, self-satisfied 36. But I do admit to a very personal affection for the ingenious, adventurous 26, the magic, versatile 7, the helpful 37, the fatherly, reliable (if somewhat stodgy) 76." Milikowski (1995) made similar observations in an investigation of why people liked and disliked certain numbers. Thus, one interviewee who preferred even numbers to odd ones explained, "And 7 that is just … no, that is not a good number to me. It is unfriendly. And 11 also … If they were people, they would be stiff and surly."

Dengfeng Yan (dy27@nyu.edu) is an associate professor of marketing at the NYU Shanghai, 1555 Century Avenue, Pudong New District, Shanghai 200122, China. Jaideep Sengupta (mkjaisen@ust.hk) is the Synergis-Geoffrey Yeh Professor of Business at the Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong. Please address correspondence to Dengfeng Yan. The authors thank seminar participants at Duke University and Georgetown University for their insightful comments and Lu Yang for her research assistance. Financial support from the National Natural Science Foundation of China (71872114, 71922018), the Program for Professor of Special Appointment (Eastern Scholar) at Shanghai Institutions of Higher Learning, and "Shu Guang" project of Shanghai Municipal Education Commission and Shanghai Education Development Foundation (19SG56) is gratefully acknowledged. Supplementary materials are included in the web appendix accompanying the online version of this article.

Editors: Vicki G. Morwitz and J. Jeffrey Inman

Associate Editor: Pankaj Aggarwal

Advance Access publication May 21, 2020

 • Vol. 47 • 2021
DOI: 10.1093/jcr/ucaa026

Although the evidence above is suggestive, it is not only anecdotal but also describes number-trait associations that may well be idiosyncratic to each individual. In contrast, the current research investigates whether a specific numerical property—namely, whether a number is divisible or indivisible[1]—leads to systematic, generalizable patterns in how people perceive numbers, and how this difference in perceptions then affects the way consumers react to products and attributes associated with such numbers.

In particular, our research builds upon insights from two different literatures—numerical cognition and psychological loneliness—to propose that relative to indivisible numbers, divisible numbers are perceived to have more "connections" and are therefore deemed to be less lonely. With this platform in place, we then investigate the downstream effects of this association on consumer preferences by exploring the role of situational loneliness. Consistent with a compensatory process (i.e., preferences are aligned with the wish to reduce loneliness), we suggest and find that heightened feelings of loneliness lead participants to respond more favorably to products and attributes associated with divisible versus indivisible numbers.

This work makes several contributions to the existing literature on numerical cognition, which looks at how numbers are perceived and processed. First, it introduces the novel thesis that numbers can be associated with human traits such as loneliness. Second, while past work in the area has investigated reactions toward various numerical features such as precision (Janiszewski and Uy 2008; Thomas, Simon, and Kadiyali 2010), ending (Manning and Sprott 2009; Schindler and Kirby 1997; Thomas and Morwitz 2005), and parity (Wilkie and Bodenhausen 2012), the current article enriches this body of research by examining a new dimension: perceived divisibility. Third, past research on numerical cognition has typically focused on investigating the effects of numerical features and product characteristics, with strikingly little attention devoted to consumer-related factors. The current work is perhaps the first to investigate how a consumer factor (i.e., experienced loneliness) interacts with numerical features to shape product preferences.

Our findings also have applied potential given the ubiquitous use of numbers in marketing. For example, numbers feature in brand names (e.g., Forever 21, Jordan 23), product series (e.g., iPhone 6, Audi A7), and attribute specifications (e.g., 15-inch MacBook Pro, 17 oz. coffee mug). In each of the pairs above, the first (second) example features a divisible (indivisible) number. This article provides insights into whether and why consumers react differently to products and attributes associated with divisible versus indivisible numbers, providing actionable insights for marketing managers.

1 Note that our discussion is restricted to the case of whole numbers. For such numbers, indivisible numbers are those that are fully divisible only by themselves and number 1; divisible numbers have at least one other divisor (Dudley 1978).

CONCEPTUAL DEVELOPMENT

Numerical Cognition

Given the ubiquity of numerical information in marketing contexts, researchers have devoted increasing attention to how consumer reactions are influenced by a variety of numerical features. For example, research on precision (the fewer the number of ending zeros, the more precise the number—e.g., 2,601 is more precise than 2,600) has shown that the relative difficulty in processing large precise numbers versus large rounded numbers can produce uncertainty-induced errors in estimation (Thomas et al. 2010). Work on numerical endings has found that because of our tendency to process from left to right, numbers ending with 9 (e.g., 299) are perceived to be significantly lower than almost-equivalent numbers ending in 0 (e.g., 300)—a finding of obvious relevance in the pricing context (Schindler and Wiman 1989). Another line of inquiry has shown that numbers that are processed more fluently, whether because of prior exposure or incidental priming, induce greater liking for the associated products (King and Janiszewski 2011). The theoretical thread tying these findings together is that they all identify differences arising from how certain numbers are processed differently from others—whether this has to do with the relative effort of processing precise versus rounded numbers (Thomas et al. 2010), the greater salience of digits on the left versus right of a number (Schindler and Wiman 1989), or the greater ease of processing previously encountered numbers (King and Janiszewski 2011).

The current research uses a different theoretical lens to argue that numbers can lead to a much broader (and somewhat less intuitive) type of inference than previously suspected. Rather than drawing on processing-based differences, our approach is based on a basic premise underlying several different lines of research: namely, that we often seek to understand target concepts by relating them to source concepts about which we possess relatively rich, accessible knowledge structures. This includes work on anthropomorphism (in which target concepts such as products, are related to and understood in terms of humanlike traits and emotions; Aggarwal and McGill 2007; Epley et al. 2008) and metaphorical cognition, in which abstract concepts, such as "importance," are associated with and understood in terms of concrete realities such as physical weight (Zhang and Li 2012).

Aligned with this view, recent research on numerical cognition has argued that because gender is such a pervasive part of social cognition, gender-related schemas are particularly rich and accessible and that people are therefore likely to ascribe gender even to numerical representations (Wilkie and Bodenhausen 2012) based on metaphorical associations. In particular, these authors suggested that the concept of "evenness" shares features that are associated with stereotypical feminine attributes such as communion; conversely, the indivisibility of odd numbers is consistent with the themes of autonomy and power that are central to masculine stereotypes such as agency. Therefore, the target concepts of "odd numbers" and "even numbers" should more likely be associated with masculinity and femininity, respectively. In support, their studies revealed that when a foreign name or baby picture was paired with an odd (even) number it was more likely to be rated as masculine (feminine; see also Yan 2016 for a similar gender-based distinction between precise and round numbers).

This research on gendered numbers provides some grounds for our supposition that numbers might be assigned human-like personality dimensions. In particular, drawing on the general premise that target concepts about which we possess relatively impoverished knowledge structures (such as numbers) are often understood in terms of more richly represented source concepts—as long as a metaphorical association can be derived between the two—we argue that indivisible numbers are likely to be viewed as being lonelier compared to divisible numbers.

The Loneliness of Numbers: Role of Divisibility

There are two related reasons as to why an association is likely to exist between the concept of indivisibility and that of loneliness, both to do with the theoretical view of loneliness. Conceptualized as a feeling of isolation or lack of companionship, loneliness involves a lack of connectedness with other beings (Cacioppo, Fowler, and Christakis 2009; Cacioppo and Hawkley 2009). Inferences regarding loneliness also, therefore, stem from individuals being perceived to lack the relevant properties of connectedness or communality with others, including intimate partners, friends, family, or groups (Hawkley, Browne, and Cacioppo 2005).

This view of loneliness suggests that a number will be perceived to be lonelier if it is not connected with other numbers. Divisibility, we suggest, is a key determinant of such connectedness. Just as a person's human connectors can be viewed as the different ways of reaching that person, so a number's divisors can be viewed as the ways of "reaching" that number. Thus, a divisible number such as 36 can be reached through several different connectors (2×18, 3×12, 4×9, and 6×6), as compared to an indivisible number, such as 37. The latter should accordingly be viewed as lonelier than the former.

The second, related, metaphorical reason for a correspondence between numerical indivisibility and loneliness stems from the view of the self as comprising other humans to whom one feels connected (Ahuvia 2005). Thus, a person's self-identity is likely to include their romantic partners, children, friends, etc. (Tian and Belk 2005). In this view, therefore, the people to whom one is connected are "components" of the self—and the more such components, the less lonely one is likely to feel. In the realm of numbers, this reasoning once again leads us to the notion of divisibility. The divisors of a number can be viewed as being its components—and the more such components, the more connected and less lonely the number will be seen as being.

Two important aspects of our theorizing are worth clarifying at this point. First, we argue that inferences about the "connectedness" of numbers are based on the property of divisibility (i.e., the multiplication/division functions) rather than on additivity (addition/subtraction). The reason this is likely is that every number, without exception, can be computed by adding and subtracting other numbers; and in each case, this can be done in a host of ways (e.g., $37 = 20 + 17$, $12 + 25$, $3 + 34$, $29 + 8$). Thus, the addition/subtraction relationship cannot produce discriminatory inferences regarding connectivity: every number, according to that relationship, has infinite connections. The divisibility function, in contrast, does carry discriminatory power: some numbers have more divisors than others. Following the simple principle that discriminatory inputs, by virtue of their greater diagnosticity, are more likely to be used in inference-making (Berger 1992; Feldman and Lynch 1988; Miniard et al. 1991), we argue that inferences regarding number connectivity are based more on divisibility than on additivity (see web appendix D for empirical support). This perspective thus yields the prediction that indivisible (vs. divisible) numbers will be perceived to be less (more) connected, and therefore lonelier (less lonely).

Second, although mathematical divisibility is an objective property (a number is either divisible or it is not), our prediction has to do with subjective—or perceived—divisibility. Of course, whether a number is actually divisible typically has an influence on whether it is perceived to be divisible (e.g., most people will accurately perceive that 7 is not divisible whereas 9 is). Most of the studies reported here thus manipulate perceived divisibility by varying objective divisibility—i.e., comparing prime versus composite numbers; but people may not always accurately gauge whether a number is actually divisible—especially in the context of larger numbers, for which divisors may not come to mind. Our theorizing predicts, however, that because the route to loneliness lies through perceived connectedness, it is also *perceived* divisibility that matters—a premise for which we find support. Thus, numbers wrongly deemed to be indivisible (even if they are actually divisible; e.g., 301) are perceived to be relatively lonely compared to numbers deemed divisible (e.g., 305; see study 6). Throughout, therefore, although we often use the simple term "divisibility" for conciseness, the term refers to *perceived* rather than *objective* divisibility.

Finally, although we propose that numerical divisibility influences loneliness judgments via perceptions of connectedness, an alternative hypothesis would argue that this effect is driven by processing fluency (cf. King and Janiszewski 2011). It seems possible that divisible numbers are easier to process and comprehend than indivisible numbers; furthermore, it may be that perceptions of a number's loneliness decrease as such processing fluency increases. As described in detail subsequently, we assessed this possibility in a number of ways throughout our studies. Results across the studies supported a connectedness account rather than a fluency account.

Consumer Reactions to Numerical Divisibility: The Influence of Loneliness

While one major goal of this research is to show that numbers that are perceived to be indivisible are associated with greater loneliness than divisible ones, the second major goal is to investigate the implications of such an association for consumer evaluations and preferences. If indeed indivisible numbers are associated with loneliness, it seems logical that consumers' own current states of loneliness will affect their reactions to products that are associated with divisible versus indivisible numbers. Loneliness—the lack of social connection—is typically viewed as an aversive state, since connectedness is deemed a fundamental need for human beings (Maner et al. 2007), stemming in part from evolutionary reasons to do with survival and safety (Baumeister and Leary 1995). It makes sense, therefore, that people will want to escape from states of loneliness. Such a tendency should produce compensatory behavior, in which lonely people seek to alleviate their loneliness by trying to establish a heightened sense of connection rather than by accepting or reinforcing their sense of solitude.

Indeed, extant research finds evidence supportive of such compensatory behavior (Maner et al. 2007; Mead et al. 2011). In the consumer domain, for instance, a recent set of studies found that participants for whom a sense of loneliness was temporarily made salient—for example, by asking them to imagine a future in which they were likely to be lonely and friendless—strategically engaged in consumption activities meant to heighten social connection (Mead et al. 2011). Such activities ranged from an increased tendency to purchase products indicative of group affiliation (e.g., university wristbands), to being willing to consume unappetizing foods simply because a peer favors that food, etc. Even more relevant to the current context, socially excluded consumers display an increased preference for a product described as possessing a "warm" personality (and thus more likely to satisfy the need for connectedness) than a "cold" personality (Chen, Wan, and Levy 2017).

In our context, such a compensatory tendency would argue that individuals who wish to escape an aversive state of loneliness should actually exhibit increased preference for products that are imbued with a heightened sense of connectedness rather than aloneness. We predict, therefore, that people who are feeling temporarily lonely (vs. those who are not) will display a heightened relative preference for marketer offerings—for example, products and prices—associated with divisible versus indivisible numbers.

It is worth noting that both our major predictions refer to a relative comparison between divisible and indivisible numbers. Thus, the first prediction—dealing with the divisibility-loneliness association—argues that holding other factors constant, numbers perceived to be indivisible will be deemed lonelier than those perceived to be divisible (equally, therefore, this prediction can be framed in terms of divisible numbers being deemed *less* lonely than indivisible ones). Similarly, the second prediction—dealing with numerical preferences—argues that lonely consumers will display a relatively *greater* preference for targets associated with divisible versus indivisible numbers; not that they will display an absolute level of liking for the former.

The first three studies reported here (studies 1–3) examine the first prediction, while the next four studies (studies 4–7) examine the second prediction.

STUDY 1: IMPLICIT PERCEPTIONS OF LONELINESS

Study 1 used an Implicit Association Test (IAT) to examine whether indivisible versus divisible numbers automatically evoke the perception of loneliness. The IAT has been widely employed to assess the strength of a person's automatic association between mental representations of concept-pairs (Greenwald, McGhee, and Schwartz 1998; Greenwald, Nosek, and Banaji 2003)—for example, "unhealthy = tasty" (Raghunathan, Naylor, and Hoyer 2006) and "emotional/rational = up/down" (Cian et al. 2015).

Method

The IAT was conducted online using the web edition of Inquisit (version 4; Millisecond Software 2013). A total of 100 participants (62 females, average age = 35.42 years) recruited from Amazon's MTurk were told that the purpose of the study was to understand individuals' categorization processes. On this pretense, they were asked to assign a series of stimuli into one of the two categories as fast as possible. For each trial, the target stimulus appeared in the center of the screen and the two category labels appeared at the two upper corners. Participants responded by pressing either the key "E" or the key "I," for the category on the left versus right upper corner, respectively. In all, each participant completed 180 trials that were divided into seven blocks (see table 1). In block 1, participants

TABLE 1

STIMULI, PROCEDURE, AND RESULTS OF STUDY 1

A. Stimuli

Word list		Number list	
Lonely	Accompanied	Indivisible	Divisible
Alone	Connected	3	8
Friendless	Relationship	17	16
Isolated	Friends	31	32
Single	Loved	23	27
Solitary	Sociable	47	49
Empty	Companion	29	24
Unattended	Affiliated	37	36
		53	21

B. Procedure and results

Block	Function	Trials	Category labels	Mean	SD
1	Practice	20	Lonely versus accompanied	1,423	1,916
2	Practice	20	Indivisible versus divisible	905	762
3	Practice	20	Lonely/indivisible versus accompanied/divisible	1,303	841
4	Test	40	Lonely/indivisible versus accompanied/divisible	1,109	716
5	Practice	20	Accompanied versus lonely	938	556
6	Practice	20	Accompanied/indivisible versus lonely/divisible	1,360	1,229
7	Test	40	Accompanied/indivisible versus lonely/divisible	1,146	873

categorized a series of words into either “lonely related” (e.g., isolated, solitary) or “companion-related” (e.g., connected, companion). Block 2 required participants to classify a series of numbers as either “indivisible” (e.g., 17, 31) or “divisible” (e.g., 16, 27). The most critical blocks were blocks 4 and 7. In both of these, participants saw a series of 40 stimuli (each of which was either a word or a number) one at a time and were asked to determine which of the two disjunctive categories each such stimulus belonged to. The key difference between the two blocks lay in how these disjunctive categories were formed. In block 4, the two categories were “Lonely or Indivisible” and “Accompanied or Divisible,” while in block 7, the two category labels were “Accompanied or Indivisible” and “Lonely or Divisible.” If numerical indivisibility is indeed more strongly associated with loneliness relative to divisibility, then participants should respond faster when the two categories are congruent (i.e., block 4) than when they are incongruent (i.e., block 7). Before responding to each of these critical blocks, participants completed several practice trials to get familiar with the procedures.

Results

Response Latencies. The average response latency across all the blocks was 1,160 ms (SD = 1,031). Participants' response latency in each block is summarized in table 1. Consistent with our hypothesis, participants' classification was faster in block 4 when the two category labels were grouped in a congruent manner than in block 7 where the two labels were incongruent. Specifically, the mean reaction time was 1,109 ms (SD = 716) when indivisible numbers were paired with loneliness-related words, compared with 1,146 ms (SD = 873) when indivisible numbers were paired with companion-related words.

The D Score. Finally, to examine the significance and magnitude of the above difference, we calculated the *D* score for each participant following the scoring algorithm proposed by Greenwald et al. (2003). The *D* score can range between −2 and 2, with a positive number indicating a positive association. The *D* scores in our study ranged from −.63 to 1.51, with the mean ($M = 0.61$, SD = 0.44) being significantly greater than zero ($t(99) = 13.73$, $p < .001$, $d = 1.39$). The effect size of this difference is close to “strong” (threshold for strong association = 0.65; threshold for moderate association = 0.35). These results provide good evidence that individuals do perceive indivisible numbers, relative to divisible numbers, as being more strongly associated with loneliness. By the same token, divisible numbers are more associated with a sense of connectedness than indivisible numbers.

It is noteworthy that evidence for this association was obtained using an unobtrusive, implicit measure (the IAT). Studies 2 and 3 provide further evidence for this association using explicit measures—i.e., asking participants to rate numbers on perceived loneliness. Had only the latter type of assessment measure been used, the possibility could not be ruled out that people think of numbers as being lonely or not lonely only when explicitly required to respond to a loneliness scale. The IAT results obtained in study 1 provide reassuring evidence that the association does indeed exist on its own, independent of an external scale being provided (as described later, consumer reactions to products tagged with indivisible vs. divisible numbers also provide evidence consistent with the existence of the indivisibility-loneliness association).

Although this study established an association between numerical indivisibility and loneliness, it did not explore whether particular numbers are deemed lonelier than others. Study 2 examined this issue by obtaining explicit loneliness ratings of a series of numbers. In addition, study 2 examined whether the observed loneliness effect is driven by differences in perceived divisibility, as we posit, or by other dimensions such as perceived fluency.

STUDY 2: LONELINESS RATINGS FOR THE FIRST 100 NUMBERS

Study 2 assessed our hypothesis by asking participants to rate the loneliness of each of the first 100 numbers using a 7-point scale. This method allowed us to examine the degree to which numbers differ in terms of their perceived

TABLE 2

STUDY 2: LONELINESS RATINGS FOR FIRST 100 NUMBERS

Number	*M*	SD	Number	*M*	SD	Number	*M*	SD	Number	*M*	SD
1	5.61	2.26	26	3.39	1.40	51	4.17	1.24	76	3.42	1.59
2	4.13	2.31	27	3.77	1.37	52	3.71	1.25	77	3.59	1.64
3	4.66	2.07	28	3.58	1.34	53	3.81	1.30	78	3.63	1.60
4	4.17	2.19	29	3.98	1.42	54	3.66	1.31	79	4.04	1.66
5	4.60	2.10	30	3.64	1.28	55	3.55	1.31	80	3.40	1.78
6	4.45	2.04	31	4.13	1.43	56	3.55	1.26	81	3.84	1.70
7	4.21	2.05	32	3.44	1.29	57	4.05	1.40	82	3.34	1.70
8	4.05	2.03	33	3.63	1.49	58	3.76	1.25	83	3.97	1.76
9	4.43	1.98	34	3.57	1.20	59	3.98	1.40	84	3.48	1.70
10	3.66	1.73	35	3.92	1.28	60	3.55	1.40	85	3.57	1.77
11	4.06	1.80	36	3.52	1.21	61	4.00	1.43	86	3.32	1.73
12	3.63	1.70	37	4.03	1.41	62	3.79	1.35	87	3.88	1.81
13	4.21	1.82	38	3.67	1.21	63	3.96	1.37	88	3.07	1.82
14	3.91	1.59	39	4.07	1.35	64	3.45	1.27	89	3.66	1.80
15	4.10	1.48	40	3.50	1.23	65	3.79	1.33	90	3.42	2.07
16	3.50	1.61	41	3.99	1.26	66	3.56	1.38	91	3.78	2.07
17	4.04	1.61	42	3.41	1.33	67	3.93	1.33	92	3.45	1.99
18	3.57	1.60	43	3.85	1.22	68	3.61	1.40	93	3.86	2.02
19	4.19	1.56	44	3.38	1.30	69	3.00	1.63	94	3.48	1.90
20	3.61	1.56	45	3.71	1.21	70	3.61	1.52	95	3.65	2.08
21	3.50	1.51	46	3.48	1.29	71	3.98	1.56	96	3.49	2.12
22	3.34	1.55	47	3.92	1.23	72	3.57	1.56	97	3.65	2.09
23	3.87	1.48	48	3.57	1.28	73	4.08	1.60	98	3.29	2.05
24	3.40	1.48	49	3.82	1.32	74	3.59	1.55	99	3.39	2.29
25	3.46	1.44	50	3.48	1.30	75	3.64	1.53	100	2.89	2.33

loneliness, and whether such differences (if any) are in accordance with our hypothesis. Second, by measuring the loneliness scores for 100 numbers, which vary along several different dimensions other than divisibility (e.g., parity, fluency, magnitude), we are able to separate our hypothesis from these competing factors.

Method

Participants were 119 MTurkers (50 females; average age = 30.55 years). Because the goal of the study was to assess the extent to which different numbers differ in terms of being associated with a human-like trait (that of loneliness), participants were first asked to think of the numbers as being human and to then rate how lonely they perceived each number to be, on a 7-point scale (1/7 = *not at all lonely*/*very lonely*). Each participant rated the first 100 numbers, which were presented in a randomized order. Finally, we collected participants' age and gender, since these factors might influence loneliness perceptions (Schmitt and Kurdek 1985).

Results and Discussion

Hypotheses Testing. Participants' average loneliness ratings for each number are summarized in table 2. We first converted each participant's ratings of the hundred numbers into 100 observations and created several variables according to the characteristics of numbers. The data were analyzed as panel data, allowing unobservable individual differences to be incorporated in the analysis. Participants' ratings were regressed on divisibility (divisible number = 0, indivisible number = 1), fluency (fluent = 0, disfluent = 1), parity (even number = 0, odd number = 1), magnitude, age, and gender (female = 0, male = 1). The coding for fluency followed prior literature (King and Janiszewski 2011): a number is coded as fluent if it appears on the addition table (1 + 1 to 10 + 10; examples include 3, 6, 13, 18, etc.) or multiplication table (2 × 2 to 10 × 10; examples include: 4, 28, 35, 56, etc.). All other numbers are coded as disfluent (e.g., 29, 34, 38, 46). Note that this coding treats fluency as an objective, externally assessed variable (King and Janiszewski 2011); later studies also examine the role of subjective fluency.

The regression analysis yielded several significant effects. Most importantly, in support of our theorizing, we found a significant positive effect of divisibility on loneliness ratings (β = .1604, SE = 0.0415; $z = 3.87$, $p <$ .0001), implying that indivisible numbers are perceived as lonelier than divisible ones. Several other effects also reached significance. First, a negative effect of magnitude was obtained, implying that participants judged larger numbers to be less lonely than small ones ($\beta = -.0055$, SE = 0.0006; $z = -9.30$, $p < .0001$). A possible reason (albeit speculative) is that larger numbers are likely to be more associated with crowdedness. Second, a significant effect of parity ($\beta = .3028$, SE = 0.0339; $z = 8.94$, $p < .0001$) suggests that compared to even numbers, odd numbers are rated lonelier. Third, age also had a positive impact (β = .0104, SE = 0.0048; z = 2.17, p = .03), with older people perceiving greater loneliness in general. We did not observe any significant effect of fluency (p > .19) and gender (p > .50).

Discussion. Although these other findings were interesting, the key result—a significant effect of divisibility—offers reassuring convergence with study 1, attesting again to the greater perceived loneliness of indivisible versus divisible numbers. Importantly, this effect held even after controlling for other relevant numerical differences. In particular, the results of this study provide initial evidence that the difference in loneliness perceptions is not due to differences in processing fluency.

It also merits mention that, while divisibility was coded as a dichotomous variable in our analysis, it can be thought of as a continuous variable—even within divisible numbers, some numbers have more divisors than other (e.g., 36 vs. 39). Our theorizing suggests that a number will be perceived as more connected (thus less lonely) if it is perceived to have many (vs. few) divisors. To test this intuition, which would offer triangulating support for our basic logic, we regressed the loneliness ratings of the first 100 numbers on each number's number of divisors, parity, and objective fluency. Consistent with our logic, this analysis revealed that after controlling other factors, the number of divisors does have a significantly negative impact on loneliness perceptions (β = −.0592, SE = 0.0076, p < .001). Furthermore, while the dichotomous divisibility remains significant (β = .1524, SE = 0.0454, p = .001), the indirect effect of divisibility on loneliness ratings through number of divisors is significant with 95% CI excluding zero [0.0661, 0.1342]. Combined, these results provide additional support to our conceptualization.

STUDY 3: THE MEDIATING ROLE OF CONNECTEDNESS

Study 3 tested our basic prediction by examining the perceived loneliness of two numbers, one of which is divisible (74) and the other not (47).[2] To provide evidence for the proposed mechanism, this study also measured the extent to which the focal number is perceived to be "connected" to other numbers; details of the measure are provided later.

The specific numbers were chosen for two reasons. First, they consist of the same two digits, decreasing the influence of digit-related confounding factors. Furthermore, the choice of these two numbers helped with another goal of the study: namely, to examine the fluency account of perceived loneliness by varying divisibility while keeping fluency constant. According to the King and Janiszewski's (2011) objective classification of numerical fluency, both of these numbers would be categorized as low fluency (since they do not fall on either the addition charts of 1 + 1 through 10 + 10 or the multiplication charts of 2 × 2 through 10 × 10). Of importance, a pretest with 40 participants (22 females; average age = 35.43 years; from the same pool as the main study) confirmed that these two numbers were equivalent in terms of subjectively experienced processing fluency as well. The two items measuring processing fluency were adopted from prior literature (Lee and Aaker 2004). Each participant rated one of the two numbers in terms of its ease of processing (1 = *difficult to process*, 7 = *easy to process*) and comprehensibility (1 = *difficult to understand*, 7 = *easy to understand*). An analysis of the average subjective fluency score (r = .62) revealed no significant difference (F < 1, p = .58), with 47 (M = 5.68, SD = 0.69) and 74 (M = 5.52, SD = 1.07) being rated similarly fluent. As confirmation, the main study also measured subjective fluency.

Main Study

One hundred MTurk participants (52 females; mean age = 35.40 years) were randomly assigned to either the divisible (74) or indivisible (47) condition. As in study 2, participants imagined the focal number being a person and rated how lonely they perceived the number to be, on a 7-point scale (1/7 = *not at all lonely/very lonely*). Next, to measure connectedness, participants were asked to indicate the extent to which they agreed with two statements: (1) this number is well connected to other numbers and (2) other numbers came to my mind when I saw this number (1 = *strongly disagree*, 7 = *strongly agree*; r = .51). Participants then responded to the two items measuring processing fluency (the same as those used in the fluency pretest).

Results and Discussion

Loneliness. Replicating study 2 results, we found that participants judged the indivisible number 47 (M = 3.92, SD = 1.60) to be lonelier than the divisible number 74 (M = 3.23, SD = 1.48; $F(1, 98)$ = 4.98, p = .03).

Connectedness. We have argued that divisible numbers are perceived to be less lonely than indivisible ones because the former group is perceived to be more connected to other numbers (via divisibility connections) than the latter. Supporting our reasoning, an ANOVA on perceived connectedness revealed that participants indeed perceived

2 In this as well as most of the subsequent studies (with the exception of study 6), perceived divisibility of the focal numbers was manipulated via objective divisibility—that is, one number was actually divisible and the other was not. In all cases, pretesting was conducted to ensure that the objectively divisible number was indeed perceived as being more divisible than the objectively indivisible number; full details of these pretests are available with the authors.

74 ($M = 4.32$, SD $= 1.48$) as being more “connected” than 47 ($M = 3.69$, SD $= 1.43$; $F(1, 98) = 4.69$, $p = .03$).

Fluency. The two items measuring fluency were averaged to form a single processing fluency index ($r = .87$). Consistent with pretest results, a one-way ANOVA on this index revealed no significant difference between two numbers ($M_{47} = 5.70$, SD $= 1.27$ vs. $M_{74} = 5.84$, SD $= 1.15$; $F(1, 98) < 1$, $p > .50$).

Mediation Analysis. Finally, we assessed the mediation model using the PROCESS macro. We have already shown that the two focal numbers differ significantly in terms of perceived loneliness and connectedness. When both the independent variable (the number manipulation) and the mediator (connectedness) were used to predict loneliness, the effect of connectedness was significant ($t(97) = 8.43$, $p < .001$) whereas the effect of the number manipulation reduced to insignificance ($t(97) = 1.05$, $p = .29$). Bootstrapping results involving generating 5,000 resamples indicate that the indirect effect is significant with 95% CI excluding zero [−0.0313, −0.0023].

Discussion. By measuring connectedness and documenting its mediating role in the influence of numerical divisibility on perceived loneliness, study 3 provides important evidence in support of our theorizing. In addition, this study further argues against the alternate account of processing fluency, by showing that the indivisibility–loneliness relationship obtains even when fluency is held equivalent across conditions.

We conducted another study, described briefly here for space reasons (please see web appendix D for full details), that provided additional support for our thesis that indivisible numbers are perceived to be lonelier than divisible ones, and also delved deeper into this perception in two directions. First, to show that it is perceived rather than actual number divisibility that drives loneliness beliefs, the target number (51) in this study was kept the same across conditions; however, divisibility perceptions were heightened by making the divisors more salient in one condition, by first requiring participants to complete a set of multiplication/division problems using the two divisors in question (3 and 17). They were later asked to judge the connectedness of the target number, and the perceived loneliness of a basketball player wearing the jersey number “51.” As predicted, connectedness perceptions of the target number were enhanced, and the player’s loneliness perceptions correspondingly lowered, in this “divisibility-salient” condition, as compared to a control condition in which the divisors were not as salient. Second, the study also obtained evidence that a number’s connectedness derives from its divisibility and not its additivity. Thus, an “additivity-salient” condition that required participants to complete a set of addition and subtraction problems (all of which centered around the target number, 51) affected neither connectedness nor loneliness perceptions as compared to the control—unlike the “divisibility-salient” condition.

STUDY 4: PRICING IMPLICATION

Building on these findings, the next four studies (studies 4–7) focused on the second overall goal of this research: exploring how the greater loneliness of indivisible versus divisible numbers affects consumers’ preferences. In particular, these studies test a compensatory process arguing that participants currently feeling lonely will display an increased relative preference for marketer offerings associated with divisible versus indivisible numbers. Study 4 provided the first demonstration of this divisibility-preference effect. We examined how varying the price of a set dinner from a lower-but-indivisible price point ($19) to a higher-but-divisible price point ($21) affects participants liking for the offered price. We predict that lonely consumers’ preference for divisible versus indivisible numbers should act as a countervailing force to the cost implications of price, such that the usual preference for a lower price (in this case, a greater liking for $19 versus $21) will be less marked for lonely versus non-lonely participants.[3]

Note that not only is price the marketing dimension perhaps most directly related to numerical information processing, the pricing context also allows for a strong test of our hypothesis. Unlike when numbers are simply affixed to products or attributes without any evaluative connotation being attached to these numbers—any price point number has a particular evaluative meaning attached to it: it signifies the cost of purchase. Furthermore, this meaning is the same across loneliness conditions—for example, a price (whether it is $19 or $21) for a set dinner signifies the same cost whether one is feeling lonely or not. In this context, therefore, if we are able to show that lonely people differ from non-lonely people in their reactions to prices, it would show that numerical divisibility/indivisibility carries meaningful implications.

Another objective of this study was to provide support for the mechanism underlying this prediction. Specifically, this study seeks to show that the preference shift for lonely consumers is driven by greater connectedness perceptions for divisible versus indivisible numbers.

Method

Participants and Design. MTurk participants ($N = 225$; 150 females, average age $= 36.42$ years) were randomly

3 Of course, such a pattern is unlikely to obtain if the price differential were so large that the cost implications of price completely overwhelm any countervailing force arising from lonely people’s relative preference for divisibility (e.g., if the two price points under comparison were $19 and $210, it is likely that a similarly large preference for the lower price would obtain across conditions).

assigned to one of the four conditions in a 2 (lonely vs. accompanied) × 2 (price: \$19 vs. \$21) between-subjects design.

Procedure. First, participants in the lonely (accompanied) condition were asked to imagine going to dinner alone (with some friends) on a Friday night. They were asked to spend a few moments to mentally picture the scenario and describe how they would feel. After this writing task, participants responded to the manipulation check: how lonely would you feel in that situation (1 = *not lonely at all*, 7 = *very lonely*)? Next, all participants were told that the restaurant was offering a special weekend deal on the set dinner. Depending on the condition, the dinner was priced at either \$19 (indivisible) or \$21 (divisible). All other information was the same across conditions (web appendix A). After reviewing the menu, participants responded to three items measuring their liking of the deal: (1) how much do you like this deal (1 = *dislike a great deal*, 7 = *like a great deal*), (2) your impression about this deal is (1/7 = *extremely negative/ positive*), and (3) how likely would you order this set dinner (1 = *extremely unlikely/likely*). These items were adapted from past research (Cai, Bagchi, and Gauri 2016; Janiszewski and Lichtenstein 1999). The average of the items formed a Deal Liking Index (α = .93). Finally, participants completed a numerical perception study in which we measured connectedness and fluency of the focal number (19 or 21). Connectedness was measured via participants' agreement with two statements: (1) 19/21 is well connected to other numbers and (2) other numbers came to my mind when I saw 19/21 (1 = *strongly disagree*, 7 = *strongly agree*). To measure fluency, the focal number was rated on the ease of processing (1 = *difficult/easy to process*) and comprehensibility (1/7 = *difficult/easy to understand*).

Results and Discussion

Manipulation Check. Three participants who did not complete the loneliness writing task were excluded from the analyses ($N = 222$). As anticipated, participants in the alone condition ($M = 4.05$, SD = 2.15) reported greater loneliness as compared to their counterparts in the accompanied condition ($M = 1.88$, SD = 1.42; $F(1, 220) = 78.36$, $p < .001$, $d = 1.19$).

Deal Liking. Under default conditions, one would expect consumers to display a greater liking for the \$19 deal versus the \$21 deal, given the lower cost of the former (it is also worth noting that consumers tend to rate prices ended with "9" as a good deal—Thomas and Morwitz 2009—which again would increase preference for the \$19 deal vs. the \$21 deal). We predict, however, that this difference should attenuate for lonely consumers. Accordingly, we anticipated an interaction effect of situational loneliness and price point on deal liking.

In support, a 2 (lonely vs. accompanied) × 2 (price: \$19 vs. \$21) ANOVA on the deal liking index revealed a significant two-way interaction ($F(1, 218) = 6.07$, $p = .015$, $d = .33$; all other effects: $ps > .20$). Planned contrasts then found evidence for the default expectation in the accompanied condition: participants indicated a clear preference for \$19 ($M = 4.79$, SD = 1.52) than for \$21 ($M = 3.97$, SD = 1.89; $t(218) = 2.51$, $p = .01$, $d = .48$). However, and also consistent with predictions, the advantage of \$19 ($M = 4.24$, SD = 1.80) over \$21 ($M = 4.55$, SD = 1.57; $t(218) < 1$, $p > .30$) disappeared in the alone condition.

Connectedness. The two items measuring number connectedness were averaged ($r = .46$) and submitted to the two-way ANOVA. Only the expected main effect of the number manipulation was obtained ($F(1, 218) = 12.51$, $p < .001$, $d = .47$; all other effects: p's $> .30$), with number 21 ($M = 4.12$, SD = 1.34) deemed more connected than number 19 ($M = 3.54$, SD = 1.11).

Processing Fluency. A two-way ANOVA on the average of the two fluency items ($r = .92$) revealed no significant effect ($ps > .25$). In particular, although 21 ($M = 5.86$, SD = 1.00) was perceived as more fluent than 19 ($M = 5.67$, SD = 1.31), the difference was not significant ($F(1, 218) = 1.28$, $p = .25$). Thus, the effect of loneliness on deal liking is unlikely to be driven by processing fluency.

Moderated Mediation Analyses. Another objective of study 4 was to illuminate the process underlying consumer preferences for targets (in this case, prices) associated with divisible versus indivisible numbers. We have argued that lonely consumers' enhanced preference for divisible versus indivisible numbers—as manifested in this study by an attenuation of the default preference for the lower price versus the higher price—is attributable to the greater perceived connectedness of divisible numbers. To test this argument, we conducted a moderated mediation analysis using the PROCESS macro (model 15). In this model, the effect of number type on deal liking is mediated by connectedness perception and the path from connectedness to deal liking (i.e., path b) is moderated by loneliness. When the interaction of the loneliness manipulation with connectedness perceptions was included in the model, this interaction had a significant impact ($t(216) = 2.69$, $p < .01$), while the interaction of loneliness and number type remained significant ($t(216) = 2.18$, $p = .03$), supporting partial mediation. Reassuringly, the overall moderated mediation effect was significant (95% CI excludes zero: [−0.32, −0.04]). Finally, and also supportive of our theorizing, analyzing the conditional effects shows that the indirect effect was significant in the alone condition (95% CI excludes zero: [0.08, 0.33]). That is, the relative increase in lonely (vs. accompanied) participants' preference for the \$21 deal versus the \$19 deal was mediated by the perception that 21 is more connected than 19. Also as expected, this indirect effect was not significant in the accompanied condition (95% CI includes zero: [−0.04, 0.17]).

Discussion. Study 4 provides initial evidence for our compensatory perspective arguing that consumers feeling temporarily lonely will display a heightened preference for divisible versus indivisible numbers. In support, the difference in deal liking for a lower-indivisible price point versus a higher-divisible price point was attenuated for lonely participants. In addition, this study offered evidence for the process underlying consumer preferences by documenting the intervening role of numerical connectedness, while ruling out the alternative account of processing fluency. That is, the change in the preference of lonely participants (vs. accompanied participants) for the divisible versus indivisible price was based on the perceived connectedness of the two price points and not their perceived fluency.

STUDY 5: TESTING THE EFFECT USING AN INCENTIVE-COMPATIBLE DESIGN

Study 5 aims to generalize study 4's results along several directions. First, to extend the results to another product category, this study examined reactions to for t-shirts associated with different numbers. Second, study 5 used a different induction of situational loneliness, one that has been used more often in the literature: making participants feel socially excluded (Mead et al. 2011; Zhong and Leonardelli 2008). Note that although social exclusion is not the same construct as loneliness (e.g., the former has connotations of rejection by the group, which is not a necessary part of the latter), it is one of the antecedents of situational loneliness (Epley et al. 2008; Zhong and Leonardelli 2008). Consistent with this view, researchers have used state loneliness as a manipulation check for the social exclusion induction (Epley et al. 2008). Third, and of most importance, in study 5, we elicited that the minimum price participants were willing to pay (WTP) for the target t-shirt, using an incentive-compatible paradigm (Wertenbroch and Skiera 2002) that allowed for the assessment of a consequential dependent variable.

Method

Two hundred five undergraduate students (138 females, average age = 21.03 years) from a major university in Hong Kong took part in this 2 (exclusion vs. inclusion) × 2 (numerical divisibility: 27 vs. 29) online study in return for 50 HKD. Following past research, participants in the exclusion condition were asked to write "an essay about a time when you experienced rejection or exclusion by others. Think of a time when you felt that others did not want to be in your company and when you did not feel a strong sense of belongingness with another person or group." In the inclusion condition, in contrast, participants were asked to write about an instance in which they experienced social acceptance from others (Maner et al. 2007; Mead et al. 2011). Participants then indicated their agreement with following statements (Epley et al. 2008): (1) I lack companionship; (2) I feel left out; and (3) I feel isolated from others, using 7-point scales (1 = *strongly disagree*; 7 = *strongly agree*). These items were selected from the UCLA loneliness scale and have been validated by past work (Hughes et al. 2004). Higher scores on the index formed by averaging these items (α = .85) indicated greater loneliness.

Before the end of the study, all participants read the following message:

> *Thank you again for your participation in this study. Before the study session concludes, we want to request a favor. Last month we ordered a batch of T-shirts for a student event. However, the event was canceled due to the outbreak of coronavirus. Because all the T-shirts were customized, they are not returnable. So we are now selling them online to minimize our financial loss. At the same time, we are using this as an opportunity to better understand how customers decide on what is an acceptable price for a product. So we are not setting a fixed price. Instead, the selling price will be randomly determined by a random-number generator (let's call this price X). Before we draw the price, you will be asked to indicate the maximum amount that you are willing to pay (Y) for this T-shirt. If your maximum acceptable price is lower than the randomly drawn price ($Y < X$), you cannot buy the T-shirt and will receive 50 HKD as your compensation as we advertised. If your maximum acceptable price is equal to or higher than the randomly drawn price ($Y \geq X$), you will receive the T-shirt and a compensation of ($50 - X$) HKD.*

After reading the instructions, all participants indicated the maximum amount that they were WTP for this t-shirt by choosing a value between 5 HKD and 50 HKD (presented in $5 intervals). Depending on the condition, the t-shirt featured either a divisible number (27) or an indivisible number (29; web appendix B). Note that the dependent variable (DV) was a consequential one, since participants believed that they would receive a correspondingly lower cash payment if their indicated WTP was higher than the randomly drawn price. At the end of the study, every participant was actually given the initially promised 50 HKD.

Results

Data Screening. Some participants spent an unusually long time completing this online study. While the median completion time was 724 seconds (about 12 minutes), quite a few participants spent more than an hour. To screen these outliers, we followed recent consumer research (Duke and Amir 2019; Mourey, Olson, and Yoon 2017) that uses a median absolute deviation (MAD) approach (Leys et al. 2013) to outlier detection. The MAD for completion time in our study was 1,442 seconds. Screening outliers whose completion time was greater than median + 2 times MAD (i.e., 1,442 seconds; cf. Mourey et al. 2017) led to the exclusion of 30 observations, leaving a sample size of 175 (116 females, mean age = 21.01 years).[4] The mean completion time for the final sample and the outlier sample was 716 and 8,924 seconds, respectively. Outliers came from each of the four study conditions, with 6, 10, 7, and 7 outliers, respectively, in the 27-Exclusion, 27-Inclusion, 29-Exclusion, and 29-Inclusion conditions. Finally, note that exactly the same pattern of results as reported below was obtained if we instead used the slightly less stringent filter of excluding outliers whose completion time was greater than median + 2.5 MAD (Duke and Amir 2019)—both the two-way interaction and the key contrast reported below remained significant at $p < .05$ (full results available with authors).

Manipulation Check. Those in the exclusion condition ($M = 3.76$, SD = 1.32) indicated greater loneliness than those in the inclusion condition ($M = 3.39$, SD = 1.15; $F(1, 173) = 3.81$, $p = .05$; $d = 0.30$), showing that our manipulation was successful.

Hypothesis Testing. Since participants' WTP was skewed (skewness = 1.20), we submitted the log-transformed WTP to a 2 (exclusion vs. inclusion) × 2 (27 vs. 29) ANOVA. This analysis only revealed a marginally significant two-way interaction ($F(1, 171) = 5.27$, $p = .02$). This interaction effect manifested in results supportive of our predictions. While participants in the inclusion condition were WTP similar prices no matter whether the t-shirt featured an indivisible number or a divisible number (Raw WTP: M_{27} = \$14.10, SD = 12.66 vs. M_{29} = \$17.19, SD = 14.10; Log WTP: $M_{27} = 2.31$, SD = 0.80 vs. $M_{29} = 2.50$, SD = 0.85; $t(171) = 1.09$, $p > .20$), those in the exclusion condition indicated higher WTP for the divisible option than for the indivisible one (Raw WTP: M_{27} = \$17.23, SD = 14.06 vs. M_{29} = \$11.34, SD = 9.88; Log WTP: $M_{27} = 2.51$, SD = 0.84 vs. $M_{29} = 2.14$, SD = 0.72; $t(171) = 2.16$, $p = .03$; $d = .48$).[5]

Thus, study 5 obtains results convergent with study 4, showing that situationally induced loneliness leads to relatively heightened consumer preference for a product associated with a divisible number versus an indivisible number. Reassuringly, these results were obtained using a different manipulation of situational loneliness, a different product category, an incentive-compatible paradigm, and a consequential DV. The remaining experiments (studies 6 and 7) continue to test the generalizability of our findings in non-price contexts.

STUDY 6: PERCEIVED DIVISIBILITY AND HOTEL ROOM CHOICE

Study 6 extended our findings in two directions. First, while the two preceding studies had examined the influence of number divisibility on product preference in the context of pricing implications (deal liking in study 4; WTP in study 5), study 6 examined preference in the context of choice between two options: one associated with a divisible number and the other associated with an indivisible number. The particular domain of study was preference between two hotel rooms, with the room numbers providing the focal numerical information.

Second, and of more importance, this study investigated an important aspect of our theorizing. As noted earlier, divisibility in our conceptualization refers to subjective perceptions, rather than a fixed objective property. This allows for the possibility that people may perceive an objectively divisible number to be indivisible, which would then lead to perceptions of lower connectedness—and heightened loneliness. This is particularly likely to be the case for larger numbers (e.g., three-digit numbers rather than the two-digit numbers examined thus far), for which it is less easy to identify whether the number is actually divisible or not.

To test this intuition, we selected 301 and 305 as the focal numbers for study 6. Although both 301 (divisible by 7 and 43) and 305 (divisible by 5 and 61) have the same number of divisors, it might be easier for individuals to identify 305 as a divisible number because divisibility by 5 (i.e., the last digit of the number is 0 or 5) is quite easy to recognize. Therefore, we speculated that relative to 305, 301 would be perceived as lonelier—and accordingly, lonely participants would display a heightened preference for hotel room 305 rather than room 301.

Method

Stimuli Selection. A pretest was first conducted to validate our reasoning regarding the perceived loneliness of these two numbers. A third number—307—was also included in the pretest to provide an anchoring comparison against an objectively indivisible number. A total of 151 participants (95 females; average age = 33.04 years) were asked to rate the loneliness of one of the three numbers: 301, 305, or 307 in a between-subjects design. They were

4 No participant was excluded on the lower end. Note also that there was no issue with outliers in any of the other online studies reported here; they were all conducted on MTurk and had a prespecified completion time window (which was lacking in the current study).

5 It is worth noting that social exclusion itself may increase a liking for money and possessions (Twenge et al. 2007). Thus, it is not appropriate to compare WTP for exclusion versus inclusion conditions within each number, since WTP for the former is likely to be lowered by this separate effect of social exclusion, for both numbers. Instead, the appropriate comparison in this study (as in study 4) lies in comparing WTP for the divisible versus indivisible number, within each level of the exclusion/inclusion manipulation.

also asked to judge whether the number was divisible. Before they were asked this question, we provided them with the definition of divisibility, and examples of a divisible (21) and an indivisible number (23).

We first examined perceived divisibility of the three numbers. Supportive of our subjective conceptualization of divisibility, we found that many participants (28 out of 52) erroneously judged 301 to be indivisible. And in line with our intuition regarding the difference in perceived divisibility of the two focal numbers, the error rate for 301 was significantly higher than it was for 305 (only 6 of 48 participants wrongly judged the latter as being indivisible; $\chi^2(1) = 19.02$, $p < .001$). The error rate for the objectively indivisible number 307 was also low (8 out 51), again significantly lower than it was for 301 ($\chi^2(1) = 16.49$, $p < .001$).

Note again that only one of the three numbers (307) is indivisible; the other two (301 and 307) are actually divisible. Thus, if objective divisibility is all that matters when assessing loneliness, 307 should be perceived to be lonelier than the other two, which should not differ from each other. If, however, perceived divisibility is the key influence on loneliness perceptions (as we argue), 301 should be rated lonelier than 305. The one-way ANOVA conducted to examine these competing theses yielded a significant difference among groups ($F(2, 148) = 3.14$, $p = .05$, $d = .41$). Consistent with our reasoning, although 301 ($M = 3.83$, SD = 1.72) is an objectively divisible number, it was rated to be lonelier than 305 ($M = 2.98$, SD = 1.58; $t(148) = 2.49$, $p = .014$, $d = .51$); indeed, its loneliness rating was not different from that of the objectively indivisible number: 307 ($M = 3.51$, SD = 1.79; $t < 1$, $p = .35$).

Having established a difference in perceived divisibility and accordingly, loneliness ratings between two objectively divisible numbers—301 and 305—the main study examined how an association with these numbers affects lonely consumers' preferences.

Participants and Design: Main Study. A total of 160 MTurk participants (95 females, average age = 34.56) were randomly assigned to either an "alone" condition or an "accompanied" condition.

Procedure. Participants in the alone (vs. accompanied) condition imagined traveling and staying in a hotel alone by themselves (with their family). They were asked to spend a few moments to visualize the scenario. All participants then rated how lonely they would feel in that situation (1/7 = *not at all*/*very lonely*). Next, we told participants that based on the room type they had selected for their stay, the hotel receptionist had informed them that two rooms were available: room 301 and room 305. All participants indicated which room they would choose.

Results

Manipulation Check. The result of a one-way ANOVA on loneliness perceptions indicated that our manipulation of loneliness was successful. Participants in the alone condition ($M = 4.01$, SD = 2.11) indicated that they would feel lonelier than those in the accompanied condition ($M = 2.30$, SD = 1.80; $F(1, 158) = 30.40$, $p < .001$, $d = .87$).

Hypothesis Test. Arising from the difference in perceived divisibility of the two numbers, we predicted that the choice share of room 305 (vs. room 301) would be relatively greater for individuals who felt temporarily lonelier. Consistent with this prediction, the choice share of room 305 was indeed higher in the "alone" condition (48/80 or 60%) than in the "accompanied" condition (33/80 or 41.25%; $\chi^2(1) = 5.63$, $p = .03$). Study 6 thus provides additional evidence that situationally induced loneliness leads to a preference for marketer offerings associated with divisible numbers, attesting to this effect in the context of a choice task. Of importance, this study also shows that the crucial factor is perceived rather than objective divisibility of the focal number—both numbers featured in the study were objectively divisible but differed in perceived divisibility.

STUDY 7: CONSEQUENTIAL CHOICE OF PAINTINGS

The final study sought to provide further evidence for the effect of numerical divisibility on consumer choice. In an advancement over study 6, choice was made consequential, so as to enhance confidence in the effect. In addition, while the numbers used in study 6 did not provide any meaningful information about the product, the numbers used in this last study actually provided such information, to check that our choice results generalize to situations where the numerical content is integral to the product. Specifically, following a manipulation of social exclusion/inclusion, all participants in this study chose between two oil paintings: one whose dimensions featured divisible numbers (45 cm × 63 cm) and another that featured indivisible numbers (43 cm × 67 cm). To make the choice consequential, participants were led to believe that they had a chance to actually receive their preferred option; they were also allowed to provide a no-preference response (Chernev 2004; Dhar 1997). As in study 5, which also manipulated exclusion/inclusion, we predicted a heightened preference for the option featuring divisible numbers in the exclusion condition.

Method

We randomly assigned 300 online participants (115 females, average age = 37.24 years) to either an "exclusion" condition or an "inclusion" condition, using the same inclusion/exclusion instructions as in study 5. After responding to the same set of loneliness measures ($\alpha = .96$) used in that study, all participants were informed that as an additional reward for their participation, 20 participants would receive a free oil painting on the basis of a lottery. They were asked to choose between two paintings, of which visual depictions were provided (web appendix C). Information was also provided as to the dimensions of the two paintings; this constituted our manipulation of divisible versus indivisible numbers. Thus, one of the paintings was described as being 43 cm × 67 cm; the other was described as being 45 cm × 63 cm. We also counterbalanced the specific painting associated with the former versus the latter dimensions; the counterbalancing factor did not affect any of the analyses, which were therefore conducted by pooling across this factor.

All participants were told that if they won the lottery, they would receive their selected painting. Participants were also explicitly asked to indicate if they did not have a preference, by selecting an "I don't have a preference" option. They were told that in that event, one of the two paintings would be chosen for them at random if they won the lottery.

Results

Manipulation Check. As anticipated, participants in the exclusion condition ($M = 4.56$, SD = 1.88) deemed themselves lonelier than those in the inclusion condition ($M = 3.39$, SD = 2.00; $F(1, 298) = 27.06$, $p < .001$; $d = .60$).

Hypothesis Test. As hypothesized, choice share of the two paintings varied for the exclusion versus inclusion conditions ($\chi^2(2) = 6.95$, $p = .03$). In line with our predictions, participants in the exclusion condition indicated a marginally stronger preference for the divisible option (74/141 or 52.5%) compared with those in the inclusion condition (60/159 or 37.7%; $\chi^2(1) = 3.63$, $p = .06$). Finally, the manipulation of exclusion did not significantly affect participants' likelihood of choosing the no-preference option (17/141 vs. 21/159; $p > .70$).

Discussion. The results from this final study reinforce confidence in the premise that numerical divisibility can affect consumer preferences, obtaining this effect under the following conditions: (1) the numerical information provided was meaningful; (2) an indifference (no preference) option was included; (3) as in study 5, participants' decision was consequential, in that participants expected to receive their preferred product.

It is worth mentioning that while the consequence studies reported here (studies 4–7) focus on a single product pair, a study reported in web appendix E replicated our findings in the context of a preference task involving multiple product pairs. Socially excluded and socially included participants engaged in four successive preference trials, each of which required them to indicate their preference between two t-shirts—one featuring an indivisible number (79, 47, 73, 29) and the other featuring a divisible number (75, 55, 25, 63). Supporting predictions, socially excluded (vs. included) participants systematically indicated greater preference for the divisible-number t-shirts.

GENERAL DISCUSSION

This research seeks to examine, first, whether and why consumers perceive divisible versus indivisible numbers differently and, second, how such divergent perceptions influence consumer preferences for marketer-created entities (e.g., products/attributes/prices) associated with divisible versus indivisible numbers. Integrating insights from two different literatures—numerical cognition and loneliness—we propose that not only are indivisible numbers deemed "lonelier" than divisible ones because they are perceived to be less connected to other numbers, but also that consequently, consumers' situational loneliness exerts systematic effects on their reactions to targets associated with divisible versus indivisible numbers.

The first three studies provide good support for the first hypothesis, showing that indivisible numbers are indeed deemed to be lonelier than divisible numbers. In addition to documenting the effect, these studies delineate the underlying process. Consistent with our theorizing, we show that divisible (vs. indivisible) numbers are judged to be less lonely because they are perceived to be more connected to other numbers. Building on these findings and the literature on compensatory consumption, the next four studies (studies 4–7) collectively show that a temporary feeling of loneliness increases participants' relative preference for various targets—products, attributes, and prices—associated with divisible (vs. indivisible) numbers, which are perceived to be relatively more connected and less lonely. Importantly, we provide evidence that the effects are driven by perceived rather than objective divisibility (study 6; web appendix D), extending the scope of these findings.

It also merits mention that our findings held for a wide variety of numbers, different product categories, and multiple operationalizations of loneliness. Further enhancing the effect's generalizability, the same pattern of results obtained regardless of whether the focal numbers contained information value about the product (e.g., study 7) or were incidental to the product (e.g., a number printed on a t-shirt, which does not change the value of the t-shirt; study 5).

Implications for Numerical Cognition

This research makes several contributions to the consumer literature. Of most importance, it adds to the existing body of work on numerical cognition (how numbers are perceived and processed) in three different ways. First, we add to this literature by introducing a different theoretical lens. Previous research has examined how consumers respond to numerical stimuli from various processing perspectives including mental representation (Janiszewski and Uy 2008), attention (Bizer and Schindler 2005), encoding (Bagchi and Li 2011), memory (Viswanathan and Childers 1996), and metacognition (Thomas and Morwitz 2009). In contrast, the current work investigates numerical information processing from an associative perspective (MacLane 1986; Pavia and Costa 1993), examining, in particular, the possibility that abstract numbers can be linked with concrete, human-like meaning. Although some recent research has shown that different types of numbers can carry gendered meanings (Wilkie and Bodenhausen 2012; Yan 2016), the current work introduces the broader idea that numbers can be associated with specific human traits such as loneliness, with corresponding consequences for product perceptions.

Second, while extant research on numerical cognition has investigated various numerical properties such as precision (Thomas et al. 2010), parity (Wilkie and Bodenhausen 2012), ending (Schindler and Wiman 1989), and fluency (King and Janiszewski 2011), the current work enriches this literature by examining a new dimension: divisibility. Both divisible and indivisible numbers are often used in marketing contexts, featuring in brand names, product series, attribute specifications, and prices. It is accordingly important to examine how divisible (vs. indivisible) numbers are perceived, a question which this research takes a step toward addressing.

Third, past work on numerical cognition has typically focused on investigating the effects of numerical features (King and Janiszewski 2011; Thomas et al. 2010) and their interplay with product characteristics (Pavia and Costa 1993; Wadhwa and Zhang 2015), with strikingly little attention devoted to consumer-related factors. By introducing the view that numbers can be associated with specific human traits, and integrating this insight with perspectives on compensatory consumption, this research, in contrast, is able to investigate how consumers' own situational state (i.e., transient loneliness) influences their responses to numerical stimuli. In doing so, we believe that this article is the first to examine how the interaction between numerical features and consumer-related factors shapes consumer preferences and choice.

Implications for Other Literatures

The current work also informs research in other areas. First, it adds to the literature on loneliness (Cacioppo and Hawkley 2009; Epley et al. 2008; Mead et al. 2011). Previous research has demonstrated a number of ways by which individuals cope with loneliness. For example, Mead et al. (2011) argued that when experiencing loneliness (operationalized as social exclusion), participants sought to compensate their need of affiliation by consuming products symbolic of group membership. Similarly, research has also shown that loneliness increases materialism because material possessions can repair the frustrated need for connectedness (Pieters 2013). The current findings suggest a novel way by which consumers seek to cope with loneliness—namely, by increasing their preference for targets associated with divisible numbers that are perceived to possess greater connectedness.

Second, this research adds to the consumer literature on anthropomorphism. While there is now much evidence for consumers' tendency to humanize products and endow them with personality traits (Aaker, Vohs, and Mogilner 2010; Aggarwal and McGill 2007; Kim and McGill 2011), the notion that even numbers can be associated with human-like traits is relatively new to that literature. It is worth noting also that support for such humanizing of numbers obtained not only with explicit measures in which participants were directly required to fill out loneliness ratings for various numbers (e.g., studies 2 and 3) but also with implicit measures that documented a spontaneous association between divisible numbers and the concept of loneliness (study 1). Furthermore, the studies that examined downstream implications of this association (studies 4–7) supported the view that abstract numbers can be anchored in concrete human-like meaning. Thus, the finding that situational loneliness induces a preference for targets associated with divisible numbers perfectly aligns with its parallel human behavior: namely, the need for greater social connectedness induced by social exclusion (Maner et al. 2007).

Finally, our findings also contain applied implications. They suggest that for people who are likely to be feeling temporarily lonely (e.g., those having to travel on work during holiday periods; singles around Valentine's Day), targets associated with divisible numbers might be particularly appealing. This might be particularly useful in the context of marketing stimuli that primarily consist of the numerical information—for example, price information (study 4) or product dimensions (study 7). Consumer reactions to such stimuli are likely to be heavily influenced by their reactions to the numbers themselves; accordingly, the difference in perceptions of divisible versus indivisible numbers identified in this research may play a significant role in driving such reactions.

Closing Comments

One may query why a lack of connectedness should produce the negative inference of loneliness, rather than simply producing inferences of "aloneness" (which the literature describes as being a non-valenced state of solitude, as compared to the negatively valenced state of loneliness; Rokach 2004; Russell et al. 2012), or indeed, positively valenced inferences such as independence and uniqueness. Our conceptualization does not rule out such possible inferences. It is possible that the lack of connectedness of indivisible numbers could lead to a multitude of related inferences (both negatively and positively valenced). However, because the state of loneliness carries implications of fundamental importance to human welfare and even survival, with psychologists arguing that loneliness is one of the key threats to health and happiness (Baumeister and Leary 1995; Dunbar 2018), it seems reasonable to assume that inferences regarding this dimension carry some primacy. This is even more likely when the loneliness dimension is made salient, either by participants being asked to assess a target's loneliness (as in studies 2 and 3) or because participants are made to feel lonely themselves (studies 4–6).

At the same time, there may be individuals who are more likely to focus on the positive aspects of a lack of connectedness. In particular, there is reason to believe that chronic loneliness might manifest effects opposite to those currently documented, where the focus has been on situational loneliness. Unlike situational loneliness, which is commonly held to be an aversive state, chronically lonely people may not be as motivated to escape loneliness and seek connection—both because they have faced multiple failures at such attempts (Maner et al. 2007), and also because a self-enhancement motive may cause them to endow loneliness with positive connotations, such as uniqueness and independence (Joubert 1987). Indeed, because of such reasons, chronically lonely people may actually develop a preference for other lonely people (on the principle that people with similar traits attract; Montoya, Horton, and Kirchner 2008). Given this eventuality, it is possible to argue that chronically lonely consumers may actually prefer products and services that also signal solitude—that is, those associated with indivisible rather than divisible numbers. Some results from our laboratory that focus on the effects of chronic rather than situational loneliness are supportive of this speculation, although further research is awaited [see also Wang, Zhu and Shiv (2012) for results that are conceptually convergent with our speculation regarding the effect of chronic loneliness].

Relatedly, another intriguing possibility lies in exploring the possible moderating impact of salient goals on number preference. The "loneliness" association of indivisible numbers might also lead them to be perceived as being relatively "unique" as compared to divisible numbers. Therefore, when individuals have a goal of establishing uniqueness—a goal that is likely to be made salient, for instance, in the context of purchasing either luxury products or even niche products—target products associated with indivisible numbers might actually be preferred to those associated with divisible numbers.

Both our findings and these follow-up speculations suggest that the field would benefit from a broader understanding of the antecedents and consequences of numerical cognition. The last few years have witnessed much progress in this area; yet, much also remains to be done. In suggesting that numbers may be associated with human-like traits, and documenting the product-relevant consequences of such an association, the current investigation takes a step in a new direction. We believe that this direction has generative potential and hope that the current work provides a platform for consumer scholars to build upon.

DATA COLLECTION INFORMATION

Data for study 5 were collected in March 2020 by a research assistant using the subject pool at the Hong Kong University of Science and Technology and were analyzed by the first author. The first author collected and analyzed data for all other studies on Amazon's Mechanical Turk during the period between April 2013 and November 2019 (study 1: June 2017; study 2: April 2013; study 3: June 2017; study 4: August 2017; study 6: July 2017; study 7: November 2019).

Footnotes

REFERENCES

Aaker, Jennifer L. (1997), "Dimensions of Brand Personality," *Journal of Marketing Research*, 34 (3), 347–56.

Aaker, Jennifer, Kathleen D. Vohs, and Cassie Mogilner (2010), "Nonprofits Are Seen as Warm and for-Profits as Competent: Firm Stereotypes Matter," *Journal of Consumer Research*, 37 (2), 224–37.

Aggarwal, Pankaj and Ann L. McGill (2007), "Is That Car Smiling at Me? Schema Congruity as a Basis for Evaluating Anthropomorphized Products," *Journal of Consumer Research*, 34 (4), 468–79.

Ahuvia, Aaron C. (2005), "Beyond the Extended Self: Loved Objects and Consumers' Identity Narratives," *Journal of Consumer Research*, 32 (1), 171–84.

Bagchi, Rajesh and Xingbo Li (2011), "Illusionary Progress in Loyalty Programs: Magnitudes, Reward Distances, and Step-Size Ambiguity," *Journal of Consumer Research*, 37 (5), 888–901.

Baumeister, Roy F. and Mark R. Leary (1995), "The Need to Belong: Desire for Interpersonal Attachments as a Fundamental Human Motivation," *Psychological Bulletin*, 117 (3), 497–529.

Berger, Ida E. (1992), "The Nature of Attitude Accessibility and Attitude Confidence: A Triangulated Experiment," *Journal of Consumer Psychology*, 1 (2), 103–23.

Bizer, George Y. and Robert M. Schindler (2005), "Direct Evidence of Ending-Digit Drop-Off in Price Information Processing," *Psychology and Marketing*, 22 (10), 771–83.

Cacioppo, John T., James H. Fowler, and Nicholas A. Christakis (2009), "Alone in the Crowd: The Structure and Spread of Loneliness in a Large Social Network," *Journal of Personality and Social Psychology*, 97 (6), 977–91.

Cacioppo, John T. and Louise C. Hawkley. (2009), "Loneliness," in *Handbook of Individual Differences in Social Behavior*, ed. Mark R. Leary and Rick H. Hoyle, New York: Guilford Press, 227–40.

Cai, Fengyan, Rajesh Bagchi, and Dinesh K. Gauri (2016), "Boomerang Effects of Low Price Discounts: How Low Price Discounts Affect Purchase Propensity," *Journal of Consumer Research*, 42 (5), 804–16.

Chen, Rocky Peng, Echo Wen Wan, and Eric Levy (2017), "The Effect of Social Exclusion on Consumer Preference for Anthropomorphized Brands," *Journal of Consumer Psychology*, 27 (1), 23–34.

Chernev, Alexander (2004), "Goal Orientation and Consumer Preference for the Status Quo," *Journal of Consumer Research*, 31 (3), 557–65.

Cian, Luca, Aradhna Krishna, and Norbert Schwarz (2015), "Positioning Rationality and Emotion: Rationality Is up and Emotion Is Down," *Journal of Consumer Research*, 42 (4), 632–51.

Dhar, Ravi (1997), "Consumer Preference for a No-Choice Option," *Journal of Consumer Research*, 24 (2), 215–31.

Dudley, Underwood. (1978), *Elementary Number Theory*, Mineola, NY: Dover Publications.

Duke, Kristen E. and On Amir (2019), "Guilt Dynamics: Consequences of Temporally Separating Decisions and Actions," *Journal of Consumer Research*, 45 (6), 1254–73.

Dunbar, R. I. M. (2018), "The Anatomy of Friendship," *Trends in Cognitive Sciences*, 22 (1), 32–51.

Epley, Nicholas, Scott Akalis, Adam Waytz, and John T. Cacioppo (2008), "Creating Social Connection through Inferential Reproduction: Loneliness and Perceived Agency in Gadgets, Gods, and Greyhounds," *Psychological Science*, 19 (2), 114–20.

Feldman, Jack M. and John G. Lynch Jr. (1988), "Self-Generated Validity and Other Effects on Measurement on Belief, Attitude, Intention, and Behavior," *Journal of Applied Psychology*, 73 (3), 421–35.

Greenwald, Anthony G., Brian A. Nosek, and Mahzarin R. Banaji (2003), "Understanding and Using the Implicit Association Test: I. An Improved Scoring Algorithm," *Journal of Personality and Social Psychology*, 85 (2), 197–216.

Greenwald, Anthony G., Debbie E. McGhee, and Jordan L. K. Schwartz (1998), "Measuring Individual Differences in Implicit Cognition: The Implicit Association Test," *Journal of Personality and Social Psychology*, 74 (6), 1464–80.

Hawkley, Louise C., Michael W. Browne, and John T. Cacioppo (2005), "How Can I Connect with Thee? Let Me Count the Ways," *Psychological Science*, 16 (10), 798–804.

Hughes, Mary Elizabeth, Linda J. Waite, Louise C. Hawkley, and John T. Cacioppo (2004), "A Short Scale for Measuring Loneliness in Large Surveys: Results from Two Population-Based Studies," *Research on Aging*, 26 (6), 655–72.

Janiszewski, Chris and Dan Uy (2008), "Precision of the Anchor Influences the Amount of Adjustment," *Psychological Science*, 19 (2), 121–7.

Janiszewski, Chris and Donald R. Lichtenstein (1999), "A Range Theory account of Price Perception," *Journal of Consumer Research*, 25 (4), 353–68.

Johar, Gita Venkataramani, Jaideep Sengupta, and Jennifer L. Aaker (2005), "Two Roads to Updating Brand Personality Impressions: Trait versus Evaluative Inferencing," *Journal of Marketing Research*, 42 (4), 458–69.

Joubert, Charles E. (1987), "Need for Uniqueness Correlates of Loneliness and Social Interest," *Journal of Social Behavior & Personality*, 2 (2), 187–90.

Kim, Sara and Ann L. McGill (2011), "Gaming with Mr. Slot or Gaming the Slot Machine? Power, Anthropomorphism, and Risk Perception," *Journal of Consumer Research*, 38 (1), 94–107.

King, Dan and Chris Janiszewski (2011), "The Sources and Consequences of the Fluent Processing of Numbers," *Journal of Marketing Research*, 48 (2), 327–41.

Lee, Angela Y. and Jennifer L. Aaker (2004), "Bringing the Frame into Focus: The Influence of Regulatory Fit on Processing Fluency and Persuasion," *Journal of Personality and Social Psychology*, 86 (2), 205–18.

Leys, Christophe, Christophe Ley, Olivier Klein, Philippe Bernard, and Laurent Licata (2013), "Detecting Outliers: Do Not Use Standard Deviation around the Mean, Use Absolute Deviation around the Median," *Journal of Experimental Social Psychology*, 49 (4), 764–6.

MacLane, Saunders (1986), "Mathematical Logic Is Neither Foundation nor Philosophy," *Philosophia Mathematica*, s2-1 (1–2), 3–14.

Maner, Jon K., C. Nathan DeWall, Roy F. Baumeister, and Mark Schaller (2007), "Does Social Exclusion Motivate Interpersonal Reconnection? Resolving the "Porcupine Problem"," *Journal of Personality and Social Psychology*, 92 (1), 42–55.

Manning, Kenneth C. and David E. Sprott (2009), "Price Endings, Left-Digit Effects, and Choice," *Journal of Consumer Research*, 36 (2), 328–35.

Mead, Nicole L., Roy F. Baumeister, Tyler F. Stillman, Catherine D. Rawn, and Kathleen D. Vohs (2011), "Social Exclusion Causes People to Spend and Consume Strategically in the Service of Affiliation," *Journal of Consumer Research*, 37 (5), 902–19.

Milikowski, Marisca (1995), "Knowledge of Numbers: A Study of the Psychological Representation of the Numbers 1–100," doctoral dissertation, University of Amsterdam, Amsterdam.

Miniard, Paul W., Sunil Bhatla, Kenneth R. Lord, Peter R. Dickson, and H. Rao Unnava (1991), "Picture-Based Persuasion Processes and the Moderating Role of Involvement," *Journal of Consumer Research*, 18 (1), 92–107.

Montoya, R. Matthew, Robert S. Horton, and Jeffrey Kirchner (2008), "Is Actual Similarity Necessary for Attraction? A Meta-Analysis of Actual and Perceived Similarity," *Journal of Social and Personal Relationships*, 25 (6), 889–922.

Mourey, James A., Jenny G. Olson, and Carolyn Yoon (2017), "Products as Pals: Engaging with Anthropomorphic Products Mitigates the Effects of Social Exclusion," *Journal of Consumer Research*, 44 (2), 414–31.

Pavia, Teresa M. and Janeen Arnold Costa (1993), "The Winning Number: Consumer Perceptions of Alpha-Numeric Brand Names," *Journal of Marketing*, 57 (3), 85–98.

Pieters, Rik (2013), "Bidirectional Dynamics of Materialism and Loneliness: Not Just a Vicious Cycle," *Journal of Consumer Research*, 40 (4), 615–31.

Raghunathan, Rajagopal, Rebecca Walker Naylor, and Wayne D. Hoyer (2006), "The Unhealthy = Tasty Intuition and Its Effects on Taste Inferences, Enjoyment, and Choice of Food Products," *Journal of Marketing*, 70 (4), 170–84.

Rokach, Ami (2004), "Loneliness Then and Now: Reflections on Social and Emotional Alienation in Everyday Life," *Current Psychology*, 23 (1), 24–40.

Russell, Daniel W., Carolyn E. Cutrona, Cynthia McRae, and Mary Gomez (2012), "Is Loneliness the Same as Being Alone?," *The Journal of Psychology*, 146 (1–2), 7–22.

Schindler, Robert M. and Alan R. Wiman (1989), "Effects of Odd Pricing on Price Recall," *Journal of Business Research*, 19 (3), 165–77.

Schindler, Robert M. and Patrick N. Kirby (1997), "Patterns of Rightmost Digits Used in Advertised Prices: Implications for Nine-Ending Effects," *Journal of Consumer Research*, 24 (2), 192–201.

Schmitt, J. Patrick and Lawrence A. Kurdek (1985), "Age and Gender Differences in and Personality Correlates of Loneliness in Different Relationships," *Journal of Personality Assessment*, 49 (5), 485–96.

Smith, Steven B. (1983), *The Great Mental Calculators: The Psychology, Methods, and Lives of Calculating Prodigies, Past and Present*, New York: Columbia University Press.

Thomas, Manoj, Daniel H. Simon, and Vrinda Kadiyali (2010), "The Price Precision Effect: Evidence from Laboratory and Market Data," *Marketing Science*, 29 (1), 175–90.

Thomas, Manoj and Vicki G. Morwitz (2005), "Penny Wise and Pound Foolish: The Left-Digit Effect in Price Cognition," *Journal of Consumer Research*, 32 (1), 54–64.

——— (2009), "The Ease-of-Computation Effect: The Interplay of Metacognitive Experiences and Naive Theories in Judgments of Price Differences," *Journal of Marketing Research*, 46 (1), 81–91.

Tian, Kelly and Russell W. Belk (2005), "Extended Self and Possessions in the Workplace," *Journal of Consumer Research*, 32 (2), 297–310.

Twenge, Jean M., Roy F. Baumeister, C. Nathan DeWall, Natalie J. Ciarocco, and J. Michael Bartels (2007), "Social Exclusion Decreases Prosocial Behavior," *Journal of Personality and Social Psychology*, 92 (1), 56–66.

Viswanathan, Madhubalan and Terry L. Childers (1996), "Processing of Numerical and Verbal Product Information," *Journal of Consumer Psychology*, 5 (4), 359–85.

Wadhwa, Monica and Kuangjie Zhang (2015), "This Number Just Feels Right: The Impact of Roundedness of Price Numbers on Product Evaluations," *Journal of Consumer Research*, 41 (5), 1172–85.

Wang, Jing, Rui Zhu, and Baba Shiv (2012), "The Lonely Consumer: Loner or Conformer?," *Journal of Consumer Research*, 38 (6), 1116–28.

Wertenbroch, Klaus and Bernd Skiera (2002), "Measuring Consumers' Willingness to Pay at the Point of Purchase," *Journal of Marketing Research*, 39 (2), 228–41.

Wilkie, James E. B. and Galen V. Bodenhausen (2012), "Are Numbers Gendered," *Journal of Experimental Psychology: General*, 141 (2), 206–10.

Yan, Dengfeng (2016), "Numbers Are Gendered: Role of Numerical Precision," *Journal of Consumer Research*, 43 (2), 303–16.

Zhang, Meng and Xiuping Li (2012), "From Physical Weight to Psychological Significance: The Contribution of Semantic Activations," *Journal of Consumer Research*, 38 (6), 1063–75.

Zhong, Chenbo and Geoffrey J. Leonardelli (2008), "Cold and Lonely: Does Social Exclusion Literally Feel Cold?," *Psychological Science*, 19 (9), 838–42.