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How and Why 1 Year Differs from 365 Days: A Conversational Logic Analysis of Inferences from the Granularity of Quantitative Expressions

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The same quantity can be expressed at different levels of granularity, for example, "1 year," "12 months," or "365 days." Consumers attend to the granularity chosen by a communicator and draw pragmatic inferences that influence judgment and choice. They consider estimates expressed in finer granularity more precise and have more confidence in their accuracy (studies 1–4). This effect is eliminated when consumers doubt that the communicator complies with Gricean norms of cooperative conversational conduct (studies 2–3). Based on their pragmatic inferences, consumers perceive products as more likely to deliver on their promises when the promise is described in fine-grained rather than coarse terms and choose accordingly (study 4). These findings highlight the role of pragmatic inferences in consumer judgment and have important implications for the design of marketing communications.

While talking with friends, you learn that your former boss has been sentenced for fraud. One of your friends thinks your boss received a jail term of "1 year," and another friend reports that it is "366 days." Who seems more knowledgeable about the details of the case? Similarly, suppose you want to order a custom-made good. You ask the service representative how long your order will take if you place it today. Would it make a difference if the representative answered, "1 month," "4 weeks," or "30 days"? In both examples, the respective expressions refer to the same extension of time and are often used interchangeably. Nevertheless, recipients may perceive the speakers' reports as differentially precise and reliable. The present research addresses this possibility and explores its consequences for marketing communications and consumer decision making.

We first place the issue in the context of Grice's (1975) logic of conversation, which provides a conceptual framework for understanding how recipients arrive at different inferences from substantively equivalent speaker utterances. Next, we test three key predictions. First, we predict, and observe, that the granularity of the communicator's quantitative utterance affects recipients' confidence in the accuracy of the information. For example, study 1 asks consumers to place a time window around the completion date of a project by indicating the earliest and latest date at which they think the project may actually get done. This window, which resembles a confidence interval, shrinks with the granularity of the quantitative expression—thus, a completion time expressed as "1 year" comes with a time window of 140 days, but this window shrinks to 84 days when the same time period is expressed as "52 weeks." This effect presumably reflects that recipients draw pragmatic inferences from the form of a communicator's utterance, which is consistent with the Gricean logic of conversation. If so, second, granularity should only influence consumers' inferences under conditions in which they can assume that the

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communicator is cooperative, that is, follows Gricean norms of conversational conduct (Schwarz 1996). Empirically, this is the case. When the communicator's cooperativeness is called into question because the communicator either lacks relevant knowledge (study 2) or general trustworthiness (study 3), the otherwise observed effects are eliminated. This observation is incompatible with alternative interpretations of the influence of numeric expressions on consumer judgment, as discussed later. Consistent with their pragmatic inferences, consumers perceive products as more likely to deliver on their promises when the promise is described in fine-grained rather than coarse terms, and they choose accordingly (study 4). In combination, these studies contribute to our understanding of biases in quantitative judgment by drawing attention to the role of conversational inference processes. They highlight that substantively equivalent quantitative utterances can give rise to differential inferences, depending on the communicator's choice of coarse or fine-grained units, and they identify theoretical and applied implications.

BACKGROUND

In everyday life, consumers encounter many quantitative expressions. Even when the values are precise and well-defined, consumers' understanding of quantitative expressions often deviates from their objective meaning. Previous research identified a number of cognitive heuristics that contribute to these biases (for a review, see Thomas and Morwitz [2009]). As observed in other domains of judgment, however, biases are not solely a function of individuals' thoughts about the respective content domain or of the accessibility of applicable procedures. Instead, they often arise from tacit assumptions underlying the conduct of conversation, which license pragmatic inferences that go beyond the literal meaning of a speaker's utterance (for reviews, see Hilton [1995] and Schwarz [1994, 1996]).

Logic of Conversation

These pragmatic inferences can be conceptualized in the context of Grice's (1975, 1978) logic of conversation. Grice, a philosopher of language, suggested that conversations proceed according to a cooperativeness principle that is composed of four maxims. First, a maxim of relation requires speakers to provide only information that is relevant to the aims of the ongoing conversation; hence, speakers' contributions come with a "guarantee of relevance" (Sperber and Wilson 1986) unless marked otherwise. Second, a maxim of manner encourages speakers to do their best to be understood by the recipient; this implies that utterances should not be more complex than needed for the task at hand. Third, a maxim of quantity asks speakers to provide as much information as the recipient needs but not more and not less. Finally, a maxim of quality urges speakers to only say things they know to be true and accurate. All four maxims bear on how speakers should communicate quantitative information. Specifically, speakers should only provide truthful information (maxim of quality) that is relevant to the purpose of the conversation (maxim of relation), and they should do so in a manner that is easy to understand (maxim of manner) by providing the relevant level of detail but neither more nor less detail than needed (maxim of quantity). Observance of these maxims is considered cooperative conversational conduct, and most forms of uncooperative conduct involve violations of more than one maxim.

Violations of these maxims are common in everyday conversations, as Grice (1975) acknowledged. Nevertheless, a large body of linguistic and behavioral research (for reviews, see Clark [1985], Clark and Schober [1992], Levinson [1983], McCann and Higgins [1992], Schwarz [1996], and Strack and Schwarz [1992]) shows that recipients interpret speakers' utterances "on the assumption that they are trying to live up to these ideals" (Clark and Clark 1977, 122). Even when recipients doubt that the speaker is cooperative, they first need to comprehend what the speaker intended them to infer before they can make meaningful corrections for the suspected intention to mislead (Gilbert 1991; Schwarz 1996) unless the statement pertains to highly accessible and specific knowledge of the recipient (Richter, Schroeder, and Woehrmann 2009). Accordingly, Grice's tacit assumptions of cooperative communication govern the conduct of conversation in daily life and guide speakers' design of their own messages as well as listeners' inferences from these messages (Grice 1975; Levinson 1983).

The implications of Grice's (1975) logic of conversation extend beyond prototypical "conversations." Although Grice's initial analyses focused on personal conversations, later work showed that the maxims of cooperative conversational conduct guide pragmatic inferences in all communicative contexts (for a discussion, see Levinson [1983]). In fact, their impact on recipients' interpretation of a speaker's utterance is particularly pronounced when no personal "speaker" is present. This is the case because the presence of the speaker allows for queries and enables the collaborative negotiation of meaning when an utterance remains ambiguous (Clark and Schober 1992). Such opportunities are missing when the speaker is absent, which forces recipients to draw on general principles of conversational conduct and language use to infer what the communicator may have intended to convey. Accordingly, Gricean inference effects are particularly pronounced in settings that preclude the mutual negotiation of meaning, as has been observed in standardized research settings, where experimenters and interviewers are often discouraged from providing explanations and where self-administered questionnaires are presented in the absence of any person who could be asked for clarifications (Schwarz 1995, 1996; Strack and Schwarz 1992). The same communicative constraint applies to most marketing communications, from product descriptions and reviews to company announcements and advertisements (Xu and Wyer 2010); throughout they lack opportunities for consumer queries and hence encourage pragmatic inferences based on message and context characteristics. We acknowledge the impersonal nature of these "conversations" by referring to the participants as communicators and recipients rather than speakers and listeners.

Granularity Effects

The above reasoning implies that Gricean considerations will affect communicators' choice of the granularity in which they express quantitative information as well as recipients' inferences from this choice. In general, quantitative communications provide more information when the quantity is expressed in fine-grained rather than coarse forms. This is most apparent when the information is communicated in the form of an interval, for example, when a price estimate is expressed as "$5,000–$6,000" or "$1,000–$10,000," Here, the choice of interval width conveys the communicator's confidence in the accuracy of the estimate. Not surprisingly, recipients prefer narrow intervals, which provide more information. Moreover, they are willing to sacrifice formal accuracy for informational value. For example, when the true value is $22.5 billion, 80% of participants prefer the estimate "$18–$20 billion" over the estimate "$20–40 billion," even though the latter interval includes the correct value, and the former does not (Yaniv and Foster 1995).

Whereas interval estimates convey the intended level of precision through the width of the interval, explicit precision information is missing when the communicator offers only one quantitative value, thus providing a point estimate. Nevertheless, recipients are aware that estimates come with a certain degree of uncertainty. Hence, you would not consider it misleading if a friend who is driving from another city said, "I'll be there in 2 hours," even though she is aware that it may take her as little as 1.5 hours or as much as 2.5 hours to arrive. On the other hand, you might wonder what has happened to her if she told you in the same circumstance that she will arrive "in 115 minutes" but has not yet shown up 30 minutes later. As this example illustrates, point estimates come with an implied interval, and the size of this interval varies with the level of granularity in which the estimate is expressed. Accordingly, cooperative communicators should satisfy the Gricean requests for simplicity, informativeness, and truthfulness by using a level of granularity that takes their own knowledge into account, conveying neither more nor less information than they can warrant.

We assume that recipients are sensitive to communicators' choice of granularity and take it into account when they interpret communicators' utterances. Hence, we predict (i) that recipients perceive the same quantitative estimate as more precise when it is expressed in fine-grained rather than coarse units, resulting (ii) in narrower interval estimates (study 1). These effects should not be observed when recipients doubt that the speaker is a cooperative communicator. While many variables can undermine recipients' perceptions of a communicator's cooperativeness (Levinson 1983; Schwarz 1996), some are particularly relevant in the present context. The most germane variable is the perceived likelihood that the communicator's factual knowledge warrants the precision entailed in his or her utterance—does the communicator really know what he or she is talking about? A second relevant variable is the communicator's perceived general credibility—is there reason to believe that the communicator may be deliberately misleading? In either case, the assumptions of cooperative conversational conduct do not apply, and recipients should hesitate to draw pragmatic inferences from the format of the utterance. This predicts (iii) that the otherwise obtained granularity effects will not be observed when recipients suspect that the implied precision of the communicator's utterance exceeds the required knowledge (study 2) or that the communicator may not be trustworthy (study 3). Finally, consumers' pragmatic inferences are likely to have behavioral consequences. If the same estimate is perceived as more precise when conveyed in fine-grained units, consumers should (iv) be more confident that a product delivers what it promises when the quantitative promise is expressed in fine rather than coarse units, affecting their product choice (study 4).

While we assume that these granularity predictions hold for all expressions of quantity, the present studies test them in the domain of time estimates. Consumers' perceptions of time are an important element in many aspects of consumer behavior, from planning (Leclerc, Schmitt, and Dubé 1995; Ülkümen, Thomas, and Morwitz 2008) and waiting (Kumar, Kalwani, and Dada 1997) to service and product evaluation (Mogilner, Aaker, and Pennington 2008).

Related Work

Before we present our studies, it is worth highlighting how they differ from previous work that explored how the format of quantity expressions affects consumers' perceptions. Previous work showed that people judge the magnitude of a quantitative expression by focusing on foreground information (i.e., the number or the numerator) at the expense of background information (i.e., the unit or the denominator; Stone et al. 2003). For example, spending $1 per day is perceived as a better deal than spending $365 per year (Gourville 1998), and a gamble with a chance of nine out of 100 is preferred to a gamble with a chance of one out of 10 (Pacini and Epstein 1999). Moreover, consumers judge prices in an unfamiliar foreign currency on the basis of their numeric face value and infer, for example, that a price of 1,100 Korean wons is higher than a price of 110 Japanese yen, despite their equivalence in U.S. dollars (Raghubir and Srivastava 2002). Similarly, people attend insufficiently to the format of a rating scale when judging the difference between two ratings and give a difference of 20 on a 100-point scale more weight than a difference of 2 on a 10-point scale (Burson, Larrick, and Lynch 2009). The latter effect is not limited to rating scales of differential length but also observed when two quantities are expressed in fine-grained rather than coarse units (Pandelaere, Briers, and Lembregts 2011). For example, when choosing between two dishwashers, a long warranty receives more weight when a fine-grained unit results in a large numerical difference between the two warranties (e.g., 84 months vs. 108 months) than when a coarse unit results in a smaller numerical difference (e.g., 7 years vs. 9 years; Pandelaere et al. 2011). These and related studies share an interest in how numeric values influence quantity estimates; they consistently find that higher values elicit perceptions of larger quantity, with downstream consequences on judgment and choice. Different accounts have been offered for such numerosity effects, including anchoring (Tversky and Kahneman 1974), magnitude priming (Oppenheimer, LeBoef, and Brewer 2008), and the operation of a numerosity heuristic (Pelham, Sumarta, and Myaskovsky 1994; see Thomas and Morwitz [2009] and Pandelaere et al. [2011] for reviews).

In contrast, the present research emphasizes that the use of fine-grained units does not merely result in higher numerical expressions, which can affect quantity estimation through several different pathways. Instead, the present research highlights that messages with fine-grained units also convey a higher level of precision because cooperative communicators (Grice 1975) are not assumed to present information in a manner that is more precise than their knowledge warrants. Hence, consumers infer that the real value is closer to the communicated value when it is conveyed in fine-grained rather than coarse units unless they have reason to assume that the communicator may not be cooperative. This can result in circumstances where "higher numbers" (i.e., more fine-grained expressions) result in lower rather than higher estimates, as our studies will illustrate (studies 1–3). Such reversals are incompatible with number-focused accounts that predict numerosity effects in the form of higher estimates in the context of higher numbers, as discussed above. Moreover, the reversals are only expected, and observed, under conditions where the communicator can be assumed to be cooperative (studies 2 and 3). In combination, these findings highlight that human judgment in a social context is a function of cognitive and communicative processes (Schwarz 1996; Sperber and Wilson 1986) and that thinking about quantities involves more than numbers. We return to these issues in the final discussion.

STUDY 1: ESTIMATES OF PRECISION

Study 1 tested the basic hypothesis: the same time expression is perceived as more precise when expressed in fine-grained rather than coarse units. We measured the perceived precision of the estimate by asking participants to report their best- and worst-case estimates for the completion of a project, given the speaker's claim. In study 1A, participants provided these estimates in an open response format; in study 1B, they marked the best and worst completion date on a calendar. On both measures, assumed low (high) precision results in a wide (narrow) time window around the speaker's claim, resembling a confidence interval.

Method

Study 1A. Two hundred and sixty-seven people were approached on the campus of the University of Michigan and asked to imagine that their car needed complicated repairs. Depending on conditions, the dealership estimated that obtaining the relevant parts and repairing the car would take "30 days," "31 days," or "1 month." Participants were asked for their best- and worst-case estimates, that is, the minimum and maximum number of days they might have to wait.

Study 1B. Ninety students taking an undergraduate marketing class read an announcement about a construction project. Depending on conditions, the expected duration of the construction project was described as "1 year," "12 months," or "52 weeks." Next, participants were handed a calendar with the start date and the estimated end date of the project marked. They were asked to circle on the calendar the earliest and latest likely completion dates, that is, their best-case and worst-case completion estimates, given the information they had.

Results and Discussion

In both studies, the unit in which the communicator expressed an otherwise identical estimate influenced participants' own time estimates: the more fine-grained the unit, the narrower the recipient's time window (i.e., confidence interval) around the communicator's estimate.

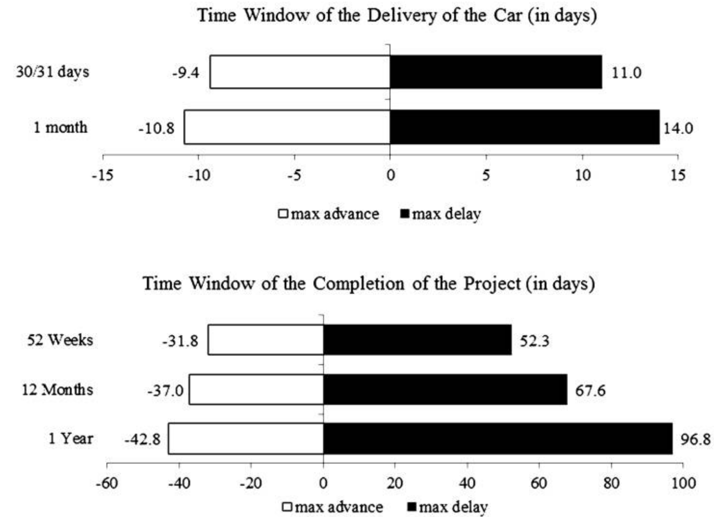
As shown in the top panel of figure 1, participants who were asked to provide best- and worst-case estimates of how long they would have to wait for their car (study 1A) indicated confidence intervals of 20.6 and 20.3 days around the speaker's estimate of 30 and 31 days, respectively. These two conditions did not differ from one another ($t < 1$) but were significantly smaller than the confidence interval of 24.8 days when the communicator's estimate was expressed as "1 month" ($t(266) = 2.42$, $p < .05$); this also holds for the underlying individual comparisons ($t(266) = 2.10$ for the contrast between 1 month and 30 days and $t(266) = 2.27$ for the contrast between 1 month and 31 days, all $p < .05$). Note also that each interval is composed of two component estimates (fig. 1), one pertaining to how many days delivery may be ahead of schedule and one to how many days delivery may be behind schedule. Each of these component estimates was smaller when the communication provided high (30 or 31 days) rather than low (1 month) numbers, in contrast to the prediction of numerosity models.

Study1B replicated this pattern with three levels of granularity (1 year, 12 months, 52 weeks) and a response format that did not require explicit numerical estimates of wait time. As shown in the bottom panel of figure 1, participants who were asked to check the earliest and latest plausible completion dates of a construction project on a calendar indicated confidence intervals of 140 days in the "1 year," 105 days in the "12 months," and 84 days in the "52 weeks" condition; thus, the more fine-grained the unit, the smaller the confidence interval ($\beta = 27.8$, $t(88) = 3.24$, $p < .005$).

In both studies, recipients went beyond the literal meaning of the communicators' utterances and attended to their choice of granularity in interpreting the meaning of time estimates. As predicted by Grice's (1975) logic of conversation, they inferred higher precision of the estimate when the communicator expressed it in more fine-grained units. Note also that the recipients' estimates reflected the common knowledge that projects of any type are more likely to be

FIGURE 1

RESULTS OF STUDY 1A (TOP) AND STUDY 1B (BOTTOM)



completed late rather than early (Kahneman and Lovallo 1993): independent of unit, their worst-case estimates deviated more from the communicators' predictions than their best-case estimates. This observation implies that the use of coarse time units in marketing communications suggests more potential downside than potential upside to consumers: although coarse granularity in principle allows for earlier as well as later delivery dates, the likelihood of long delays will loom much larger. Finally, it is worth noting that participants' estimates involved "larger numbers" when the communicator's message presented "small" (coarse granularity) rather than "large" (fine granularity) numbers, in contrast to what numerosity models would predict.

STUDIES 2 AND 3: THE ROLE OF COMMUNICATOR COOPERATIVENESS

The observed effects of granularity are consistent with Grice's (1975) logic of conversation, which licenses inferences that go beyond the literal meaning of a communicator's utterance. These inferences are based on the tacit assumption that the communicator is cooperative and presents information in a form that satisfies the maxims of conversational conduct. Once this assumption is called into question, recipients no longer rely on the form of the communicator's utterances to interpret their meaning (Dodd and Bradshaw 1980; Schwarz et al. 1991; Smith and Ellsworth 1987; for a review, see Schwarz [1996]). Given that consumers are aware that companies have an incentive to influence them (Friestad and Wright 1994), one may wonder, however, whether they apply the cooperativeness assumption to marketing communications. The empirical answer is that they do, as the success of many misleading marketing communications illustrates (Boush, Friestad, and Wright 2009). This is not surprising because acceptance of the cooperativeness assumption is the default that underlies all communication in daily life—and even when we suspect misleading intentions we need to apply Gricean inferences to determine what the communicator wants us to conclude before we can correct for it (Gilbert 1991; Schwarz 1996) unless the communicated message directly contradicts specific and highly accessible knowledge of the recipient (Richter et al. 2009). While many variables can undermine recipients' perceptions of a communicator's cooperativeness (Levinson 1983; Xu and Wyer 2010), two are particularly relevant in a marketing context, namely, the communicator's likely topic-specific knowledge (study 2) and general trustworthiness (study 3).

Study 2: Communicator's Expertise

As seen in study 1, recipients assume that quantitative statements are more precise when they are expressed in fine-grained rather than coarse units. The resulting estimation effects should be attenuated or eliminated when recipients suspect that the precision implied by the format of the communicator's message may exceed the communicator's actual knowledge. To test this prediction, study 2 attributed the message to a communicator who is versus is not likely to have the relevant factual knowledge.

Method. One hundred and twenty-eight participants were recruited from an online subject pool and received a cash reward of 10 cents. The study followed a 2 (relevant knowledge: given vs. questionable) × 2 (granularity: fine vs. coarse) between-subjects design. Participants read in an alleged news article that the world's largest car manufacturer is developing a new type of car based on cutting edge technology. The article reported that the new car would be released either in 2 years (coarse unit) or in 104 weeks (fine unit). To manipulate the communicator's perceived knowledge, half of the participants were told that the article was based on an announcement made by "the chief research officer of the company, who is well known in the industry for his strong project planning ability"; the other half was told that the news article was based on "a rumor spread by an auto fan website."

Subsequently, all participants were asked how likely it is that "the new car would be successfully launched to market as planned" (1 = extremely unlikely; 7 = extremely likely). Next, they were asked, "If the launch of the new car took longer than planned, how many months do you think it would likely be delayed?"; they answered this question in an open response format in months.

Results and Discussion. Our rationale predicts an interaction of granularity and source knowledgeability on the likelihood of on-time completion, which was obtained ($F(1, 124) = 5.03$, $p < .05$). Diagnosis of this interaction shows that the granularity effects observed in studies 1A and 1B replicated when the news article was based on an announcement of the chief research officer (see fig. 2). In this case, participants inferred that a timely launch was more likely when the article referred to "104 weeks" ($M = 4.0$) rather than "2 years" ($M = 3.3$; $t(126) = 1.74$, $p < .1$, for the simple effect). When the announcement was attributed to an auto fan website, the influence of granularity was eliminated ($M = 2.8$ vs. $M = 3.4$ for weeks and years, respectively; $t(126) = 1.42$, $p > .15$, for the simple effect).

Participants' open-ended estimates of how many months the launch might be delayed followed the same pattern. When the announcement was attributed to the chief research officer, participants predicted a longer delay in the 2-year ($M = 17.6$ months) than in the 104-week condition ($M = 9.6$ months; $t(126) = 2.82$, $p < .002$, for the simple effect, after log transformation). When the announcement was attributed to an auto fan website, the influence of granularity was again eliminated ($M = 17.4$ vs. $M = 13.8$, for the 2-year and 104-week conditions, respectively; $t(126) < 1$, $p > .4$). This pattern is reflected in a marginally significant interaction of credibility and granularity ($F(1, 124) = 3.03$, $p = .08$, after log transformation).

In sum, the previously observed granularity effect was only obtained when the communicator could be assumed to have the relevant knowledge. When the implied level of precision exceeded what the communicator was likely to know, participants' judgments were not influenced by the format of the utterance, consistent with the logic of a Gricean conversational analysis. This contingency is not predicted by other conjectures about possible underlying processes, such as differential semantic associations with the unit used (here, week vs. year) or some nonobvious effect of the numerical values (here, 2 vs. 104) themselves. Note also that participants again predicted a shorter delay when the use of fine categories resulted in a message with larger numbers, provided that they could assume that the communicator is cooperative; this runs counter to what an emphasis on the influence of numbers per se would predict. Study 3 provides an extended conceptual replication of these findings.

Study 3: Communicator's Trustworthiness

Study 3 manipulated the communicator's likely cooperativeness through general trustworthiness information. Depending on conditions, participants learned that a power company has been on Forbes's list of the "100 Most Trustworthy Companies" for the last 11 years or has repeatedly been found to "falsify financial records" over the last 11 years. In the context of a power outage, the company announced that power would be restored within "4 days" (coarse unit) or within "96 hours" (fine-grained unit). Note that these announcements imply an unusually long power outage for U.S. customers (Apt, Lave, and Morgan 2006), whose usual experience is that power is restored faster. As seen in study 1, consumers bring such real-world knowledge to bear on time estimation tasks and more so when the message conveys low rather than high precision. They should therefore (i) perceive a higher likelihood that power will be restored ahead of time when a trustworthy company announces restoration "within 4 days" rather than "within 96 hours"; conversely, they should (ii) perceive a higher likelihood that power will be restored right on time when

FIGURE 2

RESULTS OF STUDY 2

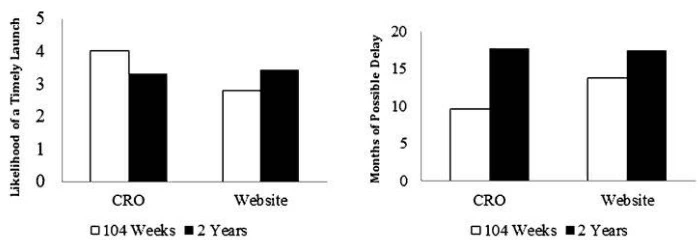


FIGURE 3

STUDY 3: ESTIMATED LIKELIHOOD OF COMPLETION TIME

a trustworthy company announces restoration "within 96 hours" rather than "within 4 days." In short, fine-grained units should result in a lower perceived likelihood of early project completion in study 3, just as they resulted in a lower perceived likelihood of late project completion in study 2. Finally, the predicted granularity effects should (iii) be attenuated or eliminated when the communicator is not trustworthy.

Method. Sixty-five participants (aged 18–68; female 62%) were paid $10 for a 1-hour study consisting of various unrelated tasks, in which the current study was embedded. The study adopted a 2 (source credibility: high vs. low) × 2 (granularity: high vs. low) × 2 (dependent variable: likelihood of completion ahead of time vs. likelihood of completion right on time) mixed design, with the first two factors manipulated between subjects and the third factor within subjects. Participants were told to imagine that a nearby power plant had an accident that resulted in a large power outage. The company promised to restore power within either "4 days" (coarse unit) or "96 hours" (fine-grained unit). Half of the participants learned that the company "has been on Forbes's list of 'The 100 Most Trustworthy Companies' for the last 11 years," whereas the other half learned that the company "has repeatedly been found to falsify financial reports over the last 11 years." After reading the scenario, participants were asked to estimate the likelihood that the power supply will be recovered within 3 days [within 72 hours], that is, ahead of time, and the likelihood that it will be recovered on the fourth day [between 72 and 96 hours], that is, right on time. Both likelihood estimates were provided with slider bars on 60 millimeter scales placed in the middle of the screen. Note that there is no reason for the two likelihood estimates to add to 100 because it is quite conceivable that power will not be restored by the announced deadline.

Results and Discussion. Our rationale predicts that fine-grained quantity expressions are perceived as more precise, which implies that power restoration should be more likely to occur on time rather than ahead of time when the communicator uses a fine-grained rather than coarse unit. However, this inference should be more likely when the speaker is considered cooperative, paralleling the perceived likelihood of delayed completion in study 2. The results support these predictions (fig. 3).

Not surprisingly, consumers assumed that a trustworthy company is more likely to deliver on its promises than an untrustworthy one; hence they reported a higher likelihood that power is restored no later than the promised deadline (the fourth day or the ninety-sixth hour) for the trustworthy ($M = 68\%$) than the untrustworthy company ($M = 54\%$; $F(1, 61) = 3.8$, $p = .055$, for the main effect of trustworthiness). More important, the predicted three-way interaction of granularity, trustworthiness, and judgment ($F(1, 61) = 10.5$, $p < .005$) was obtained and was diagnosed with separate interaction contrasts under trustworthy and untrustworthy company conditions.

When a trustworthy company promised restoration "within 96 hours," participants believed that there was only a 17% chance that the company would finish the job ahead of time (within 72 hours) but a 49% chance that it would finish the job very close to that time (in the 73–96 hours window); presumably, the company used the precise "96 hours" estimate for a reason. Participants' estimates were more optimistic when the trustworthy company promised completion "within 4 days," a less precise announcement that left more room for their real-world experience that power is usually restored faster. In this case, they believed that there is a 43% chance to have power restored early (within 3 days), which is significantly higher than in the fine-grained condition ($t(31) = 2.04$, $p < .05$); they further believed that there is a 26% chance to have it restored close to the communicated time (on the fourth day), which is significantly lower than that in the fine-grained condition ($t(31) = 2.93$, $p < .01$). These differential effects are reflected in a significant interaction contrast of granularity and judgment ($t(61) = 4.1$, $p < .001$) when the communicator is trustworthy, replicating study 2. Further replicating study 2, the impact of granularity was eliminated when the company was untrustworthy ($t(61) < 1$, $p > .6$, for the interaction contrast; see fig. 3 for means).

In combination, studies 2 and 3 highlight that the observed effects are not a function of "numbers" per se—they are a function of pragmatic inferences based on the choices made by a communicator. These inferences follow the Gricean logic of conversation and are only observed when recipients can assume that the communicator follows the maxims of cooperative conversational conduct. When this default assumption is drawn into question, for example, because the communicator lacks general trustworthiness (study 3) or lacks the relevant level of knowledge (study 2), the otherwise observed granularity effects are eliminated. This contingency is not predicted by models of numerosity effects.

In addition, the obtained pattern of quantitative judgments does not follow the predictions of numerosity models, such as anchoring (Tversky and Kahneman 1974) or magnitude priming (Oppenheimer et al. 2008) and their variants (see Pandelaere et al. 2011; Thomas and Morwitz 2009). All of these models predict that "higher numbers" result in higher estimates, which was not the case. Whether the higher numbers associated with more fine-grained expressions of quantities result in higher or lower estimates depends on the substantive nature of the message and the task. In studies 2 and 3, participants assumed that large deviations from the announced completion time were less likely when a trustworthy communicator expressed the intended time of project completion in fine-grained rather than coarse units. In study 2, this resulted in estimates of longer completion times when the unit was coarse (and associated with small numbers) rather than fine-grained (and associated with large numbers); in study 3, this resulted in estimates of longer completion times when the unit was fine-grained (and associated with large numbers) rather than coarse (and associated with small numbers).

Finally, it is worth noting that fine-grained expressions of quantities can be more vivid and concrete than coarse expressions and can give rise to more concrete mental construals (Maglio and Trope 2011). From this perspective, granularity-elicited differences in the construal of the target may influence recipients' judgment. Studies 2 and 3 render this possibility unlikely. In these studies, granularity and possibly associated differences in vividness or concreteness were identical in the cooperative and uncooperative communicator conditions—yet granularity effects were only obtained when the communicator was cooperative.

STUDY 4: IMPACT ON CHOICE

That fine-grained expressions of quantity are perceived as more accurate has potentially important implications for product descriptions. Suppose you want to go on a hike that lasts about 1.5 hours and you want to rely on a GPS device to find your way through the rough terrain. The local outfitter offers two devices that differ in their expected battery life and rental charge. Would the unit in which their battery life is expressed influence whether or not you rent the more expensive gadget to ensure a sufficient safety margin? Study 4 tests this possibility. We predict that consumers are more likely to infer that the product will deliver what it promises when the promise is expressed in fine-grained rather than coarse units and will choose accordingly.

Method

Study 4A: Estimate. Thirty-six participants from an online subject pool received descriptions of two GPS devices, whose battery life was described in hours or in minutes. One device had a battery life of "up to 2 hours" ("up to 120 minutes") and the other a battery life of "up to 3 hours" ("up to 180 minutes"). Next, participants indicated their best guess of the devices' actual battery life by moving slider bars along two 60 millimeter scales; the scales were labeled with "0" at the low end and with the respective "up-to" (i.e., 2 and 3 hours or 120 and 180 minutes, respectively) at the high end.

Study 4B: Choice. Eighty-four different participants, recruited from the same online subject pool, imagined renting a GPS device for a forthcoming hiking trip. The hike was described as a 1.5 hour (or 90-minute) trip in difficult terrain, "so having a GPS on during the entire trip is very important for completing the trip safely." Participants were shown descriptions of two GPS devices offered for rent by a local outfitter. Depending on conditions, the duration of the hike and the battery life of both devices were expressed in minutes or in hours.

One device had a battery life of "up to 2 hours" ("up to 120 minutes"), weighed 300 grams, and was $15 to rent; the other had a battery life of "up to 3 hours" ("up to 180 minutes"), weighed 400 grams, and was $25 to rent. Participants' choice of one of these two GPS devices served as the dependent variable.

Results and Discussion

Estimate. Not surprisingly, participants assumed that the actual battery life of GPS devices falls short of their producers' "up-to" estimates (study 4A). More importantly, the extent of the expected shortfall depended on the granularity used in the product description. Participants estimated that a battery life claim of "up to 2 hours" would translate into actual service of 1.49 hours (equal to 89 minutes), whereas a claim of "up to 120 minutes" would translate into actual service of 106 minutes. Similarly, they estimated that a GPS with a battery life of "up to 3 hours" would deliver 2.40 hours (equal to 144 minutes) of service, whereas a GPS with a battery life of "up to 180 minutes" would deliver 160 minutes. In sum, participants perceived the likely actual battery life as shorter in the "hours" than in the "minutes" condition ($F(1, 34) = 5.68$, $p < .05$, repeated measures ANOVA).

This pattern replicates the results of studies 1–3; consumers again inferred that the likely actual value is closer to the communicated value when a (cooperative) communicator uses a fine-grained unit. Considered in isolation, the pattern of these ratings is also compatible with numerosity accounts that predict that higher numbers per se result in higher estimates; however, those accounts are not compatible with studies 1–3, where messages with larger numbers resulted in smaller estimates.

Choice. Based on the above estimates (provided by the participants in study 4A), a GPS device with a battery life of "up to 120 minutes" should seem a safer bet for a 90-minute hike than a device with a battery life of "up to 2 hours," despite the numerical equivalence of the claims. Empirically, this is the case (study 4B). When battery life was described in minutes, 57% of the participants chose the 120-minute device over the more expensive 180-minute device. In contrast, when battery life was described in hours, only 26% of the participants chose the 2-hour device over the more expensive 3-hour device ($\chi^2(1) = 8.28, p < .005$).

Note that this large difference in choice was observed without drawing participants' attention to the granularity of the speaker's utterance. For all participants, the duration of the hike and the battery life of the GPS devices were expressed either in minutes or in hours, thus avoiding any within-participant variation in units. Moreover, participants who made a choice (study 4B) were not asked to provide any estimates of the devices' actual battery life—those data were provided by different participants in study 4A. Hence, our findings indicate that consumers who read product descriptions are sensitive to the units in which a product's performance is described. Moreover, this sensitivity does not need external prompting beyond the desire to pick a product that serves one's needs.

Our desire to test consumers' spontaneous sensitivity to the granularity used by a communicator in a choice context required that the performance estimates and the choice data not be provided by the same participants. Accordingly, the above between-subjects data do not lend themselves to further within-subjects correlational analyses to determine mediation; instead, our argument rests on testing the logic of a causal chain in a series of cumulative experiments (for further methodological discussion, see Spencer, Zanna, and Fong [2005] and Zhao, Lynch, and Chen [2010]).

GENERAL DISCUSSION

In combination, the present studies identify a granularity effect in the communication of quantities and illuminate its implications for consumer judgment and decision making. We first summarize what has been learned and then turn to alternative accounts.

Pragmatic Inferences from Granularity

According to Grice's (1975) maxims of conversation, recipients assume that communicators provide information that is relevant, truthful, and clear, which entails that their utterances are as informative as possible but not more informative than their knowledge warrants. These tacit assumptions underlie the conduct of conversation in daily life (Grice 1975; Levinson 1983) and are at the heart of many biases and shortcomings in human judgment (Hilton 1995; Schwarz 1994, 1996). Drawing on these assumptions, consumers infer (i) that the same quantitative estimate is of higher precision when it is conveyed in fine-grained (e.g., 104 weeks) rather than coarse (e.g., 2 years) units. This (ii) influences their confidence in the estimate as reflected in the width of the interval that they assume to contain the true value. When asked to estimate the earliest and latest likely completion dates of a project, for example, consumers infer a narrower window of time when the speaker describes the intended completion date as "in 52 weeks" rather than as "in 1 year" (study 1).

If these effects are based on Gricean pragmatic inferences from the communicator's message, they should be eliminated when the cooperativeness of the communicator is called into question (Grice 1975; Levinson 1983; Schwarz 1996). Consistent with this prediction, (iii) granularity only influenced consumers' inferences when they could assume the speaker to have the knowledge required for a high level of precision (study 2) and to be generally trustworthy (study 3), but not otherwise. Finally, consumers' pragmatic inferences from the granularity of a quantitative expression influence the decisions they make. Specifically, consumers are (iv) more likely to believe that a company or product will deliver on its promises when the promise is conveyed in fine-grained rather than coarse units (studies 1–4) and (v) choose accordingly (study 4B).

Not surprisingly, consumers bring additional real-world knowledge to the kinds of tasks presented in these studies. They know, for example, that projects are more likely to be delayed than to be completed early (Kahneman and Lovallo 1993; Kahneman, Lovallo, and Sibony 2011) and that companies have an incentive to present their products in a favorable light (Friestad and Wright 1994). The resulting interplay between real-world knowledge and pragmatic inference from granularity is apparent in figure 1. For example, when asked for the latest likely completion date of a project (study 1B), coarse granularity increases consumers' estimates of likely delays from 52.3 days in the "52 weeks" condition to 96.8 days in the "1 year" condition; however, it increases their estimates for possible early completion merely from 31.8 to 42.8 days. Clearly, consumers not only recognize coarse granularity as a way of hedging one's claims but also know in which direction a communicator is likely to hedge. This is also apparent in study 4, where consumers' choices reflect the insight that battery manufacturers tend to exaggerate their product performance, especially when they report battery life in terms like "up to X hours." Hence, they inferred a shorter likely battery life in all conditions, but more so when a coarser granularity was used.

Alternative Accounts

Psychological research has identified numerous biases in quantitative judgment, which has received particular attention in psychophysics (for a comprehensive review, see Poulton [1989]). Some of these biases found their way into the consumer literature, usually through work in behavioral decision making (for a review, see Thomas and Morwitz [2009]). Much of this work has focused on the influence of numbers per se. It has found that the presentation of higher numbers—either as part of the task or as part of a more or less incidental context—is likely to result in higher quantitative judgments, consistent with the anchoring heuristic (Tversky and Kahneman 1974) that inspired much of the research. Our results do not challenge the process assumptions that underlie models of numerical estimation per se; they merely highlight that forming a judgment on the basis of communicated numbers involves issues that go beyond numerical cognition.

From the perspective of numerical cognition, the important elements in the expressions “2 years” and “104 weeks” are the numbers “2” and “104.” These numbers are assumed to affect estimates through anchoring or a related process, much as marking one’s questionnaire with one’s social security number results in higher estimates on unrelated tasks when the social security number has a high rather than low numerical value (Wilson et al. 1996). But this analogy misses crucial differences. Whereas the social security numbers in Wilson et al.’s (1996) classic study are incidental to participants’ task and carry no unit of measurement, the expressions “2 years” and “104 weeks” (i) explicitly pertain to attributes of the target of judgment and are (ii) associated with differentially fine-grained units of measurement. Hence, they differ not only in numerical value but also in their conversational implicatures and the inferences these implicatures license. As long as the communicator can be assumed to be cooperative (Grice 1975), the more fine-grained expression conveys higher precision, which results in estimates of smaller likely deviation from the communicated value (studies 1–4). Whether a smaller likely deviation, in turn, leads to higher or lower absolute estimates depends on the nature of the specific task. These conversational influences do not arise when the numerical values are incidental and lack a unit of measurement, as in Wilson et al.’s (1996) anchoring study. Tasks with such characteristics presumably capture numerical estimation processes in a (relatively) pure form. Unfortunately, such tasks are rare in real-life consumer behavior, despite their popularity in consumer research. For other tasks, conversational inferences may enhance as well as impair the influence of numerical estimation processes. For example, the numerical component of the expression “104 weeks” may elicit a higher numerical estimate than the numerical component of the expression “2 years,” but the influence of numerical estimation processes may be differentially constrained by the precision implied by the respective unit component. Future work may fruitfully develop paradigms that can identify the relative contributions of numerical and conversational processes. For now, the present studies highlight the importance of conversational inferences by documenting reversals that do not follow from models that focus solely on numbers: communications with higher numbers can result in lower estimates under conditions specified by Grice’s (1975) logic of conversation.

Our conceptual analysis also suggests that some findings that have been confidently attributed to numerosity may have a conversational element. Recent results by Pandelaere and colleagues (2011) may serve as an example. Consistent with earlier work (e.g., Burson et al. 2009), they find, for example, that the difference between 704 and 903 on a 1,000-point scale is perceived as larger than the difference between 7 and 9 on a 10-point scale, even though the opposite is the case (albeit by a minuscule one per mille; 2/10 > 199/1,000). However, participants receive more information than the mere numbers—they are also told that these numbers represent ratings of the likelihood with which two different surgical procedures are successful. From a conversational perspective, this information is not irrelevant to the meaning of the numbers. The 10-point scale asks raters to differentiate at the level of deciles (where a 7 may represent a perceived success rate between 65% and 75%), whereas the 1,000-point scale asks raters to differentiate at the level of 1/10 of 1 percent. As our findings show, recipients are sensitive to such differences in implied precision and assume that cooperative communicators would not use a granularity that is more precise than their knowledge allows. This underlies the influence of granularity on the width of confidence intervals (study 1). It also suggests that the confidence intervals around values of 7 or 9 are larger than the confidence intervals around values of 704 or 903, which would itself contribute to the perception that the former difference is less reliable than the latter and should therefore carry less weight. Hence, numerosity effects (higher numerical estimates when high values are presented), granularity effects based on conversational inference (narrower confidence intervals around the communicated value when fine-grained units are used), or both may contribute to the findings reported by Pandelaere and colleagues (2011). Moreover, their relative contribution may vary depending on the specifics of the task.

In other work, Monga and Bagchi (2012) noted that people usually use large units to communicate large quantities and small units to communicate small quantities, a convention that is consistent with Grice’s (1975) conversational norms. Hence, units come with associated expectations that can run counter to the predictions of numerosity models. For example, Monga and Bagchi’s (2012) participants inferred that it takes more resources to complete a building when its height was expressed in floors rather than feet, in contrast to what numerosity models would predict on the basis of the respective number of floors versus number of feet. This influence of unit choice was only observed when the unit was more salient than the respective number, which itself can be a function of task framing, construal level, and many other variables (Monga and Bagchi 2012).

As this discussion indicates, the exploration of how consumers think about quantities would benefit from a broader perspective that replaces the currently dominant focus on numbers per se with a consideration of the interplay of numbers and units in context. Explorations of this interplay require procedures that are sensitive to the situated- and goal-directed nature of human cognition (Smith and Semin 2004) and the conversational implicatures of research procedures (Bless, Strack, and Schwarz 1993; Schwarz 1994, 1996). A final example may illustrate this point. One account of numerosity effects holds that people focus on the numbers and ignore the units in which they are expressed (Stone et al. 2003). Testing this possibility, Pandelaere and colleagues (2011) drew some participants' attention to the fact that the same quantity can be expressed in different units; as predicted, this eliminated the influence of large versus small numbers. This is consistent with the assumption that participants did otherwise not attend to the unit; but it is also compatible with a more general conversational analysis. As a default, people assume that the format of an utterance is tailored to the communicator's pragmatic intentions, which leads them to infer more precision from more fine-grained units (present studies) or larger quantities from larger units (as discussed by Monga and Bagchi 2012). Neither observation implies that people are unaware that expressions with different units can be numerically equivalent—they merely assume that a given unit is chosen for a reason. This assumption is undermined when they are asked to provide several magnitude ratings of the same quantity expressed in different units (Pandelaere et al. 2011), which conveys that units are exchangeable in the present context and the choice of one over another does not carry pragmatic information (for related findings and discussions, see Igou, Bless, and Schwarz [2002] and Schwarz [1996]). Hence, the manipulation both highlights the equivalence of quantities and undermines the conversational implicatures of units, again rendering it difficult to determine the relative contributions of different processes. In a similar vein, our own observation that conversational inferences can be undermined when the communicator is explicitly presented as unknowledgeable (study 2) or untrustworthy (study 3) is silent on how sensitive consumers are to such conversational variables in the wild, rendering it difficult to estimate the likely relative contribution of different processes under naturalistic conditions. In short, there is more to quantitative judgment than numbers or units alone, and future research may fruitfully explore the interplay of numerical and conversational processes in context.

Implications for Marketing Communication

Our findings have important implications for marketing and public relations communication. Objectively equivalent quantities take on differential meaning when expressed at different levels of granularity. Accordingly, the choice of granularity needs attention. Consumers infer low precision from coarse granularity. Depending on circumstances, low precision may be perceived as a lack of knowledge or as deliberate hedging, with the latter suggesting that the firm may actually expect not to meet its promises. Neither is beneficial for the image of a firm, and objective uncertainty is probably better acknowledged explicitly. Note, however, that these considerations do not suggest that fine-grained quantity expressions are always preferable. When the level of granularity is finer than the communicator's likely knowledge warrants, it undermines the credibility of the claim and possibly the trustworthiness of the firm. Future research may address the proper tuning of granularity in the communication of quantities, shedding light on the interplay between numeric cognition, pragmatic inferences, and consumers' knowledge about the market place.

REFERENCES

Apt, Jay, Lester B. Lave, and M. Granger Morgan (2006), "Power Play: A More Reliable U.S. Electricity System," *Issues in Science and Technology*, http://www.issues.org/22.4/apt.html.

Bless, Herbert, Fritz Strack, and Norbert Schwarz (1993), "The Informative Functions of Research Procedures: Bias and the Logic of Conversation," *European Journal of Social Psychology*, 23 (2), 149–65.

Boush, David M., Marian Friestad, and Peter Wright (2009), *Deception in the Marketplace*, London: Routledge.

Burson, Katherine A., Richard P. Larrick, and John G. Lynch Jr. (2009), "Six of One, Half a Dozen of the Other: Expanding and Contracting Numerical Dimensions Produces Preference Reversals," *Psychological Science*, 20 (9), 1074–78.

Clark, Herbert H. (1985), "Language Use and Language Users," in *Handbook of Social Psychology*, Vol. 2, ed. Gardner Lindzey and Elliot Aronson, New York: Random House, 179–232.

Clark, Herbert H., and Eve V. Clark (1977), *Psychology and Language*, New York: Harcourt, Brace, Jovanovich.

Clark, Herbert H., and Michael Schober (1992), "Asking Questions and Influencing Answers," in *Questions about Questions*, ed. Judith M. Tanur, New York: Russell Sage, 15–48.

Dodd, David H., and Jeffery Bradshaw (1980), "Leading Questions and Memory: Pragmatic Constraints," *Journal of Verbal Learning and Verbal Behavior*, 19 (4), 695–704.

Friestad, Marian, and Peter Wright (1994), "The Persuasion Knowledge Model: How People Cope with Persuasion Attempts," *Journal of Consumer Research*, 21 (1), 1–31.

Gilbert, Daniel (1991), "How Mental Systems Believe," *American Psychologist*, 46 (2), 107–19.

Gourville, John T. (1998), "Pennies-a-Day: The Effect of Temporal Reframing on Transaction Evaluation," *Journal of Consumer Research*, 24 (4), 395–408.

Grice, H. Paul (1975), "Logic and Conversation," in *Syntax and Semantics*, Vol. 3, *Speech Acts*, ed. Peter Cole and Jerry L. Morgan, New York: Academic Press, 41–58.

——— (1978), "Further Notes on Logic and Conversation," in *Syntax and Semantics*, Vol. 9, *Pragmatics*, ed. Peter Cole, New York: Academic Press, 113–28.

Hilton, Denis J. (1995), "The Social Context of Reasoning: Conversational Inference and Rational Judgment," *Psychological Bulletin*, 118 (2), 248–71.

Igou, Eric R., Herbert Bless, and Norbert Schwarz (2002), "Making Sense of Standardized Survey Questions: The Influence of Reference Periods and Their Repetition," *Communication Monographs*, 69 (2), 179–87.

Kahneman, Daniel, and Dan Lovallo (1993), "Timid Choices and Bold Forecasts: A Cognitive Perspective on Risk Taking," *Management Science*, 39 (1), 17–31.

Kahneman, Daniel, Dan Lovallo, and Olivier Sibony (2011), "Before You Make That Big Decision," *Harvard Business Review*, 89 (6), 50–60.

Kumar, Piyush, Manohar U. Kalwani, and Maqbool Dada (1997), "The Impact of Waiting Time Guarantees on Consumer Waiting Experiences," *Marketing Science*, 16 (4), 295–314.

Leclerc, France, Bernd H. Schmidt, and Laurette Dubé (1995), "Waiting Time and Decision Making: Is Time Like Money?" *Journal of Consumer Research*, 22 (1), 110–19.

Levinson, Stephen C. (1983), *Pragmatics*, Cambridge: Cambridge University Press.

Maglio, Sam J., and Yaacov Trope (2011), "Scale and Construal: How Larger Measurement Units Shrink Length Estimates and Expand Mental Horizons," *Psychonomic Bulletin and Review*, 18 (1), 165–70.

McCann, Doug, and E. Tory Higgins (1992), "Personal and Contextual Factors in Communication: A Review of the 'Communication Game,'" in *Language, Interaction, and Social Cognition*, ed. Gun R. Semin and Klaus Fiedler, Newbury Park, CA: Sage, 144–72.

Mogilner, Cassie, Jennifer L. Aaker, and Ginger Pennington (2008), "Time Will Tell: The Distant Appeal of Promotion and Imminent Appeal of Prevention," *Journal of Consumer Research*, 34 (5), 670–81.

Monga, Ashwani, and Rajesh Bagchi (2012), "Years, Months, and Days versus 1, 12, and 365: The Influence of Units versus Number," *Journal of Consumer Research* (June), electronically published September 1, 2011.

Oppenheimer, Daniel M., Robyn A. LeBoeuf, and Noel T. Brewer (2008), "Anchors Aweigh: A Demonstration of Cross-Modality Anchoring and Magnitude Priming," *Cognition*, 106 (1), 13–26.

Pacini, Rosemary, and Seymour Epstein (1999), "The Relation of Rational and Experiential Information Processing Styles to Personality, Basic Beliefs, and the Ratio Bias Phenomenon," *Journal of Personality and Social Psychology*, 76 (6), 972–87.

Pandelaere, Mario, Barbara Briers, and Christophe Lembregts (2011), "How to Make a 29% Increase Look Bigger: The Unit Effect in Option Comparisons," *Journal of Consumer Research*, 38 (August), 308–22.

Pelham, Brett W., Tin Tin Sumarta, and Laura Myaskovsky (1994), "The Easy Path from Many to Much: The Numerosity Heuristic," *Cognitive Psychology*, 26, 103–33.

Poulton, E. C. (1989), *Bias in Quantifying Judgments*, Hillsdale, NJ: Erlbaum.

Raghubir, Priya, and Joydeep Srivastava (2002), "Effect of Face Value on Product Valuation in Foreign Currencies," *Journal of Consumer Research*, 29 (3), 335–47.

Richter, Tobias, Sascha Schroeder, and Britta Woehrmann (2009), "You Don't Have to Believe Everything You Read: Background Knowledge Permits Fast and Efficient Validation of Information," *Journal of Personality and Social Psychology*, 96 (3), 538–58.

Schwarz, Norbert (1994), "Judgment in a Social Context: Biases, Shortcomings, and the Logic of Conversation," in *Advances in Experimental Social Psychology*, Vol. 26, San Diego: Academic Press, 23–62.

——— (1995), "What Respondents Learn from Questionnaires: The Survey Interview and the Logic of Conversation (1993 Morris Hansen Lecture)," *International Statistical Review*, 63 (2), 153–77.

——— (1996), *Cognition and Communication: Judgmental Biases, Research Methods and the Logic of Conversation*, Hillsdale, NJ: Erlbaum.

Schwarz, Norbert, Fritz Strack, Denis J. Hilton, and Gabi Naderer (1991), "Base Rates, Representativeness, and the Logic of Conversation: The Contextual Relevance of Irrelevant Information," *Social Cognition*, 9 (1), 67–84.

Smith, Eliot R., and Gun R. Semin (2004), "Socially Situated Cognition: Cognition in Its Social Context," *Advances in Experimental Social Psychology*, 36, 53–117.

Smith, Vicki, and Phoebe C. Ellsworth (1987), "The Social Psychology of Eyewitness Accuracy: Leading Questions and Communicator Expertise," *Journal of Applied Psychology*, 72 (2), 292–300.

Spencer, Steven J., Mark P. Zanna, and Geoffrey T. Fong (2005), "Establishing a Causal Chain: Why Experiments Are Often More Effective than Mediational Analyses in Examining Psychological Processes," *Journal of Personality and Social Psychology*, 89 (6), 845–51.

Sperber, Dan, and Deirdre Wilson (1986), *Relevance: Communication and Cognition*, Cambridge, MA: Harvard University Press.

Stone, Eric R., Winston R. Sieck, Benita E. Bull, J. Frank Yates, Stephanie C. Parks, and Carolyn J. Rush (2003), "Foreground: Background Salience: Explaining the Effects of Graphical Displays on Risk Avoidance," *Organizational Behavior and Human Decision Processes*, 90 (1), 19–36.

Strack, Fritz, and Norbert Schwarz (1992), "Communicative Influences in Standardized Question Situations: The Case of Implicit Collaboration," in *Language, Interaction and Social Cognition*, ed. Gun Semin and Klaus Fiedler, Beverly Hills, CA: Sage, 173–93.

Thomas, Manoj, and Vicki Morwitz (2009), "Heuristics in Numerical Cognition: Implications for Pricing," in *Handbook of Pricing*, ed. Vithala R. Rao, Northampton, MA: Elgar, 132–49.

Tversky, Amos, and Daniel Kahneman (1974), "Judgment under Uncertainty: Heuristics and Biases," *Science*, 185 (4157), 1124–31.

Ülkümen, Gülden, Manoj Thomas, and Vicki G. Morwitz (2008), "Will I Spend More in 12 Months or a Year? The Effect of Temporal Frames on Budget Estimates," *Journal of Consumer Research*, 35 (Augusut), 245–56.

Wilson, Timothy D., Christopher E. Houston, Kathryn M. Etling, and Nancy Brekke (1996), "A New Look at Anchoring Effects: Basic Anchoring and Its Antecedents," *Journal of Experimental Psychology: General*, 125 (4), 387–402.

Xu, Alison Jing, and Robert S. Wyer Jr. (2010). "Puffery in Advertisements: The Effects of Media Context, Communication Norms, and Consumer Knowledge," *Journal of Consumer Research*, 37 (2), 329–43.

Yaniv, Ilan, and Dean P. Foster (1995), "Graininess of Judgment under Uncertainty: An Accuracy-Informativeness Trade-Off," *Journal of Experimental Psychology: General*, 124 (4), 424–32.

Zhao, Xinshu, John G. Lynch Jr., and Qimei Chen (2010). "Reconsidering Baron and Kenny: Myths and Truths about Mediation Analysis," *Journal of Consumer Research*, 37 (August), 197–206.