Psychologists have long been intrigued by how humans and nonhuman primates process magnitudes such as “how far, how fast, how much, how long, and how many.” This fascination perhaps stems from the fact that magnitude estimations of space, time, and number form the bedrock of most of the decisions that we make in daily life. Decisions about how many cookies to eat, how many payments to make, how many days to wait for a product, all have one thing in common: they require a fundamental ability to be able to discern discriminable elements of the type of stimulus in question. Although distinguishing one from many is an ability that is shared by humans and nonhuman primates, what makes research in this area particularly intriguing is the layer of complexity that arises when we take our ability to mathematically represent different quantities in different units (e.g., 1 month, 4 weeks, 30 days) and map it on to this more fundamental ability. The mapping of this numerical system onto a more generalized magnitude representational system allows us to raise the basic question: do magnitude estimates change when they are represented in a different unit or metric?

The current collection of articles on numerosity and consumer behavior (appearing over the last two years) complements and adds to a growing body of work that has already appeared in *JCR*. The articles start with the assumption that a multitude of physical stimuli, regardless of the domain, can be represented in memory using a magnitude representational system. However, the overlay of a verbal, representational system that draws on our knowledge of mathematical symbols and provides a common basis for interpreting these quantities can sometimes produce effects that skew our ability to estimate things correctly. Thus, although there is no rational reason to suppose that a week might differ from 7 days, it does. The reasons for the occurrence of this numerosity effect are still unclear. Nevertheless, the effect leads to errors in estimation that affect not only how we make progress in goals that are set but also affect, at a more fundamental level, how we perceive things. The first two papers in this collection document this.

The first article, by Pandelaere, Briers, and Lembregts, shows that expressing an attribute in a different unit leads to greater perceived difference if the unit is on an expanded or finer-grained scale. Thus, for example, consumers see a greater difference between products that express warranty information in months (84 months) as opposed to years (7 years). The effects are attributed to a tendency for people to focus on the numbers rather than the units in which the quantity is represented. One consequence of this tendency is that as the perceived difference increases, consumers are more likely to switch to the better quality option. The authors show the implications of this for decision making by tracking how consumers switch in a variety of domains that range from product decisions to picking a healthy snack. Interestingly, drawing attention to the possibility that this estimate can be represented in different units eliminates the effect.

The second article in this series, by Bagchi and Li, examines the implications of scales that use a greater number of units in the context of loyalty programs (e.g., “earn 10 points per dollar spent and claim your reward when you reach 1,000 points” vs. “earn 1 point per dollar spent to claim a reward when you reach 100 points”). In their studies, not only does the scale representing the distance to be traveled to get the reward vary but also the step sizes to get there. At issue, then, is what consumers use in order to infer their goal progress relative to that of another person. Their findings suggest that when the step size information is ambiguous, goal progress is inferred largely from the magnitude of the scale. Consumers perceive themselves to be further away relative to someone else when the scale consists of a
larger number of units. When step size information is unambiguous, however, progress relative to another person is more likely to be inferred from the size of the step than the number of units on the scale.

The next paper in the collection raises the question: when is this effect more or less likely to occur? Monga and Bagchi point to conversational norms that exist, wherein small quantitative changes are expressed in smaller units and large changes in large units, and suggest that in some instances people might focus on units rather than the numbers associated with them. The switch to a focus on units rather than numbers can lead to situations where 1–3 weeks of delivery time is seen as greater than 7–21 days. Given that units are at a higher level of abstraction, this phenomenon is more likely to manifest when people have an abstract mind-set than a concrete mind-set. The implications of their findings (shown for several types of quantities) are important for representing information in persuasive communications more generally.

The remaining two papers in the collection focus on the processes that potentially underlie the numerosity effect. Although prior work has offered different accounts for the numerosity effects (such as anchoring or the use of the numerosity heuristic) these two papers raise alternative possibilities. The paper by Zhang and Schwarz shows why quantitative magnitudes that are expressed in fine-grained or coarse units might be perceived differently. Specifically, fine-grained utterances increase confidence that the information is accurate because listeners assume that the communicator is following Gricean conversational norms. Consumers also perceive the product to be more likely to deliver on promises in this case. One implication of this finding is that if consumers perceive lack of trust or expertise in the communicator, scales that are fine grained could lead to reverse effects or lower magnitude estimates.

Although the final paper in the collection is not directly related to numerosity, it could provide an alternative account of its effects. This account has its basis in phonetics. Coulter and Coulter show that vowel and consonant sounds (phonemes) are associated with perceptions of large and small size because of the frequency with which different sounds are used in everyday speech. When consumers verbalize or mentally rehearse a sale price (e.g., in situations when they are looking for a bargain), phonological codes are automatically elicited. If the sale price consists of phonemes that are associated with perceptions of smallness, this should increase the perception that the sale price is small relative to the regular price. If the phonological codes associated with the numbers are different (e.g., in Chinese) the effects are not observed. Seen in the context of other papers on numerosity, these findings raise a question: could finer-grained unit representations be seen as different because of their phonological codes? We hope that these papers will provide further food for thought on this fascinating topic.

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**How to Make a 29% Increase Look Bigger: The Unit Effect in Option Comparisons**

Mario Pandelaere, Barbara Briers, and Christophe Lembregts

Quantitative information can appear in different units (e.g., 7-year warranty = 84-month warranty). This article demonstrates that attribute differences appear larger on scales with a higher number of units; expressing quality information on such an expanded scale makes consumers switch to a higher-quality option. Testifying to its practical importance, expressing the energy content of snacks in kilojoules rather than kilocalories increases the choice of a healthy snack. The unit effect occurs because consumers focus on the number rather than the type of units in which information is expressed (numerosity effect). Therefore, reminding consumers of alternative units in which information can be expressed eliminates the unit effect. Finally, the unit effect moderates relative thinking: consumers are more sensitive to relative attribute differences when the attribute is expressed on expanded scales. The relation with anchoring and implications for temporal discounting and loyalty programs are discussed.

*Journal of Consumer Research, 38* (August 2011), 308–22
Illusionary Progress in Loyalty Programs: Magnitudes, Reward Distances, and Step-Size Ambiguity
Rajesh Bagchi and Xingbo Li

Loyalty programs offer rewards via mediums of different magnitudes (e.g., “$6 off when you accumulate 1,000 [100] points. Earn 10 [1] points/dollar”). The program medium presents two key pieces of information: reward distance (points required to redeem reward) and step size (points earned per dollar). In higher-magnitude (vs. lower-magnitude) programs, both reward distances (1,000 vs. 100) and step sizes (10 vs. 1 point[s]/dollar) are larger. How do these two pieces of information affect consumers’ post-enrollment inferences of progress, store loyalty, and recommendation likelihood? Do consumers always integrate both pieces? The authors identify a moderator, step-size ambiguity, and show that when ambiguity is high, only reward distance affects inferences. When ambiguity is lower, consumers integrate step size with reward distance, but in a biased manner. Implications arise in goal following and in physical and psychological distance estimation contexts (e.g., weight loss, savings) where distances and step sizes can vary (e.g., as a function of units: kilograms vs. pounds), but especially in loyalty rewards contexts.

Journal of Consumer Research, 37 (February 2011), 888–901

Years, Months, and Days versus 1, 12, and 365: The Influence of Units versus Numbers
Ashwani Monga and Rajesh Bagchi

Quantitative changes may be conveyed to consumers using small units (e.g., change in delivery time from 7 to 21 days) or large units (1–3 weeks). Numerosity research suggests that changes are magnified by small (vs. large) units because a change from 7 to 21 (vs. 1–3) seems larger. The authors introduce a reverse effect that they term unitosity: changes are magnified by large (vs. small) units because a change of weeks (vs. days) seems larger. They show that numerosity reverses to unitosity when relative salience shifts from numbers to units (study 1). Then, arguing that numbers (units) represent a low-level (high-level) construal of quantities, the authors show this reversal when mind-set shifts from concrete to abstract (studies 2–4). These results emerge for several quantities—height of buildings, time of maturity of financial instruments, weight of nutrients, and length of tables—and have significant implications for theory and practice.

Journal of Consumer Research, 39 (June 2012), 185–98

How and Why 1 Year Differs from 365 Days: A Conversational Logic Analysis of Inferences from the Granularity of Quantitative Expressions
Y. Charles Zhang and Norbert Schwarz

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.


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**Small Sounds, Big Deals: Phonetic Symbolism Effects in Pricing**

Keith S. Coulter and Robin A. Coulter

Studies suggest that certain vowel and consonant sounds (or phonemes) can be associated with perceptions of large and small size. Mental rehearsal of prices containing numbers with small phonemes results in overestimation of price discounts, whereas mental rehearsal of prices containing numbers with large phonemes results in underestimation. Mental rehearsal of the same sale prices characterized by small phonemes in one language and large phonemes in another language can yield differential effects. For example, when sale prices are rehearsed in English, an $11.00–$7.88 (28.4%) discount is perceived as greater than a $10.00–$7.01 (29.9%) discount; however, when these same prices are rehearsed in Chinese, the latter discount is perceived as greater. Non-price-related phonemes do not yield these same discount distortions. Collectively, findings indicate that the mere sounds of numbers can nonconsciously affect and distort numerical magnitude perceptions.

*Journal of Consumer Research*, 37 (August 2010), 315–28