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Vowel Sounds in Words Affect Mental Construal and Shift Preferences for Targets

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A long tradition in sound symbolism describes a host of sound–meaning linkages, or associations between individual speech sounds and concepts or object properties. Might sound symbolism extend beyond sound–meaning relationships to linkages between sounds and modes of thinking? Integrating sound symbolism with construal level theory, we investigate whether vowel sounds influence the mental level at which people represent and evaluate targets. We propose that back vowels evoke abstract, high-level construal, while front vowels induce concrete, low-level construal. Two initial studies link front vowels to the use of greater visual and conceptual precision, consistent with a construal account. Three subsequent studies explore construal-dependent tradeoffs as a function of vowel sound contained in the target's name. Evaluation of objects named with back vowels was driven by their high- over low-level features; front vowels reduced or reversed this differentiation. Thus, subtle linguistic cues appear capable of influencing the very nature of mental representation.

Keywords: language, sound symbolism, mental construal, judgment, decision making

> What's in a name? That which we call a rose by any other name would smell as sweet.
>
> —Shakespeare, *Romeo and Juliet*

One dominant theoretical view in psycholinguistics supports Shakespeare's famed adage, proposing that language is an arbitrary symbolic system (Saussure, Bally, Sechehaye, Riedlinger, & Baskin, 1966)—a perspective consistent with the sheer number of different human languages. Accordingly, different labels for the same objects should be functionally equivalent, with meaning assigned purely through established convention among a community of speakers. However, growing evidence for the phenomenon of phonetic sound symbolism argues against such a *complete* arbitrariness of language. This perspective instead holds that the individual sounds that make up words may, themselves, have systematic relationships with particular meanings. Rather than established convention, this systematicity is attributed to some shared, psychological sound–meaning link.

Accordingly, a growing body of research on phonetic sound symbolism has identified associations between individual *phonemes*—the component speech sounds that function as the building blocks of human language—and particular objects or concepts in the world. Mounting evidence supports the notion that people exhibit a variety of these linkages between meaning and individual speech sounds (for reviews, see French, 1977; Nuckolls, 1999), utilizing the sounds comprising a word in systematic ways to draw inferences about an otherwise uncertain target (Jacobson & Waugh, 1987; Sapir, 1929). These effects appear to generalize in at least some ways across cultures and peoples, as cross-linguistic work has demonstrated consistencies in these sound–meaning linkages across unrelated language families (Hinton, Nichols, & Ohala, 1994; Ohala, 1984; Ultan, 1978). Sound symbolic effects thus have an intriguing potential to deepen our understanding of language— one of the core defining psychological characteristics of the human species—as a symbolic system and may even provide insight into the very origins of language itself (Ramachandran & Hubbard, 2001).

However, phonetic sound symbolism studies, to date, have only investigated the relationship between the sounds in words and specific physical properties or qualities inferred about the referent—sound–meaning correspondences, or *what* people think about the object (e.g., its size or shape). The present investigation considers instead whether certain sounds might also exhibit sound-*representation* correspondences, steering the course for *how* peo-

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ple process and prioritize information about objects. To investigate this possibility, we draw upon two historically separate domains of psychological research: phonetic sound symbolism, on the one hand, and construal level theory (Trope & Liberman, 2010)—a theory of how objects and concepts can be represented—on the other.

The remainder of the article, providing a theoretical and empirical connection between these two domains, is organized as follows. We first briefly describe previous research in phonetic sound symbolism. We then provide a more thorough description of construal level theory; this discussion both informs the potential linkage between speech sounds and level of representation and provides background for the constructs used in the current set of studies, which borrow from construal level theory's approach to conceptual level of representation. Thereafter, we present five studies exploring how speech sounds can shape level of conceptual representation and lead to behavioral consequences.

Vowel Sound Symbolism

A first broad distinction among the individual speech sounds comprising words categorizes them as either consonants or vowels. Although a variety of sound symbolic effects have been documented for consonants (e.g., Newman, 1933), the majority of research on sound symbolism has probed concepts that are associated with vowel sounds. This focus on vowels may stem from the fact that there are simply fewer distinct vowel sounds than there are consonants, making vowels easier to classify in a manner conducive to empirical examination (Shrum & Lowrey, 2007). Alternatively (or additionally), this focus could arise from a relative strength or robustness of meaning–vowel linkages compared to meaning–consonant linkages in the context of sound symbolism. Indeed, within a word, the inference of sound symbolic associates appears to be stronger for vowels than for consonants that imply the same properties (Klink & Wu, in press).

Regardless of the reason for this asymmetry in focus, a now large body of empirical work has identified associations between meaning and one particularly important dimension on which vowels can differ: frontness/backness. This dimension refers to the location in the mouth of the highest point reached by the tongue during articulation. The front/back distinction can be felt by saying, for example "feel" followed by "fool": The highest point of the tongue is positioned relatively forward in the mouth during the production of the "ee" sound in "feel" compared to the "oo" sound in "fool." Importantly, the frontness/backness distinction can be used to classify several different vowel sounds. The vowels in the words *bee*, *bin*, *bay*, and *bet* all contain front vowels, while the vowels in *bought*, *boat*, *but*, *boot* would be classified as back vowel sounds (see MacKay, 1978).

Previous research suggests that, all else equal, people use the binary distinction of vowel frontness/backness to infer specific features about referents. For example, in an early, prototypical study, participants were given two words that differed only in the frontness/backness of the vowel (*mil* and *mal*, respectively) and were asked to match these names to two tables that differed only in size (Sapir, 1929). The overwhelming majority paired the smaller table with the front vowel name and the larger table with the back vowel name, indicating an association between physical size and vowel sound. Furthermore, cross-linguistic work has demonstrated that a wide range of existing languages—across unrelated language families—tend to exhibit a similar association (Johnson, 1967; Ohala, 1984; Ultan, 1978). For example, consider the front vowel in the first syllable of *chico* compared to the back vowel of *gordo* in Spanish to convey small or large size, respectively. While this is a trend and not a rule (e.g., the opposite pattern evinces in the English words *big* and *small*), certain vowel-sound symbolic relations may thus be somewhat universal features of human speech. Extensions of this work have revealed similar patterns for other physical features: Objects with names including relatively frontal vowel sounds are associated with being more sharp (Brown, Black, & Horowitz, 1955), hard (Koriat & Levy, 1977), bright (Newman, 1933), and angular (Köhler, 1947; Ramachandran & Hubbard, 2001), among others (see French, 1977).

The power of sound symbolic associations is reinforced by work showing that these linkages are robust enough to translate to related behavioral consequences. These sound–meaning correspondences influence speed of lexical access (Westbury, 2005) and speed and accuracy of word learning (Nygaard, Cook, & Namy, 2009) in adults, as well as accuracy (Yoshida, 2012) and generalization of word learning (Imai, Kita, Nagumo, & Okada, 2008) in children. Furthermore, people's preferences are strongest when the physical properties desirable for an object have a match (or fit) with the characteristics implied by the vowel sound in its name. Reasoning that quickness and small size (associated with front vowels) constitute positive physical characteristics for a two-seater convertible—and that back vowel sounds imply slowness and large size, desirable in a sport utility vehicle (SUV)—Lowrey and Shrum (2007) asked research participants to choose a brand name for a two-seater convertible or an SUV. As predicted, participants tended to pair front vowel names with the convertible and back vowel names with the SUV, indicative of an association between vowel sound and its implied characteristics. Yorkston and Menon (2004) documented a similar effect with respect to preference judgments, showing that participants expressed a more favorable attitude toward and greater willingness to pay for an ice cream when its name included a back vowel (Frosh) as opposed to a front vowel (Frish); this difference was attributed to a match or fit between back vowels and the concept of physical thickness/richness (desirable qualities for an ice cream). Finally, this process of associating vowel sounds with physical features happens at an automatic or nonconscious level (i.e., it happens effortlessly, uncontrollably, and without conscious awareness; Yorkston & Menon, 2004). Taken together, sound symbolic research to date has documented robust and automatic associations between vowel sounds contained in words and the physical properties of their referents.

Construal Level Theory

The present investigation extends beyond *what* people think about a target as a function of vowel sound to *how* they think about it—that is, the manner in which they represent it and process relevant information. Toward this end, we draw upon the perspective of construal level theory (Trope & Liberman, 2010). It posits that any object or concept can be mentally represented along a continuum, ranging from its primary, essential, and invariant features (i.e., abstractly, or at a high level of construal) to its secondary, incidental, and contextualized features (i.e., concretely, or at a low level of construal). For example, people thinking about actions from a low-level, concrete perspective consider the specifics of how to perform that behavior, whereas people taking a high-level perspective are attuned to why to engage in that behavior in the first place. As a result, people in a concrete frame of mind are more likely to characterize the activity "studying" in terms of the mechanics behind doing it ("reading a textbook"); people in an abstract frame of mind opt instead to describe the broad, overarching purpose that activity serves ("doing well in school"; Liberman & Trope, 1998). This and other similar studies provide evidence that construal is characterized by changes in the cognitive representation of targets (see Fujita, Henderson, Eng, Trope, & Liberman, 2006; Liviatan, Trope, & Liberman, 2008; Wakslak, Trope, Liberman, & Alony, 2006).

Changing the level at which a concept or object is construed is thus a shift in the way that concept or object is considered, evaluated, and acted upon. This shift not only determines which types of features of the target are most cognitively salient but also configures downstream attitudes and preferences. Consider, for example, properties that might characterize a cup. Some features (i.e., *high-level* features) are more essential to its core function as a cup, including a capacity to hold liquid or aspects related to that function (e.g., any cracks that would compromise its liquid-holding ability). In describing the same cup, other features (i.e., *low-level* features) are less relevant to its overarching purpose and would include its shape, color, or the presence of a handle. High-level features of an object reflect its core, invariant properties—those that do not change across different specific exemplars of that object. In contrast, low-level features are more incidental, salient within the realm of immediate experience, and sensitive to the context in which they are considered. For example, participants led to construe the purchase of a radio at a high level expressed a strong preference for a model with good sound quality (a high-level, essential feature for a radio) but a poor built-in clock (a low-level, incidental feature) over a model with the opposite characteristics (i.e., poor sound but a good clock). Conversely, those thinking at a low level showed a drastically tempered pattern of such preference differentiation, suggesting that they weighted low-level or incidental features more strongly than those thinking at a higher, more abstract level (Trope & Liberman, 2000). A variety of convergent studies demonstrate that, when thinking at a more abstract level, people show greater sensitivity to high- versus low-level features; concrete construal reduces or reverses such differentiation (e.g., Fujita, Trope, Liberman, & Levin-Sagi, 2006; Liberman & Trope, 1998; Trope & Liberman, 2000). Shifting the level at which an object is represented can thus change the relative weighting of that object's different features, which, in turn, can change attitudes and preferences regarding those objects.

More generally, concrete and abstract representations have core differences in nature. According to construal level theory, these different levels are functionally divergent in that they serve distinct purposes. Low-level construals help to navigate one's current, concrete experience, whereas high-level construals afford the opportunity to mentally transcend the here and now (Trope & Liberman, 2010). In particular, because they incorporate the contextualized, incidental details that comprise immediate experience, low-level (concrete) representations are maintained at a higher resolution and vividness relative to high-level (abstract) representations. As a consequence, people parse concrete experience into many distinct or precise elements, whereas those at a higher level make relatively coarse distinctions. Empirical evidence in support of this notion has taken a number of forms. For example, Liberman, Sagristano, and Trope (2002) asked research participants to divide a set of objects into as many categories as they saw fit. As predicted, people thinking concretely generated more (precise) categories to group the items, whereas those thinking abstractly required fewer categories for the same set. Conceptually similar results have been reported for the identification of distinct actions in which people at a lower level of construal again made relatively fine-grained distinctions (Henderson, Fujita, Trope, & Liberman, 2006).

Not only does construal impact precision, but precision also impacts construal. In one study, Maglio and Trope (2011) manipulated level of construal between participants and then asked them to create a single scalar unit of measurement to be used as the standard in a subsequent measurement task. Those thinking concretely generated an objectively smaller measurement unit in order to perform the measurement relative to those thinking abstractly. In another study, they manipulated precision in the form of measurement unit, assigning participants to use either relatively small and precise millimeters or relatively large and coarse decimeters in visually estimating the length of a path. Those assigned to measure in millimeters thought about the path in a more low-level way than those who measured in decimeters. Thus, getting people to think in precise terms seems to induce a sense of concreteness, whereas getting them to think more coarsely induces abstraction. It is this difference between concrete and abstract representations (i.e., the associated constellation of qualities characterizing precise versus coarse-grained representations) that provides the potential link between vowel sound symbolism and level of mental representation.

Linking Vowels to Construal

As we have reviewed, previous research at the intersection of language and construal suggests two crucial points. First, vowel sounds in words are associated with, and activate, a group of different concepts or physical attributes (e.g., sharpness/dullness, thinness/thickness). Second, differences in level of construal seem to vary along an overlapping set of dimensions (e.g., brightness, sharpness, and even smallness seem to characterize more precise or high-resolution representations of objects). Importantly, anything that induces a sense of representational precision also induces concrete construal of the target under consideration. Establishing a connection from vowel to physical associations to construal, we posit that different vowel sounds lead people to think in different ways (i.e., more or less precisely), in turn leading to differences in the way objects with labels containing different sounds are represented. As discussed above, prior empirical work has established that representations maintained at a concrete or lower level are characterized by a higher level of resolution—associated with more precise, fine-grained distinctions, and smaller units of measurement—than abstract or high-level representations. The defining characteristics of an object seen with a high (vs. low) degree of resolution are thus some of the same physical qualities—smallness (vs. largeness), sharpness (vs. bluntness), brightness (vs. dimness)—that have been previously established as psychological associates of the frontness/backness vowel distinction.

If vowel sounds are naturally, inherently associated with an assemblage of qualities that also characterize a key difference between abstract versus concrete levels of representation, then it follows that the mere sounds in labels will influence the level at which the label's referent is represented. To date, no studies have investigated this possibility directly, although one result is suggestive: In a separate experiment from the same aforementioned article, Lowrey and Shrum (2007) asked people to select what they felt would provide the best label for either a knife or a hammer from a list of novel names varying in vowel sound. The knife predominantly received front vowel names while the hammer predominantly received back vowel names, and the authors interpreted this finding as indicative of an association between vowel sound and physical features (knives and front vowels share an association with sharpness; hammers and back vowels are relatively blunt). Bridging this finding with our resolution-based account, we reasoned that use of a sharp object—like a knife—applies force to a smaller area, requiring greater precision (e.g., slicing a tomato). On the other hand, use of a dull or blunt object—like a hammer—might better serve coarse-grained and imprecise functions that allow greater room for error (e.g., driving a nail). Accordingly, it stands to reason that objects designed for more precise functions align with front vowel labels, while blunter functionality may be associated with back vowels. Should this relationship hold true, it follows that front vowels should activate relatively concrete construal, whereas back vowels should lead to relative abstraction.

Overview of Studies

Building from previous research on vowel sound symbolism that has explored the relationship between vowels and the physical properties of the referents, we herein consider the possibility that vowel sounds may additionally affect how people think about referents. This work thus explores a novel extension of the scope of sound symbolic effects, asking if sound-concept relationships might extend beyond links between sounds and specific representations (e.g., small versus large) to links between sounds and the relative *level* of those representations (concrete vs. abstract). In other words—in addition to sound–meaning correspondences—might there also be sound-*representation* correspondences that can influence the manner in which labeled targets are conceptualized? Specifically, we test the hypothesis that vowel sounds can manipulate mental construal: Words including front vowel sounds should elicit low-level construal of their targets, whereas back vowels should elicit high-level representation. Further, we propose that this link occurs through a process of front (back) vowels being associated with greater (lesser) precision.

First, we sought evidence that vowel sounds affect the degree of precision applied to their referents. This prediction aligns with findings from Lowrey and Shrum (2007) suggesting that vowel sounds affect the perception of physical attributes. An initial study manipulates the name assigned to a target (including either a front or back vowel) and then assesses the degree of precision applied to it in a visual task. We predict that people will use greater precision for targets labeled with front versus back vowels. A second study extends this effect to the conceptual realm, using a different (but established) measure of precision (the Behavior Identification Form; Vallacher & Wegner, 1989). This study also identifies an important moderator of our sound symbolic effect: the relevance of vowel sound to the focal target (cf. Yorkston & Menon, 2004). These studies were designed to establish empirically the predicted connection between vowel sounds and use of precision, the proposed underlying process in relating vowels to mental construal.

If front vowels lead to the application of greater precision, which in turn has been shown to induce a sense of concrete construal (Maglio & Trope, 2011), we would expect vowels to, then, also shift the level at which people construe targets. Accordingly, we present three additional studies that consider the effect of vowel sounds on construal-dependent evaluations. To gauge the level at which people construe objects, we build from past research that has established how abstract and concrete construals systematically shift the relative weighting of different types of information in judgment and decision making (e.g., Trope & Liberman, 2000). We test our hypothesis by exploring the empirically well-established tradeoff between high- and low-level features within an object, here as a function of the vowel sound contained in its name. To provide evidence for a wide-ranging effect of vowel sound on mental construal, these three studies each assess different construal-dependent tradeoffs between high- and low-level features. Across each of them, we predict that participants will give greater weight to low-level features when the same object is given a name that includes a front (vs. a back) vowel sound. The opposite should hold true for high-level features, relatively prioritized by people considering objects named with back (vs. front) vowel sounds.

Study 1: Visual Precision

Our first study tests the possibility that front vowels would lead people to parse the same referent object in a more fine-grained manner relative to back vowels. We assessed precision as applied to an aerial image of a city whose ostensible name included either a front or back vowel. Upon asking participants to divide the city into as many regions as they saw fit, we hypothesized that those perceiving a city named with a front (vs. back) vowel would create more distinct partitions. In testing this prediction, we took two important precautions in designing the city names. First, we generated fictitious names to ensure that our participants had no previous experience with the labels they encountered; this approach further allowed us to control for linguistic properties of the names. Second, we utilized a set of multiple front and back vowel names to provide evidence for an effect that generalizes beyond any individual item.

Method

Stimuli. We generated a total of six fictitious city names, with three including front vowels and three including back vowels. To make the two sets of stimuli (front and back vowel names) as similar as possible except for their vowel sounds, we created front/back pairs of names that were (a) identical in all sounds except for the vowel they contained and (b) matched on all individual position-specific internal biphone probabilities (the probability, given the phonological characteristics of the English language, that each pair of sounds would co-occur at that position in an English word), based on values returned by the Phonotactic Probability Calculator (Vitevitch & Luce, 2004). Balancing the stimuli in this way avoids potential unwanted between-item effects of differences in speed of access or familiarity (e.g., Vitevitch & Luce, 1999) on our dependent variable, and ensures that no individual experimental item would sound more familiar or like a more plausible word in English. The resulting list of city names (Fleeg/Floog; Theek/Thook; Cheetle/Chootle) was thus matched within each pair for consonants and all position-specific biphone probabilities within the word, resulting in matched average biphone probabilities for the front and back vowel conditions ($M_{\text{front}} = 0.390$; $M_{\text{back}} = 0.391$).

Procedure. One hundred eighty-seven volunteers were recruited from throughout the New York University campus and asked to complete a brief research survey related to geography. They were presented with an image of an aerial view of a rural landscape, and participants were randomly assigned to condition in which the name given to the depicted city included either a front or a back vowel. Specifically, for those in the front vowel conditions, the city name was randomly assigned as Fleeg, Theek, or Cheetle; for those in the back vowel conditions, the name was randomly assigned as Floog, Thook, or Chootle. After learning the name of the city, all participants were asked to look over the image of the city and visually divide it into as many regions as made sense to them and then provided their number to the researcher.

Results and Discussion

To determine the effect of vowel sound contained in the city names on the number of distinct geographical regions the participants saw, we conducted a mixed-model analysis of variance (ANOVA). Specifically, we constructed a model with the individual city names nested as random factors within their vowel sound (i.e., front or back). This analysis revealed a significant effect of vowel sound on geographical divisions, $F(1, 4) = 13.60$, $p = .02$, but no significant effect of city names nested within vowel sound, $F(4, 181) < 1$, $p > .5$. Given these results, we conducted a separate analysis to compare front and back vowels that collapsed across the individual city names. This comparison yielded a significant result, $t(185) = 2.64$, $p < .01$, $d = 0.39$, such that participants considering city names that included front vowels divided the cities into significantly more regions ($M = 6.38$, $SD = 2.96$) than those considering city names including back vowels ($M = 5.30$, $SD = 2.61$). Figure 1 provides a graphical depiction of the number of partitions as a function of the individual city names.

Thus, Study 1 suggests that people apply greater precision to targets labeled with front (vs. back) vowels. As such, this study makes the important contribution of going beyond the physical features inferred about a target from the vowels in its name to how people think about that target: People applied greater visual precision to a landscape image when its label included a front vowel.

Study 2: Conceptual Precision

With Study 2, we expand the scope of our investigation from visual to conceptual precision and its relationship with vowel sound. Here, we utilize the Behavior Identification Form (Vallacher & Wegner, 1989), which asks participants to classify a series of actions either on the basis of their precise means of execution or the more general (less precise) purpose behind the actions. We predicted that, by changing the ostensible name of the task to include either a front or a back vowel, participants would be relatively more attuned to the precise means or the general purpose of the tasks, respectively.

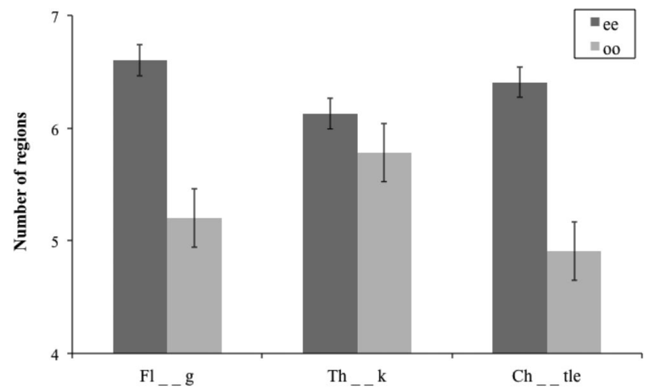

Figure 1. Mean number of regions reported by individual city name, Study 1. Stems completed with "ee" constitute city names inclusive of a front vowel; stems completed with "oo" constitute city names inclusive of a back vowel. Bars indicate standard error.

To date, the majority of research on sound symbolism has mapped its manifold associations with physical features or provided evidence that it generalizes across different languages. This focus on breadth has, perhaps, sacrificed consideration of the depth with which sound symbolic effects operate at a process level. In Study 2, we attempt to speak to the latter, as our dependent variable allowed us to consider an important potential moderator of our effect: the relevance of the name used to manipulate vowel sound in the first place. One recent sound symbolism investigation provided evidence consistent with this relevance-dependent hypothesis. In an extension of the aforementioned result on liking for ice cream, Yorkston and Menon (2004) manipulated not only the vowel sound in the name of the ice cream—including a front vowel (Frish) or a back vowel (Frosh)—but also what they termed diagnosticity. Specifically, they told the participants that the name presented (Frish or Frosh) was either the true (i.e., diagnostic) name of the ice cream or that it was simply a test name that would later be changed (i.e., nondiagnostic). When asked to rate their liking for the ice cream, participants indicated a preference for Frosh over Frish, but only if the name was its true, diagnostic name. When the name was described as a test name (and thus nondiagnostic of the ice cream), there was no difference in participants' evaluations of Frish and Frosh. This suggests that sound symbolic effects do not arise indiscriminately but rather, from our perspective, depend upon the relevance of the name for the target under consideration.

From a theoretical perspective, a core aspect of language as a communicative system is the "aboutness" of linguistic symbols, whereby language has meaning because it refers to, or is about, something else (e.g., Dennett, 1969; Fodor, 1975). This aspect of language suggests that sound symbolism, as a truly linguistic phenomenon, should depend on the linkage of the sound with the referring symbol: If a linguistic stimulus does not point, or refer, to the target under consideration, then it should not have any impact upon how people conceptualize that target. As such, we predicted that vowel sound would not activate generalized patterns of thought (i.e., high or low level construal) but, instead, that its effects would depend upon the relevance of the name in which the vowel sound was contained. Much like the established diagnosticity factor (in which sound symbolic effects only obtained for true and not test names, Yorkston & Menon, 2004), only names that are highly relevant to focal targets should steer the course for how people construe them. Accordingly, we predicted that the effect would obtain when the vowel sound manipulation was included in a name *relevant* to the focal target (the ostensible name that we provided to participants for the Behavior Identification task) but not when contained in an *irrelevant* name (the ostensible name of the website hosting the experimental survey whose name appeared at the top of the screen).

Method

Stimuli. Having established with Study 1 that the effect of vowel sound generalizes beyond the specific item (word) used, we created a single, new pair of names as experimental stimuli: Sheeb (front vowel) and Shoob (back vowel). As in Study 1, these names differed only by a single sound and were matched on all biphone probabilities.

Procedure. One hundred volunteers were recruited from a survey platform site hosted by Amazon.com (Mechanical Turk). They received a small gift certificate in exchange for completing a survey related to describing behaviors, and the sample included only people who had never before participated in a behavior description task. In this task (the Behavior Identification Form; Vallacher & Wegner, 1989), participants were told that they would see a series of 15 actions (e.g., “Making a list”) and that they would choose one of two descriptors to best categorize it. These descriptors involved choosing either a precise, specific aspect of the action (e.g., “writing things down”) or broad, general aspects (e.g., “getting organized”). To manipulate the relevance of the vowel sound, participants were randomly assigned to condition in which they were told (ostensibly) either the name of the task itself (high relevance; “You will complete a behavior classification task called the [name] task”) or the name of the company that provided web-hosting services for the task (low relevance; “You will complete a behavior classification task hosted by the [name] company”). As a second randomly assigned factor, participants were told that this name (task or hosting company) was either Sheeb (front vowel) or Shoob (back vowel). Participants were told that there were no right or wrong answers and to respond based on their personal preferences. They then completed the 15 behavioral items comprising the task, with a randomized display order for the abstract and concrete descriptors.

Results and Discussion

We recoded each specific, precise identification as a 0 and each general identification as a 1. Summing their score across all 15 items, we calculated an overall index for each participant whereby higher scores indicated more generalities (i.e., less precision). These scores were submitted to a 2 (vowel sound: front or back) × 2 (name relevance: high or low) between-subjects ANOVA. The results revealed neither a main effect of vowel sound nor relevance on the index (Fs < 2.3, ps $> .13$), but the predicted interaction between the two factors was significant, $F(1, 96) = 4.80$, $p = .03$, $\eta_p^2 = .05$. When the vowel sound manipulation was on the highly relevant name of the task, participants scored higher on the index for Shoob ($M = 8.44$, $SD = 4.94$) than Sheeb ($M = 5.16$, $SD = 3.47$), $t(48) = 2.72$, $p < .01$. This pattern was eliminated among participants exposed to the name of the web-hosting company ($p > .6$). Figure 2 summarizes the differential effect of vowel sound as a function of relevance.

Not only can vowel sounds shape how people parse a visual scene (as a function of precision, Study 1), but they can also change the conceptual level at which people represent the focal target. This latter point comes with an important qualifier: the presence of the vowel sound in the actual object-relevant linguistic symbol itself, compared to a non-object-relevant linguistic symbol. We found that the linkage between speech sound and behavior depended crucially on this aspect of the sound-containing label: Participants chose more general (i.e., less precise) descriptions of actions when the task was given a name including a back vowel (vs. a front vowel), but framing those same names as the less-relevant name of the web hosting company eliminated the effect. This suggests that names per se do not possess special significance. Instead, people utilize only object-referential, relevant names in making sound symbolic sense out of novel stimuli.

Taken together, the first two studies establish a relationship between vowel sound and both visual (Study 1) as well as conceptual precision (Study 2): Front vowels cause people to apply greater precision relative to back vowels. Because prior work has shown that getting people to think precisely leads them to think in a detailed, concrete manner (Maglio & Trope, 2011), the logical connection suggests that vowel sounds should shift level of construal via precision. To test this prediction, we next examine the direct consequences of vowel sound in impacting mental construal as evidenced by differential weighting of high- and low-level features in the evaluation of objects.

Study 3: Desirability Versus Feasibility

As an initial investigation into how vowels shape construal-dependent tradeoffs in different features of objects, Study 3 considers the role of desirability versus feasibility in choice. Because the feasibility or ease of attaining an outcome is subordinate to the

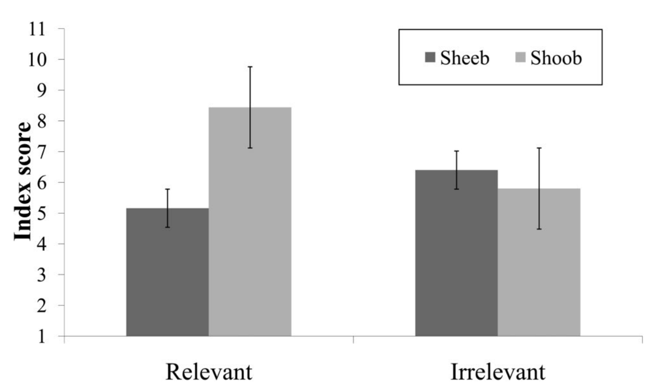

Figure 2. Behavior identifications by condition, Study 2. Bars indicate standard error.

desirability of ultimately attaining that outcome, abstract construal causes the latter to carry greater weight in judgment. For example, Liberman and Trope (1998) considered the effect of construal on willingness to attend a guest lecture. Their results indicated that, for those thinking abstractly, responses depended more upon the interest level in the topic of the lecture (its desirability), whereas people became more sensitive to the convenience of when the lecture was to be held (its feasibility) as a result of thinking concretely (see also Todorov, Goren, & Trope, 2007). Thus, Study 3 utilizes a similar tradeoff for ice creams between taste (desirability) and proximity in a store (feasibility). We predicted that evaluations would prove more sensitive to such high- over low-level features for an ice cream named with a back (relative to a front) vowel resulting from the difference in mental construal evoked by these vowel sounds.

Method

Stimuli. Here, we adapted our vowel sound manipulation—in addition to our domain of consideration—directly from past research (Yorkston & Menon, 2004). Specifically, we considered the effect of including either a front or back vowel in the name of an ice cream (Frish and Frosh, respectively). As in Studies 1 and 2, these names differ only on a single sound that changes the vowel sound of the name from front to back. Additionally, the authors of the original study provided evidence that people neither felt that one name provided a better fit as a name for ice cream nor did the names differentially activate general positive or negative associations.

Procedure. Sixty-two volunteers were recruited from the student center at New York University asked to complete a brief market research survey. They were asked to envision a scenario in which they considered buying an ice cream. Participants were randomly assigned to condition in which the ice cream under consideration was named either Frish or Frosh (Yorkston & Menon, 2004). Further, the features of that ice cream were randomly assigned such that it had either strong value for a high-level property (taste, its desirability) but weak value for a low-level property (proximity of location, its feasibility) or the opposite—weak value at the high level but strong value at the low level. All participants read a passage that began:

> Imagine that you are shopping at the grocery store. You are just about done, and as you approach the check-out line, you see someone next to the register giving out free samples of a new brand of ice cream called [Frish or Frosh]. You like ice cream, so you take a sample.

For the participants in the high-level strong, low-level weak condition, it continued:

> The taste is very good—it is rich, smooth, and creamy. However, the ice cream cartons are available in the freezer section across the store, so you would have to go all the way over there to pick up a carton.

For the participants in the high-level weak, low-level positive strong, it continued:

> The taste is not very good—it is not particularly rich, smooth, or creamy. However, the woman giving out the samples has several cartons in a cooler with her, so she easily could hand you one on your way to the check-out line.

All participants then responded to three questions related to the ice cream described in the scenario. First, they indicated how interested they would be in purchasing it on a scale from 1 (*not at all*) to 9 (*very much*). Next, they reported how they felt about it from 1 (*very negative*) to 9 (*very positive*). Finally, they were asked how much they would be willing to pay for it relative to other ice creams from 1 (*far below average*) to 9 (*far above average*).

Results and Discussion

As our three dependent variables were on the same scale and evinced strong reliability (Cronbach's $\alpha = .89$), we averaged them to calculate for each participant an overall evaluation index. These scores were submitted to a 2 (name: Frish or Frosh) × 2 (characteristics: good taste/poor accessibility or poor taste/good accessibility) between-subjects ANOVA. Participants did not generally prefer Frish or Frosh ($p = .28$), but they did prefer the good taste/poor accessibility ice cream to its opposite ($p < .001$). These were qualified by the predicted interaction between name and characteristics, $F(1, 58) = 11.32$, $p = .001$, $\eta_p^2 = .16$. For the ice cream named Frosh, participants strongly preferred the good taste/poor accessibility option ($M = 6.33$, $SD = 1.09$) to the poor taste/good accessibility option ($M = 2.60$, $SD = 1.85$), $t(29) = 9.70$, $p < .001$. Using the name Frish attenuated this spread of evaluations, $t(29) = 2.33$, $p = .03$ (good taste/poor accessibility: $M = 5.53$, $SD = 1.65$; poor taste/good accessibility: $M = 4.17$, $SD = 1.62$). Figure 3 summarizes these results, and Table 1 summarizes the individual item data (for this and the subsequent studies).

Thus, while participants provided evaluations that were more sensitive to desirability over feasibility for both ice creams, the relative strength of this preference significantly differed as a function of the vowel sound in the ice creams' names. Specifically, participants prioritized high-level desirability if the ice cream was labeled with a back vowel (Frosh); a front vowel name (Frish) resulted in greater consideration of low-level feasibility. Consistent with our hypothesis derived from construal level theory, these results suggest that abstract or concrete thought can be elicited simply as a result of the vowel sound included in a name. Importantly, Study 3 tested this prediction not in terms of precision but, rather, the downstream evaluation of objects.

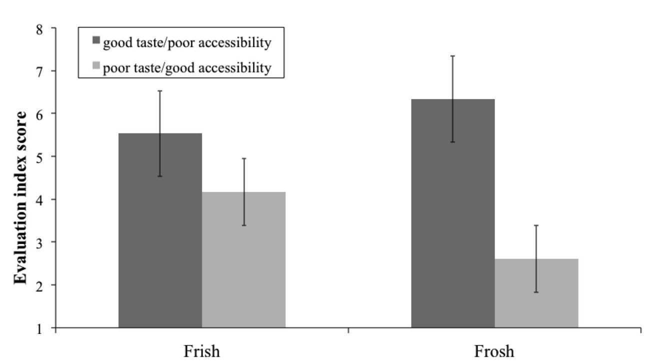

Figure 3. Ice cream evaluation by condition, Study 3. Bars indicate standard error.

Table 1
Individual Evaluation Items by Condition

	Front vowel				Back vowel			
	Good high		Good low		Good high		Good low	
Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Study 3: Desirability versus feasibility								
Interest in purchasing	5.67	1.99	4.31	2.18	5.93	1.44	2.13	1.15
Overall feeling	5.93	1.83	4.44	1.41	6.80	1.42	3.00	1.41
Willingness to pay	5.00	1.51	3.75	1.95	6.27	1.71	2.69	1.45
Study 4: Primary versus secondary features								
Interest in purchasing	5.07	2.15	4.31	2.24	6.59	1.58	3.22	1.48
Overall feeling	5.40	1.40	4.31	1.92	6.12	1.05	3.72	1.64
Willingness to pay	4.93	1.34	3.88	2.03	5.41	0.94	3.22	1.73
Study 5: Long-term versus short-term								
Interest in receiving	4.54	1.92	6.68	1.70	5.56	1.87	5.08	2.47
Overall feeling	4.85	1.78	5.76	1.36	5.56	1.71	4.79	1.96

Note. Front vowel: Frish (Study 3), Kira's (Study 4), Dari (Study 5); Back vowel: Frosh (Study 3), Kora's (Study 4), Daru (Study 5); Good high = positive high-level feature, negative low-level feature: good taste/poor accessibility (Study 3), good absorbability/poor gift bag (Study 4), good long-term relief/poor short-term comfort (Study 5); Good low = opposite characteristics of good high.

Study 4: Primary Versus Secondary Features

In order to offer evidence for an effect that generalizes beyond desirability versus feasibility, Study 4 contrasts primary and secondary features in judgment. The clock radio study described in the introduction (Trope & Liberman, 2000) captures this distinction, by which high-level construal prioritizes that which is central and defining about an option while low-level construal gives greater consideration to secondary, incidental properties. Here, we adapt characteristics from past research suggesting that the absorbability of hand lotion is a primary feature, whereas the gift bag containing it is secondary (Kim, Zhang, & Li, 2008). We created the names Kira's (front vowel) and Kora's (back vowel) and applied them to lotions that were defined by tradeoffs for these features. As in Study 3, we again expect greater relative weight to be given to high- over low-level features for the lotion labeled with a back vowel name.

Additionally, in a manner consistent with Yorkston and Menon (2004), both Studies 4 and 5 first conduct pilot testing to ensure that the names under consideration do not differ in their plausibility as a name for the given object or on the valence of their semantic associates. As such, we can conclude that any differences in the relative weighting of features between the conditions are driven only by level of construal as a function of the object's name.

Method

Stimuli. In keeping with prior research as well as the current Studies 1 and 2, we sought a new pair of names that differed only on the single sound that changed the vowel sound from front to back and that were matched on all biphone probabilities as described in Study 1. To extend beyond prior research, we incorporated not only one but two vowel sounds in the names; while one of the vowels differed between the two names as a function of its location, the other was to be from a relatively middle position on the continuum from front to back. Given these considerations, we generated the names Kira's (front vowel) and Kora's (back vowel).

We first took care to ensure that these names were relatively matched on specific variables of interest. As such, prior to the main study, we conducted a pilot study to ensure that Kira's and Kora's did not in and of themselves differentially affect preference ratings for lotion. Participants for the pilot study were recruited from the same population as our sample for the main study. Experimenters approached people throughout the New York University campus and asked them to provide two ratings regarding either the name Kira's ($n = 32$) or Kora's ($n = 33$). First, they indicated how appropriate they believed the name was for a lotion on a scale from 1 (*not at all*) to 5 (*very much*). Next, they were asked to think of the first three words that came to their mind upon hearing the name and then to evaluate the overall valence of those associates on a scale from 1 (*very negative*) to 5 (*very positive*). The results revealed neither a difference in appropriateness between Kira's ($M = 3.13$, $SD = 0.79$) and Kora's ($M = 3.24$, $SD = 0.83$; $t < 1$, $p > .5$), nor a difference in the valence of associated words ($t < 1$, $p > .5$; Kira's: $M = 3.44$, $SD = 0.67$; Kora's: $M = 3.55$, $SD = 0.71$). These were the only names tested in the pilot session.

Procedure. Sixty-six volunteers were recruited from throughout the New York University campus and asked to complete a brief market research survey. They were asked to envision a scenario in which they considered buying a hand lotion. Participants were randomly assigned to condition in which the lotion had a name of either Kira's or Kora's. The features of that lotion were then randomly assigned such that it had either strong value for a high-level property (absorbability, a primary feature) but weak value for a low-level property (packaging, a secondary feature) or the opposite—weak value at the high level but strong value at the low level (see Kim et al., 2008). All participants read a passage that began:

> Imagine that you are shopping at a large drugstore. One of the items on your list is lotion because you have some dry skin on your hands. While shopping, you see someone giving out free samples of a new brand of skin-care lotion called [Kira's or Kora's]. You take a sample and see that . . .

For the participants in the high-level strong, low-level weak condition, it continued:

> its absorbability is very good—it moisturizes your hands very well without leaving any residue. However, it comes wrapped in a gift bag that you find to be ugly.

For the participants in the high-level weak, low-level strong condition, it continued:

> its absorbability is not very good—it moisturizes your hands moderately while leaving a bit of residue. However, it comes wrapped in a gift bag that you find to be beautiful.

All participants responded to the same three evaluation questions as Study 3 but regarding the lotion. That is, they indicated how interested they would be in purchasing it on a scale from 1 (*not at all*) to 9 (*very much*), how they felt about it from 1 (*very negative*) to 9 (*very positive*), and how much they would be willing to pay for it relative to other lotions from 1 (*far below average*) to 9 (*far above average*).

Results and Discussion

Again, we created an averaged evaluation index from the three items (Cronbach's $\alpha = .87$). These scores were submitted to a 2 (name: Kira's or Kora's) × 2 (characteristics: good absorbability/ugly packaging or poor absorbability/beautiful packaging) between-subjects ANOVA. We observed no effect of name ($p = .86$) but an effect of characteristics ($p < .001$) in which the pairing of good absorbability/ugly packaging was preferred to the opposite. The main effect was qualified by the predicted interaction between the name and characteristics, $F(1, 62) = 5.84$, $p = .02$, $\eta_p^2 = .09$. For the lotion named Kora's, participants strongly preferred the good absorbability/ugly packaging option ($M = 6.04$, $SD = 0.97$) to the poor absorbability/beautiful packaging option ($M = 3.39$, $SD = 1.35$), $t(33) = 6.62$, $p < .001$. Using the name Kira's attenuated this spread of evaluations, $t(29) = 1.65$, $p = .11$ (good absorbability/ugly packaging option: $M = 5.13$, $SD = 1.33$; poor absorbability/beautiful packaging: $M = 4.17$, $SD = 1.87$). Figure 4 summarizes these results.

For a lotion named with a back vowel (Kora's), evaluations depended most strongly upon its performance on the high-level feature of serving its primary function (absorbability). Conversely, by naming the lotion with a front vowel (Kira's), these same judgments proved increasingly sensitive to a low-level feature (the appearance of the gift bag in which the lotion was wrapped). These findings expand the scope of vowel sound in names to the new construal-dependent domain of primary versus secondary feature consideration.

The evidence provided thus far suggests that vowel sounds contained in names can shape level of mental construal by changing the processing and evaluation of the targets to which they refer, such that secondary features exert a stronger influence when names contain front vowels. Still, the evidence thus far has only shown greater differentiation with back (relative to front) vowel sounds. While this relative tradeoff in the weighting of features is consistent with previous work in construal level theory and the theoretical prediction, we next sought to eliminate the alternative explanation that front vowels simply reduce differentiation in evaluation. Therefore, our fifth and final study uses experimental materials designed such that the high-level feature does not dominate the low-level feature as in Studies 3 and 4 (evidenced by the consistent main effect of features). Instead, we constructed the materials for our final study such that both features should be equally important and differentially come to the forefront in shaping evaluation based upon one's level of mental construal.

Study 5: Long-Term Versus Short-Term

With Study 5, we extend our scope to the domain of time horizons. Whereas low-level construal prioritizes immediate or short-term outcomes, high-level construal facilitates consideration of overarching, long-term interests (Fujita & Han, 2009; Fujita, Trope, et al., 2006). Accordingly, we asked people to evaluate a medical treatment that offered either (and exclusively) long- or short-term relief of pain. If, as we contend, front vowels engender relatively low-level thought while at the same time back vowels orient people toward high-level thought, then providing a medical

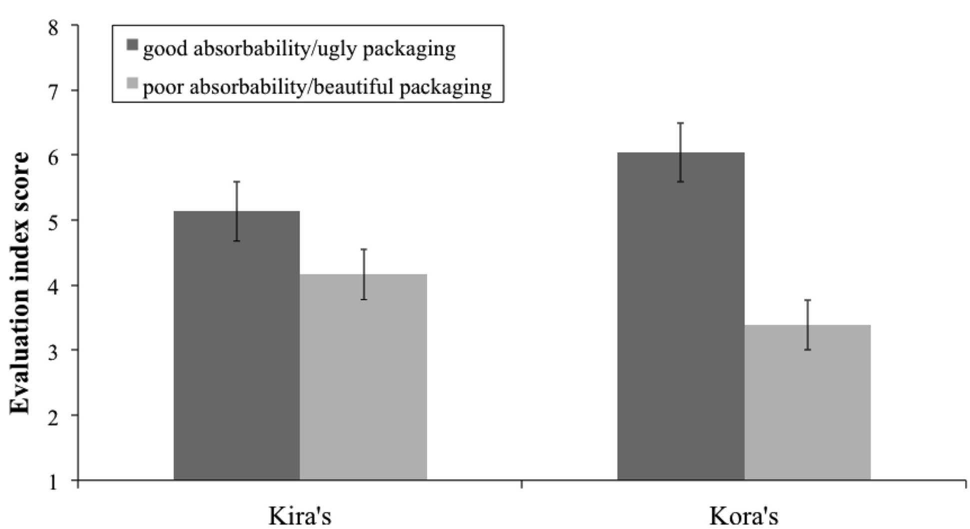

Figure 4. Lotion evaluation by condition, Study 4. Bars indicate standard error.

procedure with a name containing a front vowel (Dari) should result in the prioritization of short- over long-term relief; this pattern should reverse upon giving the same procedure a name that includes a back vowel (Daru).

Method

Stimuli. In preparing a new pair of names for Study 5, we again sought to use names that contained two vowel sounds while differing only on one. Rather than differing on the first, as in Study 4, the names for Study 5 were designed to differ on the second of the two vowel sounds in the name. We made this change to explore the robustness of our sound symbolic effect. Further, they had to seem appropriate for the domain under consideration and be matched on biphone probabilities as described in our previous studies. Therefore, we chose as our stimuli the names Dari (front vowel) and Daru (back vowel).

In a manner identical to Study 4, we subjected the names that we had devised to pilot testing prior to the main study. Participants were recruited from throughout the New York University campus to provide ratings about either Dari ($n = 35$) or Daru ($n = 34$). They were asked about the name's appropriateness as applied to a massage and the general valence of the first three words associated with the name. The two names did not significantly differ on either appropriateness ($p > .78$; Dari: $M = 3.03$, $SD = 0.95$; Daru: $M = 3.09$, $SD = 0.87$), or valence of associated words ($p > .28$; Dari: $M = 3.46$, $SD = 0.82$; Daru: $M = 3.26$, $SD = 0.67$). These were the only names tested in the pilot session.

Procedure. One hundred volunteers were recruited from throughout the New York University campus and asked to complete a brief market research survey. They were asked to envision a scenario in which they considered getting a massage for medical purposes. Participants were randomly assigned to condition in which the massage had a technique name of either Dari or Daru. Additionally, participants were randomly assigned to learn either that the features defining the massage consisted of strong value for a high-level property (long-term relief) but weak value for a low-level property (short-term discomfort) or the opposite—weak value at the high level but strong value at the low level. All participants read a passage that began:

> Imagine that you strained your back while exercising, leaving you in pain for the past several days. A friend tells you about a new Japanese massage technique called [Dari or Daru].

For the participants in the high-level strong, low-level weak condition, it continued:

> The technique is very effective in eliminating back pain in the long-term—you will be pain-free for several months. However, the procedure itself lasts 60 minutes and is known for being very painful.

For the participants in the high-level weak, low-level strong condition, it continued:

> The technique is not very effective in eliminating back pain in the long-term—you will be pain-free for only a few days. However, the procedure itself lasts 60 minutes and is known for being very soothing.

All participants responded to the interest and feeling questions from Studies 3 and 4 but related to the massage. We omitted the third question regarding willingness to pay based on an a priori assumption that respondents from this population may have less experience with or interest in the service under consideration relative to the objects from Studies 3 and 4, creating excessive variance in their reports of willingness to pay. As a result, they indicated how interested they would be in receiving the massage on a scale from 1 (*not at all*) to 9 (*very much*) and how they felt about it from 1 (*very negative*) to 9 (*very positive*).

Results and Discussion

We created an averaged index of the two evaluation items (Cronbach's $\alpha = .85$). These scores were submitted to a 2 (name: Dari or Daru) $\times$ 2 (characteristics: good long-term relief/short-term pain or poor long-term relief/short-term pleasure) between-subjects ANOVA. In line with our hypothesis, we observed no effect of name ($p = .55$) or characteristics ($p = .20$). The data did reveal the predicted interaction of name and technique characteristics, $F(1, 96) = 9.56$, $p < .01$, $\eta_p^2 = .09$. For the massage named Dari, participants preferred the poor long-term relief/short-term pleasure option ($M = 6.22$, $SD = 1.36$) to the good long-term relief/short-term pain option ($M = 4.69$, $SD = 1.72$), $t(49) = 3.50$, $p = .001$, $d = 0.98$. Using the name Daru shifted this pattern of evaluations, though it did not reach statistical significance, $t(47) = 1.14$, $p = .26$, $d = 0.33$ (good long-term relief/short-term pain: $M = 5.56$, $SD = 1.70$; poor long-term relief/short-term pleasure: $M = 4.93$, $SD = 2.10$). Figure 5 summarizes these results.

When evaluating a massage named with a back vowel (Daru), people preferred that it carry the high-level strength of long-term pain relief in spite of subjecting them to short-term pain. A name that included a front vowel (Dari) changed the direction of this pattern for massage preference: People here proved more favorable toward the short-term satisfaction of a soothing massage even if it did not offer effective pain relief beyond the scope of the session itself. This finding offers an important contribution that extends beyond the results of the previous studies. That is, the evidence from Study 5 suggests an effect of vowel sound on both ends of the construal level spectrum. As a result, switching between front and back vowel sounds in names can give rise to shifts in preference. When the high- and low-level features of a target are matched on overall attractiveness (as in Study 5, in a departure from Studies 3 and 4), people faced with tradeoffs between the two will respond in a systematic way—consistent with differential levels of construal—if the targets differ simply (and only) on the vowel sounds contained in their names.

General Discussion

Language is everywhere. Nearly every attempt to gather information or to convey messages hinges upon the transmission of an idea through the medium of words. Given this ubiquity of language and its central role in cognitive and social psychology, it remains critically important to understand its relationship with how we think. Across five studies, the vowel sounds included in names affected the level at which people represented and evaluated their referents: Front vowels elicited low-level construal while back vowels elicited high-level construal.

The effect on mental construal held not only across three different measures of low- versus high-level features but also in using a variety of vowel manipulations. First, these effects did not

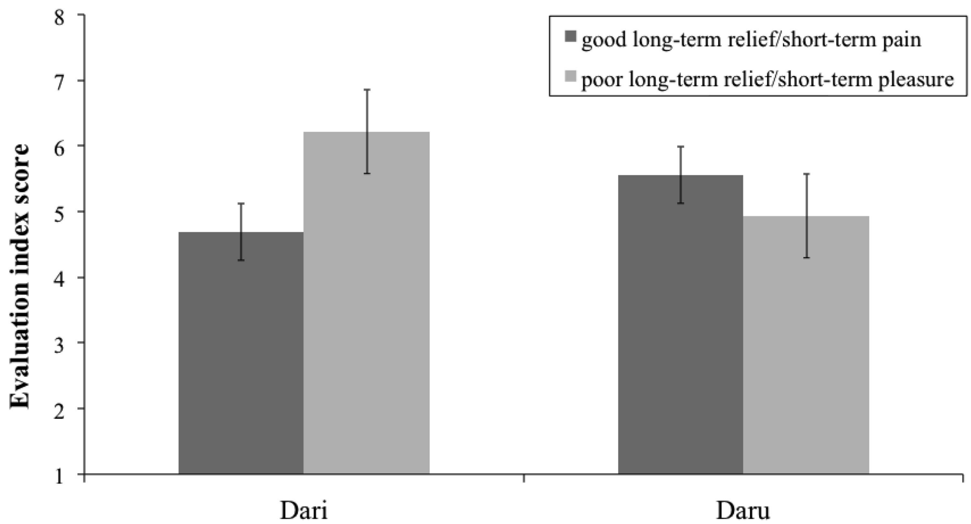

Figure 5. Massage evaluation by condition, Study 5. Bars indicate standard error.

depend upon any specific linguistic item or particular vowel sound but rather upon the general distinction between frontness and backness. We found converging results with over 20 different individual labels (a larger number than in much sound symbolism research) and with different specific vowel sounds. For example, the words Frish and Dari contain different specific front vowel sounds (despite being indicated orthographically by the same letter, *i*, in English), but they similarly evoke lower level construal relative to Frosh and Daru, which themselves contain different specific back vowel sounds. We observed a consistent effect of vowel sound for unfamiliar nonwords (for which participants had no prior knowledge) and independent of its location in the word: the only vowel (Studies 1–3), the first of two vowels (Studies 1 and 4), and the second of two vowels (Study 5). Thus, the effect generalizes beyond any individual sounds, words, or within-word vowel positions to the broader class of vowel location (front/back).

Implications for Construal

In recent years, level of construal has been brought to bear on important outcomes ranging from self-control (Fujita, Trope, et al., 2006) to creativity (Polman & Emich, 2011) and context effects (Khan, Zhu, & Kalra, 2011; Maglio & Trope, 2012). While these studies have shed light on the broad consequences of construal for judgment and decision making, less is known regarding what determines whether people think abstractly or concretely in the first place.

To date, there have been two general answers to this question. First, people adopt a high-level construal to represent objects outside of their immediate experience—objects that are psychologically distant from their current state in the here and now (Liberman & Trope, 2008; Maglio, Trope, & Liberman, 2013). The second stream of research has targeted cues to construal (e.g., money, mood, self-affirmation; Hansen, Kutzner, & Wänke, 2013; Labroo & Patrick, 2009; Wakslak & Trope, 2009) that rely upon transfer effects, whereby an initial prime puts people in a (concrete or abstract) frame of mind that carries over to new, ostensibly unrelated tasks (Förster, Liberman, & Friedman, 2009; E. R. Smith, 1994; Tulving, 1983; Wyer & Xu, 2010). Unlike these latter manipulations, vowel sounds in names are inexorably (and nonarbitrarily) linked to the objects they represent and, therefore, do not necessitate a transfer effect from the manipulation to the object being evaluated. This consistency of construal suggests, perhaps, a particularly stable level of representation—across various contexts—for objects named with either a front or a back vowel.

At the same time, however, the results of Study 2 suggest that any such consistency will only arise if construal is successfully manipulated or activated in the first place. Instead, if the vowel sound manipulation is embedded in a word irrelevant to the focal task, our findings suggest that construal will not shift. This reflects a departure from how construal has been operationalized to date. Whereas in the past, researchers embraced construal as a procedural prime to explore its relationship with novel dependent variables (e.g., Freitas, Gollwitzer, & Trope, 2004; Fujita, Trope, et al., 2006), few have attempted to moderate such carryover effects. Thus, the present findings speak to the literature on construal level theory insofar as they identify conditions under which construal does or does not operate as a procedural prime to exert wide-ranging effects on cognition more broadly. At a practical level, this insight can inform the design of future experiments on construal level theory by using sound symbolic effects in a quite targeted way. Specifically, we identify the circumstances under which researchers should exercise special caution in designing their experimental materials: Though minor, irrelevant choices in wording (and, accordingly, vowel sound) may seem trivial, sounds do tend to have substantial psychological effects for object-referential labels, suggesting that researchers should take the present findings into careful consideration.

Implications for Sound Symbolism

The present findings contribute to an ongoing discussion regarding whether sound symbolic effects arise spontaneously. The majority of early sound symbolism research explicitly asked participants to pair a label with an object (asking, for example, which object was smaller), leaving open the question of whether sound symbolic effects arise spontaneously, outside of these rather specific task demands. Indeed, the results of some studies that have not provided a prompt regarding a physical attribute can be seen as inconsistent with spontaneous sound symbolism. That is, when given a forced choice, participants will pair front vowel sounds with explicitly identified smaller objects (the table named "mil") but will not necessarily use the term *small* in describing an ambiguous object named with a front vowel sound (Bentley & Varon, 1933). However, more recent studies in the sound symbolism tradition suggest that its effects indeed are spontaneous (Lowrey & Shrum, 2007; Yorkston & Menon, 2004). For example, Lowrey and Shrum (2007) did not utilize the aforementioned prompts yet still found that people opted to use front vowel names as their preferred labels for (thin, sharp) knives and (small, fast) convertibles, demonstrating that sound symbolic effects do not depend on explicit requests for judgment about attributes. In other words, sound symbolism can arise spontaneously, the result of—in Lowrey and Shrum's (2007) work—a feeling of fit between the referent (e.g., knife) and the name given to it (e.g., including a front vowel). Our research dovetails with the latter set of findings: Our participants (in Studies 3–5) indicated the strongest preference for objects whose (high- or low-level) features matched the attributes rendered most important by the level of construal evoked by the vowel sound in their names.

Additionally, our Study 2 complements that of Yorkston and Menon (2004) by identifying relevance as a moderator and, accordingly, informs the spontaneity issue. While vowel sound may impact construal spontaneously, people managed to correct for it in a context where it was irrelevant to the task at hand. Nevertheless, our paradigm manipulated relevance in an explicit manner. If the task context (and relevance information) instead remained implicit, a truly spontaneous effect (without the potential for correction) might show differences in construal as a function of vowel sound for both relevant and irrelevant vowel sound manipulations.

The studies presented here are also in line with recent work suggesting that sound symbolic effects do not depend fully on particular word structures. The vast majority of sound symbolism studies have manipulated vowel sound either only on the first syllable of a multisyllable word (e.g., Klink, 2000; Lowrey & Shrum, 2007) or in words containing only one syllable (e.g., Yorkston & Menon, 2004). It was partially for this reason that our Study 5 manipulated vowel sound at a later location in the word (i.e., the second syllable of two); that we found a consistent effect suggests that sound symbolism does not depend only on, for instance, a primacy effect. Recently, Klink and Wu (in press) undertook a more systematic treatment of this and other questions in the context of vowel sound associations with physical size and speed. Consistent with our Study 5, they found sound symbolic effects can arise (albeit in weaker form) when the vowel manipulation is located later in the word. In addition, they found that vowels carry more sound symbolic meaning than consonants and also documented evidence of an additive effect for sound symbolism when multiple, consistent sounds are contained in a single word. Further explorations of such issues will not only help outline the scope of sound symbolic effects but also have obvious practical implications for the use of phonetic sound symbolism in, for example, stimuli construction or branding.

Open Questions

We believe the work presented here provides an important, novel extension of the scope of sound symbolic effects, demonstrating just how robust and fundamental they can be in shaping cognition. As such, the current work highlights the importance of furthering our understanding of the true nature of these sound–meaning (and sound-representation) linkages.

While the present investigation targeted only vowel sounds, it remains possible to extend the scope relating sound symbolism and mental representation to include consonants as well. Although consonants can also be conceptualized as ranging along a front-to-back continuum (marked by the location of the sound's articulation), consonants—unlike vowels—also differ in manner of articulation, or the way in which the sounds are physically formed in the mouth. One such distinction of manner is that between *fricatives* and *stops* (Ladefoged, 1975). Fricatives result from the creation of friction via partial obstruction of the air passing through the articulators (e.g., the lips, teeth, and tongue): Consider the sounds associated with the *s* and *z* in *sizzle*, or the *f* and *v* in *favorite*. Contrast these with stops, which are produced by the momentary complete obstruction of air through closure of the articulators (e.g., the *p* and *t* in *pit* and the *b* and *g* in *bog*). Parallels have been established between the inferences drawn from consonants and vowels, whereby fricatives tend to be associated with physical properties similar to front vowels (while stops appear to share associates with back vowels). These include small magnitude, faster speed, and greater angularity (Hinton et al., 1994). Might consonants (fricatives/stops), therefore, have a similar relationship with mental construal (concrete/abstract)?

It also remains important for future research to consider the possibility that the relationship between vowel sound and mental construal—or patterns of thought more generally—may not be limited to only one underlying mechanism. For our purposes, precision offered a logically possible avenue by which to connect the two heretofore disparate literatures of sound symbolism and construal level theory. Despite this linkage, we do not contend that either fully explains the other. That is, other sound–meaning associations are unrelated to precision (e.g., softness/hardness; Koriat & Levy, 1977), and precision or resolution is but one aspect on which high- and low-level construals differ (Trope & Liberman, 2010). Take two examples. First, objects named with back vowels tend to be associated with not only coarser, larger size but also greater power relative to those named with front vowels (Hinton et al., 1994). Similarly, research from construal level theory has linked the priming of interpersonal power with more abstract information processing (P. K. Smith & Trope, 2006). Because both types of power entail a degree of control, agency, or effectiveness, perhaps another link connecting back vowel sounds to abstract construal operates through such a high-level sense of permanence or consistency.

Second, we can return to the aforementioned construct of psychological distance, or removal from an egocentric reference point. Psychological proximity represents another precursor to—and output of—concrete construal and the high-resolution representation associated therewith. Said differently, things considered from a proximal perspective are afforded more fine-grained detail, whereas increasing distance reduces resolution and, in turn, increases abstraction. Therefore, perhaps vowel sounds in names convey meaning about the location of the referent in psychological space. Because objects that are close tend to be construed concretely (e.g., Liberman & Förster, 2009) and front vowels elicit low-level construal (as we have shown here), we may also consider the potential connection between front vowels and psychological proximity. Such an investigation could help situate our current construal findings more squarely in the tradition of inferring physical features (i.e., location) from vowel sounds. These and other such considerations, connecting to the broad spectrum of sound symbolic associates while at the same time mapping onto differences in level of construal, await future empirical attention.

Limitations

While the previous section considered alternate routes connecting sound symbolic physical features to level of construal, a question of internal validity also warrants consideration. That is, what *specific* aspects differentiating front from back vowels lead to differences in inferring physical features as well as to variation in concrete versus abstract thinking? In general, evidence for sound symbolism to date has taken as its primary approach the identification of connections between specific language sounds in names and concepts or representations applied to the targets to which those names refer. Our series of studies reflects this general trend. However, this approach—contrasting individual speech sounds—involves the simultaneous manipulation of a bundle of intrinsically linked aspects of those individual speech sounds. Because differences in the acoustic properties of speech sounds are, by necessity, achieved through specific articulatory movements that differ between sounds, an experimental manipulation at the level of individual speech sounds is, by necessity, a manipulation of a collection of (likely nondissociable) features. As a result, there currently exists an epistemic gap between manipulations of vowel sounds on the one hand and various cognitive consequences on the other, without a systematic and unambiguous theoretical account to connect the two. One of the most important areas for further work will undoubtedly be investigation into the underlying sources of sound symbolic effects.

To illustrate, consider pitch as one possible mechanistic explanation: Front vowels are higher in pitch than back vowels. Therefore, differences in pitch might underlie the established connections between differences in vowel sounds and downstream cognitive consequences. Indeed, because both pitch and location of articulation remain inexorably linked to the front/back distinction among vowel sounds, it may prove challenging to disambiguate the two. It is thus unclear within our studies, and more generally in sound symbolism research to date, which specific characteristics of individual speech sounds give rise to linkages between those sounds and particular meanings. Any given speech sound can be described on a variety of potentially relevant dimensions, including its particular acoustic properties, the articulatory movements required to produce it, and the way in which it would be perceived and categorized by a speaker of a particular language. Any number of properties within these individual dimensions (e.g., pitch as an acoustic property, voicing as an articulatory property) may offer insight into the sources behind particular sound symbolic effects.

The possibility that sound symbolic effects could arise from associations with particular articulatory movements associated with vocalizations could be seen as in line with the broader tradition of embodied cognition. Indeed, because people use language so often as a means of spoken communication, and physical experiences (which the articulatory movements involved in speaking certainly are) can exert a substantial impact on how people think (through grounded or embodied cognition, Meier, Schnall, Schwarz, & Bargh, 2012), it remains possible that embodiment—via vocalization—might moderate sound symbolism effects (cf. Argo, Popa, & Smith, 2010). However, we find it unlikely that embodiment alone can account for sound symbolic effects in general. Recent empirical work has found that sound symbolic linkages (specifically, those between front/back vowel/consonant combinations and shape) can appear in 4-month-old infants who do not yet even have knowledge of what sounds exist in their own language, let alone (arguably) the articulatory movements required to produce them (Ozturk, Krehm, & Vouloumanos, 2013). Accordingly, we believe it is likely that some more primitive or essential linkage—such as acoustic properties like pitch (Ohala, 1994)—underlies sound symbolic effects, at least in part. Nevertheless, it remains possible that articulatory movements may play a role for at least some sound symbolic effects in adults, highlighting a potentially important moderator of such linkages. Future work in this vein (e.g., by having participants chew gum to inhibit motor stimulation in articulatory muscles) would have the potential not only to pinpoint more precisely the origin of sound symbolic effects but also to potentially inform the nature of phonological representations.

At the broadest level, it has been proposed that sound symbolic effects can be understood as one specific type of synesthesia, or the phenomenon in which human sensory impressions in one modality (i.e., sound) are linked with unrelated sensory impressions (Ramachandran & Hubbard, 2001). This theoretical perspective, again, might more readily be reconciled with a nonembodiment account of sound symbolic effects, if this synesthetic link predates the establishment of full linguistic systems, with their accompanying canonical sound systems. This hypothesis is particularly intriguing for its potential relevance to language evolution. Is it possible that human language, as a sonic system, resulted from an accidental, synesthetic linkage between sound and physical properties in the world? Future work on the origin of sound symbolic effects thus may have the potential to inform questions about the very origins of language as a symbolic system.

In sum, a limitation of the current work (and much of sound symbolic research more generally) lies in an inability to pinpoint the precise locus of the connection between speech sound quality and other aspects of cognition. Indeed, it remains possible that sound symbolic effects like those explored here are a part of a more general cross-modal link that could include even nonlinguistic elements (e.g., lower/higher pitch in pure tones or musical stimuli). Such connections would suggest the existence of truly general sound–meaning correspondences rather than only linguistic sound–meaning correspondences. Further, this possibility would align with the aforementioned notion of synesthesia, suggesting that intuitive links between a broader class of sonic stimuli and cognitive qualities in fact underlie sound symbolic effects. Therefore, while our work is limited in that the precise nature of the link between sound and construal remains unclear, it establishes a robust connection between speech sounds and cognitive representations, highlighting the import of identifying the exact locus of these effects.

Finally, let us address one limitation of the current approach with respect to external validity. Future work will also be needed to determine the generalizability of these findings across specific linguistic stimuli. Here, we take what has been a frequent approach in sound symbolism research, contrasting participants' responses across tightly controlled items that only vary in the frontness/backness of the vowel. By using different specific nonword items in different experiments, we here offer evidence that our effect holds across multiple linguistic stimuli. However, stronger evidence of the generalizability of these effects would be afforded by taking a separate approach—now adopted in many areas of psycholinguistic research—in which a relatively large set of different linguistic stimuli varying on the dimension of interest (e.g., frontness/backness) are used and the effect of the manipulation is explicitly tested across both subjects and items as random variables (Clark, 1973). Future work linking vowels to construal level (and other cognitive associates) would likely benefit from this analytic treatment. It would not only provide more robust and formal evidence for the generalizability of these effects but also would allow for explicit, formal comparison of experimental effects across items that vary in subtle ways (e.g., the interactive effects of different sounds contained in the same word).

Conclusion

Given the staggering number of words encountered daily, the implications of the present research are at once many and everywhere. Changes in a single sound within names successfully elicited different levels of mental representation, powerful enough to affect visual and conceptual precision as well as steering the course for preference formation and behavioral intentions. In sum, while it is clear that language cannot entirely constrain thought, this work suggests that even relatively subtle characteristics of the sounds in words can exert substantial psychological effects.

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