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How Does Meaning Come to Mind? Four Broad Principles of Semantic Processing

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When we see or hear a word, we can rapidly bring its meaning to mind. The process that underlies this ability is quite complex. Over the past 2 decades, considerable progress has been made toward understanding this process. In this article, I offer four broad principles of semantic processing derived from lexical-semantic research. The first principle is that the relationship between form and meaning is *not so arbitrary*, and I explore that by describing efforts to understand the relationship between form and meaning, highlighting advances from my own lab on the topics of sound symbolism and iconicity. The second principle is that *more is better*, and I summarise previous research on semantic richness effects and how those effects reveal the nature of semantic representation. The third principle is *the many and various properties of abstract concepts.* I point to abstract meaning as a challenge for some theories of semantic representation. In response to that challenge, I outline what has been learned about how those meanings are acquired and represented. The fourth principle is that *experience matters*, and I summarise research on the dynamic and experience-driven nature of semantic processing, detailing ways in which processing is modified by both immediate and long-term context. Finally, I describe some next steps for lexical-semantic research.

Public Significance Statement
An important aspect of reading or listening is understanding what words mean. The process of understanding word meaning has been investigated in a large number of research studies, including those conducted by the author, Professor Penny M. Pexman. In this article, previous research on this process is reviewed, and four main ideas are described. These ideas should help guide future research on this topic.

Keywords: word meaning, iconicity, semantic richness, abstract concepts

Language is a complex human capacity that is central to our mental and social lives. For the past 2 decades, I have been fixated on a deceptively simple question about this important ability: When you encounter a word, how does its meaning come to mind? Word-meaning retrieval is a key component process in reading, listening, and other skills that involve language understanding. My goal in this article is to convey four broad principles distilled from my empirical work on this question. Any progress I've made on these issues is due in large part to the talented collaborators with whom I have been so fortunate to work. They are my coauthors on the articles I cite herein, and they have provided vast amounts of energy, inspiration, and fun. I am deeply grateful.

Principle 1: Not So Arbitrary

In models of word recognition, and theories of language more broadly, it has traditionally been assumed that there is an arbitrary mapping between word form and meaning (e.g., Hockett, 1963; Plaut & Shallice, 1993). Thus, there is nothing about the letters or sounds in a word that necessarily conveys its meaning. Because there is no special relationship between form and meaning, we

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must learn these arbitrary mappings through experience. Of course, there are some clear exceptions to this rule, like onomatopoeia, where a word's sound does directly resemble its meaning (e.g., *oink*, *pop*). In general, however, these have been considered to be rare exceptions, and arbitrariness was thought to characterise the human lexicon.

This assumption has been challenged by recent work on iconicity, which refers to a resemblance between form and meaning. Onomatopoeia is one example of iconicity. Iconicity can also be indirect, for example, through sound symbolism. Sound symbolism is the phenomenon by which certain kinds of phonemes are associated with certain properties (for a review, see Sidhu & Pexman, 2018a). For instance, in the *maluma/takete* effect (Köhler, 1929; or *bouba/kiki* effect [Ramachandran & Hubbard, 2001]), people tend to associate nonwords containing sonorant consonants (e.g., /l/, /m/, /n/), the voiced bilabial stop consonant /b/, and rounded back vowels (/u/) with round shapes and associate voiceless stop consonants (/k/, /p/, /t/) and unrounded front vowels (/i/) with sharp shapes (Nielsen & Rendall, 2011; Sidhu & Pexman, 2017; Westbury, Hollis, Sidhu, & Pexman, 2018). Thus, for example, a word referring to a round object containing round-associated phonemes (e.g., *balloon*) could also be considered iconic.

Sound symbolic associations have largely been explored with nonword stimuli, so their implications for real language have thus far been unknown. In a series of studies, we considered whether *maluma/takete*-type sound symbolism could also be observed for more meaningful lexical stimuli. To approach this issue, we examined whether sound symbolism can be detected in real first names. Admittedly, first names are different from other kinds of words, but first names do carry meaning, including associated memories you have for people with that name. We found that people judged round-sounding names, like *Bob* or *Molly*, to be better matches for people with rounded body shape and sharp-sounding names, like *Kirk* or *Kate*, to be better matches for people with angular body shape (Sidhu & Pexman, 2015).[1] This sound symbolism for names is also detectable for French names like *Benoit* and *Éric* (Sidhu, Pexman, & Saint-Aubin, 2016). Further, the sound symbolic associations of names extend beyond perceptual features, like body shape, to more abstract features, like personality. That is, we found that round-sounding names were associated with agreeableness, conscientiousness, and emotionality, whereas sharp-sounding names were associated with extraversion (Sidhu, Deschamps, Bourdage, & Pexman, 2019; see Figure 1). Thus, the form of a name does seem to have a perceived relationship to its meaning.

Beyond names, we recently explored the presence of sound symbolism in real language by investigating whether English words for round objects are more likely to contain the round-associated phonemes and whether English words for sharp objects are more likely to contain the sharp-associated phonemes (Sidhu, Westbury, Hollis, & Pexman, 2020). We found evidence for this pattern: The phonemes associated with roundness are more common in words referring to round things (e.g., *marble*), and the phonemes associated with sharpness are more common in words referring to sharp things (e.g., *cutlery*). Thus, the *maluma/takete* effect is represented in the English lexicon.

More broadly, iconicity seems to be present for many words (Perry, Perlman, & Lupyan, 2015), particularly those with sparser semantic neighbourhoods and more associated sensorimotor information (Sidhu & Pexman, 2018b). There is also evidence that iconic words are learned more easily than noniconic words, providing evidence that iconicity serves a function in English (Perry, Perlman, Winter, Massaro, & Lupyan, 2018). Further, in some instances, lexical processing is facilitated for iconic words (Sidhu, Vigliocco, & Pexman, 2020), presumably as a result of nonarbitrary mappings between form and meaning for these words. Thus, in contrast to traditional views (e.g., Hockett, 1963), recent research on sound symbolism and iconicity shows that there is nonarbitrariness in language.

Principle 2: More Is Better

Almost 20 years ago, I became interested in the idea of distributed semantics—the notion that word meaning is best described as a pattern of activation across many units (Hinton & Shallice, 1991; Masson, 1995). Distributed semantics was a departure from the localist models wherein concepts are represented as nodes in a semantic network (e.g., Collins & Loftus, 1975). The units in the first distributed semantic models represented features or elements of meaning, and this framework seemed well suited to the casual observation that some words seem to be associated with more semantic "stuff" than others. In the intervening 20 years, my colleagues and I have shown that there are behavioural and neural consequences of this variability, and these consequences force meaningful constraints and challenges on theories of semantic representation.

The variability in the amount of information associated with different concepts can be defined in different ways and, importantly, as a function of the various descriptions of semantic representation that have been proposed. For instance, meaning can be derived from lexical co-occurrence information (the way words are used in language; e.g., Burgess & Lund, 2000), semantic features (basic attributes derived from experience with concepts; e.g., McRae, de Sa, & Seidenberg, 1997), or sensorimotor experience (perceptual representations acquired through experience with objects and situations as in embodied cognition accounts; e.g., Barsalou, 2008; Glenberg, 2015).

Support for each of these frameworks has been provided by studies showing that each dimension is related to lexical-semantic processing. That is, lexical or semantic decision ("Is it a word?" or "Is it concrete?") performance is faster for words that occur in the context of many other words (semantic neighbourhood effects, e.g., Buchanan, Westbury, & Burgess, 2001), or that generate many semantic features in a feature-listing task (number-of-features effects; Pexman, Lupker, & Hino, 2002), or that refer to concepts with which the human body can easily interact (body–object interaction effects; Hargreaves et al., 2012; Siakaluk et al., 2008). I have referred to these effects collectively as *semantic richness effects* (Pexman, 2012). Semantic richness effects are consistent with the principle that for semantic activation in lexical

[1] To be clear, the "bodies" we had participants choose names for in this study belonged to aliens. We gave participants the task of giving names to aliens who had just arrived on Earth (none suggested this was implausible, but naming aliens is pretty routine stuff in movies/TV) and showed them pairs of alien silhouettes that David Sidhu had devised to differ only in their roundedness or spikiness of outline.

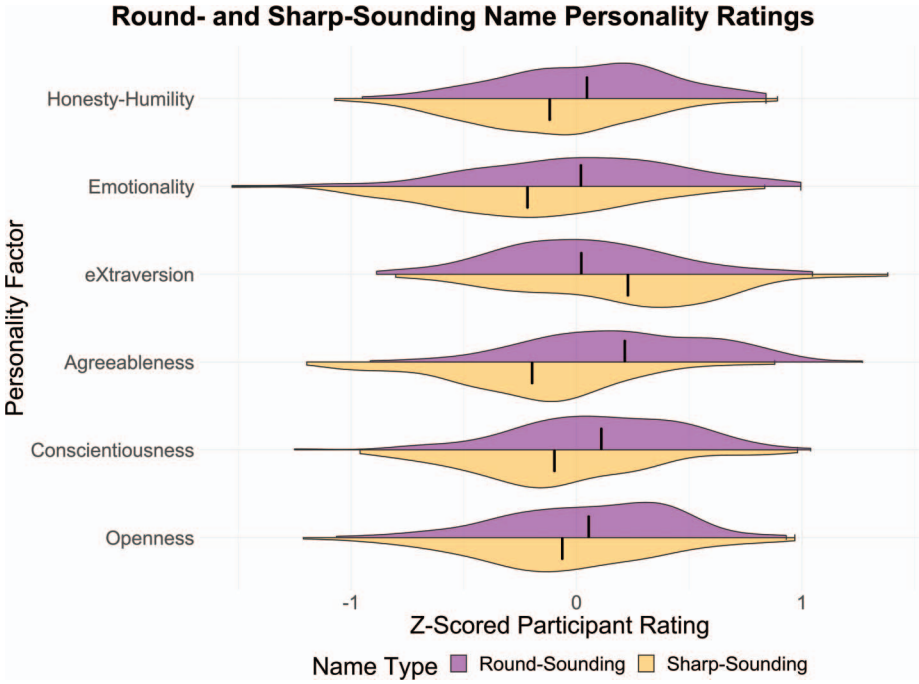


Figure 1. Associations between round-sounding (e.g., *Lou*, *Megan*) and sharp-sounding (e.g., *Eric*, *Kate*) names and each of the honesty–humility, emotionality, extraversion, agreeableness, conscientiousness, and openness to experience (HEXACO) personality factors (Lee & Ashton, 2004), across Experiments 2 and 4 in Sidhu et al. (2019). See the online article for the color version of this figure.

processing, "more is better" (Balota, Ferraro, & Connor, 1991, p. 214). Richer semantic representations generally allow faster and/or more accurate retrieval of word meanings (Pexman, Siakaluk, & Yap, 2014).

One notable exception to this "more is better" rule is semantic ambiguity: Words with many meanings show facilitated processing in some tasks, including lexical decision (e.g., Pexman & Lupker, 1999), but null effects and even inhibition in others, including semantic categorisation (Hargreaves, Pexman, Pittman, & Goodyear, 2011) and relatedness judgment (Pexman, Hino, & Lupker, 2004). There is debate about the mechanisms of semantic ambiguity effects (Armstrong & Plaut, 2016; Hino, Pexman, & Lupker, 2006), but task demands and the ways those interact with meaning retrieval are important considerations.

Many semantic theories were built on the assumption that one dimension of semantic information is central to representation. For instance, strong versions of embodied cognition hold that sensorimotor modalities are integral to the representation of conceptual knowledge (Glenberg, 2015). Recently, however, there has been support for more pluralist semantic accounts, whereby cognition is grounded in multimodal systems (Borghi et al., 2019; Borghi & Binkofski, 2014; Dove, 2009, 2019; Patterson, Nestor, & Rogers, 2007; Vigliocco, Meteyard, Andrews, & Kousta, 2009). Pluralist accounts assume that there are many different dimensions of semantic information, including dimensions that capture aspects of sensory, motor, and linguistic experience. The extent to which the classical abstractionist components are also included is something that varies across these pluralist accounts.

Pluralist accounts predict that multiple semantic dimensions should influence lexical and semantic decision performance, even simultaneously. To test these predictions, we have taken advantage of the efforts undertaken in our field to generate large sets of publicly available lexical and semantic norms and behavioural data. These include the norms for ratings of concreteness (Brysbaert, Warriner, & Kuperman, 2014), age of acquisition (Kuperman, Stadthagen-Gonzalez, & Brysbaert, 2012) and valence (Warriner, Kuperman, & Brysbaert, 2013), and the behavioural data available for lexical decision and naming in the English Lexicon Project megastudy (Balota et al., 2007). We have contributed to these efforts, for instance, collecting and sharing ratings of body–object interaction (Pexman, Muraki, Sidhu, Siakaluk, & Yap, 2019) and semantic decision data (the Calgary Semantic Decision Project; Pexman, Heard, Lloyd, & Yap, 2017) for thousands of words. These norms have allowed us to examine semantic richness effects across large word sets for which different semantic dimensions vary continuously. Our results show that, as predicted by the pluralist accounts, there are simultaneous effects of multiple semantic dimensions, with the particular patterns of effects differing as a function of task demands (Pexman, Hargreaves, Siakaluk, Bodner, & Pope, 2008; Yap, Pexman, Wellsby, Hargreaves, & Huff, 2012; Yap, Tan, Pexman, & Hargreaves, 2011). Thus, semantic representation is multidimensional, and semantic processing is dynamic.

There is support for pluralist accounts, but many theoretical questions remain. One of those unanswered questions is how we can explain the representation of abstract concepts, which represent a large part of the adult lexicon but for which there is little associated sensorimotor information (Borghi et al., 2017). I turn to that question next.

Principle 3: The Many and Various Properties of Abstract Concepts

Semantic richness effects have provided a useful framework for studying the dimensions of word meaning, but historically, much of the lexical-semantic literature has focused on concrete words. In contrast, the semantic richness approach has been used less frequently to explore the representation of abstract word meaning. Further, the meanings of abstract words like *truth* and *love* have tended to be characterised simply by what they lack, for instance, these are words that are learned *in the absence of* perceptual experience (e.g., Barsalou & Wiemer-Hastings, 2005). The small number of studies that have examined semantic richness effects for abstract words have, however, provided evidence that properties of abstract concepts can be identified; for instance, there are reports of both semantic neighbourhood (Recchia & Jones, 2012) and context availability effects (Zdrazilova & Pexman, 2013) for abstract words. These findings suggest that linguistic and situational contexts are important for abstract meaning. In addition, word valence facilitates lexical-semantic processing for abstract words (Newcombe, Campbell, Siakaluk, & Pexman, 2012; Zdrazilova & Pexman, 2013). Indeed, there is a proposal that word valence is particularly important to the representation of abstract words (Vigliocco et al., 2009). That is, through emotion, we can ground abstract meanings in felt experience. As such, one would expect that valence might play a different role in the processing of abstract and concrete concepts. One could test that expectation using existing valence ratings (Warriner et al., 2013) and semantic decision reaction times (RTs; Pexman et al., 2017; see Figure 2).

In Figure 2, the relationship between valence and semantic decision time shows a quadratic trend for abstract words and a more linear trend for concrete words. This difference is analysed more systematically in Pexman and Yap (2018), but I present these data here to illustrate the utility of large-scale rating norms and behavioural megastudies, mentioned previously, when exploring proposals about lexical-semantic processing. Figure 2 shows us



Figure 2. The relationships between valence ratings (Warriner et al., 2013) and Calgary Semantic Decision Project semantic decision task (SDT) reaction times (RTs; Pexman et al., 2017) for abstract and concrete words. For valence ratings, 1 = *negative* ("unhappy"), 5 = *neutral*, and 9 = *positive* ("happy"). Locally estimated scatterplot smoothing (LOESS) functions are plotted. See the online article for the color version of this figure.

that word valence might play a different role in the semantic processing of abstract and concrete words, and this is important because it might address some conflicting findings in the literature. In the previous literature, there have been two main patterns of valence effects reported. Some studies have reported linear effects of valence, with positive words processed more quickly than neutral words and negative words processed more slowly than neutral words (Kuperman, Estes, Brysbaert, & Warriner, 2014; Larsen, Mercer, Balota, & Strube, 2008). Other studies have reported a more quadratic pattern, with positive and negative words both processed faster than neutral words (e.g., Kousta, Vinson, & Vigliocco, 2009; Yap & Seow, 2014). Although there are likely many factors responsible for these mixed results, the effects depicted in Figure 2 suggest that differences in word concreteness might be one such factor that has not previously been considered. That is, the pattern of valence effects for concrete words more closely matches the literature showing the linear effects of valence, whereas the pattern of valence effects for abstract words more closely matches the pattern showing facilitated processing of positive and negative words versus neutral words. The different pattern of valence effects for abstract words is consistent with the proposal that valence is particularly important to the representation of abstract meanings, and it is something that will need to be considered in models of semantic representation.

Beyond harvesting insights from megastudies, I believe that we will need to more systematically consider development in order to test the various theories of abstract meaning representation (Pexman, 2019). Infants develop their earliest concepts from sensorimotor experiences and interactions (e.g., Smith, 2005). As they move through the preschool and early school years, they begin to acquire more abstract concepts (Ponari, Norbury, & Vigliocco, 2018). There is very little research on how children acquire abstract words, but exploring this question is essential to understand how best to explain the ways in which abstract meanings are represented in the mind and to guide our collective theories into complete and sophisticated understandings of semantic processing.

One proposal is that abstract concepts are acquired and understood through language and linguistic context (Andrews & Vigliocco, 2010; Andrews, Vigliocco, & Vinson, 2009; Dove, 2014). By this proposal, abstract meanings are grounded in linguistic experience and in their relationships to already-known words. As such, language proficiency should be important to children's abstract vocabulary acquisition (Howell, Jankowicz, & Becker, 2005). Another proposal is that abstract meanings are grounded through emotion (the *affective embodiment account*; Borghi et al., 2017; Kousta, Vigliocco, Vinson, Andrews, & Del Campo, 2011). For example, a child learns the meaning of a concept like *love* through the feelings that are evoked when being hugged. Emotion words can provide children with "essence placeholders" (Lindquist, MacCormack, & Shablack, 2015) that categorise their bodily experiences. Indeed, some of the earliest abstract words that children acquire are those that refer to emotions (Ponari et al., 2018), a phenomenological proof of the primacy of emotional grounding of meaning.

In a recent developmental study (Lund, Sidhu, & Pexman, 2019), we tested these proposals about abstract meaning acquisition. We found that by 6 years of age, children show sensitivity to emotion information in their lexical processing, particularly for abstract words, and that their language proficiency is related to

their acquisition of neutral (nonvalenced) abstract word meanings. Thus, we found support for both the affective embodiment account and the grounding-through-language account; the meanings of some abstract words may be grounded through emotion, and others may be understood through language. Results like these point to the need to consider different kinds of abstract meanings and the ways in which those kinds of meanings rely on different underlying representation systems. Indeed, it has been argued that abstract meanings are heterogeneous because abstract words refer to a variety of concepts, including emotions, numbers, scientific concepts, social terms, nonembodied actions, and so forth (Borghi, Barca, Binkofski, & Tummolini, 2018; Muraki, Sidhu, & Pexman, 2020).

In keeping with the idea of heterogeneous abstract concepts, in a functional magnetic resonance imaging (fMRI) study with adults, we found that abstract word meanings were associated with activation in numerous cortical regions (Pexman, Hargreaves, Edwards, Henry, & Goodyear, 2007b). This pattern suggested that abstract concepts involve a distributed network of association areas. Further, a neuroimaging meta-analysis by Desai, Reilly, and van Dam (2018) confirmed widespread representation in the brain for abstract concepts and also that different kinds of abstract concepts (numbers, emotions, moral concepts, and mental states) are associated with some distinct and some overlapping regions. Thus, they concluded that there are multiple mechanisms for representing abstract concepts (see also Zdrazilova, Sidhu, & Pexman, 2018). Certainly, there is still work to do in understanding these mechanisms and their development, but to make progress on these issues, it is important to consider the variety of abstract words and the multiple ways in which those meanings are acquired.

Principle 4: Experience Matters

It has traditionally been assumed that once developed, the lexical-semantic system is fairly stable both within an individual and across individuals. Some of our findings show, however, that the lexical-semantic system is both dynamic and experience dependent.

Evidence for dynamic semantic processing is difficult to explain by traditional accounts of semantic memory. That is, it has been assumed that semantic representation is relatively fixed and, at least at its core, context-free (e.g., Collins & Loftus, 1975). In contrast, most pluralist accounts assume that meaning is constructed dynamically to meet the demands of a particular task, and that context dictates the meanings derived (Yee & Thompson-Schill, 2016; Zwaan, 2014).

In recent work, we tested these ideas by exploring the effects of context on semantic processing, investigating the interaction of bottom-up (e.g., item-specific semantic richness effects) and top-down (e.g., task demands) processes in lexical and semantic tasks (e.g., Hargreaves & Pexman, 2014). Our findings show, for instance, that the effects of different semantic dimensions vary with the semantic decision category in terms of behavioural measures like RT and response accuracy (Hino et al., 2006; Pexman, Holyk, & Monfils, 2003; Taikh, Hargreaves, Yap, & Pexman, 2015; Tousignant & Pexman, 2012) and also in the associated cortical regions implicated by fMRI (Hargreaves, White, Pexman, Pittman, & Goodyear, 2012). The context manipulations in many of these studies are subtle; in some cases, the only change is to the way the semantic categorisation task is framed. For instance, we found systematic variation in body–object interaction effects when we changed the semantic decision framing. Using the same lists of word stimuli in each case, body–object interaction effects were large in the "Is it an entity or a non-entity?" condition, moderate in the "Is it an entity or an action?" condition, and null in the "Is it an action or a nonaction?" condition (Tousignant & Pexman, 2012). The implication is that people are highly sensitive to task context and can shift emphasis in semantic processing in order to focus on task-relevant dimensions of word meaning.

Beyond these immediate changes to processing as a function of context, we have also demonstrated that longer-term experience is associated with changes to the lexical-processing system. For instance, we examined whether individual differences in vocabulary in an undergraduate sample were related to lexical-semantic processing (Pexman & Yap, 2018). We found that in a semantic decision task, undergraduate participants with more advanced vocabulary skills were able to more quickly access semantic information and to emphasise task-relevant dimensions of word meaning.

We also explored individual differences in lexical experience in a series of studies with competitive Scrabble players. These individuals engage in intensive practice that includes many hours spent studying word lists and anagramming, as well as regular Scrabble match play. As a result of practice, they are able to recognise many letter strings as legal words but do not necessarily know the words' meanings. Thus, they do not tend to have extraordinary scores on traditional vocabulary tests. We found that compared with age-, education-, and vocabulary-matched control participants, Scrabble experts were able to make very fast lexical decisions with less reliance on word meaning, presumably because their extensive lexical-processing experience allowed them to focus more on orthographic familiarity to distinguish words from nonwords (Hargreaves, Pexman, Zdrazilova, & Sargious, 2012).[2] In Scrabble play, words can be presented in either a horizontal or vertical orientation. People are generally slow to read vertical words, but we found that Scrabble experts had developed vertical fluency: In our laboratory task, they were much better able than nonexperts to judge the lexicality of vertical letter strings.

These experience-driven changes were also evident in the neural correlates of lexical-semantic processing in Scrabble experts (Protzner et al., 2016). During lexical decision, Scrabble experts showed more substantial recruitment of neural regions associated with working memory and visual perception than did controls. As with so many other kinds of expertise, Scrabble expertise seems to be highly domain specific. Scrabble practice makes you good at Scrabble (and lexical decision) but does not seem to transfer to similar tasks involving nonlinguistic stimuli (van Hees et al., 2016), nor does it seem to ward off brain aging (Wang, Pexman, Turner, Cortese, & Protzner, 2018).

[2] This project required a rare foray into fieldwork. In order to recruit and test high-level competitive Scrabble players, then-graduate students Ian Hargreaves and Lenka Zdrazilova set up a remote lab in a suite at the hotel-casino that was hosting the Western Canadian Scrabble Championships. This made it possible for us to test some of the best players between matches. At major tournaments, players compete in several matches per day (Fatsis, 2001).

Thus, our research suggests that there is experience-driven change in the lexical-semantic system even in adulthood. There is still work to do to understand the mechanisms of this change, but the evidence so far is consistent with a dynamic semantic system that is responsive to immediate and extended context.

Conclusion

The last 2 decades of research on lexical-semantic processing have helped us understand the complex process by which meaning is derived from language. Although progress has been made, the work has limitations. For instance, in all of the studies I've described here, the word stimuli were presented in isolation; that is, we presented one word at a time for processing. Yet the language that people encounter every day is almost always connected, in the form of multiword expressions and utterances. Further, we know that association is foundational to semantic structure (Griffiths, Steyvers, & Tenenbaum, 2007; Jones & Mewhort, 2007). That is, people rarely retrieve the meaning of one word without also thinking of related words. The same mechanisms that allow people to shift lexical processing in response to context may also be implicated when people make predictions about what's coming next in connected text and utterances. In future research, it will be important to move beyond individual word stimuli and their particular properties. In recent work, we've begun to take steps in this direction. For instance, we are collecting norms for multiword expressions that will allow us to consider how the properties of connected texts (and not just the individual words in those texts) explain their processing. In addition, in a recent study, we examined whether the lexical and semantic properties of words' *associates* influence the processing of the words themselves (Muraki et al., 2020). We found that there were indeed contributions from words' associates. Thus, even when processing individual words, we can detect influences of the words' (nonpresented) associates, not just in their sheer number (Pexman, Hargreaves, Edwards, Henry, & Goodyear, 2007a) but also in their individual properties (e.g., concreteness, age of acquisition). The strategy of investigating the effects of the properties of words' associates is one that could be used to address some of the other issues I've described here, such as determining how abstract meanings are represented or identifying the dimensions of semantic representation. Many important issues remain, and if I'm lucky, I'll get to dig into some of them in the decades to come.

Résumé

Lorsque nous voyons ou entendons un mot, nous pouvons rapidement évoquer sa signification dans notre esprit. Or, le processus qui sous-tend cette capacité se veut fort complexe. Au cours des deux dernières décennies, des progrès considérables ont été réalisés en vue de comprendre ce processus. Dans le présent article, je propose quatre grands principes du traitement sémantique dérivés de la recherche lexico-sémantique. Selon le premier de ces principes, la relation entre la forme et la signification n'est *pas* si arbitraire, ce que j'explore en décrivant les efforts déployés pour comprendre la relation entre la forme et la signification, en mettant en évidence les percées réalisées dans mon propre laboratoire sur les thèmes du symbolisme phonétique et de l'iconicité phonologique. Le second principe sous-tend que *plus il y en a, mieux c'est*, et je résume les recherches menées précédemment sur les effets de la richesse sémantique, ainsi que la façon selon laquelle de tels effets traduisent la nature de la représentation sémantique. Le troisième principe concerne *les propriétés nombreuses et variées des concepts abstraits*. J'expose le fait que la signification abstraite constitue une difficulté pour certaines théories de la représentation sémantique. Par conséquent, je fournis les grandes lignes de ce que nous avons appris sur la façon dont ces significations sont acquises et représentées. Le quatrième principe souligne que l'*expérience compte*, et je résume les recherches sur la nature dynamique et fondée sur l'expérience du traitement sémantique, en détaillant comment le traitement est modifié par le contexte immédiat et à long terme. Enfin, je décris certaines des prochaines étapes de la recherche lexico-sémantique.

Mots-clés : signification des mots, iconicité, richesse sémantique, concepts abstraits.

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