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Language is more abstract than you think, or, why aren't languages more iconic?

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How abstract is language? We show that abstractness pervades every corner of language, going far beyond the usual examples of *freedom* and *justice*. In the light of the ubiquity of abstract words, the need to understand where abstract meanings come from becomes ever more acute. We argue that the best source of knowledge about abstract meanings may be language itself. We then consider a seemingly unrelated question: Why isn't language more iconic? Iconicity—a resemblance between the form of words and their meanings—can be immensely useful in language learning and communication. Languages could be much more iconic than they currently are. So why aren't they? We suggest that one reason is that iconicity is inimical to abstraction because iconic forms are too connected to specific contexts and sensory depictions. Form–meaning arbitrariness may allow language to better convey abstract meanings.

This article is part of the theme issue 'Varieties of abstract concepts: development, use and representation in the brain'.

1. Introduction

Where does abstract knowledge come from? Why isn't language more iconic? These two questions appear to be unconnected. We make the case that by considering them together, we can better understand the origins of abstract knowledge and the design principles of language.

We begin by briefly reviewing two major approaches to understanding semantic knowledge—*embodied cognition*, which emphasizes the importance of perceptual, motor and emotional experiences in our conceptual structure and word meanings (e.g. [1,2]), and what we gloss as *amodal cognition* (e.g. [3,4]), which emphasizes the role of symbolic and non-perceptual representations. Accounting for abstract knowledge has posed a challenge for both approaches, and we argue that the problem of abstract knowledge is even more acute than is often acknowledged by proponents of either view. To understand the origin of (some) abstract concepts, we argue that we need to turn to language itself. We discuss several ways that language can give rise to abstract concepts and then argue that this ability may require word forms to be arbitrarily related to their meanings, and so despite the many benefits of a more iconic language, iconicity may be a hindrance to expressing abstract meanings.

Iconicity refers to cases where a word form bears some resemblance to its meaning. This resemblance may be easy to detect, as in onomatopoetic words such as *tweet*, *chirp*, *click* and *bang*, or more subtle, as in a word like *teeny*, which is iconic because people have a robust association between smallness and the sound /i/ [5,6]. It is becoming increasingly clear that iconicity is widespread in both signed and spoken languages and offers advantages in both language learning and processing [7–11]. Given these advantages, one might expect languages to be more iconic than they presently are. So why aren't they? The answer, we argue, is that iconic words are too linked to specific referents and contexts, and so are less well suited for expressing abstractions. To support this view, we discuss novel empirical evidence which suggests that there is a tension between abstract meanings and iconicity such that to

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successfully convey abstract meanings, it is 'better' for a word for be arbitrary, or less iconic. Critically, to the extent that we *owe* many of our abstract concepts to our experiences with language (§3d), a more iconic language not only may make it more difficult to *express* abstract meanings, but may make it more difficult to learn abstract meanings in the first place.

2. Amodal versus modal approaches to representing semantic knowledge

(1) Lemons are yellow.
(2) Cats make meowing sounds.
(3) The USA was established as a representative democracy.

Understanding sentences like these requires having certain semantic knowledge. But where does this knowledge come from? Answers have spanned a continuum. On one end are approaches that emphasize the role of sensory, motor and affective experiences. This view, often glossed as 'embodied cognition', blurs the line between perception, action and cognition by positing that conceptual mental states used in understanding sentences like those above draw on (and, on some versions of embodied cognition, are identical to) mental states used in representing perceptual, motor and affective information. For example, to understand sentences (1) and (2), the comprehender would recruit visual representations of lemons and the auditory representations of cat sounds, respectively [1,12–16]. Importantly, these types of perceptual representations constitute both word meanings and conceptual knowledge itself.

Other perspectives—glossed here as *amodal*—reject the claim that perceptual, motor and affective knowledge is constitutive of semantic knowledge [4,17]. Of course, few would deny that people's knowledge of lemons and cats *derives* largely from real-world experiences with lemons and cats. Amodal approaches, however, downplay the importance of such experiences in forming the content of representations that are accessed by words. On the amodal position, words are *mapped onto* underlying conceptual states. Because the conceptual states are posited to be amodal, so are word meanings.

There are several strands of evidence for the embodied view. The first points to apparent 'perceptual simulations' that appear to be formed in the course of processing language. When comprehending sentences such as *The ranger saw the eagle in the sky* [16] and *John put the pencil in the cup* [14], participants appear to form fairly specific perceptual representations of the mentioned objects, a result that is consistent with the idea that they understand the sentence through a perceptual simulation [17]. Converging evidence comes from functional magnetic resonance imaging (fMRI) and magnetoencephalography (MEG) studies which have shown rapid activation of modality-specific regions in response to modality-specific words [2]. While these results are all correlational, a growing number of studies show that perceptual, motor and affective systems are *causally* involved in language understanding. For example, Edmiston & Lupyan [18] showed that visual interference impaired participants' ability to respond to verbal questions probing visual knowledge such as whether alligators are green. This result shows visual representations to be causally involved in verbally accessed semantic knowledge of what things look like.

Supporters of the amodal position challenge embodied views on multiple grounds [19–22]. One major objection is that people with very different perceptual experiences can, nevertheless, have very similar conceptual content. For example, people born blind are fully capable of learning and using language and their conceptual structure appears to be very similar to that of sighted people [20,23,24], even of visual concepts such as colours [25,26]. This provides a strong challenge to the assumption that perceptual (or at least visual) experiences are central to conceptual and linguistic knowledge.

Another objection of amodal theorists is that the embodied view does not adequately explain the structure of abstract concepts like *justice*, or concepts for which we have no direct perceptual experience like *atom*, and that the meanings of 'embodied' concepts like *grasp* are more abstract than acknowledged by embodied theorists [4]. In the next section, we dwell on this objection and argue that language is indeed abstract—in fact, it is more abstract than is often acknowledged by both embodied and amodal theorists. We will then argue that the abstract nature of language may offer a *solution* to the problem of abstract knowledge.

3. How abstract is language?

(a) Defining abstractness

Many discussions of abstract word meanings have centred on words such as *freedom*, *democracy* and *justice* [4,27,28]. These abstract words are often contrasted with such concrete words as *ball*, *dog* and *blinking*. What does it mean to say that *freedom* is more abstract than *ball*? Abstractness is commonly defined in opposition to concreteness. A particularly clear definition of concreteness comes from Brysbaert *et al.* [29], who asked participants to place 40 000 English words on a concreteness/abstractness scale. Concrete words were defined as those that 'refer to things or actions in reality, which you can experience directly through one of the five senses' ([29]; p. 906). Participants were told that if they tried to explain the meaning of a concrete word, they could point to the referent, or enact the meaning in some way:

> To explain 'sweet' you could have someone eat sugar; To explain 'jump' you could simply jump up and down or show people a movie clip about someone jumping up and down; To explain 'couch', you could point to a couch or show a picture of a couch

Abstract words were defined as those that refer to 'meanings that cannot be experienced directly, but which we know because the meanings can be defined by other words' ([29]; p. 906). An abstract word 'refers to something that you cannot experience directly through your senses or actions. Its meaning depends on language. The easiest way to explain it is by using other words'.[1]

Suppose we wish to evaluate what people know about concepts referred to by concrete nouns (e.g. *strawberry*, *toothbrush* and *leg*) and concrete verbs (e.g. *jump*, *fly* and *cut*). We can assess such knowledge with or without language. For example, if a person knows that strawberries are red, we can show them pictures of strawberries in various colours and ask them to select the most real-looking one. Or we can hand a person a toothbrush and ask them to indicate how they would use it. Indeed, tests like this are commonly as a way of assessing semantic knowledge without the use of language, (e.g. [30]). The same option is not

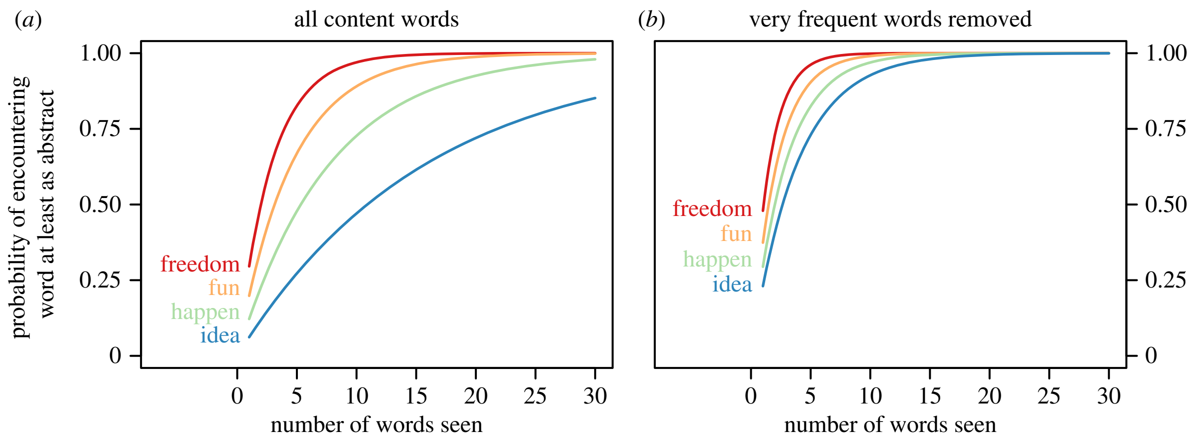

Figure 1. The cumulative probability of encountering a word at least as abstract as labelled by each line. The probabilities are derived from sampling from words from the SUBTLEX corpus in proportion to each word's frequency. (*a*) Analyses of words from Brysbaert *et al*. [29] concreteness norms, excluding closed-class words ($n = 26\,210$). (*b*) The same analysis but excluding very frequent words such as *other*, *here* and *is* rather than all closed-class words ($n = 28\,931$). (Online version in colour.)

readily available for assessing the knowledge of abstract words. How does one probe the concept denoted by the words *freedom* or *democracy* without the use of language? We cannot simply show people a picture of these entities, precisely because they have no immediately perceptible physical manifestation. And so, although it is certainly possible that conceptual representations of such abstract meanings are entirely independent of language, it should give us pause that probing people's knowledge about these concepts seems to require language.

(b) Beyond *freedom* and *justice*: language is surprisingly abstract

According to the Brysbaert *et al*.'s [29] concreteness norms, the concreteness values of *freedom*, *democracy* and *justice* (1 = most abstract; 5 = most concrete) are, respectively, 2.34, 1.78 and 1.45. These words are clearly abstract. But the focus on such lofty meanings has, we believe, minimized the ubiquity of abstract meanings in language. Just within common nouns, which are the most concrete of all lexical classes ($M = 3.53$), the words *fun* (1.97), *idea* (1.61), *chance* (1.64) and *trouble* (2.25) are all judged as more abstract than *freedom* and are all much more frequent. Moving to other word classes further reveals the ubiquity of abstract words. While some verbs are judged as being concrete, e.g. *skate* (4.6) and *blink* (4.4), many more frequent verbs are rated as quite abstract, e.g. *imagine* (1.53), *happen* (1.78), *enjoy* (2.29) and *agree* (2.31). Everyday adverbs such as *especially*, *maybe*, *already* and *never* likewise are rated as being highly abstract (<1.60). The most concrete adjectives such as *wooden* (4.61) and *bald* (4.69) are dwarfed in number by much more abstract adjectives, such as *pleasant* (1.55), *normal* (1.40) and *irrelevant* (1.50).

As a further demonstration of just how much of English is abstract, suppose we select a random noun, verb or adjective weighed by its frequency.[2] Using the SUBTLEX movie subtitle corpus, a widely used corpus in psycholinguistic research [31], we discover that we have a 59% chance of selecting a word that is above the median level of abstractness ($M = 2.15$). Example words in this part of the concrete/abstract distribution are *extrovert*, *uncomfortable*, *innovating*, *immodest* and *flamboyant*.

Even more striking results are obtained if we run the same analysis on a dataset in which abstractness and concreteness are operationalized in terms of sensory experience. Juhasz & Yap collected ratings that 'reflect the extent to which a word evokes a sensory and/or perceptual experience in the mind of the reader' [32, p. 160]. Participants rated words on a scale from 1 (no sensory experience, abstract) to 7 (maximal sensory experience, concrete). Among the words with the highest sensory experience ratings, we find *garlic* (6.56), *walnut* (6.50), *music* (6.0), *humid* (6.0) and *hamster* (5.6). Among the words with the lowest sensory experience, ratings are *choice* (1.0), *though* (1.09), *mere* (1.08), *rite* (1.10) and *plural* (1.18). These ratings are correlated with Brysbaert *et al*.'s [29] concreteness ratings only moderately ($r = 0.4$). Applying the same analysis to sensory experience ratings revealed a 73% chance of randomly picking an adjective, noun or verb with a less-than-median level of sensory experience.

We can demonstrate the ubiquity of abstract words further by extending this approach to multiple words. Figure 1 shows the cumulative probability of selecting words of various levels of abstractness in the SUBTLEX corpus. How many words before encountering a word at least as abstract as words like *freedom*, *idea* and *fun*? Figure 1 shows that the answer is surprisingly few. Given an utterance of only five words, there is a 73% chance of coming across a word that is as abstract as *idea* and 95% chance of coming across a word that is abstract as *freedom*.

As a final illustration of the ubiquity of abstract words, consider the following Yelp review of a Verizon store:

> My fiancé upgraded his phone at the Apple store, but got a strange text on his new phone about his plan. We went over to the Verizon store to see what was up, and that was about as pleasant as having forks jammed in my eyes. Awful customer service. No one came up to ask us if we needed help. We had to tear a disgruntled man away from looking at his Instagram feed to help us. He didn't say there would be a wait or to sit or anything, just said 'okay then' and left us. So we stood there waiting for help or even just directions for far too long, were ignored and told him we were leaving. Awful awful awful customer service.

Removing from this paragraph all the words more abstract than the median rating according to the Brysbaert norms, we get the following:

> Fiancé his phone Apple store, text on his phone his plan. We (Verizon) store see up, forks jammed in my eyes. Customer. One up us we. We tear man looking his (Instagram) feed us. He said us. We stood directions long, him we leaving. Customer.

These examples are not meant to minimize the abstractness of canonically abstract words like *freedom* and *justice*. These words *are* abstract, especially when compared with other nouns (*freedom* is more abstract than 82.8% of nouns in the Brysbaert norms; *justice* is more abstract than 99.5% of nouns). Rather, we wish to emphasize just how ubiquitous words with equal or greater levels of abstractness are in everyday discourse.[3] Take away nouns like *democracy* and *justice*, and our language is hardly changed. Take away all the words more abstract than *way*, *kind*, *think*, *make*, *easy*, *other*, *again* and *really* (all words on the abstract end of the scale), and we lose the ability to talk about, well, most of what we talk about!

(c) Neither embodied nor amodal representations solve the problem of abstract meanings

Proponents of embodied theories have long recognized the necessity for such theories to address the representation of abstract knowledge [1], and this topic continues to be at the centre of debates about the format of semantic knowledge [33,34], as evidenced by this special issue. Nevertheless, reading the literature on embodied cognition, one gets the impression that much of linguistic communication revolves around concrete topics, the things we see, hear, feel, taste and smell in the here and now. Typical sentences used in embodied cognition experiments include sentences such as *The ranger saw the eagle in the sky* [16] and *John put the pencil in the cup* [14], or words such as *kick* and *pick* [35]. When the issue of abstract knowledge is raised, it is usually in the context of words such as *freedom* and *democracy* rather than the much more common words such as *fun*, *idea*, *chance* and *trouble*.

The amodal position faces its own version of the abstract meaning problem. Supporters of this position are right to point out that large differences in perceptual experience do not seem to have nearly the detrimental effect on semantic knowledge/word meanings that would be expected if the bulk of such knowledge was derived from perceptual experience. However, amodal theorists do not provide a compelling alternative. If semantic knowledge does not come from direct experience with the world, where *does* it come from? One solution is to posit innate 'core knowledge' systems that span various abstract domains including animacy, agency, causality and mathematics (e.g. [36–40]). But such knowledge is far too general to account for concepts that allegedly underlie the meanings of abstract words. How do we ever get from core knowledge, such as knowledge of animacy and basic event structure, to the categories 'picked out' by the thousands of abstract words we use every day?

(d) A possible solution

One solution to the problem of abstract meanings is to turn to language [28,41–45]. On this view, the knowledge underlying abstract concepts comes from language itself.[4] What does it mean for knowledge to come from language? It is useful to distinguish between three ways that language can impact semantic knowledge:

(i) Language as a source of propositions

Most uncontroversially, language is a source of various propositions. Among these are: (1) relatively specific facts, e.g. that the mayor of Talkeetna, Alaska from 1997 to 2017, was a cat named Stubbs, (2) facts that help guide action, e.g. that sticking a fork in an electric outlet is a bad idea, and (3) more abstract knowledge, e.g. that a year is 365 days, that an even number is divisible exactly by two, and so on. No one, we think, would disagree that a sizable amount of our semantic knowledge is derived from such explicit uses of language (e.g. [48] for discussion), though a precise amount is difficult to quantify.

(ii) Language as a categorical cue

More controversially, language provides a kind of categorical overlay on the world. Rather than simply *reflecting* the pre-existing joints of nature, language may help to carve these joints (see [49,50] for reviews). Empirical evidence shows that learning verbal labels facilitates category formation beginning in early infancy (e.g. [51–53]) and continuing into adulthood [54]. Even for concrete meanings, language appears to have the effect of making representations more categorical and less linked to specific category exemplars [55–57]. For more abstract concepts, the role of labels is expected to grow [58]. Whereas there *is* perceptual information that can be used to distinguish, e.g. cats and dogs [59], such perceptual regularities simply do not exist for abstract meanings like those reviewed in the previous section. In the absence of these pre-existing joints, a learner can rely on evidence from language for guidance on what otherwise dissimilar entities should be grouped together and which similar entities should be categorically distinguished.

(iii) Language statistics as knowledge

We can learn facts, such as *The sky is blue*, by direct observation or because someone tells us. But there is a third possibility. It has long been recognized that the distributional structure of language provides an enormously rich source of knowledge. By the distributional structure, we have in mind Firth's dictum that 'you shall know a word by the company it keeps' [60, p. 11]. 'Blue' co-occurs with 'sky' much more frequently than any other colour word. 'Beard' tends to co-occur with words related to men (including male names and pronouns). Such statistics scale in surprising ways. A basic machine-learning algorithm exposed to a corpus of English text can construct a fairly accurate map of Europe simply from observing the ways in which city names co-occur in various contexts [43]. Modern distributional models, such as *word2vec* [61], construct vectors representing word meanings from large corpora of text. Not only do these models yield similar vectors for words with similar meanings, but the vectors end up representing more abstract relationships such as temporal relationships between events (see [62] for discussion). Although not without limitations [63,64], the ability of such models to capture some aspects of abstract meanings simply from patterns of word use hints at the rich information conveyed by language statistics.

Showing that machines can learn certain things from the distributional statistics of language proves that the information is there, but it is a separate question whether people use this knowledge. Experimental evidence suggests that distributional patterns influence linguistic processing, showing that language users mentally represent these statistical patterns [43,65–67]. People's ability to learn from distributional patterns has some empirical support (e.g. [68–70]), but much more work is required to test the extent of such learning. The claim that exposure to language is needed to learn word meanings is hardly surprising. But what we are claiming is that when it comes to many (perhaps most) everyday meanings conveyed by abstract words, the specific category denoted by the meaning does not exist apart from language.

As an example consider the word *fun*. This word denotes a complex category that includes events (not reducible to the set of enjoyable events), people (*a fun person*, *he wasn't very fun yesterday*) and other complexities such as self-reference as when Dr Seuss writes that 'It is fun to have fun, but you have to know how' [71]. A person never exposed to the various ways that English speakers use this word would certainly lack the relevant *word meaning*. Would they nevertheless have the concept? We think not. Recall that on a traditional perspective, words are thought to map onto pre-existing concepts (e.g. [72]). But what is the pre-existing conceptual representation that *fun* would map onto? On our view, it is observing the same word used across many disparate contexts that helps *create* a category which otherwise does not exist. We can get a hint of the kind of information linguistic experiences with the word *fun* conveys by examining its semantic neighbourhood in a model of distributional semantics (*word2vec* trained on the Google News corpus). In the immediate neighbourhood of *fun* are related terms and phrases, such as *wonderful*, *thoroughly enjoyable*, *awesome*, *laugh* and *exciting*, as well as an eclectic collection of experiences some people might describe as fun: *pumpkin carving contests*, *BMXing*, *camping*, *hiking*, *canoeing* and *toenail painting*—activities that in the absence of a common linking word may share little in common. Recognizing the richness of linguistic input also helps to solve the otherwise puzzling observation that the language of blind people is quite normal. It is normal because blind people are exposed to approximately the same linguistic inputs as sighted people.

In the next section, we turn to the second question motivating this work: Why isn't language more iconic? We argue that while it is now increasingly recognized that language is more iconic (less arbitrary) than many have thought in the past, it could be far more iconic. This raises the possibility that iconicity is resisted by something; or conversely, that arbitrariness is 'preferred'. We suggest that this something may be abstractness. If language is to be maximally useful for carving joints in nature—establishing categories where none exists—this function may be best filled by words whose forms have no resemblance to their referents. That is, language may be as arbitrary as it is because arbitrary words promote abstraction.

4. How iconic is language?

For centuries, iconicity in language was viewed as natural [73–75]. To the extent that a word's form can give a hint to its meaning, one can infer word meanings without having to learn each word anew. In this way, a more iconic language seems clearly superior to an arbitrary one. Indeed, the arbitrariness of contemporary languages was frequently viewed as a defect to be rectified [73]. With the dominance of structuralism, however, words were viewed as arbitrary signifiers, making arbitrariness the default in linguistic theorizing [76–78].

Recently, there has been a resurgence of interest in iconicity [7,9,79]. This new research shows iconicity to be more than a linguistic quirk limited to onomatopoeic words like *buzz*. Rather, it is a widespread design feature of both signed and spoken languages. For example, the ability of speakers of one language to guess the meaning of iconic words in other languages is higher than one might suppose [80–83]. The original question of whether language is predominantly arbitrary or predominantly iconic is now increasingly viewed as a false dichotomy, with researchers recognizing multiple interacting forms of iconicity that are interwoven with arbitrariness between two communicative design principles that are mutually compatible [8].

The renaissance of research on iconicity has clarified some previously reported associations between sounds and meanings, for example the tendency for many languages to use the high-front vowel /i/ in words for objects and animals of small physical size [5,6,84–86], and the tendency for languages to disproportionately use the nasal sounds /m/ and /n/ in words for 'nose' [79,87,88]. In addition to showing large-scale and widespread exceptions to arbitrariness, this research has also clarified the functions of iconicity.

One function is greater sensory vividness (for review, see [8,89,90]). Describing a sound with an iconic term like *squealing* appears to provide a more vivid impression of the described sound than paraphrasing the sound using relatively more arbitrary words, as when describing the same sound as *loud and high-pitched*. An increasing number of studies link iconicity to crossmodal correspondences and sensory imagery [91–93], and some initial evidence suggests that iconic words, compared with arbitrary words, may lead to greater activation in sensory brain areas [8].

Because iconic words essentially 'give clues' to their meanings, iconicity can facilitate word learning in children [94–97] and adults [98–101], as well as facilitate the learning of perceptual regularities underlying novel categories [102]. Using observational data, [103] showed that, controlling for numerous possible confounds, iconicity predicts age-of-acquisition: more iconic words are learned earlier by children. People also have a knack for creating iconic gestures [104,105] and vocalizations [106,107], and for understanding gestures and vocalizations created by others to express a wide range of meanings. Such advantages of iconic forms had led some to argue that iconicity played a key role in the evolution of language (e.g. [108]).

(a) Why aren't languages more iconic?

Languages are under pressure to adapt to the learning demands of their users [109,110]. Iconicity enables faster word learning, more vivid communication of sensory content and provides a means by which new word forms can be coined and (to some extent) immediately understood by others. Given these advantages, we might expect languages to not only be more iconic than they are, but to become more iconic over time. But although iconicity may play an important role in the origins of signed and spoken languages [7,9,104,106], languages appear to *shed* iconicity rather than increase it [111,112]. Why?

There are two common arguments for why language is not more iconic than it is. The first is that resemblance between words and meanings is only possible for a very small range of meanings, e.g. imitations of sounds in speech and imitations of shapes in gesture [113]. Although it is certainly true that some meanings can be 'resembled' in gesture and speech more easily than others (what would an iconic form of *democracy* look or sound like?), the iconic *potential* of language is substantially greater than what is realized in natural languages. This iconic potential is evidenced by the fact that people are highly adept at creating and interpreting novel vocalizations for expressing a wide range of meanings [107].

The second argument against more widespread iconicity is that if word forms resembled their meanings, then similar words would have similar meanings, leading to confusion. That is, widespread iconicity would lead to an increase in systematicity, which is defined as 'a statistical relationship between the patterns of sound for a group of words and their usage' [7, p. 604]. Systematicity is distinct from iconicity in that something can be systematic with or without being iconic [114]; however, if an iconic crossmodal correspondence (such as between /i/ and smallness) is productively used by speakers of a language, iconicity is expected to lead to systematicity. Although possibly beneficial for small vocabularies, systematicity can lead to confusion as the vocabulary grows. This argument is supported by computational simulations by Gasser [115] who presented vocabularies of different sizes to a simple connectionist network. The network was able to learn non-arbitrary form–meaning mappings more easily than arbitrary form–meaning mappings, but for large vocabulary sizes, arbitrariness became beneficial. Sidhu & Pexman [116] show that sparser semantic neighbourhoods (which are less prone to confusion) afford more iconicity. Arbitrariness has also been argued to have processing benefits [117,118] by allowing semantically similar words to be phonologically distinct, which can minimize interference and confusion. The potential for confusion, however, is not as problematic as it may appear because iconicity is not all-or-none. For example, as mentioned above, people associate vowels with physical size. This association means that one can have a system in which the names of large animals/objects contain back vowels and small animals/objects contain front vowels. Importantly, in such a system the words can contain additional phonological segments that distinguish the specific animals without reference to size. By combining iconicity and arbitrariness in the same word form, the potential for confusion can be greatly reduced.

(b) Iconicity limits abstraction and abstractness limits iconicity

We propose that one overlooked reason why languages are not more iconic is that iconicity is inimical to abstraction. To illustrate, consider again the word *fun*. Despite being abstract, one can imagine ways in which this word *could* be more iconic. In a signed modality, this could take the form of imitating a prototypical activity such as dancing (a student suggested 'jazz hands'). In the vocal modality, the iconicity could incorporate phonological characteristics common to laughs or cheers. Note, however, that in doing so, the word form necessarily resembles a *particular type of fun* rather than a more abstract and generalizable idea of fun [119]. This is because iconic depiction is always *selective* [120,121]—only particular aspects of a word's meaning are expressed iconically.

This argument also extends to more concrete meanings. If our word for the concept 'green' is imitative of some typically green object or animal, then it cannot help but evoke a more specific exemplar of greenness, perhaps carrying with it other aspects of the referent that have nothing to do with colour. An arbitrary word for *green*, by being associated with a range of greens, can abstract away from specific shades of green [122]. And so, while iconic forms may indeed be easier to learn, to the extent that they resemble specific exemplars or a narrower range of contexts, they may make it more difficult to form more abstract representations in the first place (see also [123,124] for related observations for American and British Sign Languages).

A similar argument has been made for signed languages. Meir [119] discusses evidence from Israeli Sign Language (ISL) and American Sign Language which suggests that certain metaphoric extensions, which are associated with abstract words in English and Hebrew, are not possible in those languages because the corresponding signs are iconic. For example, in English, we can extend the primary meaning of the verb *eat* (consume food) to cases such as *The acid ate the iron key*. In ISL, this is not possible because the sign for 'eat' is executed at the mouth, an iconic depiction of a human eating event. This more specific type of eating is incompatible with a semantic extension to acid dissolving an iron key. As another example, Meir [119] discusses the metaphoric expression *Time flies*, which is impossible (or comical) in ISL as the sign for 'flying' iconically depicts a specific type of flying (flapping with one's wings).

The restriction of iconic phenomena with respect to metaphorical extension has also been noted for spoken languages. Speakers of English and other languages frequently use so-called synaesthetic metaphors, expressions that combine different sensory words such as *rough melody* or *smooth taste*. Research on such expressions has repeatedly found that words describing sounds are less likely to be extended to other sensory dimensions [125–127], e.g. it is possible to say *dark sound* and *rough sound*, but *squealing colour* and *screeching feeling* appear odd. While there are many possible explanations for this pattern, one possibility is that words for sounds, which are among the most iconic words in English [128] and in other languages [90], may be too iconic to allow for easy abstraction. As noted by Classen [129], 'auditory terms are too echoic or suggestive of the sounds they represent to be used to characterize other sensory phenomena' (p. 55). In line with this idea, Winter [130] showed that adjectives rated high on iconicity are less likely to modify nouns associated with other sensory domains. For example, *loud* is less iconic than *squealing*, and correspondingly *loud colour* is much more frequently attested than *squealing colour*.

The answer to why languages aren't more iconic may therefore be twofold: (i) iconicity, while benefiting learning, may tie a word too closely to a specific more concrete meaning, thereby preventing abstractness and generalization, and (ii) because so much of what adults talk about is abstract, iconicity is resisted even in semantic domains that lend themselves to iconic expression.

5. Evidence that abstractness resists iconicity

In this section, we provide some correlational evidence of an antagonistic relationship between iconicity and abstraction, suggesting that abstract words 'prefer' to be arbitrary perhaps because iconicity creates an association between a

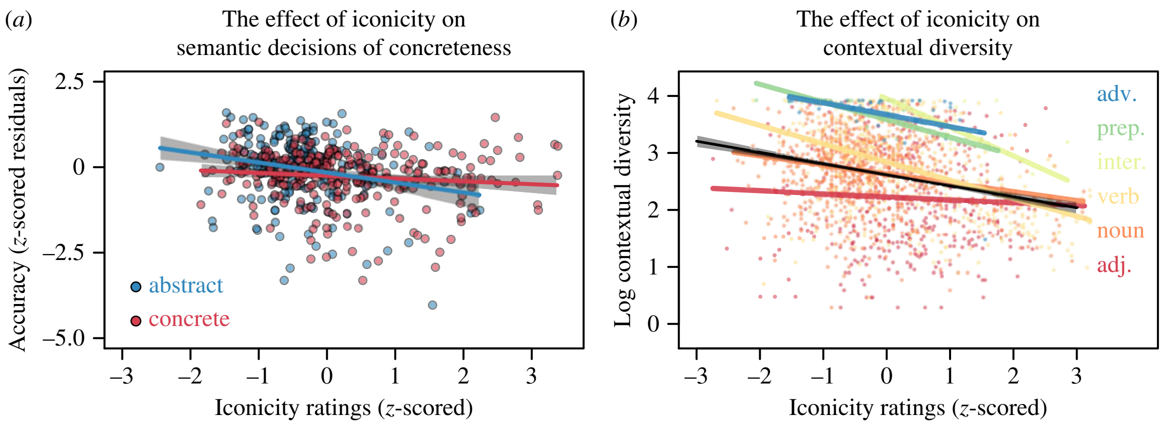

Figure 2. (*a*) Re-analysis of data reported by Pexman *et al.* [135]. More iconic-abstract words are more likely to be mistaken for concrete words. The plotted accuracy measure partials out reaction times, word-frequency and part-of-speech. (*b*) More iconic words occur in fewer contexts. Coloured lines show slope estimates for selected parts of speech (adv., adverb; prep., preposition; inter., interjection; adj., adjective). Black line shows the overall effect for all parts of speech.

form and a more specific/more vivid meaning that limits the use of a word to certain contexts, and with it, the word's potential for abstractness.

(a) Iconic words are less abstract

The first evidence for an inverse relationship between iconicity and abstractness comes from previously reported associations between measures of concreteness [29], sensory vividness [32] and iconicity, as measured by participants' judgements of whether words sound like what they mean [103]. These analyses show that words rated high on iconicity are, on average, more concrete and have more sensory vividness than words judged to be arbitrary [116,128]. The special classes of 'ideophones' attested in many of the world's languages have been described as being 'for' the depiction of sensory imagery [90], and even 'phonesthemes', clusters of word–meaning correspondences such as ***gl****immer*, ***gl****itter*, ***gl****itz*, ***gl****isten* (which all relate to particular light-reflectance patterns), often described as etymological accidents, tend to have primarily *sensory* meanings [130].

It is also worth noting that nearly all experimental demonstrations of iconicity have investigated concrete meanings [8], such as the famous *kiki*/*bouba* stimuli which are associated with spiky or round visual shapes [131,132]. To the extent that semantic generalizability of iconic forms has been experimentally demonstrated, this generalizability is of a limited type [83]. By pitting semantic notions of size (e.g. 'mouse' versus 'elephant') against the visual representation of size (e.g. small versus large images of mice and elephants), Auracher [133] was able to show that size iconicity goes beyond specific visual features. However, even in this case the semantic representations relate to a specific sensory characteristic, namely physical size. Another purported case of iconicity for abstract meanings comes from Maglio *et al.* [134], who showed that front vowels such as /i/ are related to conceptual precision, compared with back vowels such as /o/ and /u/. However, the authors note that the effect appears to stem from (concrete) differences in 'size' conveyed by phonological cues. Thus, almost all forms of iconicity discussed in the experimental and linguistic literature are sensory in nature.

(b) Abstract words that are iconic seem more concrete

Finding an inverse relationship between iconicity and concreteness (even controlling for such factors as part-of-speech and frequency) may simply indicate that people have a bias to judge more concrete words as being iconic. To examine whether there is more to it than that we re-analysed data from a recent study by Pexman *et al.* [135], who conducted a speeded classification task in which participants were shown words varying in concreteness and had to indicate, as quickly as possible, whether the word was concrete or abstract (a binary distinction in Pexman *et al.*'s study). We reasoned that if abstract words that are relatively more iconic activate a more specific semantic representation, then participants should make more errors classifying iconic-abstract words as concrete compared with arbitrary-abstract words.

To test this prediction, we regressed mean accuracy reported by Pexman *et al.* [135] on our measure of iconicity and controlling for part-of-speech, and log word-frequency as fixed factors. Overall, iconicity was not related to accuracy ($t < 1$). However, there was a significant (though small) concreteness-by-iconicity interaction, $b = 0.95$, 95% CI = [0.07, 1.84], $t = 2.13$, $p = 0.03$ (figure 2*a*). Accuracy for concrete words (i.e. words for which the correct answer was 'concrete') was unaffected by iconicity, $b = -0.46$, 95% CI = [−1.42, 0.51], $t = -0.93$, $p = 0.35$. Accuracy for abstract words was significantly negatively associated with iconicity, $b = -3.15$, 95% CI = [−4.79, −0.78], $t = -3.15$, $p = 0.004$. Abstract words with iconicity values below the 25th percentile were classified as 'abstract' with 86% accuracy. Words that had iconicity values above the 75th percentile (and which were rated off-line as equally as abstract as the less iconic words) were classified in the task as 'abstract' at an accuracy of 79%. This result provides initial evidence—in need of further confirmation—that more iconic words evoke more specific meanings than less iconic words even when controlling for previously rated abstractness.[5] The code for all analyses presented here is available at https://osf.io/b9fhx/.

(c) Iconic words are tied to more specific contexts

If iconic words resist abstraction, a further prediction is that they should occur in a narrower range of contexts. We have already discussed this idea in the context of iconicity restricting semantic extensions in metaphorical contexts (see above, [119]). We can also test this prediction in a more general way by correlating iconicity with several measures of contextual diversity while controlling for various possible confounds.

One coarse measure of contextual diversity comes from the SUBTLEX corpus and is simply the number of movies in which a given word appears. This simple measure is more predictive of reading and lexical-decision times than word-frequency [137]. Contextual diversity (log-transformed) was significantly associated with iconicity. Controlling for concreteness and part-of-speech, more iconic words occurred in fewer contexts, $b = -0.16$, 95% CI = [−0.19, −0.14], $t = -10.87$, $p < 0.00005$. This negative association remained highly significant when further controlling for SUBTLEX word-frequency, $b = -0.01$, 95% CI = [−0.02, −0.002], $t = -2.63$, $p = 0.009$. Significant negative associations are also found when we use the (log-transformed) number of documents in which a given word occurred in the British National Corpus [138] while controlling for concreteness and word-frequency, and part-of-speech, $b = -0.15$, 95% CI = [−0.18, −0.11], $t = -7.33$, $p < 0.00005$. These relationships become even stronger when we exclude closed-class words.

Another measure of contextual diversity involves not simply counting contexts, but evaluating the heterogeneity of those contexts using distributional statistics. Such a measure, termed semantic distinctiveness [138], is also negatively associated with iconicity when controlling for word-frequency and part-of-speech: $b = -0.02$, 95% CI = [−0.03, −0.01], $t = -4.02$, $p = 0.00006$, though the association does not survive further controlling for concreteness, $b = -0.005$, $t = -1.05$. Thus, a number of independent measures (SUBTLEX contextual diversity, BNC contextual diversity and distributional statistics) point in the same direction: iconicity limits the reusability of words, tying them to a narrower range of contexts.

6. Conclusion

We began by considering two seemingly unconnected questions: (i) Where does abstract knowledge come from?, (ii) Why isn't language more iconic? Neither embodied nor amodal theories of semantic knowledge provide satisfactory answers to the first question. Despite acknowledging the need to understand where knowledge underlying these word meanings comes from, the embodied position has, we believe, focused too narrowly on concrete concepts, neglecting the extent to which the meanings we use in everyday language are abstract. Examining the distribution of abstract words in language makes it clear just how ubiquitous they are. Far from being limited to meanings like *democracy* and *freedom*—common examples in discussions of abstract meanings—everyday language is filled with abstract words such as *happen*, *fun*, *sometimes* and *enjoy*. Given an utterance of only five words, there is about a 95% chance of coming across a word as abstract as *freedom*.

Amodal theorists, while long criticizing the embodied view for failing to fully acknowledge abstractness, have, for their part, tended to overlook a major source of knowledge of abstract meanings: language itself. We have argued that language is a key source of guidance not just for learning how to use these English words appropriately, but for forming the conceptual representations that underlie these meanings.

In §§4 and 5, we argued that a design feature of language that may facilitate abstraction is form-to-meaning arbitrariness. Although arbitrariness in language is often taken for granted, the extent to which languages are arbitrary is surprising given the many benefits of non-arbitrary (iconic) word forms and the potential for language to be much more iconic than it is. As an explanation of why languages are not as iconic as they could be, we suggest that iconicity interferes with abstraction because to be iconic requires resembling *some aspect* of meaning. By moving away from iconic resemblance, words can take on a life of their own, helping to carve joints into nature.

Data accessibility. The code for all analyses presented here is available at https://osf.io/b9fhx/.

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Endnotes

[1]This definition of abstract meanings appears to imply a causal connection between having/using certain words and being able to express (and more provocatively, to entertain in the first place) certain abstract meanings.

[2]This analysis is based on the cumulative frequency of tokens, while the median abstractness is based on types. R Code for these and subsequent analyses can be accessed at https://osf.io/b9fhx/.

[3]Aside from the ubiquity of highly abstract content words, languages are replete with highly abstract function words such as *the*, *it* and *to*.

[4]We do not wish to diminish the likely importance of other cognitive structures, such as affective and emotional representations [17,33,34], and metaphorical connections between abstract concepts and concrete ones [46,47].

[5]Although the concreteness-by-iconicity interaction was significant, more iconic 'concrete' words were not classified by participants as concrete at greater rates than less iconic 'concrete' words. Further investigation is necessary to determine if the iconicity effect we observed here is, in fact, limited to abstract words. In addition, it has to be noted that we are using the accuracy summary data from Pexman *et al.* [135] and analyse it using linear models, which has been argued to lead to anti-conservative estimates [136].

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