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Construals of iconicity: experimental approaches to form-meaning resemblances in language

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While speculations on form-meaning resemblances in language go back millennia, the experimental study of iconicity is only about a century old. Here we take stock of experimental work on iconicity and present a double special issue with a diverse set of new contributions. We contextualise the work by introducing a typology of approaches to iconicity in language. Some approaches construe iconicity as a discrete property that is either present or absent; others treat it as involving semiotic relationships that come in kinds; and yet others see it as a gradient substance that comes in degrees. We show the benefits and limitations that come with each of these construals and stress the importance of developing accounts that can fluently switch between them. With operationalisations of iconicity that are well-defined yet flexible enough to deal with differences in tasks, modalities, and levels of analysis, experimental research on iconicity is well-equipped to contribute to a comprehensive science of language.

Keywords: iconicity, linguistic theory, conceptual foundations, experimental linguistics

1 Introduction

Speculations on iconicity—the resemblance-based mapping of form and meaning—go back at least to Plato’s *Cratylus*, but the experimental study of iconicity is only about a century old (Levelt, 2013; Nuckolls, 1999). During that century, the study of iconicity has been mostly peripheral to the concerns of linguists and cognitive scientists. In recent years there appears to be a more durable resurgence, with iconicity rapidly gaining influence across the language sciences as a factor in explanations of language structure, language learning, language processing and language evolution (Perniss, Thompson, & Vigliocco, 2010; Ahlner & Zlatev, 2010; Svantesson, 2017; Perlman, 2017; Sidhu & Pexman, 2017; Ferrara & Hodge, 2018). When just a couple of decades ago it was largely taken for granted that arbitrariness was a key design feature of language and iconicity was negligible, it is now widely understood that iconicity plays important complementary roles in the nature of language.

To make the most of advances in these fields and enable cumulative scientific progress, it is necessary to have clarity in concepts, data and methods. This special issue on experimental approaches to iconicity presents the latest research on iconicity, combining empirical studies with methodology-

focused contributions. In this introduction we briefly survey the state of the art in iconicity research, taking stock of distinct takes on iconicity and proposing a typology of work on iconicity that can help unify disparate approaches.

2 A tripartite typology of approaches to iconicity

Iconicity is fundamentally about resemblance. Just like paintings can resemble what they depict, so linguistic signs can look and sound like what they mean in various ways and to varying degrees. Familiar examples include words that imitate sounds in spoken languages (as in *pitter-patter* ‘rapid succession of light taps, e.g. rain, footsteps’) and signs that visually depict their referents in sign languages (as in the sign for ‘walk’ in German Sign Language (DGS), which depicts legs moving on a surface using the index and middle finger of one hand on the upturned palm of the other hand). What unites such cases, even if they differ in modality, is that they present perceptual resemblances between aspects of form and aspects of meaning. Iconicity can be found at many levels of linguistic structure, from prosody (Shintel, Nusbaum, & Okrent, 2006) to lexicon (Waugh, 1994) and morphosyntax (Haiman, 1980; Wilcox, 2004).

Any cursory review of the literature reveals so many apparently different takes on iconicity that it is easy to lose the forest for the trees. How can we link findings across observational and experimental approaches, and across different communicative modalities? How can we ensure a solid theoretical base while scaling up to extensive empirical coverage? Although there is broad understanding that iconicity in language refers to some sense of resemblance between aspects of form and aspects of meaning, the conceptualisations and operationalisations of iconicity can diverge widely from there.

However, the variety in approaches is not endless. Most work falls into one of the following three broad construals of iconicity: iconicity as a discrete property that is present or absent, as involving semiotic relationships that come in kinds, or as a substance that comes in degrees. We use the term “construals” advisedly: these three takes represent different perspectives that are by no means mutually exclusive, and, as we shall see, they are most powerful in combination. We start by introducing each of these construals in more detail, and then survey how the contributions to the special issue make use of them.

2.1 ICONICITY AS A DISCRETE PROPERTY THAT IS PRESENT OR ABSENT

Iconicity is often construed as a discrete *property* that is present or absent in linguistic signs. This is common in studies that aim to contrast or compare iconic and non-iconic signs with regard to their forms and functions or their roles in learning and processing. A prolific line of work that often takes this perspective uses artificial stimuli selected for their iconic versus non-iconic properties. This work has found, for instance, that pseudowords like ‘bouba’ and ‘kiki’ tend to be matched to rounded versus pointed shapes by toddlers and adults (Maurer, Pathman, & Mondloch, 2006); that pseudowords are easier to learn when they are constructed to iconically match movement-related meanings (Imai, Kita, Nagumo, & Okada, 2008); and that infants may be sensitive to sound-symbolic mismatches in pseudowords (Asano et al., 2015). Other work using this perspective on iconicity has sometimes classified existing words from natural languages into iconic versus non-iconic groups, for instance testing the effect of iconicity on sign language lexical acquisition (reviewed in Ortega, 2017) or testing whether spoken words classified as iconic are easier to learn or guess, or are processed in a different way, than words classified as arbitrary (reviewed in Lockwood & Dingemanse, 2015).

While the iconicity-as-property perspective has proven useful for probing cognitive processes and mechanisms involved in iconicity, it also comes with challenges. For all the experimental clarity afforded by maximally contrastive artificial stimuli, it can be hard to gauge their relevance to natural

languages. For instance, it is sometimes assumed that the bouba/kiki effect applies also to actual words in natural languages, but a global comparative study of non-arbitrary mappings in basic vocabulary did not confirm the link between round meanings and rounded vowels to be a significant association across languages (Blasi, Wichmann, Hammarström, Stadler, & Christiansen, 2016), though in §2.4 below we note a more constrained interpretation that may rescue the relevance of the finding. Notably, there is evidence that the simple binary classification of lexical items as iconic or non-iconic is too reductive for many purposes. For instance, some apparently contradicting findings of studies of early sign language lexical acquisition may be attributable to the fact that they operationalise iconicity as a discrete property, losing sight of possibly relevant differences in type or degree (Perniss & Vigliocco, 2014).

2.2 ICONICITY AS SEMIOTIC RELATIONS THAT COME IN KINDS

Finer-grained distinctions are offered by approaches that take a pluralistic view of iconicity as involving *semiotic relations* that come in kinds. Considering semiotic relationships between signs, objects and concepts opens up the possibility for a wide range of subtypes of iconicity. For example, the pragmatist philosopher Peirce (1998 [1894]), who introduced the notion of iconicity, distinguished between images (which directly share a quality with their object) and diagrams (which provide structural analogies between sign and object). Independent of this is another common distinction, based on whether the form-meaning relationship is clear on its own or mediated by context or convention. This is targeted by broadly equivalent dichotomies of iconicity as strong or weak (Lyons, 1977), transparent or translucent (Bellugi & Klima, 1978), or primary or secondary (Sonesson, 1994). Most iconicity in the vocabulary of natural languages appears to be of the latter type: given only the sound or shape of a sign, it is hard to guess its meaning; but given both form and meaning, we can see iconic relations between the two.

In-depth analyses of form-meaning relations in vocabulary often yield further semiotic distinctions worth making. In the visual modality, signs have been divided into those that represent perceptual features of objects and those that represent actions related to them, a distinction variously designated as modelling versus enactment, perceptual versus pantomimic, perceptual-based versus action-based, or entity-handshaped versus handling-handshaped (Kendon, 2004; Tolar, Lederberg, Gokhale, & Tomasello, 2008; Ortega, Sümer, & Özyürek, 2016). In the spoken modality, iconic signs are sometimes divided into phonomimes, phenomimes and psychomimes (Martin, 1975; Akita, 2009) depending on whether they present likeness to sounds, events, or psychological states.

One issue of the iconicity-as-relations perspective is that sophisticated conceptual distinctions have a tendency to multiply, seen nowhere more clearly than in Peirce's triads upon triads (Esposito, 1979). A simple test of the utility of a distinction is whether it is reflected in linguistic structure more generally, and relatedly, whether it makes a difference to language users or learners. For instance, the distinction between perceptual-based versus action-based signs helps to explain typological diversity in sign language lexicons (Padden et al., 2013; Nyst, 2018) and correlates with the recognisability and learnability of iconic mappings for children (Tolar et al., 2008; Ortega et al., 2016). Likewise, in Korean, ideophones imitative of sound show greater phonotactic liberties than ideophones featuring more abstract cross-modal (or diagrammatic) iconic mappings (Kwon, 2018), supporting the common distinction between phonomimes and other ideophones (Dingemans, 2019).

2.3 ICONICITY AS A SCALAR SUBSTANCE THAT COMES IN DEGREES

Recently a third way to operationalise iconicity has gained prominence: iconicity as a scalar *substance* that comes in degrees. This perspective portrays iconicity as a scalar rather than a categorical property of words and signs. It is rooted in psycholinguistic approaches to the measurement of meaning (Osgood, 1952), in which ratings of lexical or semantic features like valence, arousal or concreteness are collected

for large numbers of lexical items (Winter, 2019). The first study to rate lexical items for their degree of iconicity is barely a decade old and presented data for 300 British Sign Language signs rated by deaf signers (Vinson, Cormier, Denmark, Schembri, & Vigliocco, 2008). Since then, available sets of ratings have grown in size and number, with ratings for 1000 American Sign Language signs (Caselli, Sevcikova Sehyr, Cohen-Goldberg, & Emmorey, 2017), 600 English and Spanish words (Perry, Perlman, & Lupyan, 2015) and most recently over 3000 English words (Winter, Perlman, Perry, & Lupyan, 2017).

One benefit of this approach is that a scalar conception of iconicity allows more nuanced analyses of the effects of iconicity on language processing. For instance, studies using the British Sign Language norms found that degree of iconicity facilitated key processing tasks like picture naming, phonological decision, and picture-sign matching (Vinson, Thompson, Skinner, & Vigliocco, 2015) and that more iconic signs were learned earlier (R. L. Thompson, Vinson, Woll, & Vigliocco, 2012). Another benefit is that, assuming sufficient similarity in methods, large-scale ratings allow cross-linguistic comparison even across modalities, as demonstrated in a recent study comparing two signed and two spoken languages (Perlman, Little, Thompson, & Thompson, 2018).

It is relatively easy to collect ratings for large swathes of vocabulary. The flip side to this is that it can be hard to achieve parity between the analyst's sense of iconicity and the raters' understanding of a lexical rating task, especially since to achieve sufficient scale, rating is often done with naïve and linguistically untrained raters. Prior knowledge can also make important differences for ratings: users of a language may have strong feelings about form-meaning fit simply due to a lifetime of exposure or due to background knowledge about iconic motivation, so they may make different choices than raters who have less experience with the signs they are rating.

2.4 BRIDGING CONSTRUALS OF ICONICITY

While the three construals —iconicity as *property*, *relations*, and *substance*— are conceptually distinct, they are not mutually exclusive. Each of them has inspired fruitful observations and experimental work, and each brings its own benefits and limitations. One of our goals in this introduction is to show how they can be made as interoperable as possible.

Prior work provides useful examples of the benefits of bridging construals of iconicity. For instance, as we saw above, a theory-driven division of iconic signs into more fine-grained subtypes of form-meaning relations (iconicity-as-relations) can help resolve apparently contradicting results delivered by iconicity-as-property takes on the early learning of iconic signs. Or, turning to spoken language, we can mitigate the risks of extrapolating from pseudoword-studies (which often take the iconicity-as-property view) by starting from associations attested in ideophones (Westermann, 1927; A. L. Thompson & Do, 2019) and testing these in empirical work on the guessability of iconic form-meaning associations (Fischer-Jørgensen, 1978; Lockwood, Hagoort, & Dingemanse, 2016). This makes it possible to understand where in spoken languages iconic associations are most likely to flourish (iconicity-as-substance) and why this is so (iconicity-as-relations).

New insights can result when operationalisations are combined, as in a recent study of creative iconic vocalisations (Perlman & Lupyan, 2018). The starting point of this study was a quest to create new iconic spoken signs (iconicity-as-property), which were then rated by naïve listeners to provide a graded measure of the degree of iconicity (iconicity-as-substance), showing that some meanings afforded more consistency and success in iconic expression than others. This in turn can be explained semiotically by the possible types of iconic relations between forms and meanings, from direct sound-based pantomime to more abstract forms of relative iconicity (iconicity-as-relations). In general, then, clarity about

construals of iconicity helps ensure solid conceptual foundations and can help link experimental findings to linguistic facts.

A general framework with unifying potential in this domain is that of iconicity as structure-mapping (Taub, 2001; Meir, 2010; Tufvesson, 2011; A. L. Thompson & Do, 2019). This approach grounds iconicity in perceptual analogies: structure-preserving correspondences between aspects of form and meaning (Gentner, 1983; Emmorey, 2014). Structure-mapping fundamentally takes an iconicity-as-relations perspective, as it is concerned with identifying exactly how aspects of form and meaning are brought into structural correspondence with each other. For instance, in the DGS sign for ‘walking’ mentioned above, there are structural correspondences between the visual shape of the fingers and that of the legs involved in walking, and also between the movement of the articulators and the movement implied by walking. Or in a form like English *pitter-patter*, there is a structural correspondence between the reduplicated form of the word and the repetition inherent in its meaning.

A theory of iconicity grounded in structure-mapping can account for the gradience of iconicity-as-substance on the assumption that signs are perceived as more iconic when they feature more alignable form-meaning correspondences and when there is a greater degree of physical resemblance (Gentner & Markman, 1997). In language use, the salience of structural correspondences may in turn be modulated by devices like foregrounding and framing, which serve to highlight and emphasise relations between form and meaning (Ferrara & Hodge, 2018). Finally, an iconicity-as-property construal can be derived from iconicity-as-substance by dividing words into iconic and non-iconic according to some threshold, though such dichotomisation inevitably comes with a degree of distortion and a loss of statistical power.

3 Contributions to the special issue

The contributions in this special issue represent a highly diverse cross-section of work on iconicity in language and communication: they cover spoken language, sign language, gesture, and writing; single-language studies as well as comparative cross-cultural approaches; and experimental studies, observational work, and methodological reviews. Here we use the tripartite framework to present the individual contributions and relate them to each other, while highlighting the overlaps between the approaches and showing where flexibility in the operationalisation of iconicity offers additional value for our understanding of the forms and functions of iconicity in language.

ICONICITY AS A DISCRETE PROPERTY. **Laing**’s contribution reviews a voluminous literature on the role of onomatopoeia in early language development. While much work in this domain has focused on the learning advantages of iconic words, Laing shows that onomatopoeia—defined as forms that imitate sounds from the environment—play facilitatory roles in perception, production and interaction. For instance, early onomatopoeia like *meow* and *baa* allow a great degree of articulatory latitude, and make way for more constrained arbitrary forms like *cat* or *sheep* only when the child’s phonological development is up to speed. Her contribution is part of a larger line of work revealing the role of onomatopoeia in early social interaction (Laing, 2014, 2017).

Vigliocco, Zhang, Del Maschio, Todd, and Tuomainen carry out a neuroimaging study of how people process iconic words. They find that onomatopoeia like ‘bark’, but not arbitrary words like ‘bike’, evoke a negativity in the 400ms time window when following an unrelated cue word, indicating that people are sensitive to violations of the privileged link between sound and meaning in onomatopoeia. Their work offers a carefully controlled experimental demonstration of the special status that onomatopoeia have in spoken language processing (Peeters, 2016), and provides a methodological approach that can also be used to investigate iconic words beyond onomatopoeia.

In a production study in the visual-spatial modality, **Sato, Schouwstra, Flaherty and Kirby** compare the fine articulatory details of reproductions of novel gestural signs that participants learned

in two conditions: an iconic condition in which gestures are presented with meanings they can be seen to imitate (e.g., a shaking movement labelled ‘to shake’), and an arbitrary condition in which there is no such link (e.g., an eating gesture paired with ‘to put on a jacket’). They find that iconic form-meaning mappings are much easier to learn than arbitrary mappings, but they also report an apparent null-result – that the forms of novel iconic gestures are not learned less accurately, unlike in previous reports (e.g., Ortega & Morgan, 2015). Notably, they diagnose this discrepancy in terms of possible differences in operationalisations of iconicity, showing how important it is to be able to flexibly move between different takes on iconicity.

Nielsen, Simner, Kirby & Smith study the role of iconicity in the learnability of spoken pseudowords. They use a design in which iconicity (where labels resemble aspects of their referents) and systematicity (where similar objects have similar labels) are orthogonal so as to tease apart the effects of these two types of form-meaning mappings (Nielsen, 2016). Their findings show that both iconicity and systematicity facilitate learning, but that mixed (iconic plus systematic) lexicons pose difficulties for learning. This raises interesting questions about the existence of iconic/sound-symbolic inventories as independent word classes in languages like Japanese or the increased presence of iconicity in certain parts of speech or semantic domains. As these latter two studies show, even studies that start out from an iconicity-as-property perspective often end up with more fine-grained characterisations of form-meaning associations.

ICONICITY AS SEMIOTIC RELATIONS. A couple of studies in the issue delve into the phonetic and phonological details of iconicity. **Johansson, Anikin and Aseyev** investigate sound-colour mappings in natural languages, taking as their point of departure a study showing cross-modal associations between the loudness of sounds and the brightness of colours. They examine words for 11 colour concepts and related terms in 245 language families. They find evidence for a pervasive form of sound-symbolism: vowels with high brightness are overrepresented in words for colours with high luminance, while sonorous consonants are more common in words for saturated colours. Their results show how some properties of speech sounds afford iconic associations to perceptually salient properties of colour like luminance and saturation, and argue these may feed into a transmission bias that may help explain the cross-linguistic commonality of these trends.

In an experimental study of sound-meaning associations, **Monaghan and Fletcher** ask whether iconic interpretations of nonwords like *pitaw*, *bitaw*, *sulay*, *zulay* are driven by individual phonemes or by phoneme features like voicing and manner or place of articulation. They systematically sample the form space by generating 320 nonwords according to a set of templates and combine these nonwords with 8 meanings covering the domains of smallness, largeness, softness, hardness, fast speed, slow speed, masculinity and femininity. Participants are asked to treat the nonwords as brand names and are asked to rank how well they promote the idea of the candidate meanings. The evidence of this systematic exploration of the form and meaning spaces points to individual phoneme-meaning relations as the primary driver (but see Joo, 2019 for typological evidence that phonological features may also play a role). The use of continuous measures in this study shows a way to link elementary sound-meaning associations like *voicing* : *size* (iconicity-as-relations) to more gradient conceptions of iconicity (iconicity-as-substance).

Ortega and Özyürek study the form and communicative efficacy of silent gestures —gestural productions not accompanied by speech— elicited with written stimulus words from Mexican and Dutch participants. They uncover systematic associations between representational strategies and semantic categories, and find that gestural iconicity is shaped not just by semantic affordances but also by considerations of ambiguity and efficiency. For instance, they find that multi-gesture sequences are systematically used for disambiguation or clarification purposes. They also find differences in the

guessability of gestures that correlate with the use of acting, drawing or representing strategies, showing another payoff of distinguishing different kinds of iconic form-meaning mappings.

Occhino, Anible and Morford critique monolithic iconicity-as-property approaches and argue that iconicity is subjective in the sense that it is influenced by prior knowledge; dynamic in the sense that construals of form-meaning associations are fluid and adjustable; and multidimensional in the sense that the articulatory complexity of signs provides ample material to build perceptual analogies. Using a handshape monitoring task, they show that American Sign Language (ASL) signers are sensitive to this fluidity and multidimensionality in a way that systematically covaries with signing proficiency, suggesting that perceived resemblances can burrow into linguistic systems, forming language-internal networks of form-meaning mappings that interact in complex ways with more transparent externally-motivated mappings.

Using a translation recognition task, **Anible** provides a direct test of the distinction between language-internal and language-external iconic motivations in American Sign Language. The task presents signers of varying levels of proficiency with ASL signs and possible translations that are either phonologically, semantically or analogically related (none of them the actual translation). By using imageability ratings as an independent proxy for language-external iconic motivation, Anible is able to tease apart form-meaning mappings accessible to novices from those accessible to expert signers. The latter tend to feature fairly subtle forms of diagrammatic iconicity, where groups of signs (sign families) display structural similarities in articulatory features like handshape that map onto schematic semantic features like animacy.

ICONICITY AS A SCALAR SUBSTANCE. **Sidhu, Vigliocco and Pexman** investigate the recognition and processing of words in relation to their degree of iconicity as measured by iconicity ratings. They find an iconicity advantage: English words higher in iconicity are responded to faster and more accurately in a word recognition task, an effect that appears to be slightly stronger in a design that foregrounds the phonological structure of the word. They take stock of the implications of this for classic psycholinguistic models that assume an arbitrary link between phonology and meaning, as well as for theories on the utility of iconicity, which so far have mainly focused on the learning advantages of iconicity.

Thompson, Perlman, Lupyan, Sevcikova Sehyr and Emmorey use the gradient notion of iconicity in a computational study comparing iconicity in the lexicons of ASL and English. They show that high-dimensional semantic vectors derived from English text can predict the iconicity of ASL signs, as well as English words. Their analysis also reveals a negative relationship between semantic density and the iconicity of both English words and ASL signs—although notably, this relationship disappears in highly iconic ASL signs, indicating that iconic signs may be more perceptually discriminable in a way that words do not afford. Altogether, this study demonstrates the value of gradient ratings to operationalise iconicity in a way that makes it commensurable between different kinds of languages.

Dingemanse & Thompson study the intersection of iconicity ratings and funniness ratings of English words, asking why words perceived as highly iconic are also often seen as funny. They introduce and benchmark a method to impute lexical ratings that enables them to study this question in over 70,000 words. They propose that foregrounding by means of structural markedness unites the two phenomena, and they uncover cues of structural markedness that are strongly skewed towards high-iconicity, high-funniness words. They also diagnose a quirk in existing iconicity ratings: to naïve raters, non-iconic analysable compound nouns like ‘sunshine’ and ‘seaweed’ are also words that “sound like what they mean”. The quirk is amplified by the imputation method but can be neutralised by looking at monomorphemic words, suggesting that when used with caution, imputation can be used to extrapolate existing norms sets to achieve greater lexical coverage.

Sevcikova Sehyr and Emmorey experimentally investigate form-meaning relations in nearly 1000 American Sign Language signs, comparing iconicity ratings by deaf ASL signers and hearing non-signers. They find the ratings are highly correlated, yet also show significant differences in semantic subcategories, iconic mapping strategies and sign handedness (one-handed or two-handed). In a second experiment they administer a stringent test of iconicity —operationalised as transparency to naïve viewers— by asking hearing non-signers to first guess the meaning and then provide a rating of how transparent they expect their guess to be for others. While these transparency ratings correlate well with iconicity ratings, only 10% of signs are guessed successfully, underlining once more the fact that iconicity in natural language lexicons is often mediated by convention and context. In discussing the implications of their experimental results, Sevcikova Sehyr and Emmorey fluently shift between iconicity-as-substance and iconicity-as-relations approaches, showing the conceptual and empirical benefits of looking at iconicity from different perspectives.

This brings us to the final contribution, one that brings together all three perspectives. **Motamedi, Little, Nielsen and Sulik** present an ambitious and comprehensive review of empirical methods for the measurement of iconic forms. They make a distinction between *operational* and *functional* approaches to iconicity. In terms of the tripartite framework introduced here, functional approaches take iconicity for granted (iconicity-as-property) and study its consequences for cognition and communication, while operational approaches focus on what iconicity is and may formalise this in various ways (iconicity-as-relations and iconicity-as-quantity). More than just a review, this contribution also includes novel simulation results that help in constructive and critical assessments of methods.

4 In closing

Throughout the long and checkered history of iconicity research, a common rhetorical move has been to present iconicity as an intriguing exception to the assumed rule of arbitrariness. As the study of iconicity is coming of age, there is now an opportunity to move beyond exceptionalism and paint a more nuanced picture of iconicity in relation to other principles of linguistic organisation. We are happy to advance this goal with this double special issue full of original contributions that showcase both the diversity and the maturity of experimental approaches to iconicity in language.

We also see the work presented in this issue as contributing to a larger goal of a comprehensive science of language (Dingemanse, 2017; Ferrara & Hodge, 2018; Perniss, 2018). By attending to linguistic and semiotic diversity and by linking iconicity to communicative strategies, semantic domains, language processing, learnability, and proficiency, the contributions in this special issue work towards integrating the notion of iconicity into the larger network of the language sciences.

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