ICONICITY IN SIGNED AND SPOKEN LEXICONS: IMPLICATIONS FOR LANGUAGE EVOLUTION

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1. Introduction

Many current theories of language origins posit that *iconicity*, or resemblance between form and meaning, played a critical role in grounding the creation of the first symbol systems (e.g. Fay, Arbib, & Garrod, 2013; Kendon, 2008; Perlman, Dale, & Lupyan, 2015). Some popular gesture-first accounts of language origins hinge on the premise that visible gestures afford dramatically more iconicity than audible vocalizations (e.g. Armstrong & Wilcox, 2007; Tomasello, 2008; Goldin-Meadow, 2016). Therefore, the rise of spoken words must have depended on the already established use of iconic signs, which served originally to ground the connection between spoken form and meaning. Part and parcel of this hypothesis is the assumption that many signs of modern signed languages clearly derive from iconic (and indexical) gestures (e.g. Klima & Bellugi, 1979), whereas, in general, the words of spoken languages are arbitrary to their core, stemming back to their original coinage (e.g. Pinker & Bloom, 1989).

However, considerable evidence now shows that the lexicons of all languages exhibit a significant amount of iconicity (Perniss, Thompson, & Vigliocco, 2010; Dingemanse et al., 2015). Moreover, this research suggests that there may be some important differences in how iconicity is spread across signs in comparison to words. Specifically, some kinds of meanings, but not others, may lend themselves to highly iconic signs, while different kinds of meanings may afford more or less iconicity in words (Dingemanse et al., 2015; Perlman & Cain, 2014). For example, Dingemanse et al. (2015) propose that qualities like spatial relations and visual shape might be easier to represent with iconic signs, but harder with iconic words. Conversely, qualities related to sound and loudness might easily be iconically represent with words, but not signs. This research

challenges the basic assumption of gesture-origin theories that signed languages are categorically more iconic than spoken languages. Furthermore, it raises the possibility that the first languages were iconic and multimodal (Perlman, 2017). The first symbol systems were built utilizing the differential suitability of each modality for the iconic representation of different kinds of meanings. Here, we investigate what such an original system might have looked like, based on a more detailed understanding of how iconicity is manifested in the lexicons of signed and spoken languages. We use iconicity ratings to compare iconicity in the vocabularies of two signed languages - American Sign Language (ASL) and British Sign Language (BLS) - with two spoken languages - English and Spanish.

2. Methods

Our study used publically available iconicity ratings of 993 ASL signs (Caselli et al. 2017), 604 BSL signs (Vinson et al., 2008), 3001 English words (Winter et al., 2017), and 637 Spanish ratings (Perry et al. 2015). These ratings were collected by different procedures. In both languages, signs were rated on a scale from 1 (arbitrary) to 7 (iconic). ASL signs were rated by non-signers, as were some BSL signs, but some were rated by native BSL signers. Spoken words were all rated by native speakers on a scale from -5 (sounds like the opposite of what it means) to 5 (sounds like what it means), with arbitrary signs being 0.

In our analysis, we examined 1) the correlation in iconicity ratings between the languages; 2) the relationship between iconicity and an array of semantic variables; 3) how iconicity varies between broad lexical classes; and 4) between more specific semantic categories (e.g. manual verbs, clothes, colors).

Our analyses made use of ratings for several variables related to the semantics of the signs and words, including concreteness (Brysbaert et al., 2014), imageability (Cortese & Fugett, 2004), sensory experience (Juhasz & Yap, 2013), and perceptual strength for vision, audition, touch, smell and taste ratings (Lynott & Connell, 2009, 2013; Winter, 2016). Notably, all of these ratings were collected only for English glosses. In addition, for the 220 meanings for which we had iconicity ratings in all four languages, we categorized the lexical class of each sign and word based on English gloss assignments in the SUBTLEX-US corpus (Brysbaert & Keuleers, 2012). More particular semantic categories for these meanings were determined post hoc by the authors.

3. Results

The results show several notable patterns that characterize how iconicity is spread across the vocabularies in the four languages, including similarities and differences between signed and spoken languages. Overall, we found substantial correlation in the iconicity ratings between the languages, including English with ASL ($r = 0.16$, $p < 0.001$), BSL ($r = 0.22$, $p = 0.001$), and Spanish ($r = 0.16$, $p = $

0.0003). The highest correlation was between ASL and BSL ($r = 0.68$, $p < 0.001$), suggesting iconicity may be more robust in signs than words.
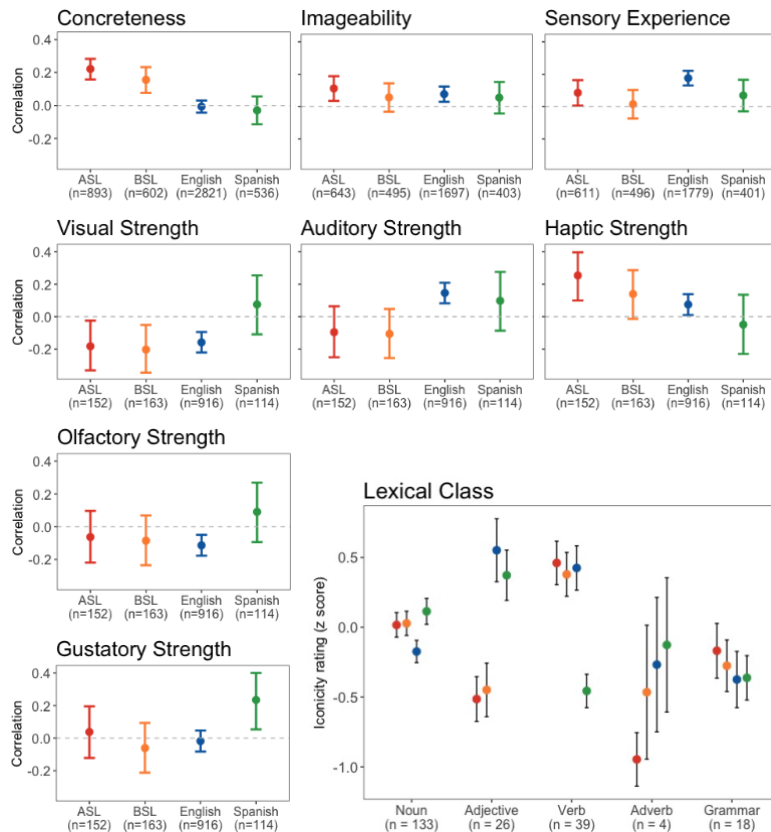

Figure 1. Top left plots show Pearson's correlations (r) between iconicity ratings and ratings of semantic properties. Error bars show 95% confidence interval. Below each language, n indicates the number of signs or words for which we had ratings. Bottom right plot shows normalized mean iconicity ratings and standard errors by (English) lexical class.

Shown in Figure 1, iconicity in each language was distributed according to the eight semantic variables in ways that reflect the semiotic affordances of the language modality. Across languages, signs and words for more sensorial meanings tended to be more iconic. More concrete meanings were more iconic in signs, but not words. Haptic strength was strongly correlated with iconicity in signs, while auditory strength was strongly correlated with iconicity in words.

Figure 1 also shows how iconicity is distributed across lexical classes in each language. For example, in the signed languages and in English, verbs were especially high in iconicity. Adjectives were relatively high in the two spoken

languages, but low in the signed languages. Counter to our prediction, nouns were about average in iconicity in ASL and BSL.

There were also distinct patterns of iconicity between signed and spoken languages in the more specific semantic categories. For example, signs for manual actions were particularly iconic in ASL and BSL, while signs for colors were particularly low. In comparison, in English and Spanish, words for perceptual properties were especially iconic, which was not the case in the signed languages.

4. Discussion and Conclusion

Modern languages, both spoken and signed, exhibit considerable iconicity across their vocabularies (Perniss et al., 2010; Dingemanse et al, 2015). This suggests a possibility that the first symbol systems were built from iconic *vocalizations*, as well as from iconic gestures, optimizing iconicity for different kinds of meanings. To examine how iconicity may have been balanced between modalities, we compared iconicity in the lexicons of modern signed and spoken languages. Our study utilized previously collected iconicity ratings, which, as a result, were collected under different protocols. Nevertheless, our findings suggest some characteristic ways that the iconicity of signs and words appears to be influenced by the language modality depending on their meaning.

Notably, our findings also have implications for understanding how modality may affect the emergence of structure in the evolution of communication systems. For example, some hypotheses on the evolution of phonological patterning in emerging sign languages make implicit assumptions about the categorically higher potential for iconicity in gestures versus vocalizations. Goldin-Meadow and McNeill (1999) and Sandler (1996) have suggested that signed languages may acquire phonological patterning a lot later than spoken languages because their high level of iconicity inhibits the reanalysis of signals as recombinable phonological units. This hypothesis is supported by a growing body of experimental work (Little et al., 2017; Roberts et al., 2015; Verhoef et al., 2015). However, these studies all use artificial signalling modalities, and the implications of this work for the real world rely on a more detailed understanding of iconicity in different kinds of natural languages. The present findings suggest that, depending on the language modality, iconicity may operate on the emergence of phonological structure differently in different semantic domains of vocabulary. This may explain, for example, why onomatopoeia in spoken languages may tend to have less standardized or "wild" phonology (Rhodes, 1994).

Altogether, our findings provide a preliminary, empirically-grounded, and detailed account of how iconicity is spread across the lexicons of signed languages in comparison to spoken languages. They demonstrate the prevalence of iconicity across human languages, no matter the modality, and suggest that theories of language evolution must consider the potential for iconicity in gesture and vocalization alike.

References

Armstrong, D. F., & Wilcox, S. E. (2007). *The Gestural Origin of Language*. Oxford ; New York: Oxford University Press.

Brysbaert and Keuleers (2012). Adding part-of-speech information to the SUBTLEX-US word frequencies. *Behavior Research Methods*, 44, 991–997.

Brysbaert, M., Warriner, A. M., & Kuperman, V. (2014). Concreteness ratings for 40 thousands generally known English word lemmas. *Behavior Research Methods, 46*, 904-911.

Caselli, N., Sevcikova, Z., Cohen-Goldberg, A., Emmorey, K. (2017). ASL-Lex: A Lexical Database for ASL. *Behavior Research Methods*. doi:10.3758/s13428-016-0742-0.

Cortese, M. J., & Fugett, A. (2004). Imageability ratings for 3,000 monosyllabic words. *Behavior Research Methods, Instruments, & Computers*, 36, 384-387.

Dingemanse, M., Blasi, D. E., Lupyan, G., Christiansen, M. H., & Monaghan, P. (2015). Arbitrariness, Iconicity, and Systematicity in Language. *Trends in Cognitive Sciences*, *19*(10), 603-615.

Fay, N., Arbib, M., & Garrod, S. (2013). How to bootstrap a human communication system. *Cognitive science*, *37*(7), 1356-1367.

Goldin-Meadow, S. (2017). What the hands can tell us about language emergence. *Psychonomic Bulletin & Review, 24,* 213-218.

Goldin-Meadow, S., & McNeill, D. (1999). *The role of gesture and mimetic representation in making language the province of speech* (pp. 155-172).

Kendon, A. (2008). Some reflections on the relationship between 'gesture'and 'sign'. *Gesture*, *8*(3), 348-366.

Klima, E., & Bellugi, U. (1979). *The Signs of Language*. Cambridge, Mass.: Harvard University Press.

Little, H., Eryılmaz, K., & de Boer, B. (2017). Signal dimensionality and the emergence of combinatorial structure. *Cognition*, *168*, 1-15.

Lynott, D., & Connell, L. (2009). Modality exclusivity norms for 423 object properties. *Behavior Research Methods*, *41*(2), 558-564.

Lynott, D., & Connell, L. (2013). Modality exclusivity norms for 400 nouns: The relationship between perceptual experience and surface word form. *Behavior research methods*, *45*(2), 516-526.

Perlman, M. (2017). Debunking two myths against vocal origins of language: Language is iconic and multimodal to the core. *Interaction Studies*, *18*, 376-401.

Perlman, M. & Cain, A.A. (2014). Iconicity in vocalization, comparisons with gesture, and implications for theories on the evolution of language. *Gesture, 14,* 320-350.

Perlman, M., Dale, R., & Lupyan, G. (2015). Iconicity can ground the creation of vocal symbols. *Royal Society open science*, *2*(8), 150152.

Perniss, P., Thompson, R. L. & Vigliocco, G. (2010). Iconicity as a General Property of Language: Evidence from Spoken and Signed Languages. *Frontiers in Psychology*, *1*. https://doi.org/10.3389/fpsyg.2010.00227

Perry, L. K., Perlman, M., & Lupyan, G. (2015). Iconicity in English and Spanish and its relation to lexical category and age of acquisition. *PLoS ONE*, *10*(9), e0137147.

Pinker, S., & Bloom, P. (1990). Natural language and natural selection. *Behavioral and Brain Sciences*, *13*, 707-784.

Rhodes, R. (1994). Aural images, In L. Hinton, J. Nichols, & J. Ohala (Eds.). *Sound Symbolism* (pp. 276-292). Cambridge: Cambridge University Press.

Roberts, G., Lewandowski, J., & Galantucci, B. (2015). How communication changes when we cannot mime the world: Experimental evidence for the effect of iconicity on combinatoriality. *Cognition,* 141, 52–66.

Sandler, W. (1996). Phonological features and feature classes: The case of movements in sign language. *Lingua*, 98(1), 197–220.

Tomasello, M. (2008). *Origins of human communication.* The MIT Press.

Verhoef, T., Kirby, S., & Boer, B. (2015). Iconicity and the emergence of combinatorial structure in language. *Cognitive science.*

Vinson, D. P., Cormier, K., Denmark, T., Schembri, A., & Vigliocco, G. (2008). The British Sign Language (BSL) norms for age of acquisition, familiarity, and iconicity. *Behavior Research Methods, 40*, 1079-1087.

Winter, B. (2016). The sensory structure of the English lexicon. PhD thesis, University of California Merced.

Winter, B., Perlman, M., Perry, L.K., & Lupyan, G. (2017). Which words are most iconic? Iconicity in English sensory words. *Interaction Studies, 18,* 430-451.