Iconicity in Language Processing and Acquisition: What Signed Languages Reveal

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Abstract

That linguistic form should be arbitrarily linked to meaning is generally taken as a fundamental feature of language. However, this paper explores the role of iconicity, or non-arbitrary form–meaning mappings for both language processing and language acquisition. Evidence from signed language research is presented showing that sign language users exploit iconicity in language processing. Further, iconicity may be at work in language acquisition serving to bridge the gap between conceptual representations and linguistic form. Signed languages are taken as a starting point since they tend to encode a higher degree of iconic form–meaning mappings than is found for spoken languages, but the findings are more broadly applicable. Specifically, the emerging evidence argues against the dominant view that connections between linguistic form and meaning need be primarily arbitrary. Instead both arbitrariness and iconicity have a role to play in language.

1. Introduction

Increasingly, our understanding of language is changing from a view of language as a system separated from other aspects of cognition, to one in which language is understood to be highly integrated with (and dependent on) other cognitive systems. However, our current understanding of language processing is based predominately on spoken languages and any conclusions drawn are necessarily tied to the oral–aural modality of these languages. Signed languages provide an important tool with which we can address questions unanswerable with spoken languages alone because, while signed languages exhibit properties found in all human languages, they are also shaped by the visual–spatial modality in which they occur. Signed language research therefore, allows for the re-examination of language from the viewpoint of a different modality; a viewpoint crucially independent of oral–aural modality-driven considerations that have previously influenced our understanding of language.

Iconicity, or the existence of non-arbitrary links between meaning and form, is one such property of language. Because iconicity is more prevalent in signed languages than spoken languages, furthering our understanding of iconicity in signed language allows for reconsideration of the role of iconicity across all languages. Iconicity is likely to be one of the first things people notice about signed languages, i.e., that sign language lexicons encode meaningful (iconic) form–meaning mappings to a greater extent than spoken languages. This prevalent feature of signed languages seemingly clashes with the traditional view that arbitrariness is a fundamental feature of language and it is likely for this reason that previously sign linguists, wanting to gain recognition of signed languages as ‘real’ paid little attention to, or simply tried to minimize the role of iconicity (Frishberg 1975; Klima and Bellugi 1979). Now that signed languages are understood to be real languages, with strong evidence showing them to be more similar to spoken languages than different
(for review, see Sandler and Lillo-Martin 2006), we can reconsider iconicity from the perspective of these visual-spatial languages. A question central to our understanding of language then, is what, if any, is the role of iconicity in sign language processing and acquisition.

In this paper, I review the sign language processing research in which iconicity has been shown to affect lexical-level processing (in both response latencies and accuracy from experimental measures). This research offers evidence that language is grounded (at least to some extent) in cognitive functions (e.g., action, perception and imagery) and that closer form-meaning mappings, provided by iconic links are in fact exploited by the system. I argue that the high degree of iconicity encoded across all sign language lexicons suggests that the balance of arbitrariness and iconicity can vary across languages, influenced in part by language modality (signed versus spoken).

While iconic words in spoken languages are limited perhaps because it is hard to iconically represent the real world through sound, signs that use the hands in space and are seen with the eyes are better suited to such forms. Nevertheless, it is unlikely that iconic form-meaning mappings would occur to the exclusion of arbitrary mappings if the modality of all languages allowed for it. Instead, the argument made here (as in Perniss et al. 2010) is that both iconicity and arbitrariness have a potential role to play in language. As suggested in recent work by Monaghan and Christiansen (2006), arbitrariness may serve an important function in language, reducing the phonological similarity of semantically similar meanings, and thus making similar word meanings easier to distinguish and learn. As for iconicity, the clear role would be to make the link between language and the real world more transparent.

One of the most obvious potential benefits in making more transparent the link between language and human experience would occur when children first enter the language system. Specifically, iconic form-meaning mappings could help to bootstrap a language-learner into the system by helping them decode it. It follows from this argument that iconicity would be particularly important in language acquisition. In terms of signed language acquisition, however, the literature has been mixed in its assessment of the role of iconicity. The second half of this paper is devoted to a discussion of the potential role of iconicity in child language acquisition with an attempt to lay out directions for future research.

2. Iconicity in Sign Language Processing

Because we live in a highly visual world, signed languages, occurring in the visual-manual modality offer the possibility of encoding many more dimensions of meaning in a sign’s form than is possible for words in a spoken language (Taub 2001). Much of what we talk about relates to the visual world around us and for signed languages, the ability to create visually iconic depictions of the world allows for a high proportion of signs that represent some aspect of meaning. Across all signed languages researched to date, iconicity is prevalent, not only for signs referring to concrete objects and actions, but also abstract domains like cognition, emotion, and communication (see Figure 1). Conversely, for spoken languages, sound does not map well onto meaning for most domains of knowledge, and iconic links between meaning and form are more limited in both number and scope.

If iconicity is found in languages that allow for it, it may be because iconicity is important in language (iconicity is found in sign languages, but also many spoken languages; see Perniss et al. 2010). While there are many insightful papers detailing the nature of iconicity in signed languages (see, e.g., Pietrandrea 2002; Pizzuto and Volterra 2000;
In the first study attempting to tap directly into possible influences of iconicity on sign processing, Grote and Linz (2003) made use of a feature-matching task (e.g., is beak a feature of eagle) for German Sign Language (Deutsche Gebärdensprache, DGS). Signs (e.g., eagle) were presented followed by pictures of possible features and subjects were asked to respond as quickly as possible whether or not the feature pictured belonged to the object presented in signed DGS. Faster response times were found when the feature was the one depicted in the sign (e.g., beak for the sign eagle produced with a curved finger on the nose representing an eagle’s beak) compared with a feature not depicted in the sign (e.g., an eagle’s wing). This first study raised the possibility that iconicity affects sign processing, however, there were some methodological problems. For example, the sign presented was often the same as the sign for the iconic feature (e.g., eagle and beak are signed the same way) and therefore, the result could have been driven by identity priming instead of iconicity.

Using a similar tack, but with revised methodology, Thompson et al. (2009) examined whether or not signers of American Sign Language (ASL) were faster at a picture–sign matching task when helped by iconicity. Participants (deaf early learners of ASL and

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**Fig 1.** Iconic British Sign Language signs for both nouns and verbs. In the first row are the nouns: (a) deer, iconically depicting the perceptual feature of a deer’s antlers and (b) monkey depicting the action-based feature of a monkey scratching. In the second row are the concrete and abstract verbs (c) cry and (d) think.
hearing proficient late-learners of ASL) were asked to respond ‘yes’ or ‘no’ does the picture (e.g., a candle) match the ASL sign (e.g., candle, produced with the fingers of one hand wiggling to represent a flame on the index finger of the other hand, representing the candle). The crucial manipulation was picture salience such that participants saw either a picture in which the iconic property of the sign was made salient (e.g., a picture of a candle with a flame similar to the fingers in the ASL sign; see Figure 2), or a picture in which the iconic property was not made salient (e.g., a picture of a candle with no flame; see Figure 2).

While both pictures were considered good representations of objects (i.e., pictures were easily recognized during picture norming), native ASL signers and late second-language learners, were faster at responding ‘yes’ when the feature of the sign matched the feature of the picture. For English-speaking controls carrying out the same task, but with the pictures followed by English words, there was no such benefit from the salient pictures. Thus, signers are found to be quicker at accessing sign forms when iconic properties match real-world objects. The results indicate a language processing advantage when a specific property of an object is represented in an ASL sign and suggest a sign lexicon that is shaped by these properties. Further, that Deaf early learners and skilled late-learners of ASL showed no difference in this effect, suggests that all signers are sensitive to, and able to take advantage of iconicity as a cue for word retrieval regardless of the age that they acquire sign.

This iconicity effect was replicated in British Sign Language (BSL; Vinson et al. forthcoming), with an additional manipulation of feature typicality to rule out the possibility that typicality encoded in signs drives the iconicity effect. Vinson et al. found no difference in the iconicity effect (i.e., faster to respond ‘yes’ the picture matches a sign when iconic features of the sign are made salient in the picture) for signs with iconic features
that are more typical compared with those that are less typical (typicality based on feature norms from McRae et al. 2005). In Sign Language of the Netherlands (Nederlandse Gebarentaal, NGT), Ormel et al. (2009) further showed that iconicity affects sign recognition in children (aged 8–12 years) akin to adults. Again using a picture/sign matching task, simultaneously displayed pictures and signs (in NGT) were presented on a computer monitor and children were asked to decide if they matched. Ormel et al. (2009) found that responses were significantly faster (to ‘yes the picture matches the sign’) for highly iconic signs compared to less iconic signs. Thus, there is some evidence that children, like adults, are affected by iconicity during language processing.

These first online experiments provide an important step to understanding the role of iconicity in language processing. Nevertheless, they are open to criticism because the tasks involved require a focus on meaning and perhaps serve to draw attention to the iconic relationship being tested. This possible criticism was directly addressed in a series of phonological decision experiments in which signers were asked to make a decision about the handshape (Thompson et al. 2010a), or the movement of a sign (Thompson et al. 2010b). For both tasks, activation of meaning is unnecessary since the focus is on phonology, and iconicity, or indeed any meaning, is irrelevant to the task. For example, in the handshape decision experiment, BSL signers were asked to indicate whether a sign had a straight or curved handshape – a decision for which the relative iconicity of a given sign is irrelevant. After other potential influences (e.g., age of acquisition and familiarity) along with non-linguistic characteristics of the signs (e.g. differences in handshape complexity or sign production time for video stimuli) were taken into account, iconicity was found to be a significant predictor of response times in making a handshape-based decision.

Interestingly, in the handshape decision task, signers proved to be slower and less accurate to respond to iconic signs than to non-iconic signs. Therefore, Thompson et al. (2010a) argue that automatic access to meaning for iconic signs results in interference when making handshape-based decisions unrelated to that meaning. This argument was supported in the movement decision experiment (Thompson et al. 2010b) in which subjects were asked to make a judgment about the motion of a sign (does it move in an upward or downward direction?). For this experiment, the meaning of the iconic sign (e.g., climb) was tied directly to the sign’s movement (integral to the meaning of climb is the upward direction of movement) and consequently movement-based decisions were faster for iconic signs, compared to non-iconic signs. In sum, for a task where the phonological decision is related to the iconic meaning encoded in the phonology facilitation was found, whereas in a task in which the phonological decision is tangential to the meaning inhibition in response times was found.

Unlike the work by Thompson and colleagues, Bosworth and Emmorey (2010) recently reported no effect of iconicity in a priming study using a lexical decision task. Specifically, subjects were faster when making a decision (‘yes’ the sign is real) to a target sign when it was preceded by a semantically related prime compared to when that target sign was preceded by a semantically unrelated sign. However, this semantic priming effect was not modulated by iconicity and semantic priming was the same whether or not the (always iconic) target was preceded by a prime that was iconic or non-iconic.

Importantly, the Bosworth and Emmorey (2010) study raises questions about the relationship between two iconic signs. To clarify, while all signs/words have semantic meaning, we would only expect semantically related pairs to result in lexical priming. Similarly, we might expect that only prime–target pairs with an iconic relationship would result in priming. However, Bosworth and Emmorey (2010) did not control for iconic relatedness in their study. However, in a post-hoc analysis, response latencies for sign
pairs classified as sharing an iconic relationship (approximately \( n = 8 \)) were not found to differ from latencies for prime–target pairs with no iconic relationship. Still, some external validity for the classification system is needed, with the authors suggesting the importance of systematically controlling for clearly defined types of iconic relationships for these types of priming studies in the future.

A more straightforward look at iconicity effects for lexical access is found in Thompson et al. (forthcoming) who use a picture-naming task to look at iconicity effects in sign production: an experiment less susceptible to task-driven strategies. Under the assumption that iconicity effects previously found in comprehension (Thompson et al. 2009, 2010a,b) are due to automatic access to meaning, then lexical retrieval driven by meaning (e.g., picture naming) should also be facilitated by iconicity. In a picture-naming experiment participants viewed a picture (displayed on a computer monitor) and produced a single sign for that picture as quickly as possible. Sign productions were analyzed to determine if iconicity affects response times after other lexical variables are taken into account (e.g., familiarity and age of acquisition based on available norms; Vinson et al. 2008) as well as other factors such as order of picture presentation and phonological complexity of a sign (using a measure based on Mann et al. 2010). Iconicity was again found to be a significant predictor of response times, such that more iconic signs were produced faster than less iconic signs during picture naming. This study reflects a more general effect of iconicity for both comprehension and production based tasks (i.e., iconicity effects are found in the directions of form to meaning and meaning to form).

The growing body of sign language research clearly demonstrates a role for iconicity in language processing. Further, while not discussed here, there is a growing body of research looking at the role of iconic form-meaning mappings in spoken language (see, e.g., Kovic, Plunkett and Westermann 2010; Louwerse and Jeuniaux 2010; Westbury 2005). The fact remains, however, that languages (spoken and signed) vary greatly in the degree of iconicity encoded in the lexicon. For visual–spatial languages many more iconic form-meaning mappings are present when compared to oral–aural languages. Perhaps it is only the greater potential that drives the degree of iconicity found in any one language and that all languages prefer iconicity to arbitrariness. Perniss et al. (2010) argue that the story is not so straightforward and that both arbitrariness and iconicity have a role to play in language. Surely the most basic constraints on language (e.g., that they be transferable and have communicative adequacy) can be satisfied in a myriad of ways. This should be apparent just from looking at the vast diversity across the world’s languages. Importantly, while languages can vary, this is only allowable to the extent that these basic constraints continue to be satisfied. Perniss et al. (2010) argue that both iconicity and arbitrariness work to satisfy two different, yet fundamental language constraints: the need to ensure an effective linguistic signal and the need to link linguistic form to human experience.

The need to ensure an effective linguistic signal would favor arbitrariness. Arbitrary links between form and meaning allow semantically related words to be phonologically dissimilar, thus enhancing communicability of the linguistic signal (Monaghan and Christiansen 2006). Related to this, Haiman (1980, 1985) notes that the degree of motivation (or iconicity) in a language varies inversely with the size of its basic vocabulary such that smaller lexicons may allow for more iconic mappings because there is less potential for confusability, while larger lexicons may require more arbitrary mappings to ensure the ability to phonologically distinguish words among classes of semantically similar meanings. Interestingly, as minority languages within a language community, signed languages tend to have relatively small core lexicons with substantial lexical borrowing from the majority spoken language (e.g., by fingerspelling borrowed words).
The role of iconicity on the other hand, would be to strengthen links between form and meaning, resulting in easier processing and additionally offering important clues about how to build up the system during acquisition. First, as demonstrated in the processing research presented above, iconic links allow for faster online access (both in comprehension and production). The idea that linguistic form and human experience are intimately linked is central to embodied theories of language (e.g. Barsalou 1999; Barsalou et al. 2003). Under an embodied view, both language production and comprehension are believed to require a mental re-enactment, or simulation of the specific embodied experience. While it remains unclear the extent to which this re-enactment activates the same systems used in actual perception and action there is strong evidence that some degree of embodiment is involved in language use (e.g., see Meteyard and Vigliocco 2008 for review). Thus, the potential role for iconicity is made clear under an embodied view that claims constant interaction between language and other cognitive systems. Iconicity could further play a role in language development providing a bridge between the language system and the real world at the crucial first stage when a child begins to map language onto the world.

3. Language Acquisition

With the focus on embodiment in early language acquisition, there has been a growing interest in the potential role of iconicity. Several studies have shown that indeed from very early on hearing children are attuned to iconic mappings between meaning and form. As an example, Walker et al. (2010) found that infants (3–4 months old) gazed longer at an animated bouncing ball accompanied by a changing sound with a congruent pitch (high pitch for high location changing to low pitch for low location), compared to when the bouncing ball was presented along with an incongruent pitch. These visual-auditory mappings may be an unlearned aspect of perceptual cognition as suggested by the sensitivity 3- to 4-month old infants show. In terms of sound-symbolism, children have also shown a sensitivity to the classic finding that specific sounds are preferentially paired with certain shapes (e.g., a round shape corresponds to ‘bouba’ while a spiky shape corresponds to ‘kiki’; Köhler 1929; see also Ramachandran and Hubbard 2001). Maurer et al. (2006) found that 2.5-year-old children showed a preference for pairing words with rounded vowels to rounded shapes and words with unrounded vowels to pointed shapes. Similarly, Imai et al. (2008) showed an advantage for 3-year-old Japanese-speaking children learning novel sound-symbolic (iconic) action-based words, compared to novel words that were not sound-symbolic. Therefore, the potential role of iconicity is supported (even for spoken languages).

Considering the high degree of iconicity encoded in signed languages it is reasonable to assume that if language learners make use of iconicity, the strongest effects would be for children acquiring a signed language as their first language. Interestingly, while the literature for spoken language acquisition clearly favors the role of iconic (sound-symbolic) mappings in acquisition, research to date on the role of iconicity in sign language acquisition has been somewhat mixed. In what follows, some of this research is presented. While inconclusive, I argue that it does suggest what further steps are needed. Specifically, as laid out below, several studies (e.g., Meier et al. 2008) claim that phonological complexity, for example, outweighs any possible benefits of iconicity. However, despite these claims, there has been no attempt to determine what iconicity might contribute after other factors have been taken into account. Further, while several methodological approaches have been taken to investigate iconicity in sign acquisition they have been
based on observable output only. Additional insight could be easily gained by making use of both production and comprehension data. Finally, most previous acquisition studies have taken iconicity as a holistic concept despite iconic representations varying greatly in both type and degree. I suggest, therefore, that more fine-grained analyses are needed.

One interesting approach to the iconicity question has been to look at sign errors. In one longitudinal study of four deaf children examining ASL sign errors (observed from as early as 8 months and continuing to as late as 17 months), Meier et al. (2008) found that single sign errors in production (those that differ from adult targets) do not tend to favor iconicity, but instead seemed to exhibit normal patterns of phonological reduction and substitution of less marked features. The authors conclude that other factors such as phonological complexity are more important than iconicity in acquisition. However, caution is advised given that the conclusions drawn presuppose awareness of iconicity would be evident in sign errors. Despite this concern, the Meier et al. study does underscore the need to consider multiple factors that could affect the time course of acquisition. Clearly, however, while complexity (phonological, syntactic, or conceptual) must be considered, this does not preclude the possibility that children make use of iconic form-meaning mappings to enter the language system.

This conclusion is echoed in the work of Slobin et al. (2003) who find acquisition of grammatical elements in ASL and Sign Language of the Netherlands (NGT) that appear earlier than would be predicted based on their complexity alone. Specifically, Slobin et al. (2003) examined the productions of deaf children with deaf parents learning ASL natively and found that iconicity promotes the early (before age 3) emergence of meaningful handshape distinctions, such as those found in handling classifiers (i.e., classifier hand-shapes that depict an agent holding an object). They conclude that while handshape and movement (both phonological parameters of a sign) are conventionalized and schematized in signed languages, during sign language acquisition, children can, ‘make use of elements of natural gesture as a “bootstrap” device in entering the formal systems of the language (2)’.

Casey (2003) similarly examines children’s productions of grammatical constructions for any tendency of iconically based constructions to emerge earlier than might be otherwise predicted. Casey focuses on the emergence of verbal agreement, which in ASL (as in many signed languages) consists of directing signs toward locations in space associated with verbal arguments. Importantly, for some verb types the movement in space is iconically transparent (as in the sign give in which the ‘giving hand’ moves from source to goal) while for other signs agreement is not so transparent (as in hate for which there is no physical object, but metaphorical movement of a feeling from agent to patient). Based on naturalistic longitudinal data from six deaf children (native in ASL) interacting with their deaf caregivers, Casey concludes that transparently iconic verbs like give, with agreement that maps directly onto real-world movement occur significantly earlier (at ages 1;6 to 2;1) than less transparent agreement verbs. Casey’s longitudinal data further suggest a developmental continuity between non-linguistic action gestures and the very similar-looking linguistic use of verb agreement, not surprising given that gestures and signs (particularly action-based) are often motivated by the same iconic features. Because action gestures and agreeing verbs are alike in indicating the participants of an event through directional movements in space, children may simply be applying an action-based model to both.

Alternatively, Meier (1982) finds that sign agreement errors are not less likely for these more transparent agreement types and further, that overall mastery of agreement occurs as late as 3 years of age (an age parallel to acquisition of complex, unstressed verb agreement

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in some spoken languages). Additionally, in a related laboratory study, Meier (1987) finds that for double agreement verbs (e.g., *give* & *take*) that mark agreement with the grammatical subject (optionally) and object (obligatorily) children make fewer object agreement errors than subject agreement errors when copying sentences. Meier concludes this asymmetrical distribution of errors for children (3–7 years old) indicates they are paying attention to grammatical features of verb agreement and not to the iconic spatial mapping of the verb moving through space.

However, because there is ambiguity between citation forms and first-person agreement forms which both start at the signer’s chest, the Meier (1987) experiment did not include first-person subjects. Thus, more subject agreement errors could have occurred because subject agreement for second- and third-person referents is conceptually more difficult than object agreement for these same referents. Specifically, while both subject and object agreement traverse space to iconically map onto the real-world motion of, for example, giving and taking events, only subject agreement requires a child to be able to conceptually represent their arm as the arm of another person (e.g., the giver or the taker).

Overall, the picture that emerges from these (seemingly) conflicting studies of ASL agreement (interestingly with some overlap of subjects; S. K. Casey, personal communication), claiming areas of iconic influence (more transparent agreeing verbs acquired earlier; Casey 2003) and areas of no influence (overall acquisition of agreement occurring quite late as is found for similarly complex agreement systems,; Meier 1982; and better performance on grammatically driven distinctions, Meier 1987) may again be explained by the presence of several influences on acquisition with iconicity just one of many potential factors along with syntactic, phonological and conceptual complexity.

Despite complexity, there is evidence that signing children enter the language system earlier than children learning a spoken language. Meier and Newport (1990) review available studies related to acquisition milestones for both sign language and speech and conclude that there is an early sign advantage, with children’s first signs beginning between 1.5 and 2.5 months earlier when compared to words for speaking children (approximately 8.5 months old for first signs versus 10–11 months old for first words). This early advantage for signers is seen at the single word stage, but not for two-word combinations or other early syntactic milestones. Meier and Newport therefore suggest that the single sign advantage arises because it takes longer to develop sufficient articulatory control of the vocal apparatus in order to produce recognizable words in speech compared to sign. However, an alternative explanation is that iconic mappings between meaning and form allow signing children to enter the system earlier.

One of the studies summarized in Meier and Newport (1990) is a longitudinal look at early sign productions based on parental diary reports for thirteen hearing children learning ASL (Orlansky and Bonvillian 1984). Not only do Orlansky and Bonvillian report earlier overall acquisition of signs, stating that both the age at which 10 signs was attained and the mean vocabulary size at eighteen months was significantly higher than reported in the literature for spoken language acquisition, they additionally analyzed signs produced at both attainment of 10 signs and at age 18 months to see if iconic signs tended to be produced earlier than other sign types. Signs were categorized into arbitrary, iconic, and metonymic, with metonymic signs defined as those in which there is a relationship between sign form and meaning, but that the relationships ‘... represent or imitate a relatively minor, obscure, or unexpected feature of the referent and would not be clearly apparent to most observers (289)’. Put another way, metonymic signs are more translucent mappings between meaning and form that are still iconic, but may require some
understanding of the system in order to understand the mapping. The results indicate that roughly 30% of the signs produced by children were iconic, 30% were metonymic, and 30% were arbitrary. Based on these numbers, Orlansky and Bonvillian conclude that iconic signs are not favored early in acquisition.

However, the conclusion drawn by Orlansky and Bonvillian is directly tied to their strict definition of iconicity as limited to those signs that are transparently iconic and not signs (while still iconic) that are metonymic, or more translucently iconic. Alternatively if, as Lloyd et al. (1985) suggest in their rebuttal to Orlansky and Bonvillian, these metonymic signs are considered as potentially aiding in acquisition, then the conclusion is that fully two-thirds of early acquired signs are iconically based. Orlansky and Bonvillian (1984) and the subsequent response by Lloyd et al. (1985) demonstrate the importance of a clear definition of iconicity. Clearly, variance in learning ease/difficulty related to different types and degree of iconic mappings should be considered. While most previous acquisition studies have taken iconicity as a holistic concept, iconicity encoded in the form of signs can vary greatly. Not only can the iconic mappings be more or less transparent, there are different ways to depict form–meaning relationships. As a simple example, signs can represent the actions of a real-world referent (e.g., hammer in BSL is produced as if you were hammering with your hands in a fist moving back and forth; motor iconicity), the form of a referent (e.g., cat in BSL indicates a cat’s whiskers; perceptual iconicity), or both (e.g., aeroplane in BSL is produced with the pinky and thumb extended to indicate the wings of an airplane, and the hand moves at head level in a straight line to indicate the action; see Figure 3). Importantly, there is no way to tell the degree to which a young child understands the iconic features of any given sign and it is quite possible that not only the degree of iconic transparency is relevant to understanding, but the type of iconic encoding as well (e.g., perceptual or motor).

Work by Tolar, Lederberg, Gokhale and Tomasello (2008) suggests differences in the ability to interpret different iconicity types (at least for English-speaking children). Shown a sign and asked to pick the picture that matched the meaning from a set of four pictures, children were better at picking the correct picture when iconic signs depicted actions, compared to signs depicting perceptual features. As Tolar et al. suggest, these results are further consistent with hearing toddlers’ gestures, which more frequently imitate actions done with objects than they depict perceptual qualities of the object (Acredolo and Goodwyn 1988).

As an example of how these issues might be addressed, currently there is work (Thompson, Vinson, and Vigliocco forthcoming) examining BSL data from a large-scale

![Fig 3. The BSL signs: (a) eat, showing motor iconicity; (b) cat, showing perceptual iconicity; and (c) aeroplane, showing both perceptual and motor iconicity in one sign.](image-url)
study making use of an adapted form of the MacArthur–Bates Communicative Development Inventory (CDI; Woolfe et al. 2010). The CDI (Fenson et al. 1994) is a widely used tool, comprising a checklist of words (grouped into categories such as ‘animals’, ‘toys’, and ‘actions’) on which parents indicate the number of words understood and produced by their children aged 8–30 months old. The adapted BSL CDI consists of a checklist of 569 items in 22 categories from which 141 data sets were collected from 31 deaf children in signing deaf families (1–8 sets per child; for more details, including socio-economic scope and signing backgrounds, see Woolfe et al. 2010).

Crucially, the CDI data contains reports of both comprehension and production allowing a more complete picture on the role of iconicity (a previous gap in the research). Further, there are independently available iconicity norms (for a subset of 95 signs in the CDI). These iconicity ratings (Vinson et al. 2008) provide a more sensitive measure of any one sign’s perceived level of iconicity with a 7-point scale ranging from ‘not iconic’ to ‘highly iconic’. The results using a scalar measure of iconicity show an effect such that iconic signs are both comprehended and produced significantly earlier compared to other signs even after other measures such as phonological complexity are taken into account.

Further, as the ASL CDI data reported in Anderson and Reilly (2002) suggest, early words/signs are unlikely to be drastically different across different languages. In a comparison of the first 35 ASL signs from the ASL CDI with the first 35 English words from Fenson et al. (1994) a large overlap is apparent, likely due to young children’s similar conceptual abilities as well as common experiences despite different cultural backgrounds. Another consideration therefore, is to determine how early sign acquisition may differ from what might be learned regardless of the language involved. Anderson and Reilly point out one such difference that could be attributed to iconicity. Specifically, while both the ASL and English CDI report a high proportion of animal concepts, children learning American English tend to produce words for animal sounds (e.g., *moo*, *woof*; a class of words that is onomatopoeic, or iconic) while in ASL children produce signs for the animals themselves (*cow*, *duck*; a highly iconic class of signs in ASL). Thus, both groups show a preference for using iconic (or sound–symbolic) words within the same semantic class, resulting in slightly different acquisition outcomes. Finding such differences could be helpful in understanding the role of iconicity in language acquisition. Importantly, Thompson et al. (forthcoming) continue to find an effect of iconicity in BSL acquisition even after English acquisition data is taken into account by factoring in age of acquisition reports from the Oxford CDI (Hamilton et al. 2000).

Thus, the goal of this work is to find a clear way forward in addressing the role of iconicity in sign language acquisition by using more sensitive fine-grained measures of iconicity, taking into account other factors such as regular cross-linguistic acquisition patterns and phonological complexity (as well as syntactic complexity when considering acquisition at higher levels) and gathering evidence from both early production and importantly comprehension (which may be less influenced by phonological complexity).

In sum, signed languages offer a unique perspective in discovering how aspects of cognition interact with language, as well as the degree to which modality shapes this interaction. At the outset of this paper, we asked why form-meaning mappings are most often arbitrary for spoken languages, while the relationship between meaning and signs is most often iconic. Part of the answer is that the ability to create iconic form–meaning mappings is partially dependent on modality. However, that is not the whole story. Iconic form–meaning mappings may be easier to encode in signed languages, but (as argued here) they occur only because these mappings make language both more accessible and easier to use. This insight is of broad interest because, while languages vary in the extent...
to which they encode iconic form–meaning mappings, evidence from signed languages shows that iconicity has as much potential benefit for processing and (perhaps) acquisition as arbitrariness. Further, from the broadest viewpoint, understanding the potential importance of iconicity allows for a better understanding of how language relates to other cognitive functions such as perception, action and imagery.

Short Biography

Robin Thompson’s holds an interdisciplinary degree in Linguistics and Cognitive Science from the University of California, San Diego (2006). She currently works as a senior postdoctoral researcher at University College London, in the Deafness Cognition and Language research centre (DCAL) housed within the Cognitive, Perceptual and Brain Sciences Research Department. Her research centers on the relationship between language processing and other aspects of human cognition (for both monolinguals and bilinguals), with a focus on what languages in different modalities (spoken and signed) can tell us.

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Note

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Works Cited


——, R. L. Thompson, R. Skinner, and G. Vigliocco. forthcoming. When is an eagle’s beak more salient than its wings? Exploring the processing consequences of iconicity in British Sign Language.

