Type of iconicity matters: Bias for action-based signs in sign language acquisition

Gerardo Ortega (gerardo.ortega@mpi.nl), Beyza Sümer (beyza.sumer@mpi.nl) and Aslı Özyürek (asli.ozyurek@mpi.nl)

Centre for Language Studies, Radboud University and
Max Planck Institute for Psycholinguistics,
Wundtlaan 1, 6525XD Nijmegen, The Netherlands

Abstract

Early studies investigating sign language acquisition claimed that signs whose structures are motivated by the form of their referent (iconic) are not favoured in language development. However, recent work has shown that the first signs in deaf children's lexicon are iconic. In this paper we go a step further and ask whether different types of iconicity modulate learning sign-referent links. Results from a picture description task indicate that children and adults used signs with two possible variants differentially. While children signing to adults favoured variants that map onto actions associated with a referent (action signs), adults signing to another adult produced variants that map onto objects' perceptual features (perceptual signs). Parents interacting with children used more action variants than signers in adult-adult interactions. These results are in line with claims that language development is tightly linked to motor experience and that iconicity can be a communicative strategy in parental input.

Keywords: sign language, acquisition, iconicity, action, perception, sound-symbolism

Introduction

Manual languages stand out for their prevalence to include a large number of linguistic labels whose forms are motivated by the form of the concepts they represent (Klima & Bellugi, 1979; Perniss, Thompson, & Vigliocco, 2010; Taub, 2001). The overwhelming abundance of iconicity in signed languages compared to spoken languages makes it a viable route to investigate whether direct links between a linguistic form and a referent have any role in language acquisition. Early investigations on the role of iconicity during sign language development concluded that non-arbitrary (i.e., motivated) links between a sign and the concept it depicts did not facilitate learning (Conlin, Mirus, Mauk, & Meier, 2000; Meier, Mauk, Cheek, & Moreland, 2008; Orlansky & Bonvillian, 1984). A recent study, however, reports that iconic signs are the first to be comprehended and produced by deaf children acquiring a sign language natively (Thompson, Vinson, Woll, & Vigliocco, 2012). An explanation behind these contradicting findings may relate to iconicity being operationalised in a broad sense when in fact a more granular differentiation between different types of iconic depictions is required. The present study furthers our understanding of this issue by investigating patterns of usage of specific types of iconic signs by deaf users of Turkish Sign Language (*Turk Isaret Dili*, TİD) from different age groups. Specifically, we investigate the use of iconic signs for which two lexical variants are possible: One depicting the action associated with a referent (action signs) and the other depicting its perceptual features (perceptual signs). By investigating the use of different types of iconic signs between interlocutors of different ages, it will be possible to understand whether iconicity plays any role in sign language acquisition. Research on this issue is timely given the growing interest on how direct mappings between a linguistic label and a referent may facilitate language development in the manual (sign) and spoken (speech) modalities of language (Perniss et al., 2010).

Iconicity in Spoken and Signed Languages

Regardless of whether they are expressed in the oral-aural or visual-manual channel, languages can "mimic" the acoustic or visual properties of their referents and use them as basis of their phonological structure. In spoken languages, words can make non-arbitrary links with the sounds produced by their referent and use them as linguistic labels. This is the case of onomatopoeia (e.g., *moo* for 'cow') and ideophones (*gblogblogblo* in Siwu for 'bubbling') (Assaneo, Nichols, & Trevisan, 2011; Dingemanse, 2012). Words representing the acoustic properties of their referents (sound-symbolism) are present in many non-Western languages, like Japanese and Siwu (Dingemanse, 2012; Perniss et al., 2010) but relative to signed languages, their occurrence is infrequent. In contrast, languages expressed in the manual-visual modality stand out for their tendency to include in their lexicons a large number of signs that incorporate features of their referents.

Through iconic depictions, signs may represent characteristics of an entity, motion patterns and spatial relationships between objects (Taub, 2001). Iconic signs may also represent whole entities, parts of an object or simply point at objects present (Mandel, 1977). Iconicity is also expressed at the sub-lexical level because the phonological constituents of signs may also express features of the concept they represent (Cuxac, 1999; Pietrandrea, 2002; van der Kooij, 2002).

Relevant to the present study is the occurrence of more than one iconic lexical variant to represent a concept. In many sign languages, lexical variants may represent physical features of a referent (perceptual signs) or an action associated with an object (action signs). In TİD, for

example, two lexical variants TOOTHBRUSH[1] can represent its thin, elongated shape (Figure 1A) or how a toothbrush is manipulated (Figure 1B). These are permissible lexicalised variants that refer to the same concept.

Figure 1 Lexical variants for toothbrush in Turkish Sign Language. TOOTHRBUSH (A) represents the perceptual (long, thin) features of the referent (perceptual sign) while TOOTHRBUSH (B) depicts how a toothbrush is manipulated (action signs).

Iconic lexical variants are common in sign languages but it is unclear what factors drive lexical choice during signing. Researchers investigating this issue have observed patterns of usage across different sign languages and thus propose that sign languages can be clustered into typological groups according to the referents they depict and the structural devices which represent them (phonological constituents). For instance, Nyst (2013) has argued that West African sign languages like Adamorobe and Malian Sign Language encode iconicity in signs through very similar mechanisms but these differ significantly in how iconicity is depicted in European sign languages. Padden et al. (submitted) coined the term *patterned iconicity* to describe the phenomena by which sign languages prefer one form of iconic depiction over another (e.g., choosing action over perceptual signs). In the present study rather than focusing on the typological preferences of iconic depictions in TİD, we ask whether different types of iconic representations have any learnability advantage by children and if so, whether signers modulate their signing accordingly.

Iconicity and Language Acquisition

Classic traditions in developmental psychology argued that mastering arbitrary linguistic forms was possible only after links between an iconic form and its referent had been established (Piaget, 1962). According to this view, the iconic links are readily accessible to children hence work as scaffolding to establish links between less transparent word-referents. This view lost momentum for several decades but recent studies have gathered some evidence to support this claim. Imai, Kita, Nagumo, and Okada (2008) found that children as young as 25 months of age were sensitive to sounds mimicking features of actions and that they took advantage of these forms during the acquisition of action verbs. Yoshida (2012) found that Japanese and American children benefited from sound-meaning mappings when acquiring action verbs. Importantly, this study shows that parents deviated from conventional 'adult speech' when talking about actions. Japanese parents, whose language has a remarkably high incidence of sound-symbolic words, used words with their children that mimicked properties of the verb they referred to (mimetic words) more often than they did in adult-adult interactions. English speakers, whose language has few instances of sound-symbolism, produced a range of idiosyncratic words that somewhat mimicked the referent. These findings show that regardless of their native language, children are sensitive to non-arbitrary sound-form mappings and exploit them during acquisition. They also show that caregivers adapt their speech to facilitate language acquisition by favouring sound-symbolic (iconic) words (Japanese parents) or by creating idiosyncratic labels (American parents) that could facilitate language acquisition.

This handful of studies would indicate that iconicity is an important factor which boosts language acquisition. However, the data are not conclusive and more empirical studies are required to confirm the beneficial properties of iconicity during language development. A high incidence of sound-symbolic (iconic) words is rare in spoken languages and as a consequence, it is difficult to make definite remarks about the role of iconicity during language acquisition. Sign languages, in contrast, exhibit iconicity in abundance and as such offer a unique opportunity to investigate whether children seize the opportunity to exploit iconic sign-referent mappings when the opportunity is at hand (i.e., when a sign depicting a referent is a permissible lexical variant). Sign languages also offer the opportunity to investigate whether caregivers adjust to children's linguistic needs and modify their (sign) language production accordingly. This has not been investigated systematically in signs showing different types of iconic depictions for the same referent.

The first studies investigating sign language acquisition do not report a facilitating effect of iconicity. Orlansky and Bonvillian (1984) followed the linguistic development of 13 deaf children acquiring American Sign Language (ASL) from birth and found that they produced an equal proportion of iconic and arbitrary signs. They conclude that structural complexity of the sign rather than iconic sign-form mappings drive sign language acquisition. Meier, Mauk, Cheek and Moreland (2008) also investigated the role of iconicity in the acquisition of ASL and did not find that children learn iconic signs faster than arbitrary signs. The negligible effect of iconicity during sign language acquisition was attributed to children not having sufficient world knowledge to make associations between a linguistic symbol and its referent (Newport & Meier, 1985). The argument is that iconicity is not accessible from the onset of language learning but instead develops gradually overt time (Namy, 2008).

The irrelevance of iconicity during sign language acquisition has been challenged recently. After analysing parental reports of 31 deaf children learning British Sign

[1] By convention, sign glosses are written in block capitals.

Language (BSL), it was found that iconic signs are the first to be comprehended and produced by children (Thompson et al., 2012). This finding holds after the phonological complexity of signs has been taken into account. The relevance of this study is that it suggests that iconicity, a prevalent feature in all studied sign languages, plays a significant role during acquisition. However, this study alone does not answer how children access the iconic links between a sign and its referent or whether certain iconic depictions have a learnability advantage. In addition, it remains unclear how these findings are compatible with earlier studies claiming that iconicity is not an aid for acquisition (Conlin et al., 2000; Meier et al., 2008). We propose that these contradicting findings are the result of defining iconicity in a broad sense when a more fine-grained operationsalisation of iconicity could reveal a more prominent role during acquisition.

The Present Study

Most studies investigating the role of iconicity in sign language acquisition are based on parental reports which may present large coding inconsistencies, and do not take into account parents' sign production. Also, studies do not expand on whether the iconic link is made accessible to children via parental input or whether the type of iconicity (e.g., action vs. perceptual signs) may be an influencing factor for learnability. The aim of the present study is to address these issues by implementing a controlled picture-description task to investigate the role of different types of iconicity during the acquisition of TİD. We ask: 1) Do signers of different age groups show a preference for one type of lexical variant (action vs. perceptual) when two variants are possible?; and 2) Do parents signing to their children chose a particular lexical variant to facilitate sign-referent mappings?

Methodology

Participants

A total of 48 deaf TİD signers living in Istanbul were recruited for this study. These were grouped in five categories according to their age: Pre-school children (N = 10, mean age: 5;02, range: 3;5 – 6;10); school-age children (N = 10, mean age: 8;03, range: 7;02 – 9;10); parents of the pre-school children (N = 9); parents of the school-age children (N = 9); and a different group of adults not related to the other groups (N = 10). All children were native signers and all adults were native or early signers (age of acquisition: 6 years or younger). All participants had lived in Istanbul all their lives and were users of the same TİD variant.

Materials

The present data comes from a larger dataset investigating spatial descriptions by deaf signers (Sumer, Zwitserlood, Perniss, & Ozyürek, 2012). Participants' task was to describe from a picture the spatial relationship between two objects. The objects selected were: *toothbrush, cup, pen, bathtub* and *bed*. These items were selected because they have two permissible lexical variants for the same referent in TİD: One representing an action associated with the object (action signs) and the other depicting its perceptual features (perceptual signs). Action signs could represent an action associated with the referent or the way it is manipulated. Perceptual signs described the form of a referent with different hand configurations or by tracing its shape in space (see Figure 1). The visual prompts consisted of 16 pictures in which the five objects were presented in different spatial relation with another object (e.g., a picture of a plane under a bed aimed to elicit the sign BED). Descriptions consisted of pictures of toys and did not show any entity performing an action on any object.

Procedure

Participants were instructed to describe the spatial relationship between two objects in a picture. These instructions made participants unaware that their lexical choice during the description would be analysed. Participants were shown the visual stimuli on a laptop. The computer screen was divided into four sections with each quadrant displaying a picture of two objects placed in different spatial arrangements. The four pictures included the same two objects (e.g., a plane and a bed) but they had different spatial relationships (e.g., the plane was on, under, next to, or in front of the bed). In a self-paced task, participants pressed a key to bring to the screen the four pictures. After pressing the key a second time, one of the four pictures was highlighted with a red frame (e.g., a plane under the bed). The red frame was indicative of the picture participants had to describe to a deaf interlocutor. Adults, pre-school children, and school-age children described the picture to a deaf research assistant. Parents of the pre-school children and parents of the school-age children described the pictures to their own children. Interlocutors had a booklet with the four pictures for each description. After participants had described the highlighted picture, the interlocutor had to point at the correct picture on the booklet.

Coding and data analysis

Signs referring to the target object were classified into action and perceptual signs. With the help of a deaf research assistant user of TİD, we verified that signs coded as action and perceptual signs were lexical variants for the same concept. For instance, we verified that the action and perceptual signs for TOOTHBRUSH (Figure 1) were both permissible forms for the concept *toothbrush*. We excluded all classifier constructions (locative predicates) so only lexicalised sign forms were included in the analysis. Figure 2 shows some of the renditions produced by participants from the five age groups for a picture eliciting the sign BED.

Figure 2. Examples of lexical variants for *bed* by participants in each age group. Adults predominantly produced perceptual signs which represent the posts and board of a bed. Both groups of children produced predominantly action-based variants which depict the action of lying on a pillow. Parents of pre-school children and parents of school-age children produced both types of lexical variants comparatively.

Results

Target signs from all descriptions were categorised as either action or perceptual signs. The overall proportion of action signs per group was: adults mean = 0.25, *SD* = 0.14, pre-school children mean = 0.81, *SD* = 0.21, school-age children mean = 0.72, *SD* = 0.12, pre-school parents mean = 0.58, *SD* = 0.28, and school-age parents mean = 0.56, *SD* = 0.19 (see Figure 3). A one-way ANOVA by participant (F_1) and by item (F_2) showed there was a statistically significant difference in the proportion of action signs produced in each group [$F_1 = 11.163$; $p < 0.001$, $\eta^2 = 0.509$; $F_2 = 16.533$, $p < 0.001$, $\eta^2 = 0.469$]. Post hoc comparison after Bonferroni corrections revealed that adults produced significantly less action variants than pre-school children [$t(9) = 6.543$, $p < 0.001$], school-age children [$t(9) = 7.663$, $p < 0.001$], pre-school parents [$t(8) = 2.664$, $p = 0.029$], and school-age parents [$t(8) = 3.296$, $p = 0.011$]. There was no significant difference in the proportion of action signs produced by both groups of children [$t(9) = 1.029$, $p = 0.330$]. There was no difference in the proportion of action signs produced by pre-school children and pre-school parents [$t(8) = 1.543$, $p = 0.161$], or school-age parents [$t(8) = 2.277$, $p = 0.052$]. Similarly, school-age children did not differ from pre-school parents [$t(8) = 1.178$, $p = 0.273$] or school-age parents [$t(8) = 1.606$, $p = 0.147$]. Both groups of parents produced the same proportion of action signs [$t(8) = 0.095$, $p = 0.927$].

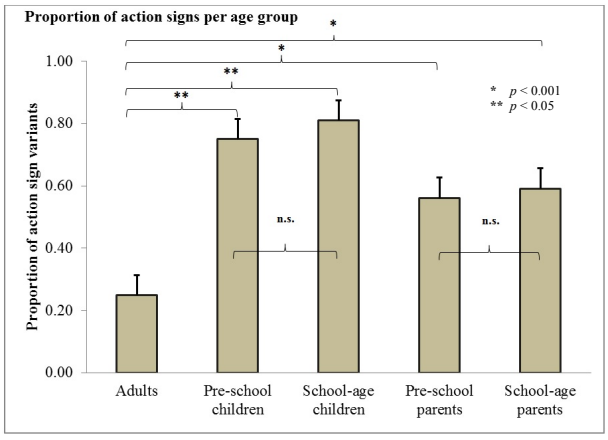

Figure 3. Proportion of action variants across age groups for all description. Bars represent standard errors.

Figure 4 shows the proportion of action-based variants per item across groups. It is clear that, despite some variation, the same pattern holds for all the items. Adults produced few action signs when interacting with a deaf adult but both groups of children prefer the action-based variants. Pre-school parents and school-age parents do not display a clear preference. This suggests that the effect is not driven by one specific lexical item because all signs exhibit the same trend.

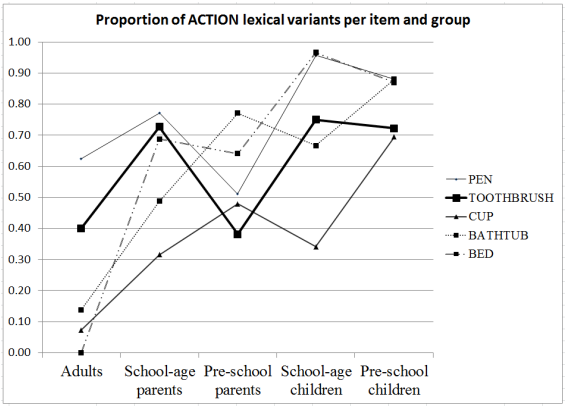

Figure 4. Proportion of action variants per item for all age groups.

In summary, these data show that action-based signs are the preferred variant for children and parents interacting with children even when the perceptual form is the prototypical choice in adult signing.

Discussion

In the present study, we investigate the role of different types of iconicity in sign language development and in the input by parents. Adults interacting with another adult had a clear tendency to produce perceptual sign variants. Children from both age groups showed the opposite trend and were significantly more inclined to produce action signs. Both groups of parents produced the same proportion of action and perceptual-based variants. Importantly, these tendencies were observed across all signs in the study. We interpret these results as meaning that children prefer action signs because they can be easily mapped onto representations in their motor schema. We also propose that when two lexical variants are possible, parent signers favour action-based

forms in child-directed signing to facilitate language development.

The present data are in line with research in spoken language development by showing that deaf as well as hearing children are biased towards producing manual forms depicting actions at the earliest stages of language acquisition. It has been shown that hearing children learning a spoken language are prone to produce iconic gestures representing actions related to a referent. Pettenati, Sekine, Congestrì, and Volterra (2012) asked Japanese and Italian toddlers to produce a word for a set of pictures while their responses and gestures were recorded. They found that children in both groups produced the same proportion of iconic gestures, which overwhelmingly depicted actions. This tendency has also been observed in toddlers (17 months and older) acquiring Turkish where there is a bias for learning action verbs early on due to typology (Furman, Küntay, & Özyürek, 2014). Children's preference for action depictions has also been found in comprehension tasks. Tolar, Lederberg, Gokhale and Tomasello (2008) investigated whether hearing children of different ages (2;6–5;0 years) were capable of matching a picture with iconic ASL signs representing actions, shapes of objects or both features together. They found that the ability to recognise signs improved with age but importantly, that the first and most accurately recognised signs were those depicting actions. The preference towards action-based gestures has been interpreted as motor representations boosting language development because they replicate the motoric context in which a word was learned (Pettenati et al., 2012). Action gestures are easily mapped onto toddlers' motor schema and help them when the linguistic label is unavailable or difficult to retrieve. Bias for action-based sign variants in our study goes in line with claims that language development is tightly linked to motor experience (Yu, Smith, & Pereira, 2008; Yu & Smith, 2012).

Our data also suggest that parents use different types of iconicity strategically to boost language development. Caregivers modify the way they typically communicate to facilitate a child's language perception both in their speech and by increasing the iconicity in their co-speech gestures (Campisi & Özyürek, 2013). Deaf parents also display a range of strategies to enhance children's capacity to perceive language, for example, modifying sign articulation (Holzrichter & Meier, 2000). Children are sensitive to these adaptations because they are more attentive and responsive to child-directed signing than to signing addressed to adults (Masataka, 2000). Our data suggests that in addition to phonetic modifications in their signing, parents use different types of iconic signs to facilitate sign language learning. It is possible that parents favour signs that map onto motor activities during child interactions because they are regarded as easier to learn. That is, when two lexical variants are available for a single concept, parents interacting with children will favour variants that map onto children's motoric schemas.

Developmental studies on languages rich in sound-symbolism are rare and thus information about how different iconic forms are exploited in mimetics in child-directed communication is limited. The available data suggest, however, that caregivers prefer labels with non-arbitrary correspondences during interactions with children. Nagumo, Imai, Kita, Haryu, and Kajikawa (2006) found that Japanese parents speaking to their children tend to use verbs that reflect iconic aspects of the action than words that do not have such iconic links. The use of action words (mimetic verbs), which are fully conventionalised words in the language, diminishes substantially when parents interact with other adults. It remains to be seen however whether different types of iconicity in mimetic speech are also favored during development and in the input.

The present data also suggest that in addition to typological differences across languages (Nyst, 2013; Padden et al., submitted), choice of certain iconic depictions (action vs. perceptual signs) may be rooted in pragmatic conventions of use (i.e., addressee design). These preferences may be attributed to the iconic properties of signs and their learnability.

It could be argued that parents' bias towards action signs may relate to their accommodating to their children's signing. That is, caregivers may be imitating the sign variants they observe in their children rather than it being a communicative strategy to facilitate language learning. We deem this possibility unlikely given that children and parents' pattern of sign use do not overlap entirely (parents produce action and perceptual signs in equal proportion). Future research should look at the signs used by parents in child and adult interactions in order to make definite claims about how they modulate their lexical choice depending on the interlocutor.

Our results support recent claims that iconicity may play a role in sign language acquisition (Thompson et al., 2012) and goes a step further by suggesting that type of iconicity matters in sign language learning and in child-directed signing. We conclude by arguing that regardless of modality, words and signs with iconic links to a referent are easily mapped to children's sensory-motor experience and that parents exploit these direct links as a strategy to boost language development. These effects might be more visible in sign language development than originally thought and require further investigation.

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