WHY DOESN'T ICONICITY HELP IN SIGN LANGUAGE ACQUISITION?*

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Abstract. *Research on the acquisition of American Sign Language (= ASL) has clearly shown that the visual iconicity of signs or grammatical structures has very little or no effect on their acquisition; in fact, the acquisition of ASL grammar strongly resembles that of typologically similar spoken languages. In this paper, some of the results of this research are reviewed. Then the s.c. 'Less is More'–hypothesis, developed by E.L. Newport to account for the data, is presented along with some new supporting evidence from a study of the perception of movement. Finally, on the basis of the development of iconic gestures in children, it is argued that many presumably iconic aspects of ASL grammar may not be iconic to a child. Thus, an alternative acquisition strategy based on iconicity may not even be available to an infant.*

The natural sign languages of the world exhibit a number of visuospatially iconic elements in their grammar and lexicon.[1] This might

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[1]It should, perhaps, be mentioned that although in many respects iconic, sign languages are not based on iconicity or on mime, and that their expressive potential equals that of spoken languages (for discussion and many wonderful examples, see Klima and Bellugi 1979: Ch. 13–14; for discussion of the iconic

lead one to suspect that the acquisition of these languages may differ radically from the acquisition of spoken languages. However, the data gathered on the subject of sign language acquisition clearly does not support such an assumption. In the present paper I shall first briefly review some of this data, and then turn to the question why this should be the case. The data reviewed is exclusively from American Sign Language (henceforth ASL). Large-scale research on the acquisition of other sign languages has not, to my knowledge, been conducted. Since the most important grammatical mechanisms (i.e. syntactic use of space, movement and orientation of signs) as well as the mechanisms of sign formation seem to be much the same in all (natural) sign languages (cf. Kyle and Woll 1985: Ch. 8), there is little reason to believe that their acquisition would be dramatically different.

1. EARLY SIGN VOCABULARY

When sign language is acquired in early childhood naturally, from signing parents, the earliest signs seem to occur significantly earlier than earliest spoken words in hearing children of hearing parents (see Meier and Newport 1990: 5–8 for a review of the data). Many signs referring to concrete entities often depict in their form an aspect of the referent, or, alternatively, an aspect of an action usually associated with the referent (a detailed treatment of the iconicity of individual signs is provided by Klima and Bellugi 1979: Ch. 1). This iconicity seems, however, to play at best a marginal role in the acquisition of early vocabulary. When investigating the contents of children's early sign vocabulary, Bonvillian, Orlansky, and Novack (1983: 123–4) found that only about 33 % of early signs could be

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languages, different sign languages are also mutually unintelligible, although Kyle and Woll (1985: Ch. 8) suggest that the deaf may be more successful than the hearing in communicating across language barriers.

considered iconic.

Thus, iconicity cannot account for this somewhat precocious development. One factor contributing to the relative insignificance of iconicity may be the fact that even iconic signs are not by any means semantically transparent (see Klima and Bellugi 1979: 22–3). And since many signs in all sign languages are completely arbitrary, iconicity may not be a salient and recurrent property in the whole set of signs perceived by an infant. The iconic bases of signs may also be such that a child cannot possibly recognize them (cf. Newport and Meier 1985: 889). A good example of this is the Finnish Sign Language sign MAITO ('milk'), in which hands clearly imitate milking movements; nowadays this iconicity is obviously non–recognizable to most infants. New signs spontaneously created by children are, however, mostly iconic (see Lillo–Martin 1988, cf. also Goldin–Meadow and Mylander 1990b: 333).

The early sign advantage is perhaps most readily explained by the earlier development of the control mechanisms of sign articulators (primarily the hands) when compared to the maturation of the vocal organs. Signs can also be taught to children by molding their hands into the proper configuration and leading them into the proper movement; furthermore, signing children can also benefit from direct visual feedback of their signing (Bonvillian et al. 1983: 123). To an adult observer, earliest attempts to sign may also be more easily recognizable than earliest attempts to articulate a word, as Newport and Meier (1985: 889) suggest.

The vocabularies of signing infants are also larger than those of speaking children of the same age (Meier and Newport 1990: 7). It seems to be the case, however, that the sign advantage in early language acquisition does not persist to the two–word stage and beyond, although, as far as early syntactic development is concerned, the data is not by any means unequivocal (for a review of the data, as well as a discussion of the problems associated with it, see Meier and Newport 1990: 8–12).

2. GRAMMAR

The following discussion will be limited to two particularly iconic aspects of ASL morphology, namely verb agreement and verbs of motion; for a review of the acquisition of other aspects of ASL grammar, see e.g. Newport and Meier (1985).

2.1. Verb Agreement

The use of space is essential for the verb agreement system of ASL. In signed discourse, signers typically set up locations in the signing space in front of them as reference point for absent entities. After this has been done, every absent entity can be referred to just by pointing deictically to the particular location reserved for each them.[2] Objects present in the signing situation are usually referred to by pointing at the objects themselves. This configuration of real-world referents and established reference points is the framework in which the verb agreement system is embedded.

Many ASL verb stems can be described as consisting, among other things, of a specified handshape and a particular type of hand movement along a specified path. The direction of this movement is determined by the verb agreement system. In the ASL verb GIVE, for example, the movement starts from the location set up for the subject and proceeds to the location set up for the recipient or indirect object (henceforth called object). The resulting form (see fig. 1) is a spatial analog of a prototypical instance of an action of giving. However, the rules of verb agreement do not always result in iconic forms, since many non-iconic, abstract verbs such as

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[2]The spatial relations between the locations established "correspond in a topographical manner to actual spatial relations among the objects described" (Poizner et al. 1987: 193).

PREACH, PITY or ASK inflect in a similar fashion (Meier 1987: 365).[3] All ASL verbs do not inflect for verb agreement.

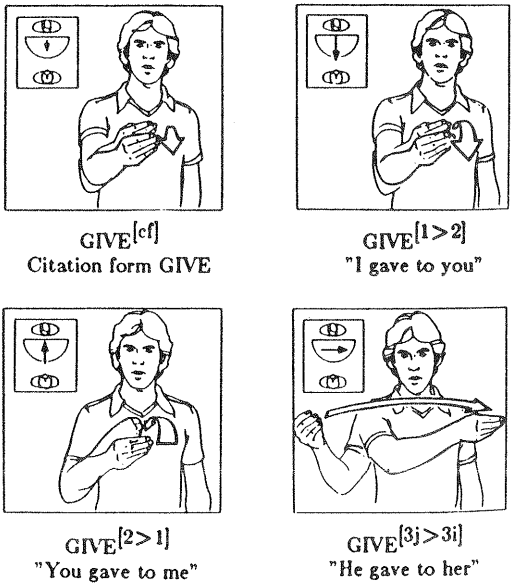

Fig. 1. Citation form and three inflected forms of the ASL verb GIVE (from Meier 1987: 364).

Until the age of 2.6 (2 years, 6 months), signing children use exclusively uninflected signs and rely instead on an SVO word order to mark syntactic relations. The acquisition of these inflections begins roughly at this age, and continues past the age of 3.0 (Meier 1987: 366; Newport and Meier 1985: 897–8). At this point verbs agree only with nouns whose

[3]The inflectional pattern of these abstract verbs can, of course, be regarded as an analogical generalization from concrete verbs such as GIVE (cf. Kendon 1980: 95). In some verbs (e.g. TAKE) the movement is directed towards the subject (Meier 1987: 365–6). Otherwise, the behavior of these TAKE–type verbs is analogous to the GIVE–type verbs.

referents are present in the situational context; the establishing of spatial loci for absent referents places considerable demands on memory and planning capabilities and is not acquired until roughly the age of 4.6–4.9 (Newport and Meier 1985: 905). The most common error during the process of verb agreement acquisition is the omission of agreement, despite the fact that the resulting incorrect form is usually considerably less iconic -- but morphologically less complex -- than the correct one. This suggests that children are acquiring the ASL verb agreement system as a system of combinable, separate elements (i.e. morphemes)[4], not as a system based on spatial analogues of real–world action (Meier 1987: 366). This assumption receives additional support from Meier's (1987) verb agreement imitation test.

Meier's (1987) imitation test was based on the fact that while the object agreement (that is, the movement going towards and ending at the location of the object) is obligatory, subject agreement (the starting of the movement at the subject's location) is optional. If subject agreement is omitted, the subject must obligatorily be marked with a deictic pronoun.[5] What is crucial for the imitation test is that the verb forms which agree with both subject and object are more iconic but also morphologically more complex than those agreeing with the object only.

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[4]The movement component of the verb signs are here regarded as consisting of one or more morphemes (i.e. consistently co–occurring form/meaning – pairings). In other words, a chereme (which is analogous to phoneme in the oral–auditive modality) is divided into morphemes, which is, of course, somewhat odd.

[5]Esa Itkonen has pointed out to me that the term 'agreement' is here (and also e.g. in Meier 1987) used in a somewhat unusual fashion. In the normal use of the term, verbs cannot *agree* with arguments that are not explicitly expressed in the sentence (although they, of course, can be *inflected* for them). The expression 'verb agreeing with X' should, then, be read as synonymous with 'verb inflected for X'. This slightly "unorthodox" terminology is, however, widespread in sign language literature, and is therefore retained in this paper.

In Meier's test, informants aged from 3.1 to 7.0 were asked to imitate simple ASL sentences containing highly iconic verbs agreeing with both subject and object. By a large margin, the most common error in verb agreement was the omitting of subject agreement (30 errors out of a total of 34, whereas only object agreement was omitted in one and both subject and object agreement in 3 cases) (Meier 1987: 372). The obligatory object agreement was thus imitated more successfully, and the errors typically resulted in forms that were morphologically simpler and less iconic than the ones required; this, again, points to a conclusion that an internal morphological analysis of these verbs has indeed been done by the children (Meier 1987: 373). Analogous courses of development can be found in spoken languages.

2.2. Verbs of Motion

The ASL verbs of motion are signed by molding a hand into a proper classifier handshape, specifying either the semantic class or the visual shape of the moving object (see Supalla 1986 for more on ASL classifiers), and moving it along a path in the signing space. When viewed holistically, the path of the moving hand is usually iconic of the path along which the object under discussion moves (for some specific exceptions to this, see Newport 1982: 472–3). Closer inspection has, however, revealed that the hand movement in these verbs is composed of a limited amount of so called "movement roots" (see fig. 2), which are themselves highly iconic (Newport and Supalla 1980, Newport 1982). These morphemes can be combined either simultaneously, in sequence, or merged, with smooth transitions (Newport 1982: 472).

The acquisition of verbs of motion in ASL also proceeds morpheme by morpheme, with no apparent recourse to the overall iconicity of these verbs. Even at age the age of three years, morphemes expressing movement (e.g. LINEAR) and manner of movement (e.g. BOUNCE) are not combined

with each other. When these morphemes first appear together, they are not combined simultaneously as in adult signing, but sequentially, thus diminishing the holistic iconicity of the verb. Even at the age of five, children sometimes omit morphemes from complex verbs of motion, although a substantial proportion of these are signed correctly; but even by the age of eight children's signing is not error–free in this respect (Newport and Meier 1985: 900–901). So, it seems that the verbs of motion, although iconic, are quite difficult from a child's point of view.

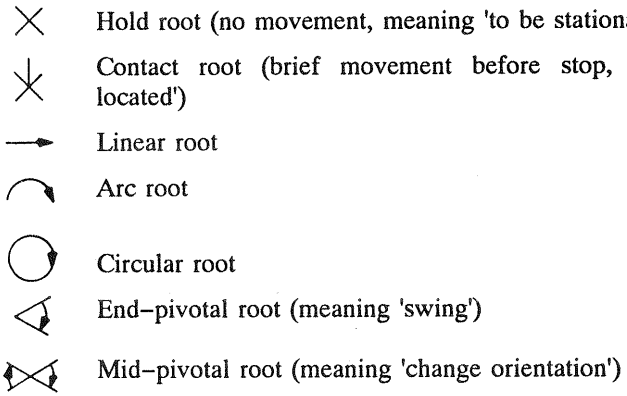

Fig. 2. ASL movement roots (from Newport 1982: 470).

3. ACCOUNTING FOR THE PHENOMENON

On the whole, the acquisition of ASL seems to be comparable to the acquisition of spoken languages with approximately equivalent degree of morphological complexity (cf. e.g. Meier and Newport 1990, Newport and Meier 1985). What is remarkable is that even in the presence of an alternative approach infants opt for an acquisition strategy based on a

morphological analysis, despite the computational problems associated with it (cf. Newport 1990: 24). This has been used by some (e.g. Poizner, Klima, and Bellugi 1987: 23–5) as an argument for an innate, task–specific, biologically determined capacity for language. Another alternative called the 'Less is More' –hypothesis has recently been proposed by Newport (1988, 1990).

3.1 The 'Less is More' –Hypothesis

In the acquisition of morphology, the learner must figure out which components of form can be consistently mapped onto components of meaning. The learning procedure, then, has to consist of storing of the words/signs along with the (nonlinguistic) events to which they refer, and analyzing this input into consistently co–occurring form/meaning pairs. Even with a small number of form and meaning components per word/sign, the problem of finding the right size of these elements is a complex computational task, and the number of possible pairings rises very rapidly as the number of different components increases. However, it is perfectly plausible that a cognitively limited learner (i.e. a child), as he/she is confronted with a word or a sign, perceives and stores only a limited number of the components of form and meaning (Newport 1990: 24). This would bring the learner two important advantages.

> First, even if the selection of form and meaning components on each exposure is random, the number of possible computations to perform is greatly reduced, and is also substantially focused on morphological rather than whole–word mappings. (Newport 1990: 25)

Newport (1990: 25) thus predicts that a morphological system in which morphemes are smaller than whole words would be learned more readily

with limited than with full memory capacities; even a system based on whole–word pairings would then have a good possibility of being erroneously interpreted as morphological. Moreover, if whole signs and signed sentences are perceived and stored as sets of components, this might naturally result in the left–hemisphere dominance in sign language suggested by Poizner, Klima, and Bellugi (1987; see, however, Brentari 1988: 808–9), as the left hemisphere is more suited for analytic tasks. Furthermore,

> if the form and meaning components selected are precisely those of the morphology ... an even greater advantage may accrue to the learner ... This could occur, however, even without advance [i.e. innate] knowledge of the morphology, if the units of perceptual segmentation are (at least sometimes) the morphemes which natural languages have developed. Since human languages have presumably evolved their structural principles at least in part under the constraints of information processing and learning abilities, this advantage may not be as implausible as it sounds. (Newport 1990: 25)

3.2. Evidence for the Less is More –Hypothesis

The perception of hand movements has been investigated by Poizner, Fok, and Bellugi (1989). They found that both hearing non–signers and deaf signers of different sign languages (American and Chinese) perceived the movements of ASL signs "in terms of a limited set of underlying dimensions" (Poizner et al. 1989: 281). These dimensions were identical in signers and non–signers, irrespective of whether they were employed in a

linguistic system or not (p. 283).[6] Furthermore, it is interesting to note that all informant groups (including hearing non-signers) perceived "ASL movements ... not as holistically different from one another nor as randomly related, but rather ... in terms of shared relationships among elements of a system" (p. 281).

If one compares the perceptual categories postulated by Poizner et al. (1989) on the basis of their tests and the movement roots of ASL signs as reported by Newport and Supalla (1980) and Newport (1982; see fig. 2), one can easily see the resemblances. The five psychologically most salient properties of movement were repetition, plane of movement, circularity, direction, and degree of arcness (Poizner et al. 1989: 281–3). Of these, circularity and degree of arcness are directly comparable to the circular and arc roots described by Newport (1982: 470). There is also some circularity in both the pivotal roots, which also account for changes in the dimensions of direction and plane (cf. Newport 1982: 472). Under the dimension of degree of arcness, Poizner et al. also put the distinction between straight (=basic?) movement and arced or circular movements (see p. 283); it thus seems that the linear movement of the linear root also has its place among the perceptually salient ones.

Only the hold and contact roots are left without a counterpart in the perception of movement. These are, however, somewhat different from the other movement roots in that they either employ no movement at all (the hold root) or a brief movement before a stop (the contact root). Thus, it may be that studies in the perception of movement are of no help when studying the perception of these roots.

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[6]When judging the similarity between presented hand movements, the different dimensions received different weights in all the informant groups (i.e. hearing non-signers vs. native users of ASL vs. native users of Chinese Sign Language). In signers, the weight received by a certain movement dimension was a function of its importance in distinguishing different signs in the signers' native language (Poizner et al. 1989: 283).

The previous analysis of Poizner's et al. (1989) and Newport's (1982; see also Newport and Supalla 1980) results suggests that the ASL movement roots which employ large-scale movement of the hands coincide with human natural perceptual categories.[7] This would serve a limited learner well, since these perceptual categories can guide the learner to segment his/her input in a way that results in an overrepresentation of the "morpheme-size" form and meaning components in the database from which the consistent form/meaning correspondences (i.e. morphemes) are abstracted. This, in turn, causes the learning to proceed towards the morphological organization evident in adult ASL. Incidentally, this may well be necessary in order for the 'Less is More' -hypothesis to work without innate preprogramming, since the limitations on memory and perception also bring a reduction of the data on which learning has to be based, and these limitations must thus somehow make up for the lost information (cf. Newport 1990: 25, fn. 5).

Newport's proposal can also account for the fact that an individual's mastery of many morphological (and syntactic) devices in signed (see Newport 1990: 16-18) and spoken languages -- both first (see Curtiss 1988) and second (see Johnson and Newport 1989) -- is comparable to the age of the individual at the onset of the acquisition process. At least in the case of ASL, the more mature learners seem to employ different learning strategies (see Newport 1988: 153ff). All this would follow naturally from the 'Less is More' -hypothesis, since the cognitive limitations which compel children to do the morphemic analysis on their input disappear during maturation. A morphological level is also attested in the

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[7]Newport (1990) cites an unpublished manuscript by D. Dufour, E.L. Newport and D. Medin, in which the imitation of ASL signs by non-signing hearing children was investigated. The tests showed that "young children tend to extract and reproduce, or selectively omit, ASL morphemes" (Newport 1990: 25). This would follow naturally from the similarities among perceptual and linguistic categories discussed in the main text.

home sign systems spontaneously created by young deaf children who are not exposed to a conventional sign language model (see Goldin–Meadow and Mylander 1990a). This should not present any difficulty to the hypothesis, either, since it would predict these children to organize their input consisting of the spontaneous gestures of their parents (cf. Goldin–Meadow and Mylander 1990b: 325) into patterns even if there isn't any noticeable patterning in the input itself (cf. Newport 1990: 25 and above, see also Newport 1988: 164–5)[8]; I see no reason why the same would not happen to the signs created by the children themselves. In sum, according to Newport's hypothesis (and contrary to any approach that would dissociate the language–learning capacity from other cognitive capacities), the fact that the rise of cognitive–perceptual abilities and the decline in the capacity to learn a language happen simultaneously would not be just a coincidence (cf. Newport 1988: 165–6).

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[8]Goldin–Meadow and Mylander (1990b: 349) see the spontaneous gestures of these parents as unstructured and uninterpretable when analyzed as primary communication systems, but admit that they were (at least potentially) meaningful and structured when analyzed in relation to simultaneous speech (cf. McNeill 1985, 1987). According to Goldin–Meadow and Mylander (1990b: 350), "It goes without saying, however, that the structure of this combined speech/gesture communication is lost on our deaf children, for whom speech input is unavailable" (cf. also p. 347, fn. 13). In my mind, this may not be as clear as in first seems, because Goldin–Meadow and Mylander overlook the existence of contextual (i.e. purely non–linguistic) cues which may at least sometimes provide the information needed in order to discover the structure in the parents' gestures. As to the suggestion that, in order to find structure in the caretaker's gestures, the deaf child "must have had prior belief that there would be structure in those gestures" (Goldin–Meadow and Mylander 1990a: 559), the 'Less is More' hypothesis would predict children to find (or create) structure in their input, irrespective of whether they had any prior belief of its existence or not (cf. Newport 1990: 25).

3.3. Iconic to the Child vs. Iconic to the Adult

Limitations on memory and perception may not be the only factors that bring about the apparent inattentiveness of children toward the iconicity of many sign language sentences. This may also result, in part, from a somewhat different conception of iconicity among infants. There is indeed evidence from the study of the development of gesture in children that can be interpreted to suggest that what is iconic from the adult point of view may not be iconic to a young child. The psychological affinity of speech and accompanying gesture has been forcefully argued by McNeill (1985, 1987).

By definition, iconic gestures depict in their form some aspect of the meaning that is simultaneously being communicated vocally (McNeill 1986: 107). Their form is also free from social control, but they still exhibit substantial interpersonal (and intercultural) similarities (McNeill 1985: 351). Interestingly, the iconic gestures of children differ from those of adults in a number of respects, the most important ones for the present issue being the ones having to do with the use of space (for a full account of the differences, see McNeill 1986).

The gesture space used by adults "can be visualized as a half disk situated in front of the body" with the lower half (below the waist) missing (McNeill 1986: 116; this space does not, incidentally, differ much from the signing space of various sign languages). The center of this space is in front of the body, and the proximal edge, which is almost never crossed, is at the frontal plane of the body. In relation to body size, the gesture space of children is larger, and it is centered on the child him/herself.

> Moreover, motion and the placement of 'objects' within the gesture space are in accord with the coordinate system of the surrounding space, so that, for example, gestures which depict a horizontal motion move horizontally with respect to the room. Children's gesture space differs from adults' ... [in

> showing] a local orientation of motions and objects toward the surfaces of other objects in the space rather than to a universal system of coordinates. (McNeill 1986: 116)

McNeill (1986) characterizes children's gesture space as "a true space within which the child is a participant, in contrast to adults' space which is *symbolic* and more like a movie screen" (p. 116, emphasis added).

Whereas the early gestures of children are truly iconic re–enactments of past situations and events (cf. McNeill 1986: 121), the iconicity evident in the iconic gestures of adults' as well as in ASL verbs of motion and in the establishment of spatial loci described earlier (and also, in some cases, in spatially inflecting verbs) is diagrammatic in nature. As Anttila (1989: 16) notes, "[a] diagram is predominantly an icon of relation, and to interpret such icons one needs conventions".[9] In the case of the iconicity in gestures and verbs of motion, the conventions needed to interpret these as iconic are much the same, and the development of iconic gestures proves that they are lacking from young children. At some point in their development, they acquire these conventions and only then are they able to perceive the iconicity in adult gestures as well as in the adult use of space in signing. It may thus be the case that an acquisition strategy based on the iconicity of e.g. ASL verbs of motion is ruled out simply because infants are unable to perceive any iconicity in them.

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[9]Iconicity comes close to its perfection in pictures and photographs. It should be noted that both of these are not immediately interpretable to members of cultures where pictorial representations are not as important as they are to us; for discussion and examples, see Deregowski (1989).

4. CONCLUDING REMARKS

From the preceding discussion it should be clear that the fact that the courses of acquisition of signed and spoken languages are in many respects alike does not give us a strong case for an innate, task–specific language module à la Chomsky (see e.g. Chomsky 1986)[10]. It is very much possible that the cognitive–perceptual limitations of infants drive them to morphemic analysis in sign language acquisition even without such a module. For them, an acquisition strategy based on iconicity may be cognitively too demanding. And, if I am right in arguing that what is iconic to adults is not always iconic to young children, there may not even be much visual iconicity available to toddlers.

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[10]Washabaugh (1986) argues against such a language module on the basis of Providence Island Sign Language. According to him, this primary communication system lacks many of the defining characteristics of natural languages, because of inopportune social conditions. Washabaugh's case is, however, less than conclusive due to his somewhat questionable research methods (see Supalla 1988 for criticisms).

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