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How handshape type can distinguish between nouns and verbs in homesign

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All established languages, spoken or signed, make a distinction between nouns and verbs. Even a young sign language emerging within a family of deaf individuals has been found to mark the noun-verb distinction, and to use handshape type to do so. Here we ask whether handshape type is used to mark the noun-verb distinction in a gesture system invented by a deaf child who does not have access to a usable model of either spoken or signed language. The child produces homesigns that have linguistic structure, but receives from his hearing parents co-speech gestures that are structured differently from his own gestures. Thus, unlike users of established and emerging languages, the homesigner is a producer of his system but does not receive it from others. Nevertheless, we found that the child used handshape type to mark the distinction between nouns and verbs at the early stages of development. The noun-verb distinction is thus so fundamental to language that it can arise in a homesign system not shared with others. We also found that the child abandoned handshape type as a device for distinguishing nouns from verbs at just the moment when he developed a combinatorial system of handshape and motion components that marked the distinction. The way the noun-verb distinction is marked thus depends on the full array of linguistic devices available within the system.

Keywords: homesign, language development, language creation

Marking nouns differently from verbs is one of the few distinctions commonly accepted as a linguistic universal in spoken languages (e.g., Robins, 1952; Sapir, 1921; Givon, 1979; Hawkins, 1988; Hopper & Thompson, 1984, 1988; Schachter, 1985; Thompson, 1988) and, not surprisingly, is also found in sign languages (Supalla & Newport, 1978; Tkachman & Sandler, 2013). Nouns and verbs can be identified in a language by the structural roles each plays in that language (e.g., by the set of inflections applied to a noun vs. a verb). However, these structural characteristics

vary from language to language — what is common across languages is the discourse functions nouns and verbs serve and the semantic characteristics that have evolved as a result of these functions (Hopper & Thompson, 1984; Sapir, 1921). Sapir (1921) grounds the noun-verb distinction in the fact that language consists of a series of propositions — there must be something to talk about and something to be said (or to predicate) of this subject once it is brought into focus. According to Sapir (1921), this distinction is so fundamental that languages emphasize it by creating a formal barrier between the two terms of the proposition — the subject of discourse, that is, the noun, and the predicate of the discourse, the verb.

The importance of the noun-verb distinction suggests that if a new human language were to spontaneously emerge, that language would also likely display a distinction between nouns and verbs. The goal of this paper is to explore this prediction. Although it is difficult, if not impossible, to find a current day spoken language that is developing "from scratch", many sign languages appear to develop *de novo* (Senghas, 2005; Aronoff, Meir, Padden, & Sandler, 2004). Take, for example, Al-Sayyid Bedouin Sign Language (ABSL), which is emerging without input from an established sign language in a Bedouin community founded 200 years ago, and now within the borders of Israel (Sandler, Meir, Padden, & Aronoff, 2005). The community is in its 7th generation and contains 3000 members, 125 of whom are deaf and descended from two of the founders' five sons. ABSL now has three generations of signers and thus offers the opportunity to observe a language in its infant stages. In recent work, Padden and colleagues (2013) have observed how nouns are constructed in ABSL. In constructing a noun label for an object, ABSL signers prefer to use a handshape that represents features of the object (e.g., extending the index finger to represent the shape of a toothbrush), rather than a handshape that represents how the object is typically held (e.g., a closed hand held as though grasping a toothbrush). Padden and colleagues have not yet explored whether ABSL signers adopt a different strategy for verbs than for nouns[1], but Haviland (2013) has examined the same handshape parameter in both nouns and verbs in a spontaneously emerging sign language within an extended family in the Mayan community of Zinacantán highland Chiapas, Mexico. Z, as the language is called, is the joint invention of three deaf siblings, their hearing sister, and two nephews, none of whom has met other deaf people or had exposure to an established sign language. Handshape use in the Z signers is similar to handshape use in the ABSL signers in that the handshape used when producing a noun for an object resembles the form of the object (e.g., a fist representing the hammer head as it pounds a surface). In addition, the Z signers use a contrasting handshape for verbs — the handshape used when producing a verb resembles the act of manipulating the object (e.g., positioning the hands as though holding a hammer and then

making pounding movements). This nascent sign language thus uses handshape to make a distinction between nouns and verbs.

Both ABSL and Z are shared systems. Z is shared across a small number of users but, critically, the signers are not only producers of the system, they are also receivers of the system (they see others produce it). We ask here whether type of handshape (i.e., whether the hand represents a hand positioned as if holding an object, or properties of the object itself) is used to distinguish nouns and verbs even in a sign system that has only one fluent user. We study the homesigns produced by an American deaf child of hearing parents, David, whose homemade linguistic system has been extensively studied (Goldin-Meadow, 2003; Goldin-Meadow & Mylander, 1984; Feldman, Goldin-Meadow, & Gleitman, 1978). David differs from both ABSL and Z signers in that he grew up in a home surrounded by hearing individuals whose goal was to teach him to speak. David's family members responded to his gestures (although not always knowingly) and the gestures that they themselves used were always produced along with speech and, as such, took on the qualities and structural properties of gestures that accompany speech (see Goldin-Meadow, McNeill, & Singleton, 1996), often called co-speech gesture. As a result, David produced homesigns but received co-speech gestures in return. We ask whether a handshape distinction between nouns and verbs will emerge when there is only a single user of a system. In other words, does David follow similar patterns of handshape development observed in emerging sign languages?

We know from previous work that David does use different forms for gestures serving a noun function vs. gestures serving a verb function (see Goldin-Meadow, Butcher, Mylander, & Dodge, 1994). During the earliest observation sessions, David primarily used pointing gestures to refer to objects playing a noun role (akin to determiners, e.g., *that*), and iconic gestures to refer to actions playing a verb role. Over time, he began to use his gestures more flexibly. For example, he used pointing gestures to refer not only to specific objects in a noun role but also to categories of objects in a noun role (Butcher, Mylander, & Goldin-Meadow, 1991; Hunsicker & Goldin-Meadow, 2012); he also used iconic gestures in noun roles (e.g., *a hammer*) as well as in verb roles (e.g., *to hammer*) (Goldin-Meadow et al., 1994); and he used his noun iconic gestures in two linguistic contexts, as nominal arguments (e.g., put *penny* here) and nominal predicates (e.g., that's a *penny*, Hunsicker & Goldin-Meadow, 2012). Later still, David began to vary the movement and location of his gestures in a systematic way; these morphological devices distinguished between nouns and verbs (noun iconic gestures were abbreviated; verb iconic gestures were displaced in space to "agree with" their arguments; Goldin-Meadow et al., 1994).

But previous work has not examined the types of handshapes David used in his iconic gestures, nor whether those handshape types differ in nouns vs. verbs.

If they do, we can then ask whether nominal predicates act like nouns (and thus pattern like nominal arguments with respect to handshape type) or whether they act like verbs (and thus pattern like verbal predicates with respect to handshape type). Our analyses not only fill this gap, but also allow us to situate David's use of handshapes for nouns vs. verbs in relation to how handshape type is used in ABSL and Z, language systems that are emerging within specific communities of signers.

Methods

Participant

David is a US child with a profound hearing loss (≥ 90 decibels) in both ears who was educated in the oral method (i.e., he was taught to use visual and kinesthetic cues to receive and produce speech). Cochlear implants were not available when David was young. At the time of our observations, David had made little progress in acquiring English, occasionally producing single words but never combining those words into sentences, and he had not yet been exposed to sign language (Goldin-Meadow & Mylander, 1984). David was videotaped in his home interacting with his family and the experimenters every two or three months between the ages of 2;10 (yrs;mos) and 4;6; eight sessions were analyzed. Sessions typically lasted about two hours and the experimenters brought a set of books, toys, and puzzles to each session to elicit communication. Coders who had not been present at the session had access to the toys, books, and puzzles in the lab and could use them to contextualize the child's gestures. In addition, when the experimenters were uncertain about the meaning of David's gesture, they asked his parents to clarify; those conversations were part of the videorecording and thus accessible to the coders.

Coding

Identifying and describing gestures. The coding of the data discussed in this paper is the coding used by Goldin-Meadow and Mylander (1984), which presents additional details of the coding system. The first step in the coding process is to isolate gestures from other motor behaviors. We used two criteria to identify a gesture: (1) the hand or body movement had to be communicative in intent (i.e., directed at an individual when the child believed he had his or her attention), and (2) the movement could not be a functional action on an object. For example, trying to open a jar while whining, no matter how effective in conveying the child's desires, would not be considered a gesture; a twist movement produced in the air while making

eye contact with an interlocutor not only communicates that the child wants the jar open, but does so symbolically. The twist movement would be considered a gesture.

Once isolated, gestures were coded along the three dimensions used to describe signs in established sign languages: movement, shape of the hand, and location of the hand in relation to the body. Changes in these dimensions signaled the end of one gesture and the beginning of another. Motoric criteria were used to determine the end of a string of gestures: Two gestures were considered separate strings if the child paused or relaxed his hands between the gestures; gestures that were not separated by pause or relaxation of the hands were considered part of the same string. The gesture strings that result when these motoric criteria are applied to homesigns resemble the early sentences produced by children learning a conventional language in content and structure (Goldin-Meadow, 2003; Goldin-Meadow & Mylander, 1984) and, in this sense, warrant the label "sentence".

Reliability was determined by having two independent coders transcribe the videotapes. Agreement between coders was 91% for isolating gestures from the stream of motor behavior, 93% for determining boundaries between signs, and 95% for determining boundaries between sentences (Goldin-Meadow & Mylander, 1984).

Coding types of gestures. Homesigners produce four different types of gestures: marker gestures, deictic or pointing gestures, iconic gestures, and conventional gestures. Markers are typically conventional gestures used to modulate the meanings of other gestures, such as a side to side head shake signaling negation, or flipping the palms from down to up when asking a question (Franklin, Giannakidou, & Goldin-Meadow, 2011a, 2011b). Markers are not included in the analyses presented in this paper because they are not used as nouns or verbs, but rather function to modulate the meaning of a sentence.

David produced two types of deictic gestures. He used deictics that literally point out the intended referent (e.g., pointing at a toy in the room to refer to that specific toy). Determiner points are versatile because they can refer to any present entity, and homesigners use their pointing gestures to refer to the full range of entities that young hearing children refer to with their early words, e.g., people, inanimate objects, body parts, and places (Feldman et al., 1978). A determiner gesture (e.g., *this, that, her*) points out a particular object but does not categorize it. For example, David produced a pointing gesture at a toy soldier followed by a *give* gesture to request that particular soldier be given to him, *give that* (*to me*).

The second type of deictic gesture, called a category point, does not refer to the particular object it indicates, but rather to an object of the same type (Butcher et al., 1991). In one instance, David pointed at an empty bubble jar present in the room in order to request a full bubble jar from the next room. Despite the fact that

the form of this gesture is a point, these gestures function more like nouns than demonstratives because they evoke the category by indexing an object which is an instance of that category to which the object belongs (in this case, the category of *bubble jars*) rather than the particular object (*that jar*).

Iconic gestures evoke some aspect of the intended referent and thus are less dependent on context than deictic gestures. Iconic gestures were originally classified according to the noun and verb discourse roles they play in Goldin-Meadow et al. (1994), which presents additional details of this coding system. For example, David moves a hand to his mouth with the fingers closed in a pinched O handshape, which is glossed as *food* if the gesture is functioning as a noun (i.e., if it denotes an object that is the focus of the discourse) and as *eat* if the gesture is functioning as a verb (i.e., if it makes a comment on the discourse topic, Goldin-Meadow et al., 1994). Noun iconic gestures, like category points do not specify a particular object, but rather specify a category of objects. In this paper, we focus on iconic gestures that function as nouns (i.e., that represent objects and serve as a nominal argument or a nominal predicate in a sentence), and how they contrast with iconic gestures that function as verbs.

We also include conventional gestures — emblems, which are conventionalized within a community of hearing speakers, in this case, the U.S. (e.g., a palm held to the cheek with the head tilted, typically used to refer to sleeping), and gesture forms that became conventionalized within the child's family (e.g., pressing both palms together as if praying to refer to David's Catholic school). David used conventional gestures as both nouns (e.g., miming a laugh with the hands resting on the stomach, which refers to Santa Claus) and verbs (e.g., the sleeping gesture described above).

Agreement between coders was 93% for assigning meanings to deictic, iconic, and conventional gestures (Goldin-Meadow & Mylander, 1984), 94% for deciding whether an iconic or conventional gesture served as a noun or verb (Goldin-Meadow et al., 1994).

Coding types of handshapes

Properties of the hand were originally coded in Goldin-Meadow and Mylander (1984). David produced four types of handshapes. In the first type, the hand is shaped as though *handling* an object. For example, David produced a pulling up gesture in front of his legs, with both hands in fists with the palms oriented inwards, as though pulling on a pair of pants. In the second type of handshape, the hand reflects the form of the *object* itself. As examples, David placed a flat palm on his head to represent a hat, or he made a circle with his thumb and index finger to represent a coin. In the third type of handshape, the hand appears to be used

as a pencil to trace either the trajectory or the shape of an object; in other words, as a *neutral* form (a handshape form that does not convey any information about the object or its characteristics). For example, David traced the smile on a puzzle piece and then traced his own smile to convey the similarity between the two; as a second example, he traced the shape of the experimenter's hair on his own head to identify her hair. The fourth type of handshape is found in conventional gestures; the hand David uses is borrowed from the emblems he sees hearing speakers use in their gestures. For example, David extends a flat hand, palm up, to request that object be given to him. Because the handshape in a conventional gesture is borrowed, it does not offer insight into David's handshape choices (i.e., a conventional handshape might capture properties of an object or how an object is handled, but because the form is borrowed, we cannot be certain that David understands the mapping). Nevertheless, we chose to include conventional gestures in the database as a baseline against which to examine how often the other types of handshapes (*handling, object, neutral*) appear in noun and verb contexts.

The four types of handshapes that David used correspond to coding categories for strategies of lexical formation used by Padden et al. (2013). Our handling handshape is also called *handling* in the Padden et al. coding system. Our *neutral* handshape is called *trace* in their system, but our category also includes neutral forms that do not involve movement (e.g., indicating the height of a round object with a flat static palm). Our object handshape encompasses two categories in Padden et al.'s system — *objects*, which are depictions of the shape of an object without motion, and *instruments*, which are depictions of an object's shape accompanied by a motion depicting an action done on or with the object.

David occasionally produced gestures with other parts of his body rather than with his hands; for example, pushing his lips out to represent a duckbill to refer to Donald Duck. These non-manual gestures are not included in our analyses, nor are gestures in which David was holding an object while gesturing since his handshape is not informative in these gestures. Reliability for coding handshape type ranged between 85–95% agreement between coders.

Results

Types of gestures

We begin by describing the types of gestures David used over development (see Table 1).[2] The number of total gestures David produced increased over time, but the distribution of pointing and iconic gestures remained relatively stable, with the exception that David produced proportionally more nouns (iconic nominal

David's Age (years; months)	Verb Iconic Gesture	Noun Iconic Gesture		Noun Category Point	Determiner Point
		Nominal Predicate	Nominal Argument		
2;10	47 (.22)	2 (.01)	1 (.00)	2 (.01)	162 (.76)
2;11	39 (.17)	3 (.01)	3 (.01)	2 (.01)	179 (.79)
3;0	16 (.15)	3 (.03)	0	1 (.01)	87 (.81)
3;3	39 (.13)	4 (.01)	11 (.04)	1 (.00)	239 (.81)
3;5	116 (.16)	45 (.06)	18 (.03)	26 (.04)	508 (.71)
3;10	112 (.14)	66 (.08)	21 (.03)	18 (.02)	612 (.74)
3;11	104 (.18)	71 (.12)	36 (.06)	33 (.06)	347 (.59)
4;6	63 (.06)	37 (.04)	36 (.04)	28 (.03)	826 (.83)

Table 1. The number of different types of pointing and iconic gestures David produced over development (the number in parentheses is the number of each type of gesture as a proportion of the total number of gestures David produced at each session)

predicates, iconic nominal arguments, and category points), and fewer verbs (iconic predicates), over time. The important point, however, is that David produced examples of all three types of iconic gestures (nominal predicates, nominal arguments, verbs) during the early sessions, thus allowing us to explore how handshape is used across these different gesture types from the beginning.

Types of handshapes

David produced all four types of handshapes in his gestures at the first session (see Table 2) — *handling* handshapes in which the hand mirrors how an object is held, *object* handshapes in which the hand displays properties of the object itself (typically its size or shape), *neutral* handshapes in which the hand serves merely as a vehicle for the motion, and *conventional* handshapes which are borrowed from hearing gesturers and which are recognizable within the culture or his family. Because our focus is on how handshape type is used in nouns vs. verbs, 57 gestures whose handshape type was ambiguous were omitted from the table[3], as were 38 gestures which were produced while David was holding an object (which meant that the shape of his hand was dictated by the object in his grasp) and 76 which were produced with a body part other than the hands (e.g., alternating up and down movements with the feet to refer to pedaling a bike). Gestures produced with other parts of the body can represent how an object is manipulated, as in the *pedal* gesture; however, they are very rarely (if ever) used to represent the shape of an object and, in this sense, are distinct from gestures made with the hand.

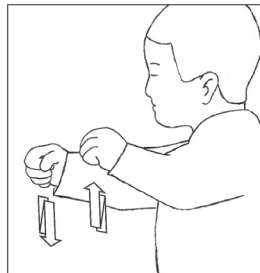| David's Age (yrs;mos)	Handling Handshape	Object Handshape	Neutral Handshape	Conventional Handshape
2;10	20	3	4	23
2;11	27	4	0	14
3;0	2	2	1	14
3;3	18	8	11	17
3;5	101	17	43	18
3;10	90	22	43	44
3;11	104	25	21	61
4;6	72	17	33	14

Table 2. The number of handling, object, neutral, and conventional handshapes that David produced in his iconic gestures over development

Handshapes in nouns vs. verbs

We found instances of each of the four types of handshapes (*handling*, *object*, *neutral*, *conventional*) in David's nouns and verbs. Figure 1 shows an example of a *handling* handshape in a noun gesture (top), *pants* (David mimics the action of pulling on a pair of pants, using both hands simultaneously), and in a verb gesture (bottom), *drum* (David's hands form a fist handshape as though holding drumsticks while playing a drum, and beats up and down with both fists simultaneously).

pants (noun)

drum (verb)

Figure 1. A *handling* handshape in a noun gesture (*pants*, top) and a verb gesture (*drum*, bottom)

Figure 2 shows David producing an *object* handshape in a noun gesture (top), *oar* (David's hand is in a flat B handshape, representing the shape of the oar paddling through the water rather than a hand holding an oar) and in a verb gesture (bottom), *shoot* (David's hand is in the shape of the object that shoots, a gun; he jerks his hand back and up slightly as if from the recoil).

David also produced gestures with *neutral* handshapes in both nouns and verbs. Figure 3 shows David producing a *neutral* handshape in a noun gesture (top), *train* (David sweeps his index finger from right to left providing information about the length of the train he is describing). Although David's gesture captures a property of the train and, in this sense, appears to be an adjective, context makes it clear that David is using the gesture as a noun; many established languages (e.g., Spanish, Waxman, Senghas, & Benveniste, 1997, although not English) permit adjectives to stand in for nouns, as David appears to be doing in this example. Figure 3 also shows David producing a neutral handshape in a verb gesture (bottom), *go over* (David moves his palm along the path a motorcycle took as it went over an obstacle). In both examples, the handshape itself provides no information about the properties of the relevant object.

Finally, David used conventional handshapes borrowed from the hearing speakers with whom he interacted in both his nouns and verbs. Figure 4 shows David producing a *conventional* handshape in a noun gesture (top), *school* (David's
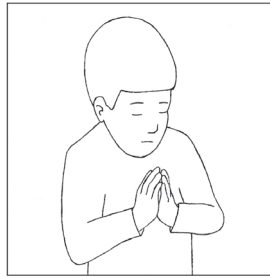

oar (noun)
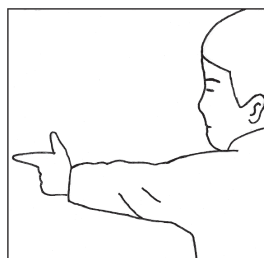
shoot (verb)

Figure 2. An *object* handshape in a noun gesture (*oar*, top) and a verb gesture (*shoot,* bottom)
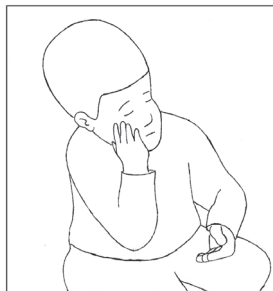
school (noun)

sleep (verb)

Figure 3. A *neutral* handshape in a noun gesture (*train*, top) and a verb gesture (*go over*, bottom)

school (noun)

sleep (verb)

Figure 4. A *conventional* handshape in a noun gesture (*school*, top) and a verb gesture (*sleep*, bottom)

palms are pressed together as though praying, an activity done daily at his catholic school) and in a verb gesture (bottom), *sleep* (David puts his palm to his cheek and tilts his head to describe a baby who is sleeping).

As these examples demonstrate, David used his four types of handshapes in both nouns and verbs; however, his distribution of handshape types across nouns and verbs was not uniform, particularly in his earliest observation sessions. Table 3 displays the number of each of the four types of handshapes (*object*, *handling*, *neutral*, *conventional*) that David used in his nouns (both nominal predicates and nominal arguments) and verbs. Focusing first on *object* handshapes, we find that David initially used this handshape exclusively in nouns, both nominal predicates and nominal arguments, and it was not until age 3;5 that he began to use these handshapes frequently in verbs. After 3;5, David used *object* handshapes approximately as often in nouns as in verbs.

In contrast, David used *handling* handshapes initially in verb contexts. It was not until age 3;5 that David consistently produced *handling* handshapes in nominal predicates and not until 3;11 that he produced these handshapes in nominal arguments. After 3;5, David used *handling* handshapes approximately as often in nouns as in verbs. *Neutral* handshapes followed the pattern for *handling* handshapes, and were used first in verbs and only later in development began to appear in nouns.

Conventional handshapes (handshapes that were borrowed from the co-speech gestures of family members) provide a backdrop against which we can evaluate how often *object*, *handling*, and *neutral* handshapes (handshapes that David himself chose) were used in noun and verb contexts. Conventional handshapes were first used in verbs and only later found in the two noun contexts. Note that *handling* and *neutral* handshapes followed the default pattern seen in *conventional* handshapes; *object* handshapes did not. Using a handshape to represent properties of the object being manipulated thus appeared to be a developmental step for David.

Age (years; months)	A. Object Handshapes		
	Verb	Nominal Predicate	Nominal Argument
2;10		2	1
2;11		3	1
3;00		2	
3;03	1		7
3;05	8	4	5
3;10	9	9	4
3;11	4	14	7
4;06	8	2	7

Age (years; months)	B. Handling Handshapes		
	Verb	Nominal Predicate	Nominal Argument
2;10	20		
2;11	26		1
3;00	1	1	
3;03	15	3	
3;05	56	40	5
3;10	46	39	5
3;11	30	49	25
4;06	27	29	16

Age (years; months)	C. Neutral Handshapes		
	Verb	Nominal Predicate	Nominal Argument
2;10	4		
2;11			
3;00	1		
3;03	11		
3;05	38		5
3;10	18	17	8
3;11	12	8	1
4;06	18	6	9

Age (years; months)	D. Conventional Handshapes		
	Verb	Nominal Predicate	Nominal Argument
2;10	23		
2;11	13		1
3;00	14		
3;03	12	1	4
3;05	14	1	3
3;10	39	1	4
3;11	58		3
4;06	10		4

Table 3. The number of Object (A), Handling (B), Neutral (C), and Conventional (D) handshapes that David produced in the iconic gestures he used as verbs, nominal predicates, and nominal arguments; note that in the early sessions *object* handshapes were used primarily in nominal predicates and arguments, and *handling, neutral, and conventional* handshapes were used primarily in verbs

In sum, early in development, type of handshape distinguished between nouns and verbs in David's gestures — before age 3;5, David used more *object* handshapes in noun contexts than in verb contexts (16 vs. 1), but showed the opposite pattern in his *handling* handshapes (5 vs. 62), p<.0001, Fisher Exact Test. However, after 3;5, type of handshape no longer distinguished between nouns and verbs

a.

Object handshapes

b.

Handling handshapes

c.

Neutral handshapes
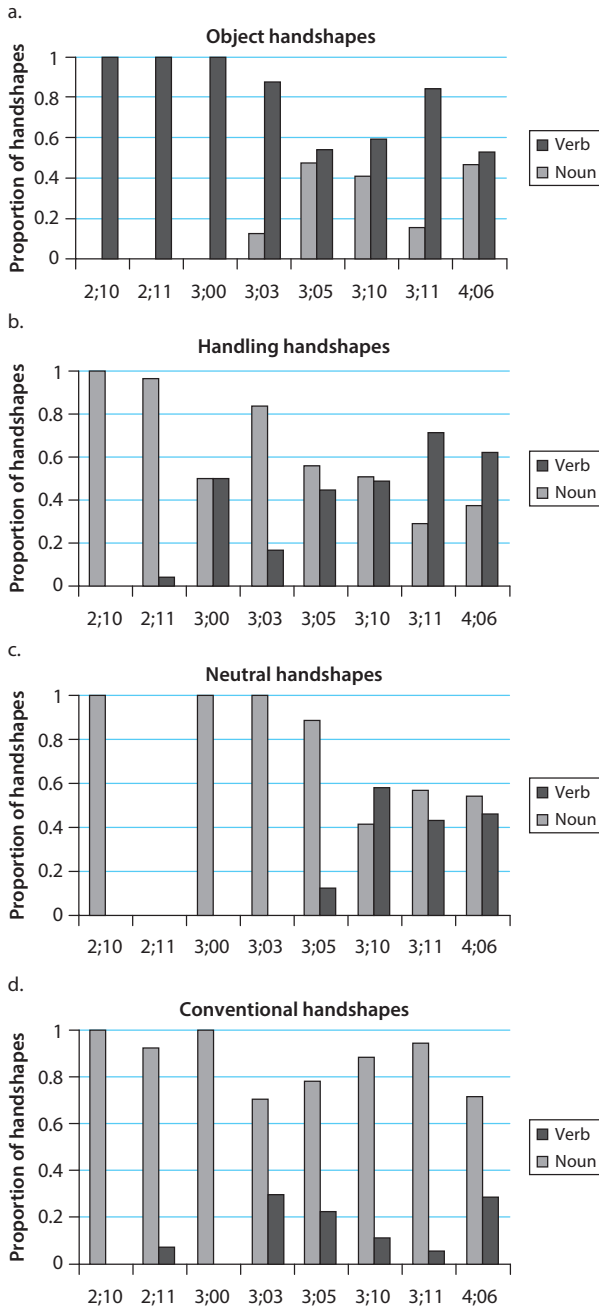

d.

Conventional handshapes

Figure 5. The proportion of Object (A), Handling (B), Neutral (C), and Conventional (D) handshapes that David used as verbs vs. nouns (including both nominal predicates and nominal arguments) at each age (in years;months)

— David displayed the same pattern of noun vs. verb uses in his *object* handshapes (29 vs. 52) as in his *handling* handshapes (159 vs. 208), p=.26, Fisher Exact Test (see Figure 5 for a graphical depiction of these developmental patterns).

Discussion

We have found that a homesigner, fashioning a gestural communication system without the benefit of a signing community, used handshape to distinguish the gestures that served noun functions from those that served verb functions. Although David primarily used demonstrative pointing gestures to serve noun functions during his earliest observation sessions, the few iconic gestures he produced to serve noun functions had handshapes that highlighted static properties of the object (*object* handshapes). In contrast, during this period, the iconic gestures he produced to serve verb functions had handshapes that highlighted how the object was held as it was manipulated (*handling* handshapes). David thus used a different type of handshape in his noun gestures than in his verb gestures. Importantly, David treated iconic gestures serving two different noun functions in precisely the same way with respect to handshape — he used *object* handshapes in iconic gestures that serve a nominal predicate function (e.g., *that's a <u>bird</u>*), as well as in iconic gestures that serve a nominal argument function (e.g., *that <u>bird</u> pedals*). This pattern suggests that *noun* is an overarching category in David's homesign system — an important finding in itself.

However, after approximately age 3;5, David started to use both *handling* and *object* handshapes in his noun and verb iconic gestures, thus eliminating this distinctive feature as a marker of nouns vs. verbs in his homesign system. We discuss the significance of these findings with respect to two issues — the role that handshape type plays in distinguishing between nouns and verbs, and where David's individual homesign system fits within spontaneous, emerging, and established sign languages.

Using handshape type to distinguish nouns and verbs

Haviland (2013) found that signers of Z, a homesign system developed and shared within a family of deaf and hearing individuals in Mexico, use a variety of ways to distinguish nouns from verbs; that is, they have devices for individuating referents as arguments (nouns) that contrast with devices for predicating about those referents (verbs). One of these devices is handshape type — like David, Z signers tend to use gestures that represent some aspect of the object with the handshape for nouns, and gestures that represent some aspect of handling the object for verbs.

The data for Haviland's (2013) analyses of Z came from picture elicitations — the signers were shown pictures of static objects (designed to elicit object descriptions) and pictures of actions performed on those objects (designed to elicit action descriptions). The signs that the Z family members produced for object pictures appeared to function as nouns, and the signs they produced for action pictures appeared to function as verbs; however, to be certain of these grammatical functions, it would be important to see how the signs are used in a discourse that does not involve picture elicitation. In contrast, David's gestures came from spontaneous interactions in the home involving daily activities and play with toys and books, and were selected for analysis on the basis of the discourse functions they served — nouns were coded when David used a gesture to denote the focus of the discourse; verbs were coded when he used a gesture to comment on the actions of the topic, as described in Goldin-Meadow et al. (1994). Not surprisingly, most of David's gestures that were coded as nouns were labels for objects, and most of his gestures coded as verbs were labels for actions. The fact that David and the Z signers both arrived at the same handshape strategy for distinguishing nouns from verbs adds credence to the pattern, and suggests that it is not limited to a particular research paradigm.

Although type of handshape type can serve as a formal linguistic marker, Haviland (2013) hypothesizes that it may not be robust enough to bear the weight of a grammatical property like the noun-verb distinction. David's data provide evidence in support of this hypothesis. At age 3;5, David starts using *handling* handshapes not only for verbs but also for nouns, and *object* handshapes not only for nouns but also for verbs. What might be happening in David's homesign system at this point to explain this change?

There are two relevant developments that took place when David was 3;5. First, there was evidence for the first time that David's gestures could be broken into component parts, and that he was constructing new gestures by recombining those parts; in other words, that the stems of his gestures could be described in terms of a combinatorial morphological system (Goldin-Meadow, Mylander, & Butcher, 1995). Second, at 3;5 David began to systematically alter his gesture stems as a function of the discourse roles they served. He used abbreviation in his noun gestures (i.e., he produced the movement in a gesture fewer times when it served as a noun than when it served as a verb); and he used inflection in his verb gestures (i.e., he displaced verb gestures, but not noun gestures, to indicate a relevant argument, e.g., a twisting gesture would be produced near the jar when used as a verb to request that the jar be opened, but it would be produced in neutral space at chest level when used as a noun to identify the jar) (Goldin-Meadow et al., 1994). David had thus developed other means for marking the distinction between nouns and verbs and no longer needed to rely on type of handshape. As Haviland (2013)

suggests, a language system (apparently even a very young one) needs to make a distinction between nouns and verbs, but the way in which the distinction is made is likely to vary as a function of the complexity of the system.

Our goal was to explore whether handshape type is used to mark the distinction between nouns and verbs not only in homesign systems constructed within a family of deaf individuals (the Z family where signers are both producers and receivers of the system they use), but also in a homesign system constructed by a single deaf child in a hearing family. This child produced gestures that have linguistic structure, but received in return co-speech gestures that are structured in relation to the speech they accompany (Goldin-Meadow, 2003). Nevertheless, the child was able to use handshape type systematically to distinguish between nouns and verbs. But other linguistic properties may be less robust — in order for these properties to appear in a linguistic system, the signer may have to be both producer and receiver of the system. Future work comparing David's homesigns to those constructed by the Z family will allow us to explore this possibility.

Situating homesign within other languages in the manual modality

We can use the data gathered by Padden and colleagues (2013) to situate David's homesign system on a continuum bounded, at one end, by the gestures hearing speakers produce when asked not to talk (silent gesturers) and, at the other, by the signs produced by users of an established sign language. Padden and colleagues looked at how objects are labeled by three groups: silent gesturers (in the US and in a Bedouin community in Israel); ABSL signers (an emerging sign language in the same Bedouin community); signers of American Sign Language (ASL) and New Zealand Sign Language (NZSL). Each of the participants was presented with pictures of static hand-held objects (e.g., a mop, a broom, pairs of pants, a nail file) and asked to indicate what the object was. The participants were not asked to label action pictures so we focus here only on David's noun gestures for comparison.

Spontaneous silent gesture. Padden and colleagues (2013) found that hearing adults in both the US and in a Bedouin community were more likely to label objects with *handling* handshapes than with *object* handshapes, a pattern that is different from the one David displayed early in development. David's pattern may differ from the silent gesturers' simply because he is a child and the silent gesturers were all adults. In fact, children in the United States (Overton & Jackson, 1973; Boyatzis & Watson, 1993; O'Reilly, 1995), as well as adults who are aphasic (Goodglass & Kaplan, 1963), have been found to rely on *object* handshapes when responding to pictures of objects and thus seem to show the same pattern as David (and not the hearing adults). But the hearing children (and the aphasic adults) may not be interpreting the task in the same way as David and the hearing adults

in Padden et al.'s study; in particular, they may not be interpreting the task as a request for a symbol — they may instead be interpreting the task as a request to actually do the action. In many instances, the children seem to use their gestures as actual implements rather than as symbols; for example, they run their fingers through their hair in response to a picture of a comb, thus using their fingers to actually comb their hair rather than to stand for a comb. Importantly, we did not consider movements that had a direct effect on the world to be gestures. As a result, none of David's gestures containing *object* handshapes was produced directly on the relevant entity; they thus functioned as symbols rather than actions on actual objects. In addition, there were methodological differences between Padden et al.'s study and the previous studies of hearing children, who were asked to show how the pictured object is used; the hearing adults in Padden et al.'s study were asked to use their hands to indicate what the object is. It would be useful to replicate the child studies in order to determine whether hearing children resemble hearing adults when tested with Padden et al.'s protocol.

Another possibility, more in line with Padden et al.'s (2013) views, is that David's pattern differs from the silent gesturers' because, unlike the adults who are fashioning their gestures on the spot, David has constructed a language over time and uses it routinely to communicate. This second view is supported by the fact that the handshape types David used in his early noun gestures are comparable to those produced by ABSL signers.

Emerging sign language. Padden and colleagues (2013) found that, unlike hearing gesturers who prefer handshapes that highlight how an object is held when labeling objects, signers of ABSL, an emerging language, prefer handshapes that highlight characteristics of the object itself. This is a particularly striking fact given that the hearing gesturers were from the same Bedouin community and performed precisely the same task as the ABSL signers. We might have expected that the hearing members of the community would produce the same types of gestures as the deaf members.

In his early observation sessions, David resembles the ABSL signers and not the hearing gesturers in that before age 3;5 only 19% of the 27 noun gestures he produces have handshapes that represent how an object is held (i.e., *handling* handshapes); the comparable number is 23% for the ABSL signers, but 73% and 83% for the Bedouin and American hearing gesturers, respectively. Like the ABSL signers, a majority of the noun gestures David produces during the early years have handshapes that represent characteristics of the object itself — 59% of his noun gestures; the comparable number is 82% for the ABSL signers, and 28% and 17% for the Bedouin and American hearing gesturers, respectively. It is important to point out, however, that our *object* handshape category is a composite of two of Padden et al.'s categories — their *object* handshape category (handshapes which

capture the size and shape features of an object without movement), and their *instrumental* handshape category (handshapes which capture not only a static feature of the object but also a movement performed with the object). Interestingly, only 1 of the 16 *object* handshapes David produced in his nouns before 3;5 contained motion — the remaining 15 all conveyed information about the size and shape of the object but not about the motion typically performed with the object (i.e., they were comparable to Padden et al.'s *object* handshapes). After age 3;5, approximately half of the 52 *object* handshapes David produced contained movement, and half did not (i.e., they were equally split between Padden et al.'s *object* and *instrumental* categories). Thus, in his early sessions, David shared with the ABSL signers a bias to represent characteristics of the object in his noun gestures, but differed from them in that he did not include motion as one of the characteristics. Later (after age 3;5) when David did include motion as one of the object characteristics he incorporated into his *object* handshapes, he no longer displayed a bias toward highlighting object characteristics.

David's data suggest that it is possible for a sign system to highlight characteristics of the object (rather than the way the object is held) in its earliest noun handshapes. Note that if the gestures that the Bedouin hearing individuals produced (which were primarily handling handshapes) had served as a starting point for ABSL, there would had to have been a moment of reorganization during which object-focused handshapes, rather than handling-focused handshapes, became the norm for noun gestures. David's data provide indirect evidence that the gestures produced by the Bedouin hearing speakers may not have served as the starting point for the ABSL signers' noun handshapes — the signers' labels for objects may have highlighted object characteristics from the beginning.

Established sign language. The two established sign languages that Padden et al. (2013) studied differ in the handshapes they use for nouns. ASL signers prefer *object* handshapes in their nouns, whereas NZSL signers prefer *handling* handshapes. The question is why.

David's data may offer hints that can help us understand this pattern. As mentioned earlier, prior to age 3;5, 59% (N=27) of David's noun gestures contained *object* handshapes. After 3;5, only 16% (N=330) of his noun gestures contained *object* handshapes (63% contained *handling* handshapes; the rest were *neutral* and *conventional*). In other words, before age 3;5, the age at which he developed other devices for distinguishing between nouns and verbs, David's pattern resembled ASL; after it, his pattern was closer to NZSL.

Examining how handshape is used in *verbs* in ASL and NZSL might help to put these findings in perspective. Extrapolating from David's and the Z family's data, we might guess that *handling* handshapes would be the norm in verbs in both ASL and NZSL. If so, it is possible that NZSL has developed a number of other ways to

distinguish between nouns and verbs besides type of handshape, more ways than are found in ASL. This is a testable prediction that awaits future research.

Conclusion

We have examined handshape type in the nouns and verbs produced by a deaf child who uses homesign but does not receive it — he produces gestures that have linguistic structure, but receives from his hearing parents co-speech gestures that are structured only when analyzed in relation to speech (which he cannot hear). We found that, despite the fact that his system is not shared, the homesigner systematically uses type of handshape to distinguish nouns from verbs at the earliest stages of development — he uses *object* handshapes in noun gestures and *handling* gestures in verb gestures. But at age 3;5 the homesigner abandons this device for distinguishing nouns from verbs (he begins to produce *object* handshapes in verb gestures as often as he produces them in noun gestures, and *handling* handshapes in noun gestures as often as he produces them in verb gestures). Age 3;5 is the point in development when the homesigner first introduced combinatorial morphological structure into his gestures (Goldin-Meadow et al., 1995) and began to use morphological devices that distinguished between nouns and verbs (Goldin-Meadow et al., 1994). Our findings thus reinforce the notion that the noun-verb distinction is fundamental to language and will appear in a language (no matter how young), and that the way in which this distinction is marked depends on the full array of linguistic devices available within the system.

Acknowledgements

Notes

1. Padden and colleagues (this volume) elicit signs by presenting their participants with pictures of objects. Since the focus of a discourse tends to be objects (rather than events), the forms elicited in this paradigm are likely to be the forms that fill noun roles in sentences. Haviland (this volume) also uses pictures to elicit signs, but those pictures depict objects in action contexts and thus might be filling either a noun or a verb role.

2. In addition to the gestures shown in Table 1, David produced another 166 gestures that functioned as adjectives (see Goldin-Meadow et al., 1994); his adjective gestures did not increase in rate over time and accounted for 4% of all gestures. Because our goal was to explore handshape in gestures functioning as nouns vs. verbs, these adjective gestures are not included in our analyses. In addition, because our goal was to examine the distribution of *handling* vs. *object* handshapes in noun and verb contexts, we focused on gestures for actions performed on entities (i.e., transitive gestures, which can be portrayed using either a *handling* or an *object* handshape) and eliminated gestures for actions in which there was no entity (i.e., intransitive gestures, which do not elicit *handling* handshapes); 194 intransitive gestures were thus excluded.

3. For example, David produced a *belt* gesture in which his hands followed the contours of the belt on his waist, which could either depict how the belt is held when it is put around the waist, or the shape of the belt as it sits around the waist (note that the movement would also be the same in both cases). As a result, we were unable to determine whether David was using a handling handshape or an object handshape to represent the belt. We excluded ambiguous gestures of this sort from the data set.

References

Aronoff, Mark, Irit Meir, Carol Padden, & Wendy Sandler (2004). Morphological universals and the sign langauge type. In Geert Booij & Jaap van Marle (Eds.), *Yearbook of morphology* (pp. 19–39). Berlin: Springer Netherland.

Boyatzis, Chris J. & Malcolm W. Watson (1993). Preschool children's symbolic representation of objects through gestures. *Child Development*, 64, 729–735. DOI: 10.2307/1131214

Butcher, Cynthia, Carolyn Mylander, & Susan Goldin-Meadow (1991). Displaced communication in a self-styled gesture system: Pointing at the nonpresent. *Cognitive Development*, 6, 315–342. DOI: 10.1016/0885-2014(91)90042-C

Feldman, Heidi M., Susan Goldin-Meadow, & Lila R. Gleitman (1978). Beyond Herodotus: The creation of language by linguistically deprived deaf children. In Andrew Lock (Ed.), *Action, symbol, and gesture: The emergence of language* (pp. 351–414). New York: Academic Press.

Franklin, Amy, Anastasia Giannakidou, & Susan Goldin-Meadow (2011a). Negation as structure building in a home sign system. In Etsuyo Yuasa, Tista Bagchi, & Katharine Beals (Eds.), *Pragmatics and autolexical grammar. In honor of Jerry Sadock* (pp. 261–278). Amsterdam: John Benjamins. DOI: 10.1075/la.176.16fra

Franklin, Amy, Giannakidou, Anastasia, & Goldin-Meadow, Susan (2011b). Negation, questions, and structure building in a home sign system. *Cognition*, 118 (3), 398–416. DOI: 10.1016/j.cognition.2010.08.017

Givon, Talmy (1979). *On understanding grammar*. New York: Academic Press.

Goldin-Meadow, Susan (2003). *The resilience of language: What gesture creating in deaf children can tell us about how all children learn language*. New York: Psychology Press.

Goldin-Meadow, Susan & Carolyn Mylander (1984). *Gestural communication in deaf children: The effects and noneffects of parental input on early language development*. With commentaries by Jill de Villiers, Elizabeth Bates, & Virginia Volterra. And reply by the authors. Chicago, IL: University of Chicago Press (*Monographs of the Society for Research in Child Development*, 49 [3/4]).

Goldin-Meadow, Susan, Cynthia Butcher, Carolyn Mylander, & Mark Dodge (1994). Nouns and verbs in a self-styled gesture system: What's in a name? *Cognitive Psychology*, 27, 259–319. DOI: 10.1006/cogp.1994.1018

Goldin-Meadow, Susan, Carolyn Mylander, & Cynthia Butcher (1995). The resilience of combinatorial structure at the word level: Morphology in self-styled gesture systems. *Cognition*, 56, 195–262. DOI: 10.1016/0010-0277(95)00662-I

Goldin-Meadow, Susan, David McNeill, & Jenny L. Singleton (1996). Silence is liberating: Removing the handcuffs on grammatical expression in the manual modality. *Psychological Review*, 103, 34–55. DOI: 10.1037/0033-295X.103.1.34

Goodglass, Harold & Edith Kaplan (1963). Disturbance of gesture and pantomime in aphasia. *Brain*, 86 (4), 703–720. DOI: 10.1093/brain/86.4.703

Haviland, John B. (2013). The emerging grammar of nouns in a first generation sign language: specification, iconicity, and syntax. *Gesture*, 13 (3), 309–353.

Hawkins, John A. (1988). Explaining language universals. In John A. Hawkins (Ed.), *Explaining language universals* (pp. 3–28). Cambridge, MA: Basil Blackwell.

Hopper, Paul J. & Sandra A. Thompson (1984). The iconicity of the universal categories 'noun' and 'verb'. In John Haiman (ed), *Iconicity in syntax* (pp. 151–183). Amsterdam: John Benjamins.

Hopper, Paul J. & Sandra A. Thompson (1988). The discourse basis for lexical categories in universal grammar. *Language*, 60 (4), 703–752. DOI: 10.1353/lan.1984.0020

Hunsicker, Dea & Susan Goldin-Meadow (2012). Hierarchical structure in a self-created communication system: Building nominal constituents in homesign. *Language*, 88 (4), 732–763. DOI: 10.1353/lan.2012.0092

O'Reilly, Anne W. (1995). Using representations: Comprehension and production of actions with imagined objects. *Child Development*, 66, 999–1010. DOI: 10.2307/1131794

Overton, Wilis F. & Joseph P. Jackson (1973). The representation of imagined objects in action sequences: A developmental study. *Child Development*, 44, 309–314. DOI: 10.2307/1128052

Padden, Carol, Irit Meir, So-One Hwang, Ryan Lepic, Sharon Seegers, & Tory Sampson (2013). Patterned iconicity in sign language lexicons. *Gesture*, 13 (3), 287–308.

Robins, Robert H. (1952). Noun and verb in universal grammar. *Language*, 28 (3), 289–298. DOI: 10.2307/410101

Sandler, Wendy, Irit Meir, Carol Padden, & Mark Aronoff (2005). The emergence of grammar: Systematic structure in a new language. *Proceedings of the National Academy of Sciences of the United States of America*, 102, 2661–2665.

Sapir, Edward (1921). *Language: An introduction to the study of speech*. New York: Harcourt, Brace & Co.

Schachter, Paul (1985). Parts-of-speech systems. In Timothy Shopen (Ed.), *Language typology and syntactic description. Vol. 1: Clause structure* (pp. 3–61). Cambridge, MA: Cambridge University Press.

Senghas, Ann (2005). Language emergence: Clues from a new Bedouin sign language. *Current Biology*, 15 (12), 463–465. DOI: 10.1016/j.cub.2005.06.018

Supalla, Ted & Elissa L. Newport (1978). How many seats in a chair? The derivation of nouns and verbs in American sign language. In Patricia Siple (Ed.), *Understanding language through sign language research* (pp. 91–132). New York: Academic Press.

Thompson, Sandra A. (1988). A discourse approach to the cross-linguistic category 'adjective'. In John A. Hawkins (Ed.), *Explaining language universals* (pp. 167–185). Cambridge, MA: Basil Blackwell.

Tkachman, Oksana & Wendy Sandler (2013). The noun-verb distinction in two young sign languages. *Gesture*, 13 (3), 253–286.

Waxman, Sandra R., Ann Senghas, & Susana Benveniste (1997). A cross-linguistic examination of the noun-category bias: Its existence and specificity in French- and Spanish-speaking preschool-aged children. *Cognitive Psychology*, 32, 183–218. DOI: 10.1006/cogp.1997.0650

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