

Abstract and Object-Anchored Deixis: Pointing and Spatial Layout in Adult Homesign Systems in Nicaragua

Marie Coppola and Wing Chee So
University of Chicago

Pointing is universal and ubiquitous. Kita (2003) notes “Pointing is a foundational building block of human communication.” He refers to language in all modalities, but his statement applies even more strongly to the manual modality, which exploits pointing for myriad grammatical functions (e.g., pronouns and anaphora, verb agreement (Wilbur, 1987)). This paper begins to address how points become transformed from everyday accompaniments to speech into indispensable spatial grammatical units in sign languages. The roots of sign language structure lie in homesign systems, which themselves exploit the spatial properties of the gestures accompanying speech (Newport & Supalla 2001).

Nicaragua, a country with a new sign language and a rich gesture culture, provides an excellent opportunity to investigate language creation at the individual and community levels. While researchers are currently observing the changes and development of Nicaraguan Sign Language (NSL) (Senghas 1995a,b; Senghas & Coppola 2001; Senghas 2003), its very early stages remain a mystery.¹ What seeds did the first creators of NSL contribute to its birth?

The four homesigners in the current study vary in age and are similar in experience to the deaf people who first came together in Managua to form the deaf community and create NSL. In this paper we examine the uses of space and pointing of adult *homesigners* in Nicaragua, who have used an idiosyncratic gestural communication system with their families all their lives, and who have not acquired any other language, either spoken or signed. Our questions are directed towards understanding language creation at the community and individual levels: (1) What were the raw materials available to the initial creators of NSL; and (2) What kinds of spatial and deictic devices can be invented without the benefit of conventional language input or a signing community?

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1. The language and community likely emerged in the late 1970s; documentation began in 1986 (Kegl & Iwata 1989).

1. Homesign systems as the seeds of language

Before the late 1970s, deaf Nicaraguans had extremely limited opportunities for contact. Marriage laws prohibited deaf people from marrying each other, so there were no deaf families, and deaf individuals' social lives revolved around their hearing families and neighbors. At that time, no deaf community or sign language existed. Deaf children (in Nicaragua and elsewhere) who cannot acquire spoken language due to their deafness, and who are not exposed to a sign language, will nonetheless gesture with their family and friends, creating idiosyncratic gestural communication systems called "homesign" (Goldin-Meadow 2003b; Coppola 2002; for a review see Morford, 1996).

In the late 1970s the deaf population at two schools for special education in Managua increased dramatically. By 1981, these schools served 200 deaf students (Polich 1998), and they served as a catalyst for the formation of the deaf community and the creation of the sign language. The teachers at the schools did not know any sign language, and they taught in spoken Spanish. Nevertheless, the First Cohort² of children (who entered school in or before 1983) began gesturing with each other on the school grounds and on the buses. They soon began to converge on a common system, which served as the input to students who entered the school after them. Second Cohort signers (who entered the school after 1983) learned the new sign language from their older peers by watching them and interacting with them. Over time, Nicaraguan Sign Language has been learned and passed down through successive cohorts of children, who have systematized and enriched its structure (Senghas & Coppola 2001; Senghas 2003; Senghas et al. 2004).

In terms of their communicative experiences and lack of exposure to a conventional sign language, the four homesigners participating in this study are very similar to the deaf individuals of the First Cohort *at the time of their arrival* at the school. Thus, these homesigners represent the first creators of NSL, and examining the devices and structure present in their homesign systems will shed light on the raw materials available in the language's very early stages. Using a specially designed elicitation task, we first ask whether homesigners use a consistent spatial layout in describing events; we then explore the other devices homesigners produced in their responses.

2. Using space for language

Sign languages universally use space for grammatical functions, but the specifics vary from language to language (Padden 1983; Supalla 1982). For example, across sign languages (as well as spoken languages), verbs with the same meaning may fall into different classes regarding whether subject and

2. First and Second Cohort are arbitrary classifications of signers depending on their year of entry into the signing community; 1983 reflects the median year of entry for subjects in Senghas & Coppola 2001.

object agreement are obligatory, optional, or prohibited (Supalla 1995). Agreement morphology is expressed using spatial modulations, which are movements to or from meaningful spatial locations. For example, in American Sign Language (ASL), the sentence “He gave it to her” can be expressed as a movement from one spatial location (associated with the giver) to another spatial location (associated with the receiver). The actual physical locations of these meaningful spaces are unimportant; what is important for the grammatical device marking subject and object is that the verb always move *from* the subject and *towards* the object. In addition to subject and object agreement, spatial modulations can mark person, number, deictic, locative, and temporal information (Fischer 1973; Klima & Bellugi 1979; Padden 1988).

Using space linguistically requires a consistent pairing of spatial form and meaning. As in the ASL example above, we are not interested in the absolute direction of the verb’s movement, but rather in the degree of consistency within a subject, as well as across groups of subjects, in the linking of direction and grammatical role. Unlike the ASL example, the spatial modulations discussed in the first analysis are not movements to and from arbitrary locations, but movements from the signer’s body towards the right or towards the left. Thus, in the present case, we can ask whether a signer uses a consistent spatial layout to link arguments and roles. In our first analysis, we ask whether the direction of a verb’s movement reliably indicates its arguments.

Note that in a young sign language like Nicaraguan Sign Language, that may not already have a rich spatial agreement system and word order regularities redundantly marking grammatical roles, the systematic use of spatial modulations may be especially important. When other spatial and discourse devices are not available or not robust, spatial modulation must carry the full burden of indicating grammatical roles. Signers of older sign languages (such as ASL) have a range of devices at their disposal; they are therefore free to vary and adapt their use of spatial layouts depending on factors such as discourse situation and the position of their interlocutor (Emmorey 2003).

The homesigners in the current study are similar to the signers of the First Cohort *before* they began to interact with each other. Thus, in terms of spatial layout, we predict that homesigners will resemble First Cohort signers. Because the homesigners have not met each other and are not part of a signing community, we might expect that: (1) they will look less similar to each other than do the members of the First and Second Cohorts, who are part of a signing community; and (2) the homesigners may be more likely to produce idiosyncratic devices that are typically not found in sign languages.

3. Method

3.1. Subjects

The subjects were four Nicaraguan homesigners tested at 14, 18, 23, and 26 years of age. The youngest three are male and the oldest is female. They do not know each other. They are all congenitally and profoundly deaf and have not acquired either a spoken language (due to their deafness) or a conventional

community sign language (due to their lack of contact with one).³ Their production and comprehension of Spanish is extremely limited. They rarely vocalize, and only produce a few words (e.g., *mamá*, *papá*). They do not comprehend common words (e.g., *tortilla*) and cannot read. They have had little or no formal education and have not received hearing aids or oral instruction.

None knows NSL, the language of the Deaf community centered in Managua, the capital. Each homesigner communicates using a gesture system developed within his or her family. Their hearing family members gesture with them with varying degrees of proficiency. Each homesigner has at least one person (a sibling, friend, or parent) who is fairly fluent in his or her system. They have each been using their homesign systems as their primary means of communication for their entire lives.

3.2. Stimuli

The materials were 40 short video clips about 2 s in duration that depicted simple events enacted by a man and two women seated at a table, who remained in the same positions throughout the task. The task was administered in two counterbalanced subsets of 20 items each. (The materials are identical to those used with NSL signers in Senghas et al. (1997).)

Table 1: Stimulus event types and examples.

Event type	Example
1 human argument	Man choke
1 human argument + 1 inanimate argument	Woman tap cup
2 human arguments	Man tap woman
2 human arguments + 1 inanimate argument	Woman give cup to man

3.3. Procedure

We showed each subject the events one at a time on a laptop computer, and asked him or her to describe the event to a partner. Participants could re-watch the vignette as often as they liked. Each subject's partner was one of his or her main communication partners in everyday life. Mothers acted as partners for

3. Homesigners 1 and 4 have never met any users of NSL. Between ages 17 and 20, Homesigner 2 attended a small deaf school outside Managua, in which only the teachers were fluent in NSL, for a total of 6 months. He acquired some NSL lexical items; otherwise his signing structure appears unchanged from his last pre-contact session. In his daily life, he does not have any NSL conversation partners and has no opportunity to use NSL. Homesigner 3 (tested at age 23) has visited the Deaf association in Managua sporadically since he was 18, but has not acquired even basic lexical items. This study forms part of an extensive longitudinal project (1996-2004) analyzing the structure of homesign systems; work began with Homesigners 2 and 3 before their limited contact with NSL.

Homesigners 1 and 3; Homesigner 2's partner was his brother, and Homesigner 4 signed to her sister.⁴ All responses were videotaped and transcribed.

3.4. Coding

A subject's first response was analyzed, unless a subsequent response included more information about the stimulus event (such as identifying more referents). Responses were segmented into utterances based on prosodic features in the manual modality (Sandler 1999). Gestures were considered *spatially modulated* if they were produced in a non-neutral location (i.e., away from the chest area) or if they incorporated non-neutral locations into their movements. Gestures produced at the chest area in neutral space or on the body were not considered to be spatially modulated. Spatially modulated gestures were further coded with respect to spatial layout.

Figure 1 shows an example stimulus item in which a woman gives a cup to a man on the left side of the screen. In this example, the man takes the role of recipient. Two possibilities exist for encoding this event spatially; we are calling these spatial layouts *rotated* and *unrotated*. Consider this example item, in which a subject saw a movement to the left of the screen. If that subject then also moved his verb to his left, that spatial modulation would be coded as reflecting an unrotated layout. "*Unrotated*" refers solely to the fact that the subject saw a *give* event that moved toward the left, and then also produced a verb with a movement to his left. In contrast, if a subject responded to this stimulus event by moving the verb to his right, it would be coded as a rotated layout (as shown in the diagram).

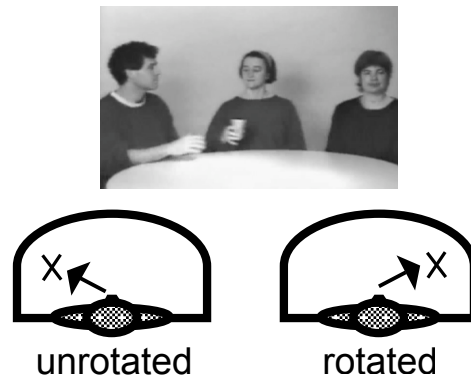


Figure 1. Example stimulus item and spatial modulation coding scheme (from Senghas 2003). The diagrams show the signer viewed from above; the arrows indicate the movement of the verb produced by the signer.

4. NSL signers signed to Deaf, signing peers who sat several feet away (Senghas et al. 1997). In contrast, the communication partners of homesigners sat next to them, which may have facilitated their use of some deictic devices.

Note that this terminology is purely descriptive; it does not label one layout as a default, and it is not intended to reflect the subject's processing of the event. Our goal in categorizing the spatial layouts used by signers is merely to determine whether they consistently link the direction of their spatial modulation with the role that a character holds in the stimulus event.

3.5. Previous results from First and Second Cohort signers of NSL

Studies of First and Second Cohort signers of NSL have found striking differences in the consistency of use of spatial layouts (Senghas et al. 1997; in prep). In Analysis 1 we will directly compare the spatial modulations produced by Nicaraguan homesigners with First and Second Cohort signers of NSL.

Figure 2 shows, for each First Cohort subject (represented by a number on the x-axis), the percentage of items reflecting a rotated, unrotated or mixed (both rotated and unrotated) spatial layout. First Cohort signers produced spatial modulations reflecting a range of spatial layouts both within and across subjects. While some subjects (1, 3, 4, 5, 6, and 8) preferred one spatial layout over another, this preference was not shown by every subject, nor was it uniform across subjects (3 preferred a rotated layout and 3 preferred an unrotated layout).

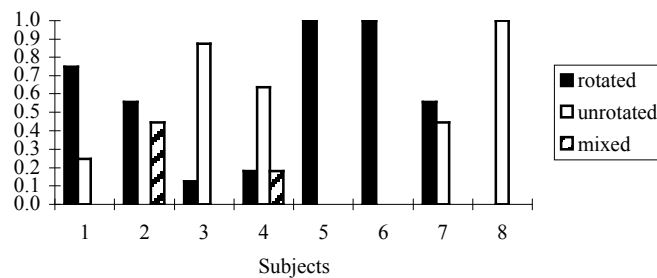


Figure 2. The proportion of spatial modulations produced by First Cohort signers of Nicaraguan Sign Language reflecting a rotated, unrotated, or mixed spatial layout (data from Senghas et al. 1997; in prep).

Second Cohort signers, however, were more consistent within and across themselves in their use of spatial layout (Figure 3). Seven of 8 Second Cohort signers overwhelmingly preferred a rotated layout to an unrotated one (and in fact produced no spatial modulations corresponding to an unrotated layout). That is, when they saw an event in which the action moved to the left, towards the patient, they always moved their verb toward the right. In contrast to First Cohort signers, the spatial modulations of Second Cohort signers reliably predict the roles of the characters in the event.

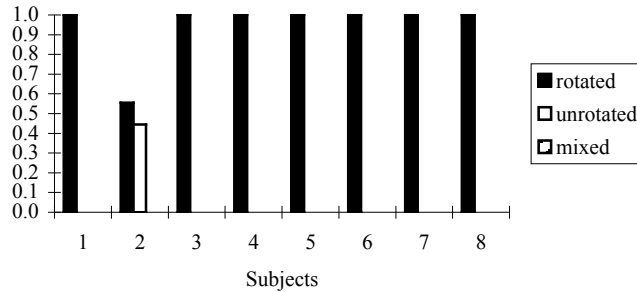


Figure 3. The proportion of spatial modulations produced by Second Cohort signers of Nicaraguan Sign Language reflecting a rotated, unrotated, or mixed spatial layout (data from Senghas et al. 1997; in prep).

4. Analysis 1: Spatial modulations (Comparison to Senghas et al. 1997)

The homesigners' data were coded as described above for First and Second Cohort signers. As in that study, we analyzed the 24 stimulus items containing an event that involved two characters (e.g., 'man tap woman' or 'woman give cup to man').

All 4 homesigners showed a preference (to varying degrees) for one spatial layout (Figure 4). Homesigners 1 and 2, and to a lesser extent, Homesigner 3, preferred an unrotated layout. Homesigner 4 produced responses consistent with a rotated layout. Recall that it is the degree of consistency in the use of a particular layout, and not the specific layout itself, that reflects the layout's usefulness for marking semantic roles. Further, because the four homesigners in this study do not know each other and do not interact with each other (unlike First and Second Cohort signers), we do not expect uniformity across subjects. As predicted, Homesigners resembled First Cohort signers in terms of their degree of consistency using a given spatial layout, as well as in the heterogeneity of layouts produced across the subjects (see Figure 2).

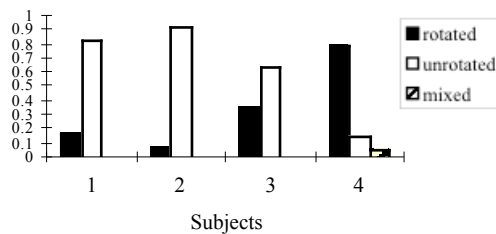


Figure 4. The proportion of spatial modulations produced by Homesigning subjects reflecting a rotated, unrotated, or mixed spatial layout.

5. Analysis 2: Points

In addition to spatial modulations, we observed that Homesigners used other types of spatial devices in their responses. Analysis 2 examined the use of different types of deictic devices used to refer to arguments and express semantic relations. Responses to all 40 stimulus items were included. All points were noted and classified into two categories: directed towards an empty spatial location (Abstract Deixis) or to a real-world object (Object-Anchored Deixis, abbreviated OAD). An example of Abstract Deixis would be a point to the subject's right followed by a gesture for 'man' which would associate that location on the right with the man in the event. Object-Anchored Deixis included points to a real person (which is more specifically called person-anchored deixis) or to fingers (more specifically, finger-anchored deixis). In person-anchored deixis, a subject could associate their communication partner (male or female) with a woman in the video by producing a point to the partner followed by the gesture for 'woman'. In an analogous way, finger-anchored deixis associates a finger on the opposite hand with a character in the event.

The referents of points were determined in one of two ways. One way is to use the subject's explicit association of the person, finger, or spatial location picked out by the point with a character in the stimulus event (e.g., a point at the homesigner's partner followed by a gesture for 'man'). Another way of determining the referent of a point is to use the spatial layout set up by the subject, that is, the correspondence of the spatial modulation on a verb with the stimulus item. For example, any points at the person toward whom the homesigner modulated a sign for push would be interpreted as referring to the person playing the patient role in the stimulus event.

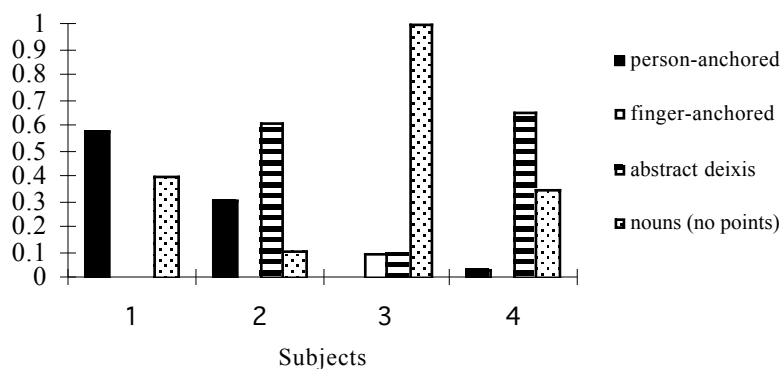


Figure 5. The proportion of Object-Anchored and Abstract deictic devices produced by Homesigners. (Object-Anchored deictics include person- and finger-anchored points. Nouns shown here were produced without points.)

6. Individual Patterns of Combining Devices to Indicate Roles

The Homesigners' performance on this task is remarkably structured given their lack of contact with a conventional language. Each Homesigner solved the problem of indicating semantic roles by using diverse combinations of spatial modulations, deictic devices, and nouns. Two homesigners who used Abstract Deixis varied in exactly how they used it.

Homesigner 1 strongly preferred an unrotated layout in his responses. Of the homesigners, he most often used Person-Anchored points (to himself or to his communication partner) to identify the roles of participants in events. While he did produce overt nouns in combination with points to his communication partner, his consistent use of an unrotated layout made it unnecessary to explicitly identify the participants on every item.

Homesigner 2 also preferred an unrotated layout. Despite this highly consistent spatial layout, he also used both Abstract and person-anchored deixis to identify the roles of participants in events. His abstract points were usually toward a position just beyond his communication partner, and referred to the third character in the event (the woman seated at the end of the table). Like Homesigner 1, his highly consistent use of spatial layout obviated the need to explicitly identify participants with nouns (produced on only 10% of items).

Homesigner 3 displayed the most inconsistent use of spatial layout based on lateral spatial modulations. He is also the only subject who used finger-anchored deixis,⁵ in which he associated the fingers of one hand with participants in the event by pointing to each finger and producing a noun to identify it. He then moved verbs through space (albeit a very small space) with respect to those fingers. The spatial layout expressed via this unique system is 100% consistent – it simply does not use the type of side-to-side spatial modulation used by the other homesigners and NSL signers. Homesigner 3 also uses non-spatial devices (namely, word order, which was not analyzed in the current study) to encode semantic roles: He produced nouns in every response (Fig. 5); because they were produced without points, these nouns did not participate in a deictic device.

Homesigner 4 alone preferred a rotated layout. Like Homesigner 2, she frequently used Abstract Deixis in combination with nouns to identify referents. While Homesigner 2 pointed to an empty location next to his communication partner (to refer to the woman at the end of the table in the vignette), Homesigner 4 indexed arbitrary spatial locations.⁶ Though not included here, she also used finger-anchored deixis combined with nouns at the beginning of the task (during the practice items) to establish the relative positions of the

5. We note Homesigner 3's use of finger-anchored deixis, despite its infrequent occurrence in the present data, due to its uniqueness and its robustness in the overall corpus (in both elicited and spontaneous gesturing).

6. Homesigner 4's abstract deictics were ASL bent-B-handshapes; all other points produced by her and the other homesigners were typical 1-handshapes.

characters in the vignette and to identify them. She did not, however, continue using this device in her subsequent responses.

7. Discussion

Recall that these Homesigners, who have not been in contact with each other, represent First Cohort signers at the initial stages of the formation of the Nicaraguan Deaf community and Nicaraguan Sign Language. As predicted, Homesigners resemble First Cohort signers in their internal and across-group consistency in using spatial layout. While Homesigners' spatial layouts are more internally consistent than those of First Cohort signers, they lack the striking internal consistency shown by Second Cohort signers. (The Homesigners' lack of across-group consistency is unsurprising, given that they have not met.)

Each homesigner in the present study used a different combination of spatial modulation, pointing, and nouns to encode contrasts in semantic roles. These individual solutions to the problem of conveying who does what to whom span a range of possibilities, and likely reflect the raw materials that were available to the first group of Nicaraguan signers. Some of these solutions persisted in the early stages of NSL; some are found in other sign languages around the world; and some, like OAD, appear only in homesign systems.⁷

These results raise interesting questions about the origin and function of such deictic devices: Why do Homesigners use Object-Anchored Deixis? One possibility is that OAD helps other people understand them. Because their communication partners do not use homesign as their primary language, the "concreteness" of OAD may result from pressures to be understood. However, available evidence indicates that it does not in fact aid comprehension. When homesigners point to objects, and the intended referent is the object itself, hearing family members generally correctly interpret the point. However, family members are much less reliable in comprehending deictic devices in which a point associates an empty space or a person with some other referent (even when they have a pre-existing spatial layout to fall back on and are familiar with the task) (Coppola, unpublished data). Thus, it appears not to be the pointing that is difficult, but the conceptualization of space as grammatically meaningful.

A second reason to use OAD is that anchoring referents in the physical world may help homesigners understand and express themselves. Gesturing facilitates performance in tasks executed under a cognitive load (Goldin-Meadow 2003a). The cognitive load imposed by inventing your own language

7. Children acquiring a sign language produce person-anchored deictics (Hoffmeister 1978b; Lillo-Martin personal communication); this is unsurprising given their difficulty in maintaining the association of abstract spatial locations with referents (Newport & Meier 1985). Finger-anchored deixis is occasionally used in "listing" expressions in sign languages; however, in such forms, fingers generally do not take on the agent role and/or move with respect to other fingers, as observed in Homesigner 3's usage.

system, and communicating every day with people who do not share it, is likely great. This issue could be explored by further studies on the automaticity of homesign devices, which could also illuminate their linguistic status.

Another question raised by these results is why NSL signers do not appear to use OAD. The first answer is that maybe they do -- Ann Senghas has informally observed NSL signers using OAD. While OAD has not yet been investigated systematically, the signers who use it tend to be those who do not use a consistent spatial layout. Recall that the communication partners of NSL signers sat far away, and were not easy targets of spatial modulations and points, while the experimenter sat next to the subject in order to present the stimuli. Senghas notes that NSL signers did occasionally produce signs and points towards the experimenter, but did not point to the experimenter and assign her a role in the event, as in person-anchored deixis. Ongoing analyses are systematically investigating the word orders used in conjunction with deictic devices by homesigners (Coppola et al. in prep) as well as consecutive cohorts of Nicaraguan signers (Senghas et al. in prep).

The present study focused on two types of expressions: the consistent use of spatial layout and the combination of deictic devices (pointing) and spatial modulation on verbs. In accord with previous research conducted with child and adult homesigners (Goldin-Meadow 2003b; Coppola 2002; Coppola et al. 1997), the homesigners in the present study produced consistent, language-like patterns that were not modeled in their input. All 4 homesigners used consistent spatial layouts, and two of the four specified abstract locations in space and identified them with elements in the discourse, as do established sign languages. The consistent modulation of verbs, as well as production of Object-Anchored and Abstract Deictic devices, therefore do not appear to require conventional language input, a long period of time, or a community of users to develop. In the context of a newly formed signing community, such as the one in Managua in the late 1970s, these expressions likely formed the basis for grammatical devices marking semantic relations in the course of language genesis.

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