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26. Homesign: gesture to language

1. Introduction: What is homesign?
2. The properties of homesign
3. The input to homesign
4. From co-speech gesture to homesign
5. Literature

Abstract

Deaf children whose hearing losses are so severe that they cannot acquire the spoken language that surrounds them and whose hearing parents have not exposed them to sign language lack a usable model for language. If a language model is essential to activate whatever skills children bring to language-learning, deaf children in these circumstances ought not communicate in language-like ways. It turns out, however, that these children

do communicate and they use their hands to do so. They invent gesture systems, called “homesigns”, that have many of the properties of natural language. The chapter begins by describing properties of language that have been identified in homesign – the fact that it has a stable lexicon, has both morphological and syntactic structure, and is used for many of the functions language serves. Although homesigners are not exposed to a conventional sign language, they do see the gestures that their hearing parents produce when they talk. The second section argues that these gestures do not serve as a full-blown model for the linguistic properties found in homesign. The final section then explores how deaf children transform the gestural input they receive from their hearing parents into homesign.

1. Introduction: What is homesign?

Deaf children born to deaf parents and exposed to sign language from birth learn that language as naturally as hearing children learn the spoken language to which they are exposed (Lillo-Martin 1999; Newport/Meier 1985; see also chapter 28 on acquisition). Children who lack the ability to hear thus have no deficits whatsoever when it comes to language learning and will exercise their language learning skills if exposed to usable linguistic input. However, most deaf children are born, not to deaf parents, but to hearing parents who are unlikely to know a conventional sign language. If the children’s hearing losses are severe, the children are typically unable to learn the spoken language that their parents use with them, even when given hearing aids and intensive instruction. If, in addition, the children’s hearing parents do not choose to expose them to sign language, the children are in the unusual position of lacking usable input from a conventional language. Their language-learning skills are intact, but they have no language to apply those skills to.

What should we expect from children in this situation? A language model might be essential to activate whatever skills children bring to language-learning. If so, deaf children born to hearing parents and not exposed to conventional sign language ought not communicate in language-like ways. If, however, a language model is not necessary to catalyze a child’s language-learning, these deaf children might be able to communicate and might do so in language-like ways. If so, we should be able to get a clear picture of the skills that children, deaf or hearing, bring to language-learning from the communication systems that deaf children develop in the absence of a conventional language model. This chapter describes the home-made communication systems, called ‘homesigns’, that deaf children develop when not exposed to a usable model for language.

Homesign systems arise when a deaf child is unable to acquire spoken language and is not exposed to sign language. A defining feature of the homesign systems described in this chapter is that they are not shared in the way that conventional communication systems are shared. The deaf children produce gestures to communicate with the hearing individuals in their homes. But the children’s hearing parents are committed to teaching their children to talk and use speech whenever communicating with them. The parents gesture, of course, as do all hearing speakers (McNeill 1992; Goldin-Meadow 2003a), but only when they talk. Their gestures form an integrated system

with the speech they produce (see chapter 27 for details) and thus are not free to take on the properties of the deaf child's gestures. As a result, although the parents respond to their child's gestures, they do not adopt the gestures themselves (nor do they typically acknowledge that the child even uses gesture to communicate). The parents produce co-speech gestures, not homesigns. It is in this sense that homesign differs from conventional sign languages and even from village sign languages, whose users produce the same types of signs as they receive (see chapter 24, Shared Sign Languages). Homesigners produce homesigns but receive co-speech gestures in return.

The disparity between co-speech gesture and homesign is of interest because of its implications for language-learning. To the extent that the properties of homesign are different from the properties of co-speech gesture, the deaf children themselves must be imposing these particular properties on their communication systems.

The chapter begins in section 2 by describing the properties of natural languages that have been identified in homesign thus far. Homesigners' gestures form a lexicon. These lexical items are themselves composed of parts, akin to a morphological system. Moreover, the lexical items combine to form structured sentences, akin to a syntactic system. In addition, homesigns contain lexical markers that modulate the meanings of sentences (negation and questions), as well as grammatical categories (nouns/verbs, subjects/objects). Finally, homesign is used not only to make requests of others, but also to comment on the present and non-present (including the hypothetical) world – to serve the functions that all languages, signed or spoken, serve.

Section 3 explores whether the linguistic properties found in homesign can be traced to the gestures that the homesigners' hearing parents produce when they talk. Although homesigners are not exposed to input from a conventional sign language, they are exposed to the gestures that hearing people produce when they talk. These gestures could serve as a model for the deaf children's homesign systems. However, co-speech gestures are not only different from homesign in function (they work along with speech to communicate rather than assuming the full burden of communication, as homesign does), they are also different in form – gesture relies on mimetic and analog representation to convey information; homesign (like conventional sign languages) relies on segmented forms that are systematically combined to form larger wholes. Thus, the gestures that homesigners see their hearing parents produce are different from the gestures that they themselves produce. The section ends by asking why this is the case.

The final section explores how deaf children transform the co-speech gestural input they receive from their hearing parents into homesign, and ends with a discussion of the implications of this transformation for language-learning and the creation of sign languages.

2. The properties of homesign

Homesigns are created by deaf children raised in circumstances where a sign language model is not available. In Western cultures, these children are typically born to hearing parents who have chosen to educate their child in an oral school. These children are likely to learn a conventional sign language at some later point in their lives, often around adolescence. However, in many places throughout the world, homesigners con-

tinue to use the gesture systems they create as children as their sole means of communication (for example, Coppola/Newport 2005; Coppola/Senghas 2010; Jepson 1991; Spaepen et al. 2011), and these systems typically undergo structural changes as the children enter adolescence and adulthood (see, for example, Fusellier-Souza 2006; Morford 2003; Kuschel 1973; Yau 1992).

The homesigners who are the focus of this chapter are deaf children born to hearing parents in a Western culture. They have not succeeded at mastering spoken language despite intensive oral education and, in addition, have not been exposed to a conventional sign language by their hearing parents. Do deaf children in this situation turn to gesture to communicate with the hearing individuals in their worlds? And if so, do the children use gestures in the same way that the hearing speakers who surround them do (i.e., as though they were co-speech gestures), or do they refashion their gestures into a linguistic system reminiscent of the sign languages of deaf communities?

There have been many reports of deaf children who are orally trained using their hands to communicate (Fant 1972; Lenneberg 1964; Mohay 1982; Moores 1974; Tervoort 1961). Indeed, it is not all that surprising that deaf children in these circumstances exploit the manual modality for the purposes of communication – after all, it is the only modality that is readily accessible to them and they see gesture used in communicative contexts all the time when their hearing parents talk to them. However, it is surprising that the deaf children's homesigns turn out to be structured in language-like ways, with structure at a number of different levels.

2.1. Lexicon

Like hearing children at the earliest stages of language-learning, deaf children who have not yet been exposed to sign language use both pointing gestures and iconic gestures to communicate. Their gestures, rather than being mime-like displays, are discrete units, each of which conveys a particular meaning. Moreover, the gestures are non-situation-specific – a twist gesture, for instance, can be used to request someone to twist open a jar, to indicate that a jar has been twisted open, to comment that a jar cannot be twisted open, or to tell a story about twisting open a jar that is not present in the room. In other words, the homesigner's gestures are not tied to a particular context, nor are they even tied to the here-and-now (Morford/Goldin-Meadow 1997). In this sense, the gestures warrant the label “sign”.

But can a pointing gesture really be considered a sign? Points are not prototypical words – the point directs a communication partner's gaze toward a particular person, place, or thing, but doesn't specify anything about that entity. Despite this fundamental difference, points function for homesigners just like object-referring words (nouns and pronouns) do for hearing children learning a conventional spoken language and deaf children learning a conventional sign language. They do so in three ways:

- Homesigners use their points to refer to precisely the same range of objects that young hearing and deaf children refer to with their words and signs – and in precisely the same distribution. (Feldman/Goldin-Meadow/Gleitman 1978, 380)
- Homesigners combine their points with other points and with iconic signs just as hearing and deaf children combine their object-referring words with other words and signs. (Goldin-Meadow/Feldman 1977; Goldin-Meadow/Mylander 1984)

- Homesigners use their points to refer to objects that are not visible in the room just as hearing and deaf children use words and signs for this function. For example, a homesigner points at the chair at the head of the dining room table and then signs ‘sleep’; this chair is where the child’s father typically sits, and the child is telling us that his father (denoted by the chair) is currently asleep.
(see Figure 26.1; Butcher/Mylander/Goldin-Meadow 1991)



Fig. 26.1: Pointing at the present to refer to the non-present. The homesigner points at the chair at the head of the dining room table in his home and then produces a ‘sleep’ gesture to tell us that his father (who typically sits in that chair) is asleep in another room. He is pointing at one object to mean another and, in this way, manages to use a gesture that is grounded in the present to refer to someone who is not in the room at all.

Iconic signs also differ from words. The form of an iconic sign captures an aspect of its referent. The form of a word does not. Interestingly, although iconicity is present in many of the signs of American Sign Language (ASL), deaf children learning ASL do not seem to notice. Most of their early signs are either not iconic (Bonvillian/Orlansky/Novack 1983) or, if iconic from an adult’s point of view, not recognized as iconic by the child (Schlesinger 1978). In contrast, deaf individuals inventing their own homesigns are forced by their social situation to create signs that not only begin transparent but remain so. If they didn’t, no one in their world would be able to take any meaning from the signs they create. Homesigns therefore have an iconic base (see Fusellier-Souza (2006), Kuschel (1973), and Kendon (1980b) for evidence of iconicity in the signs used by older homesigners in other cultures).

Despite the fact that the signs in a homesign system need to be iconic to be understood, they form a stable lexicon. Homesigners could create each sign anew every time they use it, as hearing speakers seem to do with their gestures (McNeill 1992). If so, we might still expect some consistency in the forms the signs take simply because the signs are iconic and iconicity constrains the set of forms that can be used to convey a meaning. However, we might also expect a great deal of variability around a prototypical form – variability that would crop up simply because each situation is a little different, and a sign created specifically for that situation is likely to reflect that difference. In fact, it turns out that there is relatively little variability in the set of forms a homesigner uses to convey a particular meaning. The child tends to use the same form,



Fig. 26.2: Homesigns are stable in form. The homesigner is shown producing a break gesture. Although this gesture looks like it should be used only to describe snapping long thin objects into two pieces with the hands, in fact, all of the children used the gesture to refer to objects of a variety of sizes and shapes, many of which had not been broken by the hands.

say, two fists breaking apart in a short arc to mean ‘break’, every single time that child signs about breaking, no matter whether it’s a cup breaking, or a piece of chalk breaking, or a car breaking (see Figure 26.2; Goldin-Meadow et al. 1994). Thus, the homesigner’s signs adhere to standards of form, just as a hearing child’s words or a deaf child’s signs do. The difference is that the homesigner’s standards are idiosyncratic to the creator rather than shared by a community of language users.

2.2. Morphology

Modern languages (both signed and spoken) build up words in combination from a repertoire of a few dozen smaller meaningless units (see chapter 3 for word formation). We do not yet know whether homesign has phonological structure (but see Brentari et al. 2012). However, there is evidence that homesigns are composed of parts, each of which is associated with a particular meaning; that is, they have morphological structure (Goldin-Meadow/Mylander/Butcher 1995; Goldin-Meadow/Mylander/Franklin 2007). The homesigners could have faithfully reproduced in their signs the actions that they actually perform. They could have, for example, created signs that capture the difference between holding a balloon string and holding an umbrella. But they don’t. Instead, the children’s signs are composed of a limited set of handshape forms, each standing for a class of objects, and a limited set of motion forms, each standing

for a class of actions. These handshape and motion components combine freely to create signs, and the meanings of these signs are predictable from the meanings of their component parts. For example, a hand shaped like an ‘O’ with the fingers touching the thumb (👉), that is, an *OTouch* handshape form, combined with a *Revolve* motion form means ‘rotate an object < 2 inches wide around an axis’, a meaning that can be transparently derived from the meanings of its two component parts (*OTouch* = handle an object < 2 inches wide; *Revolve* = rotate around an axis).

Importantly, in terms of arguing that there really is a system underlying the children’s signs, the vast majority of signs that each deaf child produces conform to the morphological description for that child and the description can be used to predict new signs that the child produces. Thus, homesigns exhibit a simple morphology, one that is akin to the morphologies found in conventional sign languages. Interestingly, it is much more difficult to impose a coherent morphological description that can account for the gestures that the children’s hearing parents produce (Goldin-Meadow/Mylander/Butcher 1995; Goldin-Meadow/Mylander/Franklin 2007), suggesting that morphological structure is not an inevitable outgrowth of the manual modality but is instead a characteristic that deaf children impose on their communication systems.

2.3. Syntax

Homesigns are often combined with one another to form sentence-like strings. For example, a homesigner combined a point at a toy grape with an ‘eat’ sign to comment on the fact that grapes can be eaten, and at another time combined the ‘eat’ sign with a point at a visitor to invite her to lunch with the family. The same homesigner combined all three gestures into a single sentence to offer the experimenter a snack (see Figure 26.3).



Fig. 26.3: Homesign sentences follow a consistent order. The homesigner is holding a toy and uses it to point at a tray of snacks that his mother is carrying = *snack* (the tray is not visible) [patient]. Without dropping the toy, he jabs it several times at his mouth = *eat* [act]. Finally, he points with the toy at the experimenter sprawled on the floor in front of him = *you* [actor]. This is a typical ordering pattern for this particular homesigner (i.e., patient-act-actor).

Interestingly, homesign sentences convey the same meanings that young children learning conventional languages, signed or spoken, typically convey with their sentences (Goldin-Meadow/Mylander 1984). In addition, homesign sentences are structured in language-like ways, as described in the next four sections.

2.3.1. Predicate frames

Sentences in natural language are organized around verbs. The verb conveys the action, which determines the thematic roles (θ -roles) of arguments that underlie the sentence. Do frameworks of this sort underlie homesign sentences? Homesign sentences are structured in terms of underlying predicate frames just like the early sentences of children learning conventional languages (Goldin-Meadow 1985). For example, the framework underlying a sentence about giving contains three arguments – the giver (actor), the given (patient), and the givee (recipient). In contrast, the framework underlying a sentence about eating contains two arguments – the eater (actor) and the eaten (patient). Homesigners (like all children, Bloom 1970) rarely produce all of the arguments that belong to a predicate in a single sentence. What then makes us think that the entire predicate frame underlies a sentence? Is there evidence, for example, that the recipient and actor arguments underlie the homesign sentence *cookie-give* even though the patient *cookie* and the act *give* are the only elements that appear in the sentence? In fact, there is evidence and it comes from production probability. Production probability is the likelihood that an argument will be signed when it can be. Although homesigners could leave elements out of their sentences haphazardly, in fact they are quite systematic in how often they omit and produce signs for various arguments in different predicate frames.

Take the actor as an example. If we are correct in attributing predicate frames to homesign sentences, the actor in a *give* predicate should be signed less often than the actor in an *eat* predicate simply because there is more competition for slots in a 3-argument frame (e.g., *give* predicate) than in a 2-argument frame (*eat* predicate). The *giver* has to compete with the *act*, the *given*, and the *givee*. The *eater* has to compete only with the *act* and the *eaten*. This is exactly the pattern homesign displays. Both American and Chinese homesigners are less likely to produce an actor in a sentence with a 3-argument underlying predicate frame (e.g., the *giver*) than an actor in a sentence with a 2-argument underlying predicate frame (e.g., the *eater*). Following the same logic, an *eater* should be signed less often than a *dancer*, and indeed it is in the utterances of both American and Chinese homesigners (Goldin-Meadow 2003a).

In general, production probability decreases systematically as the number of arguments in the underlying predicate frame increases from 1 to 2 to 3, not only for actors but also for patients – homesigners are less likely to produce a sign for a *given* apple than for an *eaten* apple simply because there is more competition for slots in a 3-argument *give* predicate than in a 2-argument *eat* predicate; that is, they are more likely to sign *apple-eat* than *apple-give*, signing instead *give-palm* to indicate that mother should transfer the apple to the palm of the child's hand.

Importantly, it is the underlying predicate frame that dictates actor production probability in the homesigner's sentences, not how easy it is to guess from context who the actor of a sentence is. If predictability in context were the sole factor dictating action production, 1st and 2nd person actors should be omitted regardless of underlying predicate frame because their identities can be easily inferred from the context (both persons are on the scene); and 3rd person actors should be signed quite often regardless of underlying predicate frame because they are less easily guessed from the context. However, the production probability patterns described above hold for 1st, 2nd, and

3rd person actors when each is analyzed separately (Goldin-Meadow 1985). The predicate frame underlying a sentence is indeed an essential factor in determining how often an actor will be signed in that sentence.

2.3.2. Devices for marking who does what to whom

In addition to being structured at underlying levels, homesign sentences are also structured at surface levels. They display (at least) three devices that mark ‘who does what to whom’ found in the early sentences of children learning conventional language (Goldin-Meadow/Mylander 1984, 1998; Goldin-Meadow et al. 1994).

Firstly, homesigners indicate the thematic role of a referent by preferentially producing (as opposed to omitting) signs for referents playing particular roles. Homesigners in both America and China are more likely to produce a sign for the patient (e.g., the eaten cheese in a sentence about eating) than to produce a sign for the actor (e.g., the eating mouse) (Goldin-Meadow/Mylander 1998). Two points are worth noting. The first point is that homesigners’ patterns convey probabilistic information about who is the doer and who is the done-to in a two-sign sentence. If, for example, a homesigner produces the sign sentence ‘boy hit’, our best guess is that the boy is the hittee (patient) and not the hitter (actor) precisely because homesigners tend to produce signs for patients rather than transitive actors. Indeed, languages around the globe tend to follow this pattern; in languages where only a single argument is produced along with the verb, that argument tends to be the patient rather than the actor in transitive sentences (DuBois 1987). The second point is that the omission/production pattern found in the homesigners’ sentences tends to result in two-sign sentences that preserve the unity of the predicate – that is, patient + act transitive sentences (akin to OV in conventional systems) are more frequent in the signs than actor + act transitive sentences (akin to SV in conventional systems).

Secondly, homesigners indicate the thematic role of a referent by placing signs for objects playing particular roles in set positions in a sentence. In other words, they use linear position to indicate who does what to whom (Feldman/Goldin-Meadow/Gleitman 1978; Senghas et al. 1997). Surprisingly, homesigners in America and China use the same particular linear orders in their sign sentences despite the fact that each child is developing his or her system alone without contact with other deaf children and in different cultures (Goldin-Meadow/Mylander 1998). The homesigners tend to produce signs for patients in the first position of their sentences, before signs for verbs (*cheese–eat*) and before signs for endpoints of a transferring action (*cheese–table*). They also produce signs for verbs before signs for endpoints (*give–table*). In addition, they produce signs for intransitive actors before signs for verbs (*mouse–run*). Interestingly, at least one of these patterns – placing patients before verbs – is found in older homesigns in a variety of cultures (Britain: MacLeod 1973; Papua New Guinea: Kendon 1980c), although as they grow older, homesigners display more different types of word orders in their systems than younger homesigners do (Senghas et al. 1997).

Third, homesigners indicate the thematic role of a referent by displacing verb signs toward objects playing particular roles, as opposed to producing them in neutral space (at chest level). These displacements are reminiscent of inflections in conventional sign languages (Padden 1983, 1990). In ASL, signs can be displaced to agree with their

noun arguments. For example, the sign GIVE is moved from the signer to the addressee to mean ‘I give to you’ but from the addressee to the signer to mean ‘You give to me’ (see chapter 7, Verb Agreement). Homesigners tend to displace their signs toward objects that are acted upon and thus use their inflections to signal patients. For example, displacing a twist sign toward a jar signals that the jar (or one like it) is the object to be acted upon (Goldin-Meadow et al. 1994). These inflections are sensitive to the underlying predicate frame, as we might expect since they are marked on the verb – 3-argument verbs are more likely to be inflected than 2-argument verbs. Indeed, inflection appears to be obligatory in 3-argument verbs but optional in 2-argument verbs where it trades off with lexicalization. For example, verbs in sentences containing an independent sign for the patient are less likely to be inflected than verbs in sentences that do not contain a sign for the patient (Goldin-Meadow et al. 1994).

Thus, homesign sentences adhere to simple syntactic patterns marking who does what to whom.

2.3.3. Recursion

Homesigners combine more than one proposition within the bounds of a single sentence, that is, they produce complex sentences. A complex sentence is the conjunction of two propositions (see chapter 16). Importantly, there is evidence that the two propositions in a complex sentence are subordinate to a higher node, and are not just propositions that have been sequentially juxtaposed. The frame underlying such a sentence ought to reflect this unification – it ought to be the sum of the predicate frames for the two propositions. For example, a sentence about a soldier beating a drum (proposition 1) and a cowboy sipping a straw (proposition 2) ought to have an underlying frame of 6 units – 2 predicates (*beat, sip*), 2 actors (*soldier, cowboy*), and 2 patients (*drum, straw*). If the homesigners’ complex sentences are structured at an underlying level as their simple sentences are, we ought to see precisely the same pattern in their complex sentences as we saw in their simple sentences – that is, we should see a systematic decrease in, say, actor production probability as the number of units in the conjoined predicate frames increases.

This is precisely the pattern we find (Goldin-Meadow 1982, 2003b). There is, however, one caveat. We find this systematic relation only if we take into account whether a semantic element is shared across propositions. Sometimes when two propositions are conjoined, one element is found in both propositions. For example, in the English sentence ‘Elaine cut apples and Mike ate apples’, the patient argument *apples* is shared across the two propositions (the second *apples* could be replaced by *them* and the pronoun would then mark the fact that the element is shared). The homesigners’ complex sentences exhibit this type of redundancy, and at approximately the same rate as the sentences produced by children learning language from conventional models (Goldin-Meadow 1987, 117). For example, one child produced *climb–sleep–horse* to comment on the fact that the horse climbs the house (proposition 1) and the horse sleeps (proposition 2). There are three units underlying the first proposition (actor, act, object – *horse, climb, house*) and two in the second (actor, act – *horse, sleep*), but one of those units (*horse*) is shared across the two propositions. The question is whether the shared element appears once or twice in the underlying predicate frame

of the conjoined sentence. If *horse* appears twice – [(*horse* climbs house) & (*horse* sleeps)] – the sentence will have an underlying frame of five units. If *horse* appears once – *horse* [(climbs house) & (sleeps)] – the sentence will have an underlying frame of four units. In fact, it turns out that production probability (the probability that a gesture for a particular semantic element will be produced in sentences where that element ought to be produced) decreases systematically with increases in underlying predicate frame only if we take shared elements into account when calculating the size of a predicate frame – in particular, only if we assign shared elements one slot (rather than two) in the underlying frame (Goldin-Meadow 1982).

The homesigner is likely to be attributing two roles to the climbing and sleeping horse at some, perhaps semantic or propositional, level. However, the production probability patterns underlying complex sentences make it clear that we need a level between this semantic/propositional level and the surface level of the sentence – a level in which dual-role elements appear only once. This underlying level is necessary to account for the surface properties of the complex sentences. Moreover, in order to account for the production probability patterns in the complex sentences, we need to consider overlaps (i.e., redundancies) across the propositions. In other words, because the underlying frame must take into account whether a semantic element is shared across the propositions contributing to that frame, it cannot reflect mere juxtaposition of two predicate frames – we need to invoke an overarching organization that encompasses all of the propositions in the sentence to account for the production probability patterns. Thus, the homesigner's complex sentences result from the unification of two propositions under a higher node and, in this sense, display hierarchical organization.

There is further evidence for hierarchical organization in homesign. At times, a collection of signs functions as an elaborated version of a single sign, that is, the collection substitutes for a single sign and functions as a phrase. For example, rather than point at a penny and then at himself (*that-me*) to ask someone to give him a penny, the homesigner produces an iconic sign for penny along with a point at the penny ([*penny-that*]-*me*); both signs thus occupy the patient slot in the sentence and, in this sense, function like a single unit, a nominal constituent (Hunsicker/Mylander/Goldin-Meadow 2009; Hunsicker/Goldin-Meadow 2011). This is a crucial design feature of language, one that makes expressions with hierarchical embedding possible.

2.3.4. Negation, questions, past, and future

Homesign also contains at least two forms of sentence modification, negation and questions. Young homesigners express two types of negative meanings: rejection (e.g., when offered a carrot, the homesigner shakes his head, indicating that he doesn't want the object) and denial (e.g., the homesigner points to his chest and then signs *school* while shaking his head, to indicate that he is not at school). In addition, they express three types of questions: where (e.g., the homesigner produces a two-handed flip when searching for a key), what (e.g., the homesigner produces the flip when trying to figure out which object his mother wants), and why (e.g., the homesigner produces the flip when trying to figure out why the orange fell). As these examples suggest, different forms are used to convey these two different meanings – the side-to-side headshake

for negative meanings, the manual flip for question meanings. These signs are obviously taken from hearing speakers' gestures but are used by the homesigners as sentence modulators and, as such, occupy systematic positions in those sentences: headshakes appear at the beginning of sentences, flips at the end (Franklin/Giannakidou/Goldin-Meadow 2011; see also Jepson 1991).

Homesign also includes ways of referring to the past and future (Morford/Goldin-Meadow 1997). For example, one homesigner produced a sign, not observed in the gestures of his hearing parents, to refer to both remote future and past events – needing to repair a toy (future) and having visited Santa (past). The sign is made by holding the hand vertically near the chest, palm out, and making an arcing motion away from the body (see Figure 26.4).



Fig. 26.4: Homesign has markers for the past and future. The homesigner is shown using a gesture that he created to refer to non-present events – the ‘away’ gesture which the child uses to indicate that what he is gesturing about is displaced in time and space (akin to the phrase ‘once upon a time’ used to introduce stories).

Another homesigner invented a comparable sign to refer only to past events. In addition to these two novel signs, homesigners have been found to modify a conventional gesture to use as a future marker. The gesture, formed by holding up the index finger, is typically used to request a brief delay or time-out and is glossed as *wait one minute*. The homesigners used the form for its conventional meaning but they also use it to identify their intentions, that is, to signal the immediate future. For example, one homesigner produced the sign and then pointed at the toy bag to indicate that he was going to go retrieve a new toy. Hearing speakers use *wait* to get someone’s attention, never to refer to the immediate future. The form of the sign is borrowed from gesture but it takes on a meaning of its own.

2.4. Grammatical categories

Young homesigners use their morphological and syntactic devices to distinguish nouns and verbs (Goldin-Meadow et al. 1994). For example, if the child uses *twist* as a verb, that sign would likely be produced near the jar to be twisted open (i.e., it would be inflected); it would not be abbreviated (it would be produced with several twists rather than one); and it would be produced after a pointing sign at the jar (*that-twist*). In contrast, if the child uses that same form *twist* as a noun to mean 'jar', the sign would likely be produced in neutral position near the chest (i.e., it would not be inflected); it would be abbreviated (produced with one twist rather than several); and it would occur before the pointing sign at the jar (*jar-that*). Thus, the child distinguishes nouns from verbs morphologically (nouns are abbreviated, verbs inflected) and syntactically (nouns occur in initial position of a two-sign sentence, verbs in second position). Interestingly, adjectives sit somewhere in between, as they often do in natural languages (Thompson 1988) – they are marked like nouns morphologically (*broken* is abbreviated but not inflected) and like verbs syntactically (*broken* is produced in the second position of a two-sign sentence).

Older homesigners also have the grammatical category subject (possibly younger ones do, too, but this has not been investigated yet). Grammatical subjects do not have a simple semantic correlate. Also, no fixed criteria exist to categorically identify a noun phrase as a subject, but a set of common, multi-dimensional criteria can be applied across languages (Keenan 1976). A hallmark of subject noun phrases cross-linguistically is the range of semantic roles they display. While the subject of a sentence will likely be an agent (one who performs an action), many other semantic roles can be the subject. For example, the theme or patient can be a subject (*The door* opened), as can an instrument (*The key* opened the door) or instigator (*The wind* opened the door). Older homesigners studied in Nicaragua used the same grammatical device (clause-initial position) to mark agent and non-agent noun phrases in their gestured responses, thus indicating that their systems include the category subject (Coppola/Newport 2005).

2.5. The uses to which homesign is put

Homesign is used to comment not only on the here-and-now but also on the distant past, the future, and the hypothetical (Butcher/Mylander/Goldin-Meadow 1991; Morford/Goldin-Meadow 1997). The homesigners use their system to make generic statements so that they can converse about classes of objects (Goldin-Meadow/Gelman/Mylander 2005), to tell stories about real and imagined events (Phillips/Goldin-Meadow/Miller 2001; Morford 1995), to talk to themselves (Goldin-Meadow 2003b), and to talk about language (Goldin-Meadow 1993).

Thus, not only do homesigners structure their signs according to the patterns of natural languages, but they also use those signs for the functions natural languages serve. Structure and function appear to go hand-in-hand in the deaf children's homesigns. But the relation between the two is far from clear. The functions to which the deaf children put their signs could provide the impetus for building a language-like

structure. Conversely, the structures that the deaf children develop in their signs could provide the means by which more sophisticated language-like functions can be fulfilled. More than likely, structure and function complement one another, with small developments in one domain furthering additional developments in the other.

In this regard, it is interesting to note that language-trained chimpanzees are less accomplished than the deaf children in terms of both structure and function. Not only do the chimps fail to display most of the structural properties found in the deaf children's sign systems, they also use whatever language they do develop for essentially one function – to get people to give them objects and perform actions (see, for example, Greenfield/Savage-Rumbaugh 1991).

3. The input to homesign

Homesigners, by definition, are not exposed to a conventional sign language and thus could not have fashioned their sign systems after such a model. They are, however, exposed to the gestures that their hearing parents use when they talk to them. Although the gestures that hearing speakers typically produce when they talk are not characterized by language-like properties (McNeill 1992), it is possible that hearing parents alter their gestures when communicating with their deaf child. Perhaps the deaf children's hearing parents introduce language-like properties into their own gestures. If so, these gestures could serve as a model for the structure in their deaf children's homesigns. We explore this possibility in this section.

3.1. The hearing parents' gestures do not exhibit the properties of homesign

Hearing parents gesture when they talk to young children (Bekken 1989; Shatz 1982; Iverson et al. 1999) and the hearing parents of homesigners are no exception. As mentioned earlier, the deaf children's parents are committed to teaching their children to talk and send them to oral schools. These schools advise the parents to talk to their children as often as possible. And when they talk, they gesture. The question is whether the parents' gestures display the language-like properties found in homesign, or whether they look just like any hearing speaker's gestures.

To find out, Goldin-Meadow and Mylander (1983, 1984) analyzed the gestures that the mothers of six American homesigners produced when talking to their deaf children. In each case, the mother was the child's primary caretaker. Goldin-Meadow and Mylander used the analytic tools developed to describe the deaf children's homesigns to describe the mothers' gestures – they turned off the sound and coded the mothers' gestures as though they had been produced without speech. In other words, they attempted to look at the gestures through the eyes of a child who cannot hear.

Not surprisingly, all six mothers used both pointing and iconic gestures when they talked to their children. Moreover, the mothers used pointing and iconic gestures in roughly the same distribution as their children. However, the mothers' use of gestures did not resemble their children's homesigns along many dimensions.

First, the mothers produced fewer different types of iconic gestures than their children, and they also used only a small subset of the particular iconic gestures that their children used (Goldin-Meadow/Mylander 1983, 1984).

Second, the mothers produced very few gesture combinations. That is, like most English-speakers (McNeill 1992), they tended to produce one gesture per spoken clause and rarely combined several gestures into a single, motorically uninterrupted unit. Moreover, the very few gesture combinations that the mothers did produce did not exhibit the same structural regularities as their children's homesigns (Goldin-Meadow/Mylander 1983, 1984). The mothers thus did not appear to have structured their gestures at the sentence level.

Nor did the mothers structure their gestures at the word level. Each mother used her gestures in a more restricted way than her child, omitting many of the handshake and motion morphemes that the child produced (or using the ones she did produce more narrowly than the child), and omitting completely a very large number of the handshake/motion combinations that the child produced. Indeed, there was no evidence at all that the mothers' gestures could be broken into meaningful and consistent parts (Goldin-Meadow/Mylander/Butcher 1995).

Finally, the hearing mothers' iconic gestures were not stable in form and meaning over time while their deaf children's homesigns were. Moreover, the hearing mothers did not distinguish between gestures serving a noun role and gestures serving a verb role. As argued in section 2.4, the deaf children made this distinction in their homesigns (Goldin-Meadow et al. 1994).

Did the deaf children learn to structure their homesign systems from their mothers? Probably not – although it may have been necessary for the children to see hearing people gesturing in communicative situations in order to get the idea that gesture can be appropriated for the purposes of communication. But in terms of how the children structure their homesigns, there is no evidence that this structure came from the children's hearing mothers. The hearing mothers' gestures do not have structure when looked at with tools used to describe the deaf children's homesigns (although they do when looked at with tools used to describe co-speech gestures, that is, when they are described in relation to speech).

3.2. Why don't the hearing parents gestures look like homesign?

The hearing mothers interacted with their deaf children on a daily basis. Therefore we might have expected that their gestures would eventually have come to resemble their children's homesigns (or vice versa). But they didn't. The question emerges why the hearing parents didn't display language-like properties in their gestures? The parents were interested in teaching their deaf children to talk, not gesture. They therefore produced all of their gestures with speech – in other words, their gestures were co-speech gestures and had to behave accordingly. The gestures had to fit, both temporally and semantically, with the speech they accompanied. As a result, the hearing parents' gestures were not 'free' to take on language-like properties.

In contrast, the deaf homesigners had no such constraints. They had no productive speech and thus always produced gesture on its own, without talk. Moreover, because the manual modality was the only means of communication open to the children, it

had to take on the full burden of communication. The result was language-like structure. Although the homesigners may have used their hearing parents' gestures as a starting point, it is very clear that they went well beyond that point. They transformed the co-speech gestures they saw into a system that looks very much like language.

But what would have happened if the children's hearing parents had refrained from speaking as they gestured? Once freed from the constraints of speech, perhaps the parents' gestures would have become more language-like in structure, assuming the segmented and combinatorial form that characterized their children's homesigns. In other words, the mothers might have been more likely to use gestures that mirrored their children's homesigns if they kept their mouths closed. Goldin-Meadow, McNeill and Singleton (1996) tested this prediction by asking hearing speakers to do just that – use their hands and not their mouths to describe a series of events.

The general hypothesis is that language-like properties crop up in the manual modality when it takes on the primary burden of communication, not when it shares the burden of communication. To test the hypothesis, Goldin-Meadow and colleagues (1996) examined hearing adults' gestures when those gestures were produced with speech (sharing the communicative burden) and when they were produced instead of speech (shouldering the entire communicative burden). As expected, the gestures the adults produced without speech displayed properties of segmentation and combination and thus were distinct from the gestures the same adults produced with speech.

When they produced gesture without speech, the adults frequently combined those gestures into strings and these strings were consistently ordered, with gestures for certain semantic elements occurring in particular positions in the string; that is, there was structure across the gestures at the sentence level (Goldin-Meadow/McNeill/Singleton 1996; see also Gershkoff-Stowe/Goldin-Meadow 2002). In addition, the verb-like action gestures that the adults produced could be divided into handshape and motion parts, with the handshape of the action gesture frequently conveying information about the objects in its semantic frame; that is, there was structure within the gesture at the word level (although the adults did not develop a system of contrasts within their gestures, that is, they did not develop the morphological system characteristic of homesign (Goldin-Meadow/Gelman/Mylander 2005; Goldin-Meadow/Mylander/Franklin 2007). Thus, the adults produced gestures characterized by segmentation and combination and did so with essentially no time for reflection on what might be fundamental to language-like communication.

Interestingly, when hearing speakers of a variety of languages (English, Chinese, Turkish, and Spanish) are asked to describe a series of events using only their hands, they too produce strings of segmented gestures and their gesture strings are characterized by consistent order. Moreover, they all create the same gesture order, despite the fact that they use different orders (the predominant orders of their respective languages) when describing the same scenes in speech (Goldin-Meadow et al. 2008). Interestingly, this gesture order is SOV – precisely the order that we see young Chinese and American homesigners use (OV, with the S omitted, Goldin-Meadow/Mylander 1998) and also the order that has been found in a newly emerging sign language developed in a Bedouin community in Israel (Al-Sayyid Bedouin Sign Language; Sandler et al. 2005; see also chapter 24 on shared sign languages). This particular order may reflect a natural sequencing that humans exploit when creating a communication system over short and long timespans.

The appearance of segmentation and combination in the gestures hearing adults produce without speech is particularly striking given that these properties are not found in the gestures hearing adults produce with speech (Goldin-Meadow/McNeill/Singleton 1996). Co-speech gestures are not used as building blocks for larger sentence or word units and are used, instead, to imagistically depict the scenes described in the accompanying speech.

4. From co-speech gesture to homesign

Homesigners are not exposed to a model of a conventional language to which they can apply their language-learning skills, but they are exposed to the gestures that the hearing speakers who surround them use when they communicate. The question is how deaf children transform the input they do receive, co-speech gesture, into a system of communication that has many of the properties of language, that is, into homesign.

4.1. Examining homesign around the globe

How can we learn more about the process by which co-speech gesture is transformed into homesign? The fact that hearing speakers across the globe gesture differently when they speak (Özyürek/Kita 1999; Kita 2000; see also chapter 27) affords us with an excellent opportunity to explore if – and how – deaf children make use of the gestural input that their hearing parents provide. We can thus observe homesign around the globe and examine the relation between the co-speech gestures homesigners see as input and the communication systems they produce as output. There are, in fact, descriptions of homesigns created by individuals from a variety of different countries: Bangladesh (Morford 1995); Belgium (Tervoort 1961); Great Britain (MacLeod 1973); the Netherlands (Tervoort 1961); Nicaragua (Coppola/Newport 2005; Senghas et al. 1997); Papua New Guinea (Kendon 1980a,b,c); Rennell Island (Kuschel 1973); United States (Goldin-Meadow 2003b); and the West Indies (Morford 1995). However, these homesign systems have not been described along the same dimensions, nor have the co-speech gestures that might have served as input to the systems been studied.

Selecting languages that vary along a particular dimension, with co-speech gestures that vary along that same dimension, is an ideal way to explore whether co-speech gesture serves as a starting point for homesign. For example, the gestures that accompany Spanish and Turkish look very different from those that accompany English and Mandarin (see chapter 27 for details). As described by Talmy (1985), Spanish and Turkish are verb-framed languages, whereas English and Mandarin are satellite-framed languages. This distinction depends primarily on the way in which the path of a motion is packaged. In a satellite-framed language, path is encoded outside of the verb (e.g., *down* in the sentence ‘he flew down’) and manner is encoded in the verb itself (*flew*). In contrast, in a verb-framed language, path is bundled into the verb (e.g., *sale* in the Spanish sentence ‘*sale volando*’ = exits flying) and manner is outside of the verb (*volando*). One effect of this typological difference is that manner is often omitted from Spanish sentences (Slobin 1996).

However, McNeill (1998) has observed an interesting compensation – although manner is omitted from Spanish-speakers' talk, it frequently crops up in their gestures. Moreover, and likely because Spanish-speakers' manner gestures do not co-occur with a particular manner word, their gestures tend to spread through multiple clauses (McNeill 1998). As a result, Spanish-speakers' manner gestures are longer and may be more salient to a deaf child than the manner gestures of English- or Mandarin-speakers. Turkish-speakers also produce gestures for manner relatively frequently. In fact, Turkish-speakers commonly produce gestures that convey only manner (e.g., fingers wiggling in place = manner alone vs. fingers wiggling as the hand moves forward = manner + path; Özyürek/Kita 1999; Kita 2000). Manner-only gestures are rare in English- and Mandarin-speakers.

These four cultures – Spanish, Turkish, American, and Chinese – thus offer an excellent opportunity to examine the effects of hearing speakers' gestures on the homesign systems developed by deaf children. If deaf children in all four cultures develop homesign systems with the same structure despite differences in the gestures they see, we will have strong evidence of the biases children themselves must bring to a communication situation. If, however, the children differ in the homesign systems they construct, we will be able to explore how a child's construction of a language-like system is influenced by the gestures she sees. We know from previous work that American deaf children exposed only to the gestures of their hearing English-speaking parents create homesign systems that are very similar in structure to the homesign systems constructed by Chinese deaf children exposed to the gestures of their hearing Mandarin-speaking parents (Goldin-Meadow/Gelman/Mylander 2005; Goldin-Meadow/Mylander 1998; Goldin-Meadow/Mylander/Franklin 2007; Zheng/Goldin-Meadow 2002). The question for future work is whether these children's homesign systems differ from those created by Spanish and Turkish deaf children of hearing parents.

As a first step in this research program, Özyürek et al. (2011) presented vignettes designed to elicit descriptions of path and manner to Turkish-speaking adults and children and to Turkish homesigners. They found that, although the Turkish-speakers mentioned both path and manner in their speech, very few produced both in their gestures; they preferred instead to produce only gestures for path along with their speech. In contrast, the Turkish homesigners frequently produced both path and manner within the same sentence. This outcome makes sense since the manual modality was the sole means of communication available to the homesigners; the speakers could (and did) use both gesture and speech. To determine whether the fact that the manual modality was the homesigners' only means of communication led to their production of both path and manner in gesture, they asked the adult speakers to describe the vignettes again, this time using only their hands and not their mouths. In this condition, the adults produced gestures for both path and manner, just as the homesigners did. Importantly, however, the form that the hearing adults used to express path and manner differed from the homesigners' form. The hearing adults tended to conflate path and manner into a single gesture (e.g., rotating the index finger while moving it forward), whereas the homesigners produced separate signs for path and manner (e.g., rotating the index finger; then moving the index finger forward). Thus, communicative pressure led the homesigners and the hearing adults to explicitly mention both path and manner with their hands. However, it did not dictate the form – the homesigners segmented the two meanings into separate signs; the hearing adults conflated them into a single

gesture. This same pattern has been found in comparisons of co-speech gesture and the early stages of a newly emerging sign language (Nicaraguan Sign Language (ISN)) – the signers segmented path and manner into separate signs; the gesturers conflated them (Senghas/Kita/Özyürek 2004; see also chapter 27).

Although the Turkish results underscore once again that co-speech gesture cannot serve as a straightforward model for homesign, they do not tell us whether the gestures have any influence at all on the homesigns. To address this issue, we need to compare homesigners who see gestures produced by speakers of a satellite-framed language (e.g., English-speakers who tend to conflate path and manner into a single gesture) to homesigners who see gestures produced by speakers of a verb-framed language (e.g., Turkish-speakers who conflate path and manner less often than English-speakers). If co-speech gesture is influencing homesign, we would expect American homesigners to segment their path and manner gestures, but to do so less often than Turkish homesigners. Future work is needed to address this question.

In one sense, we ought not expect big differences in homesigns as a function of the co-speech gestures that surround them. After all, co-speech gestures have a great deal in common. No matter what language they speak, hearing speakers tend to produce gestures one at a time, rarely combining their gestures into connected strings. Moreover, they all produce gestures for the same semantic elements (elements central to action relations) and in the same distribution. Aside from a few differences in the way that speakers of typologically distinct languages package path and manner in gesture (differences that have the potential to influence the amount of sequencing the deaf children introduce into their gesture systems), the gestures that hearing speakers use are remarkably similar. However, when hearing speakers are asked to abandon speech and use only their hands to communicate, their gestures change and take on a variety of language-like properties (e.g., the gestures are likely to appear in connected strings; the strings are characterized by order). What would happen if a homesigner were exposed to gestural input of this sort?

Most of the homesigners who have been extensively studied thus far were being educated orally. Their hearing parents had been advised to use speech with their children and, as a result, the gestures the parents produced were almost always produced with speech. If, however, there were no oral education available for deaf children and no pressure put on parents to speak to their deaf children, hearing parents of deaf children might talk less and gesture more. This appears to be the case in rural Nicaragua. Hearing parents frequently produce gestures without any talk at all when attempting to communicate with their deaf children (Coppola/Goldin-Meadow/Mylander 2006). These children (who have not been exposed to ISN) thus routinely see gestures produced without speech. Will this gestural input, which is likely to be more language-like in structure than the gestural input received by homesigners who are being educated orally (see section 3.2), lead to the construction of a more linguistically sophisticated homesign system? Future work is needed to address this question and, in so doing, tell us if and how homesigners use the gestural input they see in constructing their communication systems.

4.2. Implications for language learning and the creation of sign languages

The homesigns described in this chapter are created by individual children without the support of a community, indeed, without the support of a partner who knows and uses the system. Nonetheless, homesigns contain many, although not all, of the properties of natural languages, suggesting that these properties are fundamental to human communication and do not need to be handed down from generation to generation in the form of a codified system. They can instead be invented *de novo* by a child who lives in a community but does not share her communication system with that community. The properties of language that are found in homesign are truly resilient (Goldin-Meadow 1982, 2003).

It is worth noting that compositional structure, one of the defining features of language found in homesign and, in this sense, resilient, does not arise in human communication in all circumstances. Selten and Warglien (2007) asked hearing adults to communicate with one another using a computer. The adults' task was to develop a common code referring to geometrical figures that differed from one another by up to three features. The code had to be made up of a limited repertoire of letters, and each letter had a cost. The interesting result from the point of view of the present discussion is that compositional structure was created only in an environment that had novelty, that is, only when the adults were forced to communicate about new figures that had not been described before. Homesigners are, in a sense, always in a situation where they must express novelty – thoughts for which they do not have a previously established code. Selten and Warglien's (2007) results suggest that such a situation leads naturally, perhaps inexorably, to compositional structure in human communicators.

The properties of homesign may also hold a special place in the analysis of sign languages. It is likely that many, if not all, current day sign languages have their roots in homesign (Fusellier-Souza 2006). Homesigns appear to have much in common even if developed in very different circumstances around the globe. These shared properties may reflect linguistic capacities that all human beings possess, or perhaps constraints imposed by the manual modality itself. Whatever the origin of the commonalities that characterize homesign, charting the differences between conventional sign languages and homesign can offer insight into the pressures that move languages away from their original starting point. Languages respond to, and are likely shaped by, a variety of pressures; for example, the need to be semantically clear, to be processed efficiently, to be rhetorically interesting (Slobin 1977). Homesign may rely on patterns that have the virtue of semantic clarity, for both producer and receiver. But as a language community grows and the language functions become more complex, additional pressures may exert their influence on language form, in some cases pushing it away from its homesign roots. Homesign thus offers us a glimpse into the most fundamental properties of language and provides an anchor point against which to examine the trajectories sign languages (and perhaps all languages) take as they evolve.

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