



How Gestures Pave the Way for Lexical Development

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

In development, children often use gestures to communicate before they use words. The question is whether these gestures merely precede language development or are fundamentally tied to it. I examined four children making the transition from single words to two-word combinations and found that gesture had a tight relation to the children's lexical and syntactic development. First, a great many of the lexical items that each child produced initially in gesture later moved to that child's verbal lexicon. Second, children who were first to produce gesture-plus-word combinations conveying two elements in a proposition were also first to produce two-word combinations. Changes in gesture also predict changes in language, suggesting that early gesture may facilitate future developments in language.

Keywords: Gesture; words; language development; lexical development; syntactic development

1. INTRODUCTION

People move their hands as they talk – they gesture. Gesturing is a robust phenomenon, found across cultures, ages, and tasks. Gesture

is even found in individuals blind from birth [1]. Young children communicate using gestures before they are able to speak. Children typically produce their first gestures between 9 and 12 months, usually pointing to indicate objects in the

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environment [2,3]. Even after children begin to talk, they continue to produce gestures in combination with words (e.g., pointing at cup while saying “cup”; e.g., [4], and these gesture-plus-word combinations generally precede production of two-word combinations. Gesture development thus predates language development. The question we address here is whether gesture is fundamentally tied to language development.

Over the past 20 years, two lines of research have underscored the important role of gesture in the first stages of communicative development. One body of work [3] has indicated that the onset of intentional communication between the ages of 9 and 13 months is marked in part by the emergence of a series of gestures – giving, showing, pointing, and ritualized requests – that precede the appearance of first words. These gestures, called *performatives*, or more recently, *deictic gestures*, are used to refer to external objects or events and express only communicative intent on the part of the child [5]. The precise referent of these gestures can only be interpreted by referring to the extra linguistic context in which communication occurs. Some researchers have attributed a special role to pointing, which [6] described as an important way of establishing the joint attention situations within which language will eventually emerge.

A second line of work [3,7], looking at children in approximately the same age range, has reported striking parallels between early vocal production and gestural schemes of symbolic play. Many of the referential meanings expressed by these symbolic gestural schemes (e.g., eat) were equivalent to those conveyed by first words (e.g., “*puppa*” <lunch>; [8]. In addition, both the production of first words and the representation of symbols in the gestural modality have been shown to undergo a similar process of progressive decontextualization. Children’s first gestures and words are initially found as parts of routines from which they are progressively detached until they are used in a referential manner to name new objects or events independent of a specific context [9].

Taken together, these findings highlight the remarkable similarities between production in the gestural and the vocal modalities during the first stages of language acquisition. They also raise an interesting issue with regard to the communicative and linguistic value of early words and gestures.

The gestures that children produce early in language development provide a way for them to communicate information that they cannot yet express verbally. For example, pointing gestures (e.g., point at cup) offer children a technique for referring to objects before they have words for those objects. Moreover, gesture-plus-word combinations offer children a technique for communicating two pieces of information within a single utterance before they can produce two-word utterances (e.g., point at cup while saying “mine”; [10,11,12]. The fact that gesture allows children to communicate meanings that they may have difficulty expressing verbally raises the possibility that gesture serves a facilitating function for language learning. If so, changes in gesture should not only predate but also predict changes in language.

I tested this hypothesis by examining gesture production in relation to lexical and syntactic development in the early stages of language development. I asked (a) whether children’s use of gesture to refer to specific objects is related to the emergence of verbal labels for those objects and (b) whether children’s production of gesture-plus-word combinations is related to the emergence of two-word utterances.

Sometime around the end of the first year, normal children make the crucial discovery that things have names. Although naming is in some sense the quintessential linguistic act, [13 and 14] have argued that it is just one manifestation of a more general symbolic capacity reflected in such diverse domains as memory for objects, imagery, problem solving, imitation and symbolic play. Recent correlational studies provide only partial support for this hypothesis. Some areas of non-linguistic development do indeed correlate with the emergence of meaningful speech, in particular symbolic play, imitation, and some limited aspects of tool use in problem-solving [3]. However, several other central areas of sensorimotor development do not seem to correlate with language at all, at least in the earliest stages of one-word speech. These include spatial relations and object permanence [3]. These correlational patterns suggest a revision of the Piaget-Werner hypothesis, in the direction of “domain specific” or “local homology” models [3] in which tasks are correlated in limited ways at particular points in time when they share specific underlying structures.

Goldin-Meadow & Alibali [15] investigated the contribution that gestures make to how we

communicate and think. According to them, gesture can play a role in communication and thought at many timespans [15]. They found that the gestures speakers produce when they talk are integral to communication and can be harnessed in a number of ways. (a) Gesture reflects speakers' thoughts, often their unspoken thoughts, and thus can serve as a window onto cognition. Encouraging speakers to gesture can thus provide another route for teachers, clinicians, interviewers, etc., to better understand their communication partners. (b) Gesture can change speakers' thoughts. Encouraging gesture thus has the potential to change how students, patients, witnesses, etc., think about a problem and, as a result, alter the course of learning, therapy, or an interchange. (c) Gesture provides building blocks that can be used to construct a language. By watching how children and adults who do not already have a language put those blocks together, we can observe the process of language creation. Our hands are with us at all times and thus provide researchers and learners with an ever-present tool for understanding how we talk and think [15].

Goldin-Meadow [16] argues that even a child who has never seen or heard language is able to invent a language [16]. She writes about children who are congenitally deaf and cannot learn the spoken language that surrounds them and also those who have not been exposed to sign language, either by their hearing parents or their oral schools and argues these children use their hands to communicate – they gesture [16].

Clues to the puzzle of how language and cognition interact are now being sought in comparisons between development of vocal and gestural language. The logic behind such comparisons is the idea that traditional views of language as synonymous with speech may have resulted in inaccurate perceptions of relations between cognitive and language milestones. For example, data showing that a specific cognitive skill immediately precedes a specific milestone in vocal language may be conceptualized as causative. Such a conclusion, however, would presumably need to be reevaluated if the same language milestone were achieved significantly earlier in the gestural modality. Given the long history of attention to language as exclusively vocal in nature, many such reevaluations might be required. Thus, the empirical question of whether or not development of language proceeds differently in the two modalities is of pressing theoretical import [17].

US research into the nature of sign language, the acquisition and development of American Sign Language (ASL) and the education of hearing impaired children are strongly developed. In fact, scholars in the United States have considered the deaf community as a social group and hence have studied ASL as an integral system, without primary reference to the English language with which it is in contact. This community view has also resulted in a focus on acquisition of language by children in settings outside formal education and on an interest in various bilingual models for educational programs [18].

Because gestures are produced along with speech and thus in the service of communication, they take on the intentionality of speech [19]. But gestures are not part of a codified system – their forms and meanings are constructed in an ad hoc fashion in the context of the speech they accompany. They are communicative acts that are free to take on forms that speech cannot assume or, for a child at the earliest stages of language learning, forms that the child cannot yet articulate in speech. And children use gesture before they are able to speak [19].

While children are developing and they have limitations as what to say, gestures are of use and they help children to express themselves more freely. Children typically begin to gesture between 8 and 12 months [19]. They first use deictics, pointing or hold-up gestures whose meaning is given entirely by the context and not by their form. Pointing gestures typically precede spoken words by several months and give children an easy way to refer to objects before they have words for those objects [19].

We all know that people use gestures when they talk. But the question is that is this behavior learned from watching others move their hands when talking? According to Iverson & Goldin-Meadow [20], individuals who are blind from birth never see such gestures and so have no model for gesturing. But these researchers show that congenitally blind speakers gesture despite their lack of a visual model, even when they speak to a blind listener. Gestures therefore require neither a model nor an observant partner [20].

When hearing children acquiring a spoken language make the transition from prelinguistic gestural communication to language, a modality change occurs. Deaf children acquiring a sign language communicate prelinguistically and linguistically in the same visual-gestural modality.

Thus, comparison between hearing children acquiring spoken language and deaf children acquiring sign language may help to clarify the relationship between prelinguistic communication and language [21].

Broadly speaking, the phenomenon of gesture can be viewed in two seemingly opposite ways. On one of these views, it is a 'window' into the mind, and is regarded as part of the individual speaker-gesturer's ongoing mental life. Part of the story of gesture is the role that it performs in *interaction*: gestures as something engaged in our social lives [22].

The phenomenon of gesture has been remarked upon for at least 2000 years, across domains as diverse as philosophy, rhetoric, theater, divinity and language. The gestures that are most salient to speakers, and to listeners, are the codified (or conventionalized) forms that can substitute for speech. There is, however, another type of gesture that people routinely produce – informal non-codified hand movements, fleetingly generated during the course of speaking. The content of these gestures is not typically the objects of public scrutiny. As a result, these speech-accompanying gestures have the potential to reflect thoughts that may themselves be relatively unexamined by both speaker and listener. This type of gesture may thus reveal aspects of thought that are not seen in other, more codified forms of communication [1].

2. METHOD

2.1 Participants

Four typically developing children (1 male, 3 females) participated; they were all from middle- to upper-middle-class monolingual Persian-speaking families. On average, each child was observed 8 times, between 6 and 10 times to be more precise.

2.2 Procedure

The children were taken both still frames and continuous videos for approximately 30 min. This took place in their day care center, during play with a primary caregiver and during a snack or mealtime. Toys were provided by the researcher, but the children were also free to play with their own toys.

2.3 Coding

I focused on gestures and speech used communicatively. The child had to make an effort

to direct the listener's attention (e.g., through eye gaze, vocalization, postural shift) for a behavior to be considered communicative. A communicative behavior could be gesture on its own, speech on its own, or a combination of gesture and speech produced together.

2.4 Coding Gesture

Two additional criteria were used to ensure that a gesture was functioning as a communicative: First, the gesture could not be a direct manipulation of some relevant person or object. All acts performed on objects were excluded, except for instances in which a child held up an object to bring it to another person's attention, an act that serves the same function as pointing. Second, the gesture could not be a ritual or game.

Each gesture was classified into one of three categories: deictic gesture, conventional gesture, or ritualized reach. *Deictic gestures* indicate referents in the immediate environment. Children produced three types of deictic gestures: (a) *showing*, holding up an object in the listener's potential line of sight; (b) *index point*, extending the index finger toward a referent; and (c) *palm point*, extending a flat hand toward a referent. The referent of a deictic gesture was assumed to be the object indicated (or held up) by the hand. *Conventional gestures* have a form and meaning that are either culturally defined (e.g., nodding the head "yes") or specified in the context of particular caregiver-child interactions (e.g., smoothing the hands over the hair to mean "pretty"). *Ritualized reaches* are arm extensions toward an object, usually accompanied by repeated opening and closing of the palm.

2.5 Coding the Relation between Gesture and Speech

All instances in which a gesture was produced co-temporally with speech were classified as gesture-plus-word combinations and were divided into two categories based on the relation between the information conveyed in the two modalities. One category included gestures that complemented speech by singling out the referent indicated by the accompanying word (e.g., pointing to flowers while saying "go!" (flowers) to indicate the flowers on the table). The second category included gestures that supplemented speech by providing a different but related piece of information about the referent (e.g., pointing to a picture of a bird while saying

“*khaab*” (sleep) to indicate that the bird in the picture is “sleeping”).

3. RESULTS

3.1 Object Reference in Gesture and Early Lexical Development

Do the early gestures that a child produces have any relation to the words that the child subsequently utters? For these analyses, I identified all instances in which children referred to an object and classified them into three categories: speech only (i.e., using only a word to refer to an object), gesture only (i.e., using only a gesture to refer to an object), or speech and gesture (i.e., using both a word and a gesture, not necessarily at the same time, to refer to an object). In fact, only nouns and deictic gestures were included in the lexical analyses. If a child only pointed at a ball (one or more times) during the session, ball was counted as one type in the gesture-only category. If the child only said “*toop*” (ball) one or more times during the session, ball was counted as one type in the speech-only category. If a child produced the word “*toop*” (ball) and also pointed at a ball in the same session whether simultaneously or at different times, I counted ball as one type in the speech-and-gesture category.

The children relied extensively on gesture to refer to objects: Approximately half of each child’s object references across sessions occurred in gesture only. But gesture did become less important over time.

Gesture thus appears to provide a way for children to refer to objects at a time when they are not producing words for those objects. If gesture serves a facilitating function in lexical development, one might expect an individual lexical item to enter a child’s repertoire first in gesture and then, over time, transfer to speech. To explore this possibility, we identified lexical items that a child used in multiple sessions and classified them into four categories according to whether they (a) appeared initially in speech and remained in speech, (b) appeared initially in gesture and remained in gesture, (c) appeared initially in speech and transferred or spread to gesture, or (d) appeared initially in gesture and transferred or spread to speech. Items that appeared initially in both speech and gesture were excluded from this analysis.

Modality had a clear impact on lexical development. Significantly more items were

produced initially in gesture than in speech. Moreover, a significant proportion of the items either switched or spread from one modality to the other (as opposed to staying in one modality). Items were more likely to move from gesture to speech than from speech to gesture. On average, children produced a gesture for a particular object before they produced the word for that object. Thus, the results are consistent with the gestural-facilitation hypothesis, as we were able to predict a large proportion of the lexical items that eventually appeared in a child’s verbal repertoire from that child’s earlier gestures. Because the relation between a deictic gesture and its referent is more transparent than the arbitrary relation between most words and their referents, gesture can provide children with a temporary way to communicate about objects, allowing them to circumvent difficulties related to producing speech [17,14]. Gesture may thus serve as a transitional device in early lexical development.

4. DISCUSSION

It was found that gesture both precedes and is tightly related to language development. At the lexical level, items found initially in children’s gestural repertoires subsequently appeared in their verbal lexicons. At the sentence level, the onset of gesture-plus-word combinations conveying two elements of a proposition predicted with great precision the onset of two-word combinations. The findings of the study are thus consistent with the hypothesis that gesture plays a facilitating role in early language development.

What might gesture be doing to facilitate language learning? One possibility is that gesture serves as a signal to the child’s communicative partner that the child is ready for a particular kind of verbal input. Consider a child who points at his or her father’s hat while saying “*dada*.” The child’s caregiver might respond by saying, “Yes, that’s daddy’s hat,” in effect “translating” the child’s gesture-plus-word combination into a two-word utterance and providing the child with timely verbal input [21].

Gesture may also play a role in language learning by affecting the learners themselves. Although gesture and speech form a single integrated system, gesture exploits different representational resources than does speech [22]. Meanings that lend themselves to visuospatial representation may be easier to express in gesture than in speech [23].

In addition to relying on a different representational format, gesture reduces demands on memory. Pointing at an object is likely to put less strain on memory than producing a word for that object.

Gesture may thus provide a way for new meanings to enter children's communicative repertoires. It may also give children a means for practicing these new meanings, laying the foundation for their eventual appearance in speech. There is, in fact, evidence that the act of gesturing can itself promote learning [24].

In sum, the findings underscore the tight link between gesture and speech, even in children at the earliest stages of language learning. Gesture may even pave the way for future developments in language [23].



In this picture, four-year-old Hamid is telling a story about ancient Persian kings. He is looking at his right palm and fingers while talking about the number of kings existing then (deictic gesture). It is important here to note a shift between an emphasis on gesture as more informative than the oral speech at the peak of the gesture [25].



"*khaaleh sooskeh mikhaast bereh biroon*" (Auntie Cockroach wanted to go out) Four-year-old Mina is telling the famous Persian story about a cockroach who wanted to leave home and she went to a store to buy something and then she was proposed by the shopkeeper. Here, Mina is saying this utterance using her both arms showing an iconic gesture for the word "out" indicating the direction towards out (deictic gesture).



"*baa ham zendegiye khoobi daashtan*" (they had a good life together)

Four-year-old Rose is telling a story about a crow, a turtle, and an antelope. Here, at the beginning of the story, she brings her hands together to show that the animals had a good life together (deictic gesture).



"*zanet nemisham*" (I won't become your wife)

In this picture, Mina is telling the same story saying this utterance stretching out her both arms showing an iconic gesture for a negative response (I won't become your wife) (deictic gesture).



"*komak*" (Help!)

In this story, Rose says that the three animals, the crow, the turtle, and the antelope, had a happy life together. Once, the antelope did not show up at play and the other two were concerned. So they decided that since the crow could fly, it goes and looks for the antelope. Suddenly, the crow heard someone saying

'Help'. The antelope was trapped by a hunter. Rose is uttering the word "*komak*" (Help) circling her lips as if she is the antelope asking for help.



"*baʔdan*" (then; later)

She keeps saying "*baʔdan*" (later) anytime she wants to say what happened next while telling the story (deictic gesture).



"*aahoo faraar kardeh*" (the antelope has escaped)

This is toward the end of the story when she says the trapped antelope was freed by a mouse who chewed the trap and that when the hunter arrived he saw the antelope had escaped.



"*baagh-e bozorg*" (big garden)

Five-year-old Yekta was the best narrator/story teller among others in terms of using gestures. She is telling the story of some antelopes and foxes living in a big garden. She stretches out

her arms showing "*bozorg*" (big) for the size of the garden (deictic gesture).



"*panj taa roobaah*" (five foxes)

She is showing her left palm and five fingers to show there were five foxes in the garden (deictic gesture).

There is no doubt that a study of four participants may not warrant firm conclusions. There must be further study for sufficient justifications. Furthermore, variables such as participants' native culture and how gestures are interpreted in those cultures can be taken into consideration.

5. CONCLUSION

It can be concluded that gesture has a tight relation to the children's lexical and syntactic development. In this study, many of the lexical items that each child produced initially in gesture later moved to that child's verbal lexicon. Also, children who were first to produce gesture-plus-word combinations conveying two elements in a proposition were also the ones who first produced two-word combinations. It can be said that changes in gesture also predict changes in language, suggesting that early gesture may facilitate future developments in language.

The children who participated in this study relied heavily on gesture to refer to objects: approximately half of each child's object references across sessions occurred in gesture only. However, gesture became less important over time.

Gesture thus appears to provide a way for children to refer to objects at a time when they are not producing words for those objects. If gesture serves a facilitating function in lexical development, one might expect an individual lexical item to enter a child's repertoire first in gesture and then, over time, transfer to speech. Modality had a noticeable effect on the children's lexical development. Significantly more items

were produced initially in gesture than in speech. On average, children produced a gesture for a particular object before they produced the word for that object. Since the relation between a deictic gesture and its referent is more transparent than the arbitrary relation between most words and their referents, gesture can provide children with a temporary way to communicate about objects, allowing them to circumvent difficulties related to producing speech [17,14]. Gesture may thus serve as a transitional device in early lexical development.

What might gesture be doing to facilitate language learning? One possibility is that gesture serves as a signal to the child's communicative partner that the child is ready for a particular kind of verbal input. Gesture may also play a role in language learning by affecting the learners themselves. Although gesture and speech form a single integrated system, gesture exploits different representational resources than does speech [22]. Meanings that lend themselves to visuospatial representation may be easier to express in gesture than in speech [23]. In addition to relying on a different representational format, gesture reduces demands on memory. Pointing at an object is likely to put less strain on memory than producing a word for that object.

In sum, the findings underscore the tight link between gesture and speech, even in children at the earliest stages of language learning. Gesture may even pave the way for future developments in language [23].

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CONSENT

As per international standard written participant consent has been collected from the concerned

parents of the participants and preserved by the authors.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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