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# Lexical Patterns in the Expression of Motion Events in a Self-Styled Gesture System

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## 1. Introduction

All natural languages, be they signed or spoken, have lexical and grammatical devices that encode spatial notions. Languages differ, however, in how those devices are used to represent spatial constructs (Talmy, 1985; Berman & Slobin, 1994). As a result, the spatial domain is a particularly rich one in which to explore the effects of linguistic form on thought (cf. Bowerman, 1996).

One view of the relationship between language and thought in this domain is that spatial concepts are formulated independently of language (e.g., Clark, 1973; Levine & Carey, 1982; Slobin, 1985). A second view holds that spatial notions are necessarily encoded in terms of the language to which the child is exposed (Bowerman, 1996; Choi & Bowerman, 1991; Gopnik & Choi, 1990). Note, however, that these two approaches are not mutually exclusive. The language model to which children are exposed is very likely to influence the spatial notions they encode in their talk (and perhaps even the notions they habitually entertain, cf. Lucy, 1996). Nevertheless, it is still possible that children come to the language-learning situation armed with a set of spatial notions ripe for communication.

This issue is difficult to explore in a typical language-learning situation simply because child talk appears to be influenced by the language model from the very start. Studies of how young children communicate about motion across space have found that children talk about these events in language-specific ways as soon as they begin to speak (Choi & Bowerman, 1991; Berman & Slobin, 1994). As a result, it is virtually impossible to explore the spatial notions children bring to the language-learning situation by observing children learning language from a conventional linguistic model. We need to turn instead to language-learning in atypical circumstances – in particular, to a situation in which the child is not exposed to a usable language model. We focus here on such a situation – deaf children whose hearing losses prevent them from taking advantage of the spoken language that surounds them, and whose hearing parents have chosen not to expose them to a conventional sign language.

Previous studies have found that these deaf children produce self-styled gestural communication systems characterized by many of the structural properties of natural language (Feldman, Goldin-Meadow & Gleitman, 1978; Goldin-Meadow & Mylander, 1984). We concentrate here not on the structure of the deaf children's self-styled gesture systems, but on their content. The notions these deaf children express in gesture come as close as we can currently envision to reflecting the expressible and grammaticizable notions that children themselves bring to the language-learning situation – thought that has not yet


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been filtered through a conventional language model. The present study examines one such deaf child, focusing on his expression of spatial notions.

## 2. Expressing motion events in a self-styled gesture system

The subject of the study, David, is a deaf American child who was not exposed to usable conventional linguistic input. The child was congenitally deaf (hearing losses over 90 dB in both ears) with no other reported cognitive or physical disabilities. The cause of his deafness was unknown. At the time of videotaping, he attended an oral preschool for the deaf but had made little progress in acquiring spoken English. In addition, he had not been exposed to ASL or any other conventional sign system. The child was videotaped in his home during free-play sessions in which toys were provided to facilitate communication. He was observed longitudinally over 7 sessions from ages 2;10 to 4;11 (years;months).

The motion events we focus on here are translative events in which an entity changes its location by moving across space (motion from one place to another). Both transitive ('I moved the duck to the cage') and intransitive ('the duck moved to the cage') movements were included. We used the "discourse unit" as the unit of analysis, and defined it as a set of communications focusing on a single topic. Thus, for example, if the child produced a number of gesture sentences to describe the movement of a mechanical duck toward its cage, all of the gestures produced on this topic would be considered part of a single unit. A discourse unit could, as a result, be as small as a single gesture or as large as several gesture sentences depending upon how long the topic of conversation was maintained.

Talmy (1985) has identified four basic components that appear in motion events across languages: Figure (duck), Motion (moved), Path (into), and Ground (cage). A motion event can also have a Manner (the duck moved into the cage by <u>waddling</u>) and a caused motion, by definition, involves an Agent (<u>the boy</u> moved the duck into its cage). In addition, the way in which the deaf child in our study referred to locations allowed us to make finer distinctions within the Ground category (Origin, Endpoint and Place) than did Talmy. The eight core semantic elements of motion events that we used to code the deaf child's motion events are listed, along with definitions, below.

| | |
|---|---|
| Figure: | the object whose Path is specified |
| Motion: | generalized motion (conveyed not by an iconic gesture for the path but by a non-specific gesture representing movement resulting in a change of location) |
| Path: | the course followed by the Figure with respect to the Ground |
| Manner: | the way the Figure moves |
| Origin: | the point where the Path originates |
| Endpoint: | the point where the Path ends |
| Place: | the location in which the Path occurs |
| Agent: | the animate being who initiates the motion |

To code the data, we began by isolating all of David's discourse units that contained a translative motion event. We used context to determine whether the described movement across space was caused by an external agent (caused motion) or initiated by the figure itself (spontaneous motion). In addition, we determined which semantic element(s) the child explicitly conveyed in the discourse unit. For example, to request that a toy bag be moved to a particular spot, David pointed at the toy bag, thus conveying the Figure of a caused motion event. In the same discourse event, he extended his hand, palm up, toward the object (the non-specific gesture David often used to request the transfer of an object) and pointed at the floor where he wanted the bag moved, thus conveying Motion and Endpoint.[1] As a second example, to describe a toy frog that hopped as it moved forward, David moved his flat palm forward in a straight line while simultaneously moving the palm up and down. He thus conveyed Path (via the linear motion) and Manner (via the up-and-down motion) and did so in a single conflated gesture. At times, David incorporated other elements into a single gesture. For example, he could start his path gesture at precisely the place where the frog began its trajectory, thereby indicating the Origin of the motion within the Path gesture.

Results. We found that David was able to convey each of the eight core motion components described above in his gestural communications. Figure 1 shows how often David produced each of the eight semantic elements. Note that all eight elements could, in principle, be expressed within a single discourse unit. As a result, the proportion for each element could be as high as 1.00. In

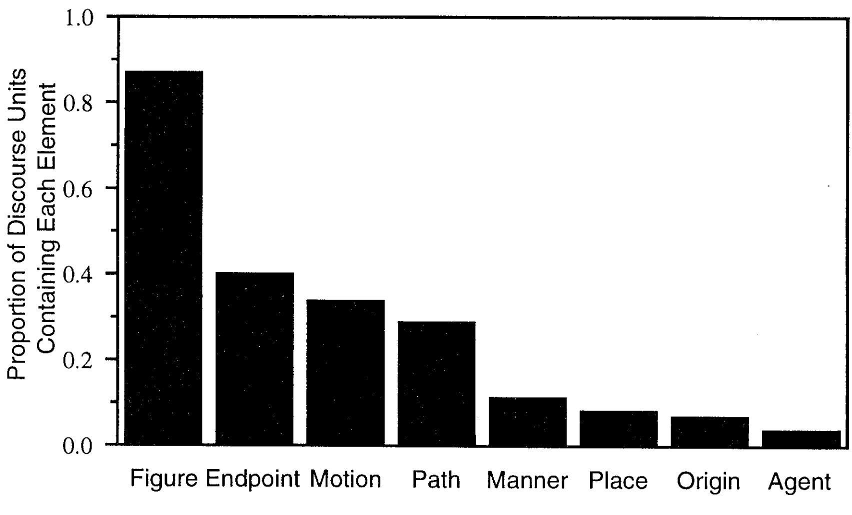


**Figure 1**. The Distribution of Semantic Elements in David's Discourse Units. The bars represent the proportion of discourse units in which David explicitly conveyed each of the eight semantic elements.

fact, David did, at times, produce a large number of core elements within a single discourse unit – we have found as many as seven of the eight elements within a single unit. However, as Figure 1 reveals, even though David was able to express all of the eight motion elements in one discourse unit, he did not do so routinely. Rather, he was selective in the motion elements he explicitly expressed in gesture – conveying Figure most often, followed by Endpoint, Motion, and Path.

## 3. Expressing caused vs. spontaneous motion

We turn next to an analysis of caused and spontaneous motion in David's gesture system. Choi and Bowerman (1991), comparing children learning Korean vs. English, found that, from the earliest stages of language-learning, children look like native speakers rather than universal speakers with respect to making a distinction between spontaneous and caused motions. Adult Korean speakers do not interchange verbs across caused and spontaneous situations. Children who are learning Korean appear to adhere to this restriction very early in development: They never use the same verb to describe a caused event and a spontaneous event.

In contrast, English allows the same verb construction to be used to describe a caused ("I skipped the rock across the lake") or spontaneous ("the rock skipped across the lake") event. Children who are learning English follow suit and do so early in development: They often use the same motion word in both contexts, blurring the distinction between caused and spontaneous events. For example, young children use "move" to describe an act in which an agent moves the toy, and one in which the toy moves on its own. Thus, children can make a distinction between caused and spontaneous events in their early language (Korean-learners), but they need not (English-learners).

The question we ask here is whether children come to the language-learning situation prepared to make a distinction between spontaneous and caused events in their communications (a distinction that subsequently can be blurred by the language model the child receives), or whether they come without such a distinction and require a language model to fashion one. We turn to David's gesture system to explore this question.

Results. Figure 2 presents the data displayed in Figure 1, divided into caused (black bars) and spontaneous (white bars) motions (the Agent category does not appear in Figure 2 since, by definition, Agents do not appear in spontaneous motions).

It is clear from the figure that David used gestures differently to convey caused and spontaneous motions. When conveying caused motions, David rarely produced a gesture for the Path. Rather, he tended to produce gestures for the Figure, Endpoint and Motion. For example, when David wanted his sister to put a cookie on the napkin, he pointed at the cookie (the Figure) and then pointed at the napkin (the Endpoint). In contrast, when conveying spontaneous motions, David relied heavily on Path gestures, often in combination with the Figure. For example, when David wanted to comment on the fact that he had just blown a bubble, he pointed at the bubble (Figure) and then moved his hand across space to indicate the trajectory (Path).[2]

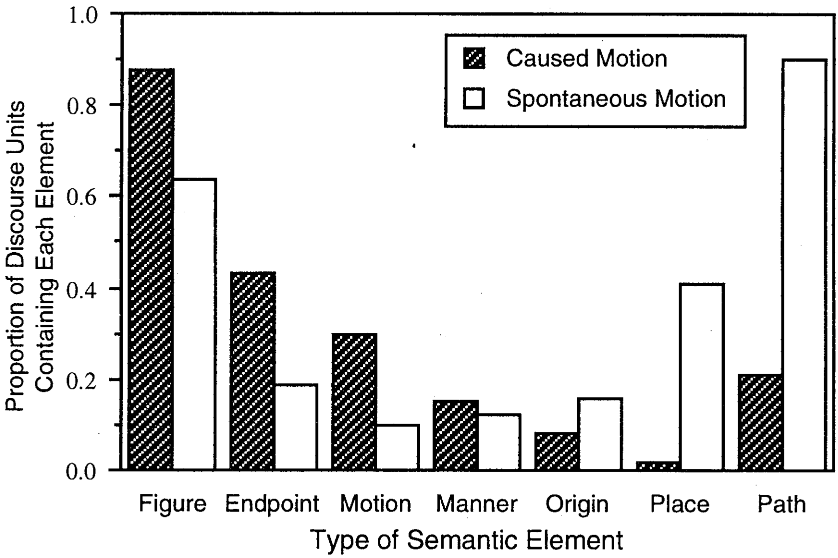


**Figure 2.** The Distribution of Semantic Elements in David's Discourse Units Conveying Caused Motion vs. Spontaneous Motion. The black bars represent the proportion of discourse units conveying caused motion in which David explicitly gestured each semantic element. The white bars represent the proportion of discourse units conveying spontaneous motion in which David explicitly gestured each semantic element.

Talmy (1995) notes that languages allow speakers to highlight any of three possible points of focus within a motion event: the beginning state (when the Figure is at rest), the medial state (when the Figure is in motion), and the end state (when the Figure reaches its endpoint). Talmy refers to the selective attention to certain portions of a motion event as "windowing." The portion of an event that does not have a window upon it is de-emphasized by the lack of sentence constituents referring to it, and thus in Talmy's terms is "gapped."

David focused on different aspects of the event when describing a caused as opposed to a spontaneous motion: He focused on the beginning and end state of the moving object when conveying caused motion, but on the beginning and medial portions of the event when conveying spontaneous motion. In Talmy's terms, David tended to window the initial and final portions of a caused event and gap the medial portion, while windowing the initial and medial portions of a spontaneous event and gapping the final portion.

These data suggest that children do not require a conventional language model in order to make a distinction between caused and spontaneous motions in their communications. Children appear to bring to the language-learning situation the capacity to distinguish caused vs. spontaneous motions. This distinction can then be further reinforced (as in the case of Korean-learners whose language model keeps the two types of motions quite separate) or down-played (as in the case of English-learners whose language model blurs the boundaries between the two).

## 4. Expressing causal-chain events

In the previous section, we examined spontaneous and caused motions when they were described separately in discrete events. However, certain situations allow both types of motions to be conveyed within a single event. For example, if the child twists the key on a toy duck and the duck then walks forward on its own, the event contains both a caused motion (the twisting action) and a spontaneous motion (the walking action). Following Talmy (1995), we call these situations "causal-chain events." A number of such situations arose throughout David's 7 observational sessions, providing us with the opportunity to explore how David expressed causal-chain events over developmental time.

We identified a causal-chain event in our data if the child expressed either link of the chain. Thus, if the child produced a "twisting" gesture to comment on the above situation, we included the gesture in the data base for this analysis, noting that the child expressed only the caused motion in the event. An event would also be considered a causal-chain event if the child produced a "go-forward" gesture in this context, expressing the resulting spontaneous motion but not the initiating cause.

During the first session (age 2;10), David was already conveying causal-chain events. However, the way in which he conveyed these events was limited. He produced a gesture for the caused motion ("twist," the initiating event) but not for the spontaneous motion. In the second session (2;11), David began to convey causal-chain events by producing a gesture for the spontaneous motion ("go-forward"), thus focusing on the resulting event.

Over time, David continued to develop his range of expression for causal-chain events. He began to produce gestures for both the caused and spontaneous motions within the same discourse unit but in different turns. For example, he would produce the "twist" gesture in one turn and, in another turn still focused on the duck-walking topic, he produced the "go-forward" gesture. This type of communication was first noted at age 3;3.

Finally, at age 3;11, David began producing gestures for both the caused and spontaneous components of the causal chain within a single gesture string (the bounds of a gesture string are determined by motoric criteria such as relaxation of the hand, cf. Goldin-Meadow & Mylander, 1984). Thus, David would produce his "twist" and "go-forward" gestures without pausing or breaking the flow of movement between the two gestures. Note that the relatively late onset of gesture strings conveying causal-chain events cannot be explained by an absence of gesture strings in general – David was producing gesture strings that were structured in language-like ways as early as his first observation session at age 2;10.

The developmental trajectory David followed in conveying causal-chain events is summarized below:

| Type of Motion Explicitly Conveyed | Age of Onset |
| --- | --- |
| Caused only | 2;10 |
| Spontaneous only | 2;11 |
| Caused & spontaneous within a discourse unit | 3;3 |
| Caused & spontaneous within a sentence unit | 3;11 |

What we see here is a child literally building up a causal-chain event over developmental time. The child first focused on a single segment of the causal-chain (the initiating caused motion, or the resulting spontaneous motion). He then produced gestures for both segments of the causal-chain and packaged them within a larger discourse unit. Finally, he packaged gestures for the two segments within a single sentence.

Bowerman (1982) described a comparable developmental pattern in English-learners who did not provide evidence of productivity in their cause-result constructions until approximately age 3;6. Bowerman suggests that, even after a child has worked out the components of expression of a cause-and-effect event, it still takes time for the child to discover the "overarching pattern" that connects those components. Although it is not clear what precipitates this "discovery" in either the deaf or the hearing child, our data suggest that these developmental changes are neither motivated, nor guided, by the presence of a conventional language model.

## 5. Discussion

We have shown that, without benefit of a conventional language model, a child can convey spatial notions in his untutored gestural communications. Moreover, the child in our study was able to produce gestures for each of the core components identified by Talmy (1985) as basic to motion event frames in natural languages. Although he could have conveyed each of these components equally often, the child was selective in his focus when communicating about motion across space. He produced gestures for components highlighting the initial and final portions of a caused motion, but gestures for components highlighting the initial and medial portions of a spontaneous motion. In this way, the child showed not only that his production of the core motion elements was patterned, but also that he distinguished between caused and spontaneous motions in his communication system. Finally, the child followed a developmental trajectory that culminated in the expression of a causal-chain event (containing both caused and spontaneous motions) within the bounds of a single gesture sentence.

The characteristics that we have noted in the deaf child's expression of motion events have not been shaped by a conventional language model and therefore may be thoughts that children themselves bring to the language-learning situation – what Slobin (in press) has called "emergent categories." Emergent categories are hypothesized to be the conceptual starting points for grammaticized notions. However, as Slobin points out, we do not yet know whether these starting points are universal, or whether each child brings to the language-learning situation his or her own set of emergent categories. Continued study of the gesture systems generated by other deaf children in our sample, both within and across cultures (see below), should provide useful data on this question.

The properties found in the deaf child's gesture system, because they have been developed without benefit of a language model, may be considered untainted manifestations of child 'thought' – for example, on cognitive grounds, the young child may appreciate the importance of the initial and final portions of an event to a caused motion and the importance of the initial and medial portions to a spontaneous motion. However, the form that the deaf child's expressions take may well be influenced by other factors. One obvious factor is the manual modality – perhaps certain distinctions are relatively easy to make in a manual language, while others are more difficult. In other words, while the patterns we see in the deaf child have clearly not been influenced by a conventional language model, they could have been shaped, at least in part, by the modality through which they are expressed. An analysis of the particular motion event components that deaf children learning a conventional sign language from their deaf parents (e.g., ASL) spontaneously produce at the earliest stages of development would be relevant here.

Another factor that could influence the form of the deaf child's gestures is the gestures that their hearing parents produce when communicating with their children. The hearing parents of the deaf children in our studies were attempting to teach their children to talk and, as a result, addressed their children through speech. However, they did produce gestures along with their speech, as hearing parents tend to do when they talk to their hearing children. The question is whether the gestures that the hearing parents used formed a model after which the deaf children could have patterned their gesture systems. In previous work, we have shown that the gestures the hearing parents produced were not sufficiently complex to serve as a model for the sentential structure (Goldin-Meadow & Mylander, 1984), the morphological structure (Goldin-Meadow, Mylander & Butcher, 1995), or the grammatical categories (Goldin-Meadow, Butcher, Mylander & Dodge, 1994) their deaf children eventually developed. It remains to be seen whether the patterns found in the deaf child's expression of motion events can be traced back to patterns in the hearing mother's gestures.

Even if (as we suspect) the hearing mother's gestures do not serve as a model for the deaf child's expression of motion events, it is possible that other (nonverbal) aspects of the child's culture may have influenced the way the child conveys motion events in gesture. To explore this possibility, we have begun an analysis of the gestures produced by deaf children of hearing parents in a second culture, a Chinese culture. To the extent that there are similarities across the two gesture systems (particularly in the face of cultural differences in the way the mothers interact with the children), we will have evidence that such cultural factors play an insignificant role in shaping the deaf children's gesture systems. To the extent that there are differences across the children's gesture systems, we will have evidence for the role that cultural, albeit nonverbal, factors play in shaping the thoughts that the deaf children bring to their gesture systems.

In sum, our goal in this study was to explore the child's initial state with regard to expressing motion events before a conventional language model has taken effect. To do so, we observed a deaf child who had had no exposure to a usable conventional linguistic model, and examined the ways in which the child used gesture to make semantic distinctions about spatial motion events. We found that the child used gestures systematically to communicate the basic semantic elements of motion events identified in natural languages around the world, and thus appeared to be predisposed to communicate about motion events in a language-like fashion even without exposure to a linguistic model. It is these predispositions that a child presumably brings to the language-learning situation and that are then shaped by the language to which the child is exposed.

## Endnotes

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1. Note that when the child conveyed the Figure and Endpoint in a single gesture sentence (e.g., point at the toy bag followed by a point at the floor), he had to move his hand along some path in order to transport it from the bag to the floor. We made a distinction between a movement that appeared to function merely to get the hand from one location to the next, and a movement that appeared to be an explicit portrayal of a Figure's trajectory of motion (i.e., the Path). Although this sounds like a difficult coding decision to make, in fact, it was quite easy and was one upon which we were very reliable (see Goldin-Meadow & Mylander, 1984).
2. 80% of the caused motions David described were requests, while only 39% of his spontaneous motions were requests (the rest were comments, questions, etc.). As a result, it is possible that the patterns we observe here reflect the child's attention to the speech act rather than the motion type. To explore this possibility, we divided the spontaneous and caused motions the deaf child described into requests and non-requests and examined the proportion of semantic elements expressed for speech acts of each motion type. We found that the patterns seen in Figure 2 were essentially unchanged. For example, the child was as likely to produce a gesture for the Path in a spontaneous motion that was a request (.87) as in a spontaneous motion that was a non-request (.91). Moreover, these proportions for spontaneous motions were both higher than the comparable proportions for caused motions (.07 and .42, respectively). However, the fact that the child produced more Path gestures in non-request caused motions (.42) than in request caused motions (.07) suggests that the type of speech act also played a role in determining which semantic elements the child explicitly encoded.

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