Signed and spoken languages share many fundamental properties. Signed and spoken languages have learned, “conventional” vocabularies. Languages in both modalities share the property of having words/signs that are built of meaningless phonological units; thus, signed and spoken languages exhibit duality of patterning. Signed and spoken languages share mechanisms for building new vocabulary through compounding and derivational morphology. And signed and spoken languages exhibit similar rules for combining words or signs to form sentences.

Signed and spoken languages also exhibit interesting differences in how they are produced and perceived. Whereas the manual articulators move in a transparent, three-dimensional space, the speech articulators are largely hidden from view. For this reason, speech reading (“lip reading”) does not yield sufficient information for a deaf child to understand speech. In speech as in sign, there are a variety of articulators. But, unlike the oral articulators, the manual articulators are paired. The signer must coordinate the action of the two hands. These differing articulatory properties may explain, in part, why speech has a limited capacity for iconicity, whereas sign has a much greater capacity for iconic representation. In particular, the movement of the two arms in a transparent space may allow signed languages to represent the shapes of objects and their movement trajectories.

The differing articulatory and perceptual characteristics of the visual-gestural and oral-aural modalities raise the possibility that the two language modalities may place

---

1 This research is supported in part by NSF grant #BCS-0447018 to Catharine H. Echols (PI) and RPM (co-PI). Please direct correspondence to Richard P. Meier, Department of Linguistics, The University of Texas at Austin, 1 University Station B5100, Austin, TX 78712 USA or to rmeier@mail.utexas.edu. I thank Chris Moreland for serving as the model in Figure 3 and Claude Mauk for preparing that photograph.
different constraints on the language learner and may offer different resources to that learner. The question then for this paper is this: how is the learning of words and signs affected by these differing constraints and resources? I'll discuss three arenas of early sign learning in which we might detect the effects of modality-specific constraints upon the child and of modality-specific resources afforded the child. Those three studies will examine: 1) properties of child-directed signing, 2) the interaction of iconicity and infant sign production, and 3) motoric constraints upon infant sign production.

Child-Directed Signing

Consider the problem of how signs and their referents are presented to children. In particular, let’s consider the problem of object labels (common nouns). Spoken labels and their referents are generally presented in distinct sensory modalities; auditorally-presented labels are paired with visually-perceived referents. The speaking child may attend simultaneously to the label and its referent, without shifting gaze from the referent. In contrast, a signed label and its referent are generally available to the child through a single sensory channel (vision). In signed language, labels and their referents must compete for the child’s limited visual attention. Children often must shift their regard from the referent to the label. In learning spoken languages, parental attempts to redirect a child’s attention to a new referent are costly for word learning (Tomasello & Farrar, 1986). We might wonder whether, by comparison to speech, sign learning is impeded by the fact that the child must learn to shift his attention from object to label.

One issue in early sign development is therefore this: how do signing parents make signed labels visible to their infants? More generally, do signing parents accommodate the visual demands upon their infants? Surprisingly there is some suggestion in the literature that one way in which signing parents accommodate their infants is by producing fewer utterances than do the hearing parents of hearing children. For example, Spencer and Harris (2006) have reported a lower quantity of input from deaf mothers to deaf infants than from hearing mothers to hearing infants. Why? Spencer and Harris suggest that “the lower rate of signed communications seems to be another natural consequence of deaf mothers’ sensitivity to their children’s immature patterns of visual attention. Mothers almost never sign when they know their young child is not
attending…” (p. 81). In other words, deaf mothers don’t sign when their children aren’t looking.

Yet despite possible differences in the quantity of input available to children, signed and spoken languages are acquired on very similar developmental schedules (Newport & Meier, 1985). Signing and speaking children display similar developmental milestones at similar ages. There is no evidence at any point in child development that the acquisition of sign is delayed. To the extent that there are any differences in sign versus speech milestones, those differences may disfavor speech (Anderson & Reilly, 2002). Specifically, there have been claims that continue to be quite controversial of a delay for first words (Meier & Newport, 1990; and, for a critique, Volterra & Iverson, 1995). In sum, despite possible differences in the quantity of sign input available to signing children, the acquisition of sign is robust.

Perhaps therefore it’s the quality of input—not sheer quantity—that matters. In particular, the child-directed signing of deaf mothers may be carefully tuned to the child’s attentional capacities (Spencer & Harris, 2006). One way in which in which mothers can accommodate their children is by altering the form of their signs in order to ensure that those signs are within the child’s visual field. Ginger Pizer and I (Pizer & Meier, this vol.) have been analyzing the child-directed signing that deaf mothers address to their deaf children. One way in which a mother may accommodate her child is by leaning into the child’s visual field. For example, Katie (13 months old) and her mother were looking at a picture book; both were seated on the floor, with the mother on her daughter’s left and somewhat behind her. Katie’s mother leaned over to label the picture of a duck in the book that Katie was examining:

<table>
<thead>
<tr>
<th>M’s gaze:</th>
<th>book</th>
<th>Katie</th>
<th>book</th>
<th>Katie</th>
</tr>
</thead>
<tbody>
<tr>
<td>M’s posture:</td>
<td></td>
<td>leans in</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RH:</td>
<td>Point [held on book], DUCK³X, Point [on book] DUCK⁴X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LH:</td>
<td>DUCK⁴X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>K’s gaze:</td>
<td>to book........to Mom.......to book.....Mom</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

There is much to observe in this brief interaction: 1) With the first token of DUCK (a one-handed sign articulated at the mouth that suggests the opening and closing of a duck’s bill), the mother leaned in so that it was possible for her daughter to see a sign
such as DUCK that is articulated on the face. She continued to lean in for the remainder of the interaction. 2) The first token of DUCK was produced with the left hand, so that the mother could maintain the right-handed pointing gesture to the picture of the duck. Thus the mother simultaneously indexed and labeled the referent. 3) The first and third tokens of DUCK may have been over-repeated by the mother; both had four movement cycles, in contrast to the two or three cycles that would be common in adult-directed signing. By repeating the sign, the mother may have extended its duration so that it might be seen by her child; nonetheless Katie did not turn to view her mother’s signing until the next token of DUCK. 4) During this episode, Katie twice shifted her attention from the book to her mother. Had she not shifted her regard, she would not have seen her mother’s signed label.

By leaning in towards her daughter, Katie’s mom altered her production of a span of four signs. Other properties of child-directed signing are more selective in affecting the articulation of just single signs. For example, in one interaction, Noel (17 months) was seated on her mother’s lap. In this conversation, the mother was labeling the colors of four blocks that were arrayed on the floor in front of them. The color signs BLUE, YELLOW, and GREEN are articulated in neutral space; see Figure 1. Consequently, the mother could readily sign those signs in front of the child and know that they would be fully visible to her daughter. But what about the sign ORANGE? This sign has a repeated, hand-internal closing movement that is articulated at the mouth. If the mother had produced this sign at her own mouth, it would not have been visible to her daughter. Instead, she produced the sign on her daughter’s mouth, thus ensuring that the child received visual and tactile information about the form of this sign.
In our analyses of child-directed signing, Ginger Pizer and I (Pizer & Meier, this vol.) have examined longitudinally-collected samples of the signing of three mother-child dyads. In all cases, the mother and child are deaf and use ASL as their primary language. Samples from 9, 13, 18, and 24 months have been examined. Depending on the sample, 30-60% of the mothers’ signs were altered, whether through repetition of the sign’s movement, displacement of the sign in space, signing on the child, lengthening of the duration of the sign, or enlargement of the sign movement. Modified signs may result from the mother’s attempts to gain the child’s visual attention (Waxman & Spencer, 1997). However, these modifications also sometimes appear when the mother already has the child’s attention, indicating that these properties of sign motherese are not purely a product of the mother’s sensitivity to the child’s visual attention. Instead, for example, mothers sometimes repeat signs in situations in which she is attempting to get the child to imitate her signs.

Properties of child-directed signing may be an important contributor to the robustness of early sign learning in deaf children born into deaf families. Carefully tuned input might obviate whatever consequences may follow from the relatively lower quantity of input that signing parents may present to their children (Spencer & Harris, 2006). However, at this point, we can’t know whether all deaf mothers produce child-directed signing that appropriately accommodates their deaf children. Are there other
factors that might contribute to robust vocabulary acquisition in signing children? I’ll discuss two types of factors. First, I’ll ask whether the iconicity of many signs might guide early sign production. I’ll then ask whether properties of infant motor development may contribute to children’s success at early sign production.

**Iconicity and Early Vocabulary Development**

Iconicity is a much richer resource in the visual-gestural modality than in the oral-aural modality of spoken languages. In spoken languages, the typical word is an arbitrary pairing of form and meaning (Saussure, 1916). Nonetheless, some spoken words iconically represent the characteristic sounds of objects. For example, roosters belonging to English speakers say *cockadoodle-doo*; those belonging to Portuguese speakers say *cocoricó*; and those belonging to Spanish speakers say *quiquiriquí*. The differing words across these three languages demonstrate that these iconic forms are conventionalized. But the fact that these forms are fully conventional does not mean that they are fully arbitrary. Across many spoken languages, a rooster’s call is represented by a multisyllabic, often reduplicative word, in which CV syllables beginning with a velar consonant are most typical (Ball, undated). The crosslinguistic similarity in these words demonstrates that not all words in spoken languages are arbitrary in form; some are motivated at least in part by iconicity.

The visual-gestural modality offers more frequent opportunities for iconic representation. The movement of the two hands in space allows signs to represent the shape of objects, as well as the movements of objects in space. The iconic potential of the visual-gestural modality means that deaf children of hearing parents can invent gestures (so-called “home signs”) that will be understood by non-signing parents (Goldin-Meadow, 2003). Even though different signed languages may choose different iconic representations for the same concept (see Klima & Bellugi’s, 1979, illustration of the signs for ‘tree’ in American, Chinese, and Danish Sign Languages), signed languages may independently arrive at signs that share the same icon. The result is that even unrelated signed languages such as Japanese and Mexican Sign Languages may exhibit considerable overlap in their vocabularies. On one estimate based on a small sample of signs (Guerra Currie, Walters, & Meier, 2002), approximately 20% of the vocabulary in
Japanese and Mexican Sign Languages is similar, where “similar” was defined as exhibiting the same values on two of the three major parameters of sign formation (handshape, place of articulation, and movement).

In spoken languages, transparent form-meaning mappings may facilitate children’s acquisition of morphology; thus, inflectional morphology may be early to emerge in children acquiring morphological systems (e.g. Turkish) in which there is a one-to-one mapping between units of form and meaning (Slobin, 1982). Children’s over-regularization errors (e.g., ungrammatical *runned* in lieu of the irregular past tense verb *ran*) might be seen as a bias on the part of children that leads them to produce form-meaning mapping that are sometimes more transparent than those in the adult language. However, because monomorphemic words are generally arbitrary in spoken languages, we can’t readily ask whether children would prefer more transparent—that is, more iconic or more imagistic—mappings between form and meaning in such words. In contrast, the frequency of iconic mappings between form and meaning within simple, monomorphemic signs makes this an important question to explore in research on the acquisition of signed languages. Recently, Slobin et al. (2003) have argued that the iconicity of certain ASL classifier forms permits their early use by signing children. Casey (2003) has also argued that there are effects of iconicity on children’s acquisition of verb agreement in ASL.

My colleagues and I have reasoned that signing children might notice that the mappings between form and meaning are frequently non-arbitrary in signed languages (Meier, Mauk, Cheek, & Moreland, 2008). The iconicity of signs might facilitate a child’s identification of the meaning of a novel sign. And, importantly for current purposes, iconicity might guide children’s production of signs; children might seek to enhance the transparency of form-meaning mappings and thereby produce erroneous forms that are more iconic than the adult target forms.

In a series of studies, we have examined the acquisition of ASL by four deaf girls whose ages ranged from 8 to 17 months. All four deaf children had Deaf, signing parents; all had at least one Deaf grandparent. Thus, each of the children had at least one native-signing parent. We followed their language development longitudinally; children were videotaped in their home while interacting with a parent and/or a signing experimenter. In
subsequent coding of these videotapes, we identified a corpus of 632 sign tokens. Pointing signs were excluded from consideration. Each of these sign tokens was then judged by a Deaf adult rater as to whether it was more iconic than the adult target sign, less iconic than the adult target sign, or as iconic as the adult target sign. Inter-rater reliability was high.

The results were unequivocal. Contrary to the hypothesis that children would err by enhancing the transparency of the signs they attempted, only 5% of their tokens were judged to be more iconic than the adult target. For example, the ASL sign MILK is a one-handed sign in which there is a repeated opening-and-closing movement of a fisted hand in neutral space; one child’s rendition (Noel 12 mo., 2 weeks) was two-handed rather than one-handed. In contrast, 39% of the children’s tokens were judged to be less iconic than the adult target. The balance were considered to be no more and no less iconic than the adult target sign.

An example of a child’s production that was judged to be less iconic than its adult target was Noel’s production of FALL at 15 months. The adult sign suggests that a legged being changes orientation while falling onto the horizontal surface represented by the static nondominant hand; see Figure 2. When she produced her rendition of the sign, Noel was commenting on the fact that a toy horse had just tumbled over. Noel substituted an index handshape (index finger only extended; others fisted) for the V-handshape of the target sign, thus obscuring the image of legs. Instead of the nondominant hand being oriented with palm up, the nondominant palm was oriented inward toward the midline; the image of a horizontal flat surface was lost. The movement of the sign was executed entirely from the shoulder; there was no change in the orientation of the dominant hand. And, crucially, the nondominant arm moved downward in tandem with the dominant hand, exactly mirroring its movement. So, in Noel’s rendition, the surface (that in the adult language is represented by the nondominant hand) moves with the falling object represented by the dominant hand. In sum, although the downward movement of the Noel’s sign may be considered iconic, the many ways in which her sign diverged from the adult model made it less iconic than the adult target sign.
What do we conclude from this study? First, it is clear that iconicity cannot explain the bulk of children’s errors in early sign production. Although pro-iconic errors do occur (see Launer, 1982), children’s errors are far more likely to reduce the judged iconicity of a sign than to increase it. These results on early sign production are consistent with a variety of prior results. For example, iconic signs do not appear to be over-represented in children’s earliest vocabularies (Orlansky & Bonvillian, 1984). The forms that children produce are often less motivated than the adult targets; this appears to be true in children’s acquisition of ASL pronouns (Petitto, 1987), verb agreement (Meier, 1982, 1987), and classifiers (Supalla, 1982). In sum, iconicity clearly has an important role in children’s innovation of sign systems (Goldin-Meadow, 2003). As children gain metalinguistic awareness, they may come to recognize the iconicity that motivates particular signs belonging to the vocabularies of established signed languages. But we have to look to other factors besides iconicity if we are to explain the bulk of the errors that very young children make in their articulation of signs. I’ll suggest that motoric factors may explain many of the patterns that emerge from close analysis of children’s early sign production.
Articulatory Constraints on Early Sign Production

Parameters of Sign Formation

Signs can be described informally in terms of three major parameters of sign formation: handshape, place of articulation, and movement. Figure 3 shows the ASL sign *good*. Its initial place of articulation is the chin. Its handshape is a flat hand with the fingers closed (a B-hand in the parlance used for describing ASL signs). Its movement is an outward movement away from the signer.

Let’s consider first the accuracy with which children produce these three major parameters of sign formation. In Cheek et al. (2001), we examined the same database of signs that I just discussed in the analysis of the iconicity of children’s sign productions. Figure 4 shows the accuracy with which these four children (aged 8-17 months) produced handshape, place of articulation, and path movement (hand-internal movements and rotations of the forearm are excluded here). These data reveal a pattern that has now been found in several studies of ASL and of other signed languages. Specifically, the children were quite accurate on place of articulation, less accurate on path movement, and quite inaccurate on handshape. This same result has been reported for other signed languages, including LIBRAS (Karnopp, 1994, 2002) and Spanish Sign Language (Juncos et al., 1997). Children’s accuracy on place of articulation may help parents and experimenters...
to recognize their earliest signs. This may be one factor that has contributed to persistent, but controversial, reports that first signs are earlier to emerge than first words (Meier & Newport, 1990; Anderson & Reilly, 2002).

![Figure 4](image_url)

**Figure 4. Accuracy by parameter of sign formation of children’s early sign productions (adapted from Cheek et al., 2001).**

Why does the accuracy of children’s early sign articulation vary as a function of parameter of sign formation? Motoric factors seem to offer a plausible account of the relative ease of place of articulation and the relative difficulty of handshape. Achieving the correct place of articulation simply requires a child to reach to a location on his/her body; producing a sign at the mouth requires the same kind of gross motor control as when a child feeds itself. However, accurate production of sign handshapes requires considerable fine motor control; the visual similarity of certain handshapes (e.g., a 7-handshape with the thumb and ring finger opposed, all others extended and spread vs. an 8-hand with the thumb and middle finger opposed, all others extended and spread) also raises the possibility of perceptual confusions. Errors in handshape production persist until relatively late ages (see Meier, 2006, for a review).
**Articulatory constraints on movement**

But what accounts for children’s relative inaccuracy on movement? Articulatory explanations for why children show relatively poor control over movement, whether path or hand-internal, have not been available. In our work (Meier et al., 2008) we’ve looked at three trends in infant motor control that may help us understand the kinds of errors that young children make. In doing this, we have also looked at which joints of the arm and hand children employ in early sign production.

**Sympathy.** Spoken and signed languages differ in that signed languages employ paired articulators; we have two arms and hands, but only one jaw, one tongue, and one velum. As is well known, some signs involve action of just the dominant hand; in other signs, both hands execute the same movement (although the two hands may be out of phase); in a third class of signs, the dominant hand is active, while the nondominant hand is static (Battison, 1978). In articulating signs from this third class, children must inhibit movement of the nondominant hand.

Early in infant motor development, the nondominant hand tends to mirror the movement of the dominant hand. So when the dominant hand rolls a toy truck across a table, the nondominant hand may execute a similar movement (even though it holds no toy). Production of these mirror movements, or what I have called sympathetic movements, is normal in typically-developing infants, but persists in children with developmental disorders (see Mayston, Harrison, & Stephens, 1999, for a recent report). Bimanual behaviors in which one hand must remain static emerge at 9-10 months (Fagard, 1994).

Cheek et al. (2001) report data on a small sample of signs that have a static nondominant hand in the adult language (just 62 tokens); in 40%, the action of the child’s nondominant hand mirrored that of the dominant hand. An example of this phenomenon was described earlier: in Noel’s production of FALL at 15 months, her nondominant hand was not static, as in the adult target sign. Instead, the nondominant hand matched the downward movement of the dominant hand.

**Cyclicity.** The infant tendency to movement sympathy appears in deaf and hearing children alike, but only for signing infants will this tendency affect their production of language. In contrast, an infant tendency toward cyclic, repetitive motor patterns may
characterize children’s early articulation of sign and speech. Infants show a tendency toward repetitive movement patterns in their nonlinguistic behavior (Thelen, 1979) and in their vocal development (MacNeilage & Davis, 1993; Meier et al., 1997). Thus, typically-developing speaking children at 8 months produce repetitive babbles such as [bababa]. Meaningless prelinguistic gestures, whether from deaf children with early sign exposure or from hearing children with no sign exposure, tend to be multicyclic (Meier & Willerman, 1995; Cheek et al., 2001). Given that children favor repeated movement patterns in their prelinguistic gesture, we hypothesized that this tendency might carry over into their early signing. We also predicted that children would tend to preserve repetition in adult target signs that have repetition, but that they would tend to err when producing adult signs that have only a single movement (Meier et al., 2008).

Most sign tokens in the sample we examined were multi-cyclic, with the median number of cycles per sign being three and the maximum number of cycles in a single sign token being 37. Fewer than 25% of the children’s productions consisted of just a single movement cycle. The children in our sample favored multicyclic productions of multicyclic signs. In contrast, they attempted many fewer monocyclic signs and, when they did so, they typically erred; across the four children 69% of the monocyclic targets were produced with repeated, that is, multicyclic, movement. A typical example was produced by Noel at 12 months; she produced the monocyclic ASL sign BLACK with three movement cycles; in the same conversation, her native-signing mother produced the sign with just one cycle. Similar errors have also been reported in a case study of a young child learning British Sign Language (Morgan, Barrett-Jones, & Stoneham, 2007).

**Proximalization.** Unlike the oral articulators, the manual articulators comprise a series of jointed segments; signs are articulated at joints ranging from the shoulder to the second knuckles. The shoulder joint is “proximal” to the torso, whereas the second knuckles are “distal” from it. A proximal-to-distal trend has long been observed in the literature on infant motor development (Gesell & Thompson, 1934). According to this hypothesis, children show better early control over joints that are close to the torso, as opposed to joints that are relatively far from it. A tendency to proximalization has been observed in children’s walking (Jensen et al., 1995) and in their writing (Saida & Miyashita, 1979). Adults may also show proximalization of movement under certain
circumstances, for example when asked to write with the nondominant hand (Newell & McDonald, 1994). Proximalization of movement has also been reported in adult learners of signed languages (Mirus, Rathmann, & Meier 2001; Rosen, 2004), suggesting that it may in part be a phenomenon of the acquisition of new motor skills.

We hypothesized that in early sign production infants might tend to use proximal joints of the arm in lieu of the more distal articulators that would be expected in adult signing (Meier et al., 2008). For this analysis we therefore had to code, for each early sign token in our database, the joints that the child used. We compared the child’s usage to what would be expected in the adult language. Our results were clear: when children substituted a joint for the expected target joint, they tended to substitute a joint that was proximal to the adult target joint. A good example is Suzie’s production of the sign HORSE at 12 months. The adult target sign has a repeated bending at the first knuckles of the extended first and second fingers; Suzie instead produced a repeated bending at the wrist. In an analysis of children’s omission errors (from signs that required action at two or more target joints), children were more likely to omit action at the more distal joint than at the more proximal joint.

Our results were not entirely simple, however; we also found a surprising class of distalization errors. Specifically, when the children attempted a sign that had the first knuckles as the target joint, they tended to add movement at the second knuckles. The results was a production that seemed to have a simple opening and closing action of the hand, much as when a child might grasp an object. For example, Katie (15mo., 1 wk.) produced the sign DIRTY. The target sign has a fluttering movement at the first knuckles; she substituted an opening-and-closing movement of the hand that was articulated at the first and second knuckles.
The results that I’ve discussed pertain to children’s errors. With the exception of the one class of distalization errors that I’ve just noted, children tended to proximalize. Does this mean that children only showed effective control over the proximal joints of the arm? The answer is no. In fact, children were accurate in their usage of two joints: the elbow and the first knuckles (Meier et al., 2008). Children thus controlled two movement types: path movements articulated at the elbow and hand-internal movements articulated at the first knuckles. This means, in essence, that from a rather early age signing children control two “syllable” types: elbow oscillations and open-close movements of the hand. Still, however, when children erred, they typically proximalized.

**Conclusion**

Let’s return now to the issue of the differing properties of the two language modalities and the consequences that those properties may have for language development in speaking and signing children. As discussed at the outset of this paper, the information necessary to identify words and referents occupies distinct sensory channels in speech. In contrast, signs and their referents compete for a single visual channel. Yet, early vocabulary development occurs on very similar developmental schedules for signing and speaking children. Given published evidence suggesting that signing children may receive relatively less linguistic input than hearing, speaking children (Spencer & Harris,
it may be that signing children’s acquisition of vocabulary is actually facilitated by the fact that they must make intramodal associations between sign and referent, unlike hearing children who must make intermodal (i.e. cross-modal) associations between words and their referents. Another possibility is that deaf mothers are carefully tuning the linguistic input they address to their deaf children to the attentional demands that signing places on those children. As we observed, some of the characteristic properties of sign motherese may not only ensure that signs are visible to children, but may also juxtapose signs and their referents. However, the hypothesis that deaf mothers carefully tune their signing to the attentional demands upon their children raises the possibility that the course of language development in signing children — even in deaf children of deaf parents — will be strongly linked to the sensitivity that individual deaf mothers show to the visual and attentional capacities of their children.

The fact that the mappings between signs and their referents are generally intramodal is not the only respect in which signs and words differ. The visual-gestural modality also affords richer opportunities for motivated mappings between form and meaning in sign than in speech. In particular, many mappings between form and meaning in ASL and other signed languages show some degree of iconicity. However, in our data, the potential for iconic representation seldom leads infant signers to produce forms that are more iconic than would be expected in the adult language. Nonetheless, iconicity has a crucial role to play when deaf children innovate home sign systems (Goldin-Meadow, 2003).

When we seek to account for the bulk of the errors that children make in early sign production, we need to look to articulatory factors, just as we need to look to articulatory constraints when we describe infant speech production. However, there are very different articulators in sign and speech; we might thus be tempted to conclude that there is no overlap between the motoric tendencies guiding early sign and speech development. As we’ve seen, however, an infant tendency toward repetitive movement patterns persists into early sign and speech production. Other motoric factors are modality-specific: for example, both proximalization of movement and the tendency for the nondominant hand to mirror the movement of the dominant hand may be aspects of motor control in signing infants that have no obvious counterparts in speech motor control in infancy. Properties
of maternal input may also promote some of the patterns we have encountered in early sign production; repetition of signs and enlargement of them (with consequent proximalization) are frequent in child-directed signing (Holzrichter & Meier, 2000).

Where infant speech and sign development may show a surprising and interesting difference is in the number of available oscillators. This difference may extend to the articulation of spoken and signed syllables. MacNeilage and Davis (1993) have argued that there is single oscillator that constitutes the “frame” around which the spoken syllables are organized; that oscillator is the mandible. They have also argued that hearing infants in the babbling period only have effective control of the mandible and may have little independent control of the tongue. In signed languages, it does not appear that there is a single predominant oscillator around which syllables are organized. To understand this suggestion, note that in the sign GOOD, articulation is restricted to the elbow, whereas the adult sign DIRTY has articulation at the first knuckles. The infants in our sample controlled articulation at both these joints.

The patterns of success in children’s early sign production suggest that infants have relatively early and effective control of place of articulation, although errors certainly occur (Marentette & Mayberry, 2000). Their control of place may also mean that they control a number of phonological contrasts (Siedlecki & Bonvillian, 1993). Likewise, the early independent control of two or more articulators in sign may mean that infants have an early phonological contrast between path movements of the elbow and hand-internal movements produced at the first knuckles. These results lead to the speculation that more phonological contrasts may be available to signing infants than speaking infants. The signing infant’s control of a set of contrasts may make their early sign productions recognizable. This possibility suggests a particular interpretation of oft-discussed claims that first signs appear somewhat earlier than first words. Signing infants may not be attempting signs any earlier than hearing infants are attempting words; instead their early clumsy attempts may be more recognizable to parents and experimenters than are the garbled first words of speaking children (Newport & Meier, 1985).
References


Ball, C. undated. Sounds of the world’s animals. [http://www.georgetown.edu/faculty/ballc/animals/animals.html](http://www.georgetown.edu/faculty/ballc/animals/animals.html). Retrieved 5/19/07.


