Modality and structure in signed and spoken languages

edited by

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1 Why different, why the same? Explaining effects and non-effects of modality upon linguistic structure in sign and speech

Richard P. Meier

1.1 Introduction

This is a book primarily about signed languages, but it is not a book targeted just at the community of linguists and psycholinguists who specialize in research on signed languages. It is instead a book in which data from signed languages are recruited in pursuit of the goal of answering a fundamental question about the nature of human language: what are the effects and non-effects of modality upon linguistic structure? By modality, I and the other authors represented in this book mean the mode – the means – by which language is produced and perceived. As anyone familiar with recent linguistic research – or even with popular culture – must know, there are at least two language modalities, the auditory–vocal modality of spoken languages and the visual–gestural modality of signed languages. Here I seek to provide a historical perspective on the issue of language and modality, as well to provide background for those who are not especially familiar with the sign literature. I also suggest some sources of modality effects and their potential consequences for the structure of language.

1.2 What's the same?

Systematic research on the signed languages of the Deaf has a short history. In 1933, even as eminent a linguist as Leonard Bloomfield (1933:39) could write with assurance that:

> Some communities have a gesture language which upon occasion they use instead of speech. Such gesture languages have been observed among the lower-class Neapolitans, among Trappist monks (who have made a vow of silence), among the Indians of our western plains (where tribes of different language met in commerce and war), and among groups of deaf-mutes.
>
> It seems certain that these gesture languages are merely developments of ordinary gestures and that any and all complicated or not immediately intelligible gestures are based on the conventions of ordinary speech.

Why Bloomfield was so certain that speech was the source of any and all complexity in these gesture languages is unclear. Perhaps he was merely echoing

Edward Sapir (1921:21) or other linguists who had articulated much the same views.

Later, Hockett (1960) enumerated a set of design features by which we can distinguish human language from the communication systems of other animals and from our own nonlinguistic communication systems. The first of those 13 design features – the one that he felt was "perhaps the most obvious" (p.89) – is the vocal-auditory channel. Language, Hockett argued, is a phenomenon restricted to speech and hearing. Thus, the early conclusion of linguistic research was that there are profound differences between the oral–aural modality of spoken languages and the visual–gestural modality of Bloomfield's "gesture languages." On this view, those differences were such that human language was only possible in the oral–aural modality.

However, the last 40 years of research – research that was started by William Stokoe (1960; Stokoe, Casterline, and Croneberg 1965) and that was thrown into high gear by Ursula Bellugi and Edward Klima (most notably, Klima and Bellugi 1979) – has demonstrated that there are two modalities in which human language may be produced. We now know that signed and spoken languages share many properties. From this, we can safely identify many non-effects of the modality in which language happens to be produced; see Table 1.1. Signed and spoken languages share the property of having conventional vocabularies in which there are learned pairings of form and meaning. Just as each speech community has its own idiosyncratic pairings of sound form and meaning, so does each sign community. In sign as in speech, meaningful units of form

Table 1.1 *Non-effects of modality: Some shared properties between signed and spoken languages*

- Conventional vocabularies: learned pairings of form and meaning.
- Duality of patterning: meaningful units built of meaningless sublexical units, whether units of sound or of gesture:
  - Slips of the tongue/Slips of the hand demonstrate the importance of sublexical units in adult processing.
- Productivity: new vocabulary may be added to signed and spoken languages:
  - Derivational morphology;
  - Compounding;
  - Borrowing.
- Syntactic Structure:
  - Same parts of speech: nouns, verbs, and adjectives;
  - Embedding to form relative and complement clauses;
  - Trade-offs between word order and verb agreement in how grammatical relations are marked: rich agreement licenses null arguments and freedom in word order.
- Acquisition: similar timetables for acquisition.
- Lateralization: aphasia data point to crucial role for left hemisphere.

are built of meaningless sublexical units, whether units of sound or units of manual gesture; thus signed and spoken languages amply demonstrate duality of patterning, another of Hockett's design features of human language. Slips of the tongue and slips of the hand show that in sign, as in speech, these sublexical units of form are important in the adult's planning of an utterance; the fact that speech phonemes or sign handshapes can be anticipated, perseverated, or switched independently of the word or sign to which they belong demonstrates the "psychological reality" of such units (Fromkin 1973; Klima and Bellugi 1979). The chapter in this volume by Annette Hohenberger, Daniela Happ, and Helen Leuninger provides the first crucial evidence that the kinds of slips of the hand found in American Sign Language (ASL) by Klima and Bellugi are also encountered in other sign languages, in this instance German Sign Language (*Deutsche Gebärdensprache* or DGS). The kinds of online psycholinguistic tasks that David Corina and Ursula Hildebrandt discuss in their chapter may offer another window onto the psycholinguistic reality of phonological structure in signed languages.

Like spoken languages, signed languages can expand their vocabularies through derivational processes (Supalla and Newport 1978; Klima and Bellugi 1979), through compounding (Newport and Bellugi 1978; Klima and Bellugi 1979), and through borrowing (Padden 1998; Brentari 2001). Borrowings enter the vocabulary of ASL through the fingerspelling system (Battison 1978) and, recently, from foreign signed languages, which are a source of place names in particular. In the fact that they add to their vocabularies through rule-governed means and in the fact that novel messages may be expressed through the constrained combination of signs and phrases to form sentences, signed languages are fully consistent with another of Hockett's design features: productivity.

In the syntax of signed languages, we find evidence that signs belong to the same "parts of speech" as in spoken languages. In ASL, consistent morphological properties distinguish nouns such as CHAIR from semantically and formationally related verbs, in this instance SIT (Supalla and Newport 1978). ASL and other signed languages exhibit recursion; for example, sentence-like structures (clauses) can be embedded within sign sentences (e.g. Padden 1983). Word order is one means by which ASL and other signed languages distinguish subject from object (Fischer 1975; Liddell 1980). An inflectional rule of verb agreement means that the arguments of many verbs are marked through changes in their movement path and/or hand orientation (Padden 1983, among others).[1] As in such Romance languages as Spanish and Italian, there is a tradeoff between word order and rich morphological marking of argument structure, the result

[1] For a recent critique of the analysis of this property of verbs as being a result of agreement, see Liddell (2000), but also see Meier (2002) for arguments from child language development suggesting that what has been called agreement in signed languages is properly viewed as a linguistic rule.

being that when arguments are signaled morphologically ASL exhibits "null arguments," that is, phonologically empty subjects and objects (Lillo-Martin 1991). As Diane Lillo-Martin reviews in her chapter, Brazilian Sign Language – unlike ASL, perhaps – allows a further tradeoff, such that agreeing verbs sanction preverbal objects, whereas only SVO (subject – verb – object) order is permitted with non-agreeing verbs (Quadros 1999).

Studies of the acquisition of ASL and other signed languages have revealed strong evidence that signed languages are acquired on essentially the same schedule as spoken languages (Newport and Meier 1985; Meier 1991; Petitto and Marentette 1991). There is evidence of an optimal maturational period – a critical period – for the acquisition of signed languages, just as there is for the acquisition of spoken languages (Mayberry and Fischer 1989; Newport 1990). In the processing of signed languages, as in the processing of spoken languages, there is a crucial role for the left hemisphere (Poizner, Klima, and Bellugi 1987) although there is ongoing controversy about whether there might be greater right hemisphere involvement in the processing of signed languages than there is in spoken languages (e.g., Neville, Bavelier, Corina, Rauschecker, Karni, Lalwani, Braun, Clark, Jezzard, and Turner 1998; and for discussion of these results, Corina, Neville, and Bavelier 1998; Hickok, Bellugi, and Klima 1998).

On the basis of results such as those outlined above, there were two conclusions that many of us might have drawn in the early 1980s. One conclusion is unassailable, but the other is more problematic:

Conclusion 1: The human language capacity is plastic: there are at least two modalities – that is, transmission channels – available to it. This is true despite the fact that every known community of hearing individuals has a spoken language as its primary language. It is also true despite plausible claims that humans have evolved – at least in the form of the human vocal tract – specifically to enable production of speech.

The finding that sign and speech are both vehicles for language is one of the most crucial empirical discoveries of the last decades of research in any area of linguistics. It is crucial because it alters our very definition of what language is. No longer can we equate language with speech. We now know that fundamental design features of language – such as duality of patterning, discreteness, and productivity – are not properties of a particular language modality. Instead these design features are properties of human language in general: properties presumably of whatever linguistic or cognitive capacities underlie human language. Indeed, we would expect the same properties to be encountered in a third modality – e.g. a tactile gestural modality – should natural languages be indentified there.[2]

Conclusion 2: There are few or no structural differences between signed and spoken languages. Sure, the phonetic features are different in sign and speech: speech does

[2] In his contribution to this volume, David Quinto-Pozos discusses how deaf-blind signers use ASL in the tactile–gestural modality.

not have handshapes and sign does not have a contrast between voiced and nonvoiced segments, but otherwise everything is pretty much the same in the two major language modalities. Except for those rules that refer specifically to articulatory features – or to auditory or visual features – any rule of a signed language is also a possible rule of a spoken language, and *vice versa*.

It is this second conclusion that warrants re-examination. The hypothesis that there are few or no structural differences between sign and speech is the subject of the remainder of this chapter. The fact that we know so much more now about signed languages than we did when William Stokoe began this enterprise in 1960 means that we can be secure in the understanding that discussion of modality differences does not threaten the fundamental conclusion that signed languages are indeed languages. The last 40 years of research have demonstrated conclusively that there are two major types of naturally-evolved human languages: signed and spoken.

Why should we be interested in whether specific aspects of linguistic structure might be attributable to the particular properties of the transmission channel? Exploration of modality differences holds out the hope that we may achieve a kind of explanation that is rare in linguistics. Specifically, we may be able to explore hypotheses that this or that property of signed or spoken language is attributable to the particular constraints that affect that modality.

1.3 Why is it timely to revisit the issue of modality effects on linguistic structure?

Several developments make this a good time to reassess the hypothesis that there are few fundamental differences between signed and spoken languages. First, our analyses of ASL – still the language that is the focus of most research on signed languages – are increasingly detailed (see, for example, Brentari 1998; Neidle *et al.* 2000). Second, there are persistent suggestions of modality differences in phonological and morphological structure, in the use of space, in the pronominal systems of signed languages, and in the related system of verb agreement.

It is a third development that is most crucial (Newport and Supalla 2000): there is an ever-increasing body of work on a variety of signed languages other than ASL. Even in this one volume, a range of signed languages is discussed: Annette Hohenberger, Daniela Happ, and Helen Leuninger discuss an extensive corpus of experimentally-collected slips of the hand in German Sign Language (DGS). Roland Pfau analyzes the syntax of negation in that same language, while Gladys Tang and Felix Y. B. Sze discuss the syntax of noun phrases in Hong Kong Sign Language (HKSL). Anne-Marie P. Guerra Currie, Keith Walters, and I compare basic vocabulary in four signed languages: Mexican, French, Spanish, and Japanese. Christian Rathmann and Gaurav Mathur touch on a variety of signed languages in their overview of verb agreement: not only

ASL, but also DGS, Australian Sign Language, and Japanese Sign Language (*Nihon Syuwa* or NS). Gary Morgan and his colleagues discuss how Christopher – a hearing language savant – learned aspects of British Sign Language (BSL). Research on signed languages other than ASL means that discussion of modality differences is not confounded by the possibility that our knowledge of signed languages is largely limited to one language that might have many idiosyncratic properties. Just as we would not want to make strong conclusions about the nature of the human language capacity on the basis of analyses that are restricted to English, we would not want to characterize all signed languages just on the basis of ASL.

1.4 Why might signed and spoken languages differ?

Signed and spoken languages may differ because of the particular characteristics of the modalities in which they are produced and perceived; see Table 1.2. I mention three sets of ways in which the visual–gestural and oral–aural modalities differ; these differences between the language modalities are potential sources of linguistic differences between signed and spoken languages. At this point in time, however, we have few conclusive demonstrations of any such effects. In addition to those factors that pertain to specific properties of the two language modalities, I mention a fourth possible source of differences between signed and spoken languages: Signed and spoken languages may differ not only because of characteristics of their respective channels, but because of demographic and historical factors that suggest that sign languages are, in general, rather young languages. Young languages may themselves be distinctive. However, even here a property of the visual–gestural modality may come into play: one resource for the development of signed languages may be the nonlinguistic gestures that are also used in the visual–gestural modality.

1.4.1 The articulators

I turn first to the differing properties of the articulators in sign and speech (cf. Meier 1993). That the hands and arms are in many ways unlike the tongue,

Table 1.2 *Possible sources of modality effects on linguistic structure*

1. Differing properties of the articulators
2. Differing properties of the perceptual systems
3. Greater potential of the visual–gestural system for iconic and/or indexic representation
4. The youth of signed languages and their roots in nonlinguistic gesture

Table 1.3 *Some properties of the articulators*

Sign	Speech
Light source external to signer	Sound source internal to speaker
Sign articulation not coupled (or loosely coupled) to respiration	Oral articulation tightly coupled to respiration
Sign articulators move in a transparent space	Oral articulators largely hidden
Sign articulators relatively massive	Oral articulators relatively small
Sign articulators paired	Oral articulators not paired
No predominant oscillator?	Mandible is predominant oscillator

mandible, lips, and velum surely comes as no surprise to anyone.[3] Table 1.3 lists a number of ways in which the oral and manual articulators differ. The oral articulators are small and largely hidden within the oral cavity; the fact that only some of their movements are visible to the addressee accounts for the failure of lipreading as a means of understanding speech. In contrast, the manual articulators are relatively large. Moreover, the sign articulators are paired; the production of many signs entails the co-ordinated action of the two arms and hands. Yet despite the impressive differences between the oral and manual articulators, their consequences for linguistic structure are far from obvious. For example, consider the fact that the sound source for speech is internal to the speaker, whereas the light source for the reflected light that carries information about the signer's message is external to that signer.[4]

[3] The articulators in speech or sign seem so different that, when we find common properties of sign and speech, we are tempted to think that they must be due to general, high-level properties of the human language capacity or perhaps to high-level properties of human cognition. But a cautionary note is in order: there are commonalities in motoric organization across the two modalities that mean that some similar properties of the form of sign and speech may be attributable to shared properties of the very disparate looking motor systems by which speech and sign are articulated (Meier 2000b). Here are two examples: (1) in infancy, repetitive, non-linguistic movements of the hands and arms emerge at the same time as vocal babbling (Thelen 1979). This motoric factor may contribute to the apparent coincidence in timing of vocal and manual babbling (Petitto and Marentette 1991; Meier and Willerman 1995). More generally, all children appear to show some bias toward repetitive movement patterns. This may account for certain facts of manual babbling, vocal babbling, early word formation, and early sign formation (Meier, McGarvin, Zakia, and Willerman 1997; Meier, Mauk, Mirus, and Conlin 1998). (2) The sign stream, like the speech stream, cannot be thought of as a series of beads on a string. Instead, in both modalities, phonological units are subject to coarticulation, perhaps as a consequence of principles such as economy of effort to which all human motor performance – linguistic or not – is subject. Instrumented analyses of handshape production reveal extensive coarticulation in the form of ASL handshapes, even in very simple sign strings (Cheek 2001; in press).

[4] There are communication systems – both biological and artificial – in which the light source is internal: the most familiar biological example is the lightening bug.

This fact may limit the use of signed languages on moonless nights along country roads, but may have no consequence for how signed languages are structured.[5]

To date, the articulatory factor that has received the most attention in the sign literature involves the relative size of the articulators in sign and speech. In contrast to the oral articulators, the manual articulators are massive. Large muscle groups are required to overcome inertia and to move the hands through space, much larger muscles than those required to move the tongue tip. Not surprisingly, the rate at which ASL signs are produced appears to be slower than the rate at which English words are produced, although the rate at which propositions are produced appears to be the same (Bellugi and Fischer 1972; Klima and Bellugi 1979). How can this seeming paradox be resolved? Klima and Bellugi (1979; see also Bellugi and Fischer 1972) argued that the slow rate of sign production encourages the simultaneous layering of information within the morphology of ASL; conversely, the slow rate of sign production discourages the sequential affixation that is so prevalent in spoken languages.[6] Consistent with this suggestion, when Deaf signers who were highly experienced users of both ASL and Signing Exact English (SEE) were asked to sign a story, the rate at which propositions were produced in SEE was much slower than in ASL (a mean of 1.5 seconds per proposition in ASL, vs. 2.8 seconds per proposition in SEE). In SEE, there are separate signs for the morphology of English (including separate signs for English inflections, function words, and derivational morphemes). In this instance an articulatory constraint may push natural signed languages, such as ASL, in a particular typological direction, that is, toward nonconcatenative morphology. The slow rate at which propositions are expressed in sign systems such as SEE that mirror the typological

[5] Similarly, the use of spoken languages is limited in environments in which there are very high levels of ambient noise, and in such environments – for example, sawmills – sign systems may develop (Meissner and Philpott 1975).

[6] Measurements of word/sign length are, of course, not direct measurements of the speed of oral or manual articulators; nor are they measures of the duration of movement excursions. Some years ago, at the urging of Ursula Bellugi, I compared the rate of word production in English and Navaho. The hypothesis was that the rate of word production (words/minute) would be lower in Navaho than in English, consistent with the fact that Navaho is a polysynthetic language with an elaborate set of verbal prefixes. The results were consistent with this hypothesis. Wilbur and Nolen (1986) attempted a measure of syllable duration in ASL. They equated movement excursion with syllable, such that, in bidirectional signs and in reduplicated forms, syllable boundaries were associated with changes in movement direction. On this computation, syllable durations in sign were roughly comparable at 250 ms to measures of English syllable duration that Wilbur and Nolen pulled from the phonetics literature. Note, however, that there is little phonological contrast – and indeed little articulatory change – across many of the successive "syllables" within signs; in a reduplicated or bidirectional form, the only change from one syllable to the next would be in direction of path movement. See Rachel Channon's contribution to this volume (Chapter 3) for a discussion of repetition in signs.

organization of English may account for the fact that such systems have not been widely adopted in the Deaf community.

The two language modalities may also differ in whether they make a single predominant oscillator available for the production of language, as I discussed in an earlier paper (Meier 2000b). Oscillatory movements underlie human action, whether walking, chewing, breathing, talking, or signing. Although there are several relatively independent oral articulators (e.g. the lips, the tongue tip, the tongue dorsum, the velum, and the mandible), MacNeilage and Davis (1993; also MacNeilage 1998) ascribe a unique status to one of those articulators. They argue that oscillation of the mandible provides a "frame" around which syllable production is organized. Repeated cycles of raising and lowering the mandible yield a regular alternation between a relatively closed and relatively open vocal tract. This articulatory cycle is perceived as an alternation between consonants and vowels. Mandibular oscillation may also be developmentally primary: MacNeilage and Davis argue that, except for the mandible, children have little independent control over the speech articulators; cycles of raising and lowering the mandible account for the simple consonant–vowel (CV) syllables of vocal babbling.

When we observe individual ASL signs we see actions – sometimes repeated, sometimes not – of many different articulators of the arm and hand. ASL signs can have movement that is largely or completely restricted to virtually any joint on the arm: The sign ANIMAL requires repeated in-and-out movements of the shoulder. Production of the sign DAY entails the rotation of the arm at the shoulder. The arm rotates toward the midline along its longitudinal axis. The signs GOOD and GIVE (citation form) are articulated through the extension of the arm at the elbow, whereas TREE involves the rotation of the forearm at the radioulnar joint. YES involves the repeated flexion and extension of the wrist. The movement of still other signs is localized at particular articulators within the hand (e.g. TURTLE: repeated internal bending of the thumb; BIRD: repeated bending of the first finger at the first knuckle; COLOR: repeated extension and flexion of the four fingers at the first knuckle; BUG: repeated bending at the second knuckle). Still other signs involve articulation at more than one joint; for example, one form of GRANDMOTHER overlays repeated rotation of the forearm on top of an outward movement excursion executed by extension of the arm at the elbow. Facts such as these suggest that it will be hard to identify a single, predominant oscillator in sign that is comparable to the mandibular oscillation of speech. This further suggests that analysts of syllable structure in sign may not be able to develop a simple articulatory model of syllable production comparable to the one that appears possible for speech. On the view suggested by MacNeilage and Davis's model, speech production – but not sign production – is constrained to fit within the frame imposed by a single articulator.

Table 1.4 *Some properties of the sensory and perceptual systems subserving sign vs. speech*

Sign	Speech
Signer must be in view of addressee	Speaker need not be in view of addressee
High bandwidth of vision	Lower bandwidth of audition
High spatial resolution of vision; lower temporal resolution than audition	High temporal resolution of audition; lower spatial resolution than vision
Visual stimuli generally not categorically perceived	Categorical perception of speech (and of some highly dynamic nonspeech stimuli)
Articulatory gestures as the object of perception	Acoustic events as the object of perception

1.4.2 The sensory or perceptual systems

A second source of linguistic differences between signed and spoken languages could lie in the differing properties of the sensory and perceptual systems that subserve the understanding of sign and speech (again see Meier 1993 for further discussion, as well as Diane Brentari's contribution to this book). In Table 1.4, I list some pertinent differences between vision and audition.[7] Specific claims about the relationship between these sensory/perceptual factors and linguistic structure have hardly been developed. One instance where we might make a specific proposal pertains to the greater bandwidth of the visual channel: to get a feel for this, compare the transmission capacity needed for regular telephone vs. a videophone. Greater bandwidth is required to transmit an adequate videophone signal, as opposed to a signal that is adequate for a spoken conversation on a standard telephone. The suggestion is that at any instant in time more information is available to the eye than the ear, although in both modalities only a fraction of that information is linguistically relevant.

A more concrete statement of the issue comes from an important discussion of the constraints under which spoken languages have evolved. Pinker and Bloom (1990:713) observed that "[The vocal–auditory channel] is essentially a serial interface . . . lacking the full two-dimensionality needed to convey graph or tree structures and typographical devices such as fonts, subscripts, and brackets.

[7] In an earlier article that addressed some of the same issues as discussed here (Meier 1993), I listed categorical perception as a modality feature that may distinguish the perception of signed and spoken languages. The results of early studies, in particular Newport (1982), suggested that handshape and place distinctions in ASL were not categorically perceived, a result that indicated to Newport that categorical perception might be a property of audition. Very recent studies raise again the possibility that distinctions of handshape and of linguistic and nonlinguistic facial expression may be categorically perceived (Campbell, Woll, Benson, and Wallace 1999; McCullough, Emmorey, and Brentari 2000).

The basic tools of a coding scheme using such a channel are an inventory of distinguishable symbols and their concatenation. Thus, grammars for spoken languages must map propositional structures onto a serial channel . . .” In her chapter, Susan McBurney makes an interesting distinction between the modality and the medium of a human language. For her, modality is the biological or physical system that subserves a given language; thus, for signed languages it is the manual and visual systems that together make up the visual–gestural modality. Crucially, she defines the medium “as the channel (or channels) through which a language is conveyed. More specifically, channel refers to the dimensions of space and time that are available to a given language.” Like Pinker and Bloom, she considers the medium for speech to be fundamentally one-dimensional; speech plays out over time. But sign languages are conveyed through a multidimensional medium: the articulatory and perceptual characteristics of the visual–gestural modality give signed languages access to four dimensions of space and time. The question then becomes: to what extent do signed languages utilize space and what consequences does the use of space have for the nature of linguistic structure in sign?

1.4.3 The potential of the visual–gestural modality for iconic representation and for indexic/ostensive identification of referents

Visual representations – not just language, but also gesture and visual media in general – seem to have greater access to iconicity than do auditory representations: compare the rich possibilities for iconic portrayal in painting and photography to the much more limited possibilities in music. Moreover the visual–gestural modality has great capacity for indexic motivation: with gestures an individual can point to the referents that he or she is discussing. Not only do the possibilities for iconic and indexic motivation seem greater in the visual–gestural modality of signed languages, but the kinds of notions that can be encoded through non-arbitrary gestures may be more important and varied than the kinds of notions that can be encoded in a non-arbitrary fashion in spoken languages. In speech, imagistic words can represent the sounds of objects. Sound symbolism may loosely be able to indicate the relative size of objects. Order of mention may reflect the temporal sequence of events. Gesture can likewise signify size and order, but it can also point to the locations of objects, sketch their shapes, and describe their movements.

Goldin-Meadow and McNeill (1999:155) suggest that the manual and oral modalities are equally good at what they call “segmented and combinatorial encoding.” Consistent with this suggestion, signed and spoken languages share fundamental aspects of linguistic structure. But Goldin-Meadow and McNeill also suggest that, for “mimetic encoding,” the manual modality is a superior vehicle to the oral modality. In spoken conversations, such mimetic encoding

is achieved through the nonlinguistic gestures that accompany speech. On their view the oral modality – unlike the manual one – is constrained in that it is only suitable for segmented, combinatorial, categorical encoding of information. They conclude (p.166) that, in the evolution of human languages:

> speech became the predominant medium of human language not because it is so well suited to the segmented and combinatorial requirements of symbolic communication (the manual modality is equally suited to the job), but rather because it is not particularly good at capturing the mimetic components of human communication (a task at which the manual modality excels).

1.4.4 The youth of sign languages and their roots in nonlinguistic gesture

As best we can tell, signed languages are young languages, with histories that hardly extend beyond the mid-eighteenth century. With some effort we can trace the history of ASL to seventeenth century Martha's Vineyard (Groce 1985). The youngest known signed language – Nicaraguan Sign Language – has a history that extends back only to the late 1970s (Kegl, Senghas, and Coppola 1999; Polich 2000). We also know of one class of young spoken languages – specifically, the creole languages – and, importantly, these languages tend to be very uniform in structure (Bickerton 1984).

The demographics of Deaf communities mean that children may have been, and may continue to be, key contributors to the structure of signed languages. Few deaf children have native signing models. Only third-generation deaf children – in other words, those with a deaf grandparent – have at least one native-signing parent. The fact that most deaf children do not have native-signing models in the home – indeed the preponderance of deaf children (specifically, the 90 percent of deaf childen who are born to hearing parents) do not even have fluent models in the home – may mean that deaf children have freer rein to use linguistic forms that reflect their own biases, as opposed to the conventions of an established linguistic community. The biases of different deaf children are likely to have much in common. That deaf children can create linguistic structure has been shown in a variety of situations:

- in the innovated syntax of the "home sign" systems developed by deaf children born to nonsigning, hearing parents (Goldin-Meadow and Feldman 1977; Goldin-Meadow and Mylander 1990);
- in the acquisition of ASL by a deaf child who had input only from deaf parents who were late – and quite imperfect – learners of ASL (Singleton and Newport, in press);
- in the innovated use of spatial modification of verbs ("verb agreement") by deaf children exposed only to Signing Exact English with its thoroughly nonspatial syntax (Supalla 1991); and

- in the apparent creation of Nicaraguan Sign Language since the late 1970s (Kegl *et al.* 1999).

Young spoken and signed languages need not be structured identically, given the differing "substrates" and "superstrates" that contributed to them and the differing constraints upon the oral–aural and visual–gestural modalities. For young spoken languages – that is, for creole languages – the preponderance of the vocabulary derived from the vocabulary of whatever the dominant (or "superstrate") language was in the society in which the creole arose; so, French Creoles such as Haitian drew largely from the vocabulary of French. But signed languages could draw from rather different resources: one source may have been the gestures that deaf children and their families sometimes innovate in the creation of home sign systems. Other contributors to the vocabularies of signed languages may have been the gestures that are in general use among the deaf and hearing populations; in their chapter, Terry Janzen and Barbara Shaffer trace the etymology of certain modal signs in ASL and in French Sign Language (*Langue des Signes Française* or LSF) back to nonlinguistic gesture. Because many gestures – whether they be the gestures of young deaf home signers or the gestures of hearing adults – are somehow motivated in their form, these gestures may exhibit some internal form–meaning associations. It seems possible that such latent regularities may be codified and systematized by children, yielding elaborate sign-internal morphology of a sort that we would not expect within the words of a spoken creole (Meier 1984).

1.5 What are possible linguistic outcomes of these modality differences? What, if anything, differs between signed and spoken languages?

In Table 1.5, I list five types of linguistic outcomes that may arise as consequences of the modality differences listed in Table 1.2. Let us look at the first of these possible outcomes.

Table 1.5 *Possible outcomes of studies of modality effects*

1. Not much: Signed and spoken languages share the same linguistic properties. Obviously the distinctive features of sign and speech are very different, but there are no interesting structural differences.
2. Statistical tendencies: One modality has more instances of some linguistic feature than the other modality.
3. Preferred typological properties differ between the modalities.
4. Rules or typological patterns that are unique to a particular modality.
5. Relative uniformity of signed languages vs. Relative diversity of spoken languages.

1.5.1 Not much

There are different sets of distinctive features available to signed and spoken languages, but otherwise everything could be pretty much the same. I have already asserted that this finding is true of the basic architecture of signed and spoken languages. It may also be true generally of certain areas of linguistic structure. It is not easy to identify factors that would lead to systematic differences between signed and spoken languages in syntax and semantics, in what categories are encoded in grammatical morphologies, in how the scope of quantifiers is determined, and so on.

Demonstrations that sign and speech share a particular linguistic property will remain important: they show that the existence of a given property in, say, speech is not attributable to the peculiar properties of the oral–aural modality. For example, we might think that iconic signs would be represented in the mental lexicon in terms of their global, imagistic properties; on this view, the representation of lexical items in terms of meaningless, sublexical units of form would be reserved for arbitrary words (and, perhaps, signs) in which the overall shape of the lexical item is of no matter. The abundant evidence for sublexical structure in speech might then be seen as a consequence of the fact that speech is so poor at iconic representation. But it turns out that iconic signs also have sublexical structure. For example, slips of the hand can disrupt the iconicity of signs. Klima and Bellugi (1979:130) cite an example in which a signer attempted to produce the sentence RECENT EAT FINISH '(I) recently ate.' In the slip, the signer switched the places of articulation of RECENT and EAT, so that RECENT was made at the mouth (instead of at the cheek) and EAT was made at the cheek (instead of at the mouth). The error disrupts the iconicity of EAT whose target place of articulation is motivated by the fact that the sign is an icon of the act of putting food in one's mouth. Evidence from studies of short-term memory likewise suggests that signers who had been asked to memorize lists of signs represented those signs in terms of their sublexical structure, not in terms of their global iconic qualities (Klima and Bellugi 1979). The way in which these signers represented signs in memory closely parallels the ways in which hearing individuals represent the words of a spoken language. In sum, duality of patterning in speech is not a consequence of the fact that speech is poor at iconic representation. Duality of patterning characterizes word and signs, whether arbitrary or iconic.

In her contribution to this volume, Diane Lillo-Martin (Chapter 10) notes that in the generative tradition the autonomy of syntax has long been assumed. On this hypothesis, syntactic rules of natural languages do not refer to phonological categories or structures, and conversely phonological rules do not refer to syntactic categories or structures. Thus, in signed and in spoken languages, the syntax should be blind to the kinds of modality-specific properties that are

encoded by the distinctive features of phonetics; we should find no modality effects on syntactic structure (or indeed semantic structure). Lillo-Martin sees one potential class of exceptions to this generalization in the stylistic reordering rules that may apply in the interface between syntax and phonology. More generally, it is at the articulatory–perceptual interface where the vocabulary of linguistic rules is modality specific. Mapping phonology to articulation requires references to voicing or to circular movements. Here modality effects of a sort may be numerous, but such effects may reflect nothing more than the defining properties of the two modalities (i.e. one modality makes the hands available for language, the other makes the mouth available).

1.5.2 Statistical tendencies

Statistical tendencies can lead to important conclusions about the nature of language. Let us consider Saussure's (1916/1959) assertion that linguistic symbols are fundamentally arbitrary. Following Saussure's lead, Hockett (1960) listed arbitrariness as one of the design features of language. Thus, English words like *dog* or Spanish words like *perro* do not look or sound like their referents. But iconic signs seem to be much more frequent than iconic words and they seem to occupy comparatively central places in the lexicons of signed languages. In contrast, onomatopoetic words occupy a rather marginal place in the vocabulary of a language like English. Why is there this difference between signed and spoken languages in the frequency of iconic lexical items? As already suggested above, the oral–aural modality seems to have very limited possibilities for the iconic representation of meaning. Here the speech modality is impoverished. In contrast, the visual–gestural modality grants signed languages the possibility of having many relatively iconic signs.

Thus, the iconicity of many signs and of some iconic words suggests that the human language capacity is not unduly troubled by iconicity; it does not demand that all words and signs be strictly arbitrary. Instead what is key in both speech and sign is that form–meaning pairings are conventionalized. That is, such pairings are specific to a particular language community and are learned by children reared in those communities. The frequency of iconic signs in signed languages leads me to the conclusion that there are in fact two pertinent design requirements on linguistic vocabularies:

1. Languages have vocabularies in which form and meaning are linked by convention.
2. Languages must allow arbitrary symbols; if they did not, they could not readily encode abstract concepts, or indeed any concept that is not imageable.

We know, of course, that ASL has many arbitrary signs, including signs such as MOTHER or CURIOUS or FALSE.

Note that this statistical difference between sign and speech in the frequency of iconic lexical items may indeed be a consequence of differences in the oral–aural and visual–gestural modalities. Yet this difference may have few or no consequences for the grammar of signed and spoken languages. And, thus, the linguist could continue to believe a variant of Outcome 1: specifically, that linguists could quite reasonably believe that, with regard to grammar, not much differs across the two modalities. Even so, there could be consequences for acquisition, but I do not think that there are (for reviews, see Newport and Meier 1985; Meier 1991). Or there could be consequences for the creation of new languages. And, indeed, there may be. For example, the greater resources for iconic representation in the visual–gestural modality allow deaf children of hearing parents to innovate gestures – "home signs" – that can be understood by their parents or other interlocutors (Goldin-Meadow and Feldman 1977). This may jump-start the creation of new signed languages.[8]

1.5.3 Preferred typological properties differ between signed and spoken languages

Klima and Bellugi (1979) argued that the relatively slow rate of manual articulation may push sign languages in the direction of simultaneous, tiered, nonconcatenative morphology. In contrast, affixal morphology is the norm in spoken languages, although the Semitic languages in particular have abundant nonconcatenative morphology. ASL and other signed languages make great use of patterns of repetition, of changes in rhythm, of "doubling" of the hands (i.e. making a normally one-handed sign two-handed), and of displacement of signs in space to mark temporal and distributive aspect, derived nouns or adjectives, and subject and object agreement. In contrast, prefixes and suffixes are rare in signed languages (Aronoff, Meir, and Sandler 2000), although ASL has an agentive suffix (among a small set of possible affixes) and Israeli Sign Language appears to have a derivational prefix. Thus, the difference between signed and spoken languages appears to be this: signed languages generally opt for nonconcatenative morphology, but make occasional use of sequential affixes. Spoken languages generally opt for concatenative morphology, but make limited use of nonconcatenative morphology.

Developmental evidence suggests that children acquiring signed languages prefer nonconcatenative morphology, as discussed by Samuel J. Supalla and

[8] Having said this, there is at least anecdotal evidence (discussed in Meier 1982) that deaf children of hearing parents are not limited by the iconicity of their home signs. For example, Feldman (1975) reports that one deaf child's home sign for ice cream resembled the action of licking an ice cream cone. Early on, the gesture was used only in contexts that matched this image. But, with development, the child extended the gesture to other contexts. So, this same gesture was used to refer to ice cream that was eaten from a bowl.

Cecile McKee in their contribution to this volume (Chapter 6). Many deaf children in the USA are exposed to some form of Manually Coded English (MCE) as part of their school curriculum. Supalla (1991) examined the signing of a group of children who had been exposed to Signing Exact English (SEE 2), one of the MCE systems currently in use in the schools. This artificial sign system follows the grammar of English. Accordingly, SEE 2 does not use the spatial devices characteristic of ASL and other natural signed languages, but does have separate signs for each of the inflectional affixes of English. Thus, in SEE 2, verb agreement is signaled by a semi-independent sign that employs the S handshape (i.e. a fist) and that has the distribution of the third-person singular suffix of spoken English. Supalla's subjects were deaf fourth- and fifth-graders (ages 9–11), all of whom came from hearing families and none of whom had any ASL exposure. The SEE 2 exposed children neglected to use the affixal agreement sign that had been modeled in their classrooms; instead they innovated the use of directional modifications of verbs, despite the fact that their input contained little such modification.[9] Through such directional modifications, many verbs in conventional sign languages such as ASL – and in the innovative uses of the SEE 2 exposed children – move from a location in space associated with the subject to a location associated with the object. No affixes mark subject and object agreement; instead an overall change in the movement path of the verb signals agreement.[10]

1.5.4 Rules or typological patterns that are unique to signed or spoken languages

Identifying grammatical rules or typological patterns that are unique to sign or speech presents clear methodological problems. Rules that have been identified only in spoken languages may be of little interest because there are so many more spoken languages than signed languages. Therefore, our failure to identify a given property (say, ergative case) in signed languages could be a reflection merely of sampling problems. Alternatively, some "exotic" patterns exemplified in spoken languages may never occur in young languages, whether spoken or signed. If so, age may bring more rule types to signed languages. But testing this hypothesis is going to be difficult.

[9] In their chapter, Supalla and McKee (Chapter 6) raise problems for any account that would look solely to articulatory factors (including rate of production) in order to explain the tendency toward noncatenative morphology in signed languages. These authors suggest certain perceptual and grammatical factors that may explain the difficulties that children have in acquiring English inflectional morphology as encoded in SEE 2. Specifically, they argue that when these forms are affixed to ASL signs, constraints on the wellformedness of signs are violated. Further, because these suffixal signs are so sign-like, children may not identifiy the stem and the suffix as constituting a single sign, thereby leading to errors in the segmentation of the sign stream.

[10] Crucially, childen's innovative use of directional verbs is not identical to the forms that are sanctioned in conventional signed languages such as ASL or French Sign Language. For discussion of this, see Meier 2002.

What about rules or patterns that are unique to signed languages? Such rules or patterns are perhaps most likely to be found in pronominal/agreement systems and in spatial descriptions where the resources available to signed languages are very different than in speech. Here are three candidates:

- The signed languages examined to date distinguish first and nonfirst person – and ASL has lexical first-person plural signs WE and OUR – but may have no grammatical distinction between second and third person, whereas all spoken languages distinguish first, second, and third persons (Meier 1990). Spatial distinctions – not person ones – allow reference to addressees to be distinguished from reference to non-addressed participants. This characterization of the pronominal system of ASL has gained wide acceptance (see, for example, Neidle *et al.* 2000, as well as the chapters in this volume by Diane Lillo-Martin [Chapter 10] and by Christian Rathmann and Gaurav Mathur [Chapter 14]) and has also been adopted in the analysis of signed languages other than ASL: for example, Danish Sign Language (Engberg-Pedersen 1993) and Taiwanese Sign Language (Smith 1990). However, this is a negative claim about signed languages: specifically that signed languages lack a grammatical distinction that is ubiquitous in spoken languages.[11]
- Signed languages favor object agreement over subject agreement, unlike spoken languages. For verbs that show agreement, object agreement is obligatory, whereas subject agreement is optional.[12] Acceptance of this apparent difference between signed and spoken languages depends on resolution of the now raging debate as to the status of verb agreement in signed languages. Is it properly viewed as a strictly gestural system (Liddell 2000), or is it a linguistically-constrained system, as argued in the chapters in this volume by Diane Lillo-Martin (Chapter 10) and by Christian Rathmann and Gaurav Mathur (Chapter 14; see also Meier 2002)?
- Instead of the kinds of spatial markers that are familiar in spoken languages (e.g. prepositions such as *in*, *on*, or *under* in English), signed languages always seem to use the signing space to represent the space being described. This is the topic of Karen Emmorey's contribution to this volume (Chapter 15).

1.5.5 Relative uniformity of signed languages vs. relative diversity of spoken languages

In general, sign languages may not exhibit unique linguistic rules, but may display a more limited range of variation than is true of spoken languages. This

[11] Acceptance of the first–nonfirst analysis of person in ASL and other signed languages is by no means universal. Liddell (2000) and McBurney (this volume, Chapter 13) have each argued for an analysis of sign pronominal systems that makes no person distinctions.

[12] However, Engberg-Pedersen (1993) cites the work of Edward Keenan to the effect that there are a couple of known spoken languages that show object but not subject agreement.

hypothesis was advanced most prominently by Newport and Supalla (2000). The general picture that has emerged from recent research on a variety of signed languages is that signed languages use word order and verb agreement to distinguish the arguments of verbs. For a variety of signed languages, three classes of verbs have been distinguished: plain, agreeing, and spatial. This proposal was first made for ASL (Padden 1983). Spatial verbs agree with locative arguments, whereas agreeing verbs agree with the direct or indirect object (depending on the verb in question) and with the subject. Agreeing verbs may show either single or double agreement; singly-agreeing verbs show object agreement. For agreeing verbs, subject agreement appears to be optional, whereas object agreement is obligatory (Meier 1982; Padden 1983). This basic description of verb agreement has been extended to a variety of other signed languages including British (Sutton-Spence and Woll 1998), French (Moody 1983), Israeli (Meir 1998), and Danish (Engberg-Pedersen 1993) Sign Languages, as well as the Sign Language of the Netherlands (Bos 1990). In general, signed languages have been described as topic–comment languages. Topic structures, as well as verb agreement, license null arguments (Lillo-Martin 1991). Signed languages have grammaticalized facial expressions that distinguish important sentence types: for example, declaratives, yes–no questions, *wh*-questions, and conditionals (although different signed languages may assign different facial expressions to a particular linguistic function; cf. Kegl, Senghas, and Coppola 1999). In their morphological structure, signed languages tend to use patterns of repeated movement (loosely, reduplication) to mark temporal aspect. Verb agreement is signaled by the movement of verbs with respect to locations in space that are associated with subject and object. Within verbs of movement and location, so-called classifier handshapes identify referents as belonging to the class of humans, or small animals, or flat, flexible objects, or vehicles, among others (see Emmorey, in press).

Of course, signed languages also differ. Most obviously they do so in their vocabularies; the distinct vocabularies of American Sign Language and British Sign Language render those languages mutually unintelligible. In their phonological structures, signed languages differ in their inventories of contrastive phonological elements, perhaps particularly so in handshape inventories (e.g. Woodward 1982). ASL and Chinese Sign Language have been shown to differ in constraints on how the two hands interact, such that an F-hand sign in ASL cannot contact the nondominant hand at the tips of the extended fingers, but can do so where the thumb and first finger meet. The opposite is apparently true in Chinese Sign Language (Klima and Bellugi 1979). In syntax, the most interesting known difference amongst sign languages lies in whether or not they have auxiliary-like elements; some signed languages – but not ASL – have auxiliaries that carry agreement when the main verb is a plain verb (i.e. a non-agreeing verb). Among those signed languages are Taiwanese (Smith 1990), Brazilian

(Quadros 1999), and German (Rathmann 2000). Signed languages also vary in their predominant word order; some like ASL are predominately SVO, whereas others – including Japanese Sign Language – are SOV (subject – object – verb). And, as Roland Pfau demonstrates in his chapter (Chapter 11), the grammar of negation varies across signed languages.

However, as Newport and Supalla (2000) have observed, the variation that we encounter in signed languages seems much more limited than the variation found in spoken languages. Spoken languages may be tonal, or not. Spoken languages may be nominative/accusative languages or they may be ergative. They may have very limited word-internal morphology or they may have the elaborate morphology of a polysynthetic language. And some spoken languages have elaborate systems of case morphology that permit great freedom of word order, whereas others have little or no such morphology. Why is variation apparently so limited in signed languages? The distinctive properties of the visual–gestural modality may be a contributor. But, as mentioned before, the limited variation in signed languages could be less a product of the visual–gestural modality, than of the youth of the languages that are produced and perceived in that modality.

1.6 Conclusion

What I have sketched here is basically a classification of potential causes and potential effects. It is not a theory by any means. The chapters that follow allow us to jettison this meager start in favor of something much meatier: rich empirical results placed within much richer theoretical frameworks.

But even from this brief review, we have seen, for example, that recent research on a range of signed languages has led to the surprising suggestion that signed and spoken languages exhibit distinct patterns of variation (Newport and Supalla 2000). Although signed languages differ in their vocabularies, in word order, in the presence of auxiliary-like elements, and in other ways, they seem on the whole to be much less diverse typologically than are spoken languages. The relative uniformity of signed languages, in contrast to the typological diversity of spoken languages, may be due to the differing resources available to sign and speech and the differing perceptual and articulatory constraints imposed by the visual–gestural and oral–aural modalities. The apparent fact that signed languages are young languages may also contribute to their uniformity.

The suggestion that signed languages are less diverse than spoken ones is a fundamental hypothesis about the factors that determine what structures are available to individual human languages. Yet this hypothesis has hardly been tested. Doing so will demand that we examine a large sample of signed languages. But just like many spoken languages, the very existence of some signed languages is threatened (Meier 2000a). The pressures of educational policy, of more prestigious spoken and signed languages, and of the ease of