THE PARADOX OF SIGN LANGUAGE MORPHOLOGY

MARK ARONOFF
Stony Brook University

IRIT MEIR
University of Haifa

WENDY SANDLER
University of Haifa

Sign languages have two strikingly different kinds of morphological structure: sequential and simultaneous. The simultaneous morphology of two unrelated sign languages, American and Israeli Sign Language, is very similar and is largely inflectional, while what little sequential morphology we have found differs significantly and is derivational. We show that at least two pervasive types of inflectional morphology, verb agreement and classifier constructions, are iconically grounded in spatiotemporal cognition, while the sequential patterns can be traced to normal historical development. We attribute the paucity of sequential morphology in sign languages to their youth. This research both brings sign languages much closer to spoken languages in their morphological structure and shows how the medium of communication contributes to the structure of languages.*

Si l'on pouvait inventer une langue dont les dictions eussent leur signification naturelle, de sorte que tous les hommes entendissent la pensée des autres à la seule prononciation sans en avoir appris la signification, comme ils entendent que l'on se rejoueit lorsque l'on rit, et que l'on est triste quand on pleure, cette langue serait la meilleure de toutes les possibles; car elle ferait la mesme impression sur tous les auditeurs, que feraient les pensées de l'esprit si elles se pouvaient immédiatement communiquer entre les hommes comme entre les Anges. (Mersenne, *Harmonie universelle,* 1636)

[If one could invent a language whose expressions had their natural signification, so that all men could understand the thought of others by pronunciation alone without having learned its signification, as they understand that one is happy when one laughs, and that one is sad when one cries, this language would be the best of all possible: for it would make the same impression on all hearers as would the thoughts of the spirit if they could be communicated immediately between men as between the angels.] [our translation]

If humans could communicate by telepathy, there would be no need for a phonological component, at least for the purposes of communication; and the same extends to the use of language generally. (Noam Chomsky, *The minimalist program*, 1995:221)

1. THE PARADOX OF SIGN LANGUAGE MORPHOLOGY. In the early days of linguistic research on sign languages, in the 1970s and 1980s, researchers noticed that sign languages have complex morphology. Further research showed that this morphological structure is simultaneous, in the sense that the different morphemes of a word are simultaneously superimposed on each other rather than being strung together, as those of spoken languages usually are. As sign-language research expanded to include more linguistic structures as well as more sign languages, several generalizations emerged. First, all sign languages studied were found to have this particular kind of morphology. Second, the grammatical categories encoded by many of these morphological structures, as well as the form that they take, were found to be quite similar across different sign languages. That is, sign languages show strong crosslinguistic similarities in their morphological structures.

Researchers also noticed early on that sign languages share many properties with young creole languages (Fischer 1978, Meier 1984); yet they differ markedly from young creoles in one crucial respect, the same one that ties sign languages together as

* The authors' names are listed in alphabetical order. This research was supported by US-Israel Binational Science Foundation Grant no. 95-00310/2 to Wendy Sandler and Mark Aronoff and by Israel Science Foundation Grant no. 820/95 to Wendy Sandler. We are grateful to anonymous referees for their helpful comments.

a group: their complex simultaneous morphology. What has gone largely unnoticed so far is that sign languages are not confined to simultaneous morphological structures. At least some sign languages also have sequential affixation. These linear structures differ significantly from the simultaneous type, not only in the way the morphemes are affixed to each other, but in other ways as well:

- the occurrence, grammatical function, and form of the sequential morphological constructions are language-specific;
- the sequential morphological constructions are variable among signers;
- the sequential morphological constructions are often of limited productivity.

This morphological state of affairs presents us with two puzzles; we call them the young language puzzle and the typology puzzle.

THE YOUNG LANGUAGE PUZZLE: Sign languages exhibit certain key properties characteristic of young creole languages, which we enumerate below (§2.2).[1] These commonalities have been attributed to similarities in the age and conditions of acquisition of sign languages and young creoles. But sign languages differ radically from young spoken creole languages in one respect. The latter normally have little inflection, very little derivation (McWhorter 1998), and what little morphology they have consists largely of affixation, with no simultaneous morphology. Furthermore, the affixation found in creole languages varies from one to another. Even Bickerton's BIOPROGRAM HYPOTHESIS (1981), which claims that creole languages are similar to one another because they spring from universal grammar, does not argue for such close similarities in the morphologies of all spoken creole languages. Sign languages, in contrast, have rich morphological structure, both inflectional and derivational. If sign languages share some of the linguistic patterning of young creoles, why do the two types differ so in their morphological systems?

THE MORPHOLOGICAL-TYPOLOGY PUZZLE: Sign languages exhibit two radically different morphological types in their grammars. On the one hand, they have complex morphological structures—verb agreement, classifier constructions, and verbal aspects, to name a few. Depending on the particular analysis, a single verb may include five or more morphemes. For example, the American Sign Language verb LOOK-AT may be inflected for subject and object agreement as well as for temporal aspect, and it could be accompanied by a grammatical nonmanual (e.g. facial) marker that functions as an adverbial. Such a verb, meaning, for example, 'he looked at it with relaxation and enjoyment for a long time', consists of five morphemes. This type of morphology is reminiscent of very heavily inflecting languages. All of these complex morphological structures—verb agreement, classifier constructions, and verbal aspects—have been found in all well-studied sign languages. On the other hand, some sign languages, including the two that form the subject matter of this article, American Sign Language (ASL) and Israeli Sign Language (ISL), also have simple affixal morphology. In both of these languages, the affixed elements are related to free content words, from which they appear to have evolved. They are, moreover, confined to derivational processes and they are not sign-language universal. A particular affix may occur in one sign

[1] DeGraff (2003) takes strong issue with the characterization of creole languages as somehow simpler than other languages. We distinguish young creoles, those in their first generations, which do indeed have simple morphology, from older creoles, which have had the time to develop arbitrary morphology (Roberts 1998).

language but not in another. These morphological phenomena are very similar to those found in young creoles: they are the product of change, grammaticizations, and they are infrequent within the language.

Sign-language morphology thus seems to comprise two radically different types. One is rich, complex, and simultaneous, and the other is sparse, relatively simple, and sequential. Sign languages seem to present the impossible combination of Navajo-like and Tok-Pisin-like languages, a typological puzzle. Only sign languages seem to have this dichotomy in their morphology and the dichotomy appears time and again when a previously undescribed sign language is studied in detail. We know of no spoken language with this property.

We have found an explanation for this difference between languages in the two modalities in a pair of observations about sign languages. First, because they are transmitted by the hands, face, and body and perceived by the eyes, sign languages have the capacity to represent certain spatio-temporal concepts in a more direct manner than spoken languages do. This property allows sign languages to have morphological structures that are not entirely arbitrary and that might be similar across sign languages. In this sense, sign languages differ from spoken languages. The second observation points in the opposite direction, towards expected similarities between signed languages and spoken creoles. As natural human languages produced by the same brain under similar sociocultural-ecological conditions, sign languages have many structural properties in common with young spoken languages.

In themselves, these observations are not new, yet neither has been developed in sufficient detail, nor have the two been expressly integrated. Our work on agreement in spoken and signed languages, on the one hand, and on sequential affixation in sign language, on the other, provides the foundation for a theoretical explanation of these apparently disparate observations. We develop that theoretical framework here.

Sign languages, unlike young creoles, have complex inflectional systems because these systems are not entirely arbitrary. They are motivated representations of certain visuo-spatial concepts like source, goal, theme, path, and size or shape of an object. Since these systems are motivated in the sense of de Saussure, they do not follow the regular course of development of inflectional morphology. This nonarbitrary system seems to follow a quicker course of development than that of spoken languages. Even if we assume that the categories of inflectional morphology are given in advance, still, overt inflection in spoken languages takes time to emerge, because spoken morphological forms are arbitrarily associated with the grammatical categories they represent. It is precisely because sign languages can develop these motivated associations between form and meaning so readily that they differ from young spoken languages in having overt inflection.

At the same time, sign languages have at their disposal one of the same mechanisms for developing complex word-internal structures that spoken languages have: grammaticization of free words. For our purposes, we use the term GRAMMATICIZATION to refer to the result of processes that turn lexemes into grammatical formatives (see Campbell & Janda 2001 for definitions of the related term GRAMMATICALIZATION). As several scholars have recently demonstrated, grammaticization results from well-documented processes of language change, such as reanalysis, extension, phonological erosion, borrowing, and semantic bleaching, which may occur independently or in various combinations (Joseph 2001, Newmeyer 2001). In order for a lexeme to turn into a grammatical affix, some combination of these processes must occur, and these take time to be

fully realized. We do not deal here with the processes involved, only with the result, to which we refer simply as grammaticization.

Sign languages, then, have two different routes to morphological complexity. These two paths differ from each other both in the amount of time required to develop a bound morpheme and in the types of morphology that result. The processes leading to grammaticization take time, and the result is sequential at first, since the grammaticized morpheme has evolved from a free word that necessarily preceded or followed another. The simultaneous morphology arises from the ability of a language produced in space to represent certain spatial and visual concepts iconically, concepts like source, path, theme, goal, size, shape, and location. In the physical phenomenon of motion, for example, the theme and the source-goal path are simultaneously visible and involved, and their expression in a verb in a spatial language is similarly simultaneous. These two different resources for morphological structures explain the second puzzle.

This explanation also clarifies the observed differences between signed and spoken languages. Because of the modality through which they are transmitted, spoken languages cannot convey spatial concepts in a motivated way. Sound waves cannot convey visual and spatial information iconically, and the morphology of spoken languages is therefore necessarily arbitrary in this domain and in most others.[2] The bifurcated morphological systems of sign languages can thus be explained on the basis of two factors, the youth of sign languages, and the modality of their transmission.

2. THE YOUNG LANGUAGE PUZZLE: SIGN LANGUAGES AS YOUNG LANGUAGES. Young languages in the spoken modality arise as the result of contact between groups of people whose languages are not mutually intelligible. Pidgins start off as simplified contact languages, with limited vocabulary, few grammatical categories, and simple grammatical structure. A creole develops 'as a pidgin acquires native speakers and/or becomes the primary language . . . for some or most of its speakers' (DeGraff 1999:5). Linguists agree that creole languages acquired by children at a very young age in a home environment without overt instruction are full-fledged native or natural languages (Sankoff & Laberge 1974). On the most radical view, the simple fact of nativization or naturalization results in greater grammatical complexity in a young creole than in a pidgin (Bickerton 1981, Roberts 1998).

At the outset, let us be specific about what aspects of creoles are relevant for the ensuing discussion. Creole languages vary in at least two respects that should be taken into consideration in making the comparison we wish to make. First, they vary in age. As creole languages age, they undergo normal processes of language change. Second, the sociolinguistic conditions of usage in a given community may give rise to a creole continuum with mesolectal varieties that are grammatically more similar to the lexifier language (Holm 1988). Each of these factors can make a difference in the grammatical properties of the contemporary creole. For example, older creoles may have a relatively large inventory of grammatical formatives.[3] Mesolects that mirror the grammar of

[2] Spoken languages may make limited use of sound symbolism, and a few of them, like Japanese, even have a developed system of mimetics. But in spoken languages such systems are marginal, language-specific, and, crucially, not morphological.

[3] Haitian Creole is an example. The language began to evolve around the middle of the seventeenth century from several substrate languages belonging to the same language family that are even described as mutually intelligible (Lefebvre 1998). As a result, Haitian readily relexified grammatical formatives from the substrate, adopting word forms from the lexifier language, French. Indeed, as Lefebvre convincingly argues, Haitian has a relatively large number of function words relexified from Fongbé. But even under these optimal conditions for introducing grammatical complexity in a contact language, the majority of

the lexifier (or acrolect) language are clearly uninteresting for any discussion of the morphological properties of young contact languages.

Our focus here is the kind of morphology that arises in young languages. While we find that creoles generally have few bound affixes (McWhorter 1998), for the sake of clarity we consider here only a subset of creole languages. Specifically, we refer to young creoles, and to grammaticized affixes with no source in lexifier or substrate languages. Henceforth, we imply both properties in the category of languages we refer to as YOUNG CREOLES.

2.1. CHARACTERISTICS OF YOUNG CREOLE LANGUAGES. Young creole languages differ from more established spoken languages in two ways. The first is their course of development. The development of established languages can generally be traced historically along a chain of successive essentially similar states. The input for any new generation is a fully developed linguistic system. The doctrine of UNIFORMITARIANISM that linguistics adopted from geology in the early nineteenth century forces us to assume that languages have not changed in their essential structure for at least tens of millennia.[4] A young creole is different. It typically emerges through a discontinuity in transmission, as a result of contact between a lexifier language and a substrate language, under conditions of social dominance on the part of speakers of the lexifier language, and it is 'the result of the pidginization of lexifier sources' (McWhorter 1998:790). The linguistic input for the first generation of creole speakers is thus very different from that of children learning an established language, in that this input may not always be a consistent full-fledged language.

The second difference between young creole languages and more established languages, a dearth of inflectional morphology, follows from the simple fact that they are young. Inflectional morphology can be called the morphology of syntax (Anderson 1992, Aronoff 1994), since it involves grammatical categories that play a role in the syntax of a language and are also reflected (we say REALIZED) morphologically. The categories that meet this definition are the morphosyntactic or inflectional categories of the language (Matthews 1991, Zwicky 1985, Anderson 1992).[5] Therefore, the emergence of inflectional morphology in a given language requires both the emergence of a grammatical category and the development of particular bound morphemes that mark the grammatical distinctions encoded in this category.

A GRAMMATICAL category is arbitrary to the extent that it does not directly and unambiguously reflect real-world distinctions. Grammatical gender (or agreement class) is one example.[6] Many Indo-European languages distinguish two or three grammatical

grammatical formatives in Haitian are transcribed in Lefebvre's work as independent words and not as affixes. Be that as it may, for clarity, we remove relexified grammatical formatives from our purview.

[4] According to this doctrine, existing processes acting in the same manner and with essentially the same intensity as at present are sufficient to account for all past changes.

[5] This definition of what it means to be inflectional is much narrower than that used by some syntacticians in the last two decades or so, who do not impose on morphosyntax the condition that it be realized morphologically, but our definition both preserves the essential connection between inflection and morphology and gives the morphosyntactic categories of a language a basis in material reality.

[6] Linguists who study grammatical gender have long restricted the scope of the term to coincide with AGREEMENT CLASS (Meillet 1964 [1937], Hockett 1958, Corbett 1991). We do not say that a language has grammatical gender unless the genders of nouns are reflected in grammatical agreement of other categories, usually adjectives, verbs, pronouns, or some combination of all of them. The familiar European languages have sex-based grammatical genders, but many others have grammatical genders rooted in animacy, shape, and other categories.

genders: masculine, feminine, and sometimes neuter, a categorization inherited from Proto-Indo-European (Meillet 1964 [1937]). These particular genders may have had their roots in the natural category of sex, but in all Indo-European languages in which these genders play a true morphosyntactic role through agreement, including the most ancient Indo-European languages attested (e.g. Sanskrit and Ancient Greek), membership in a given gender is often arbitrary. So, tables are feminine in French, girls are neuter in German, and trees are masculine in Latin. Similar examples can be found in most of the languages that have grammatical gender (Corbett 1991), even though it is reasonable to assume that genders arise from cognitively salient categories. The reason is simply that a category old enough to become both an obligatory part of the syntax and reflected in the morphology usually acquires items whose membership in that category is not determined intensionally.

If the emergence of morphosyntactic categories takes time, then establishing systematic morphological expression of them only adds to the problem. Morphology in spoken language is typically arbitrary, in that there is no motivated connection between the sound of a morphological sign and its meaning.[7] For example, although many Latin feminine nouns and adjectives end in [a], making [a] a marker of the feminine gender in Latin, there is nothing about the sound [a] that makes it feminine, as one can easily determine by turning to Hindi, where [a:] is the predominant masculine marker and [i:] the feminine. Similarly for the English past tense marker *-ed* or any other case of an inflectional marker: because they are both part of the grammar and arbitrary in form, they cannot develop overnight.

New language stages evolving gradually from older ones inherit their inflectional systems as well. In the course of typical historical development, an inflectional category may, and often does, change. For example, though Latin had three genders—masculine, feminine, and neuter—its Romance descendents have only two. But the grammatical category of gender and the particular morphemes realizing it have been inherited from Latin, and therefore need not have risen anew. Creole languages are different because they arise through abrupt contact among speakers of different, often unrelated, languages. Most young creole languages are simply not old enough to have developed either morphosyntactic categories or the morphology that marks them.

As a well-documented case of the emergence of an inflectional category, consider the French future tense, exemplified by *chanterai* 'I will sing', descended from the Latin *cantare habeo* 'I have (something) to sing' and attested in documents from 40 BC. By about the fourth century, the string was apparently interpreted not as two clauses but as a single verb phrase with a main verb followed by an auxiliary, translated 'I have to sing' or 'I will sing' (Hopper & Traugott 1993). Later, the two independent lexical items are found written in documents as a single word, in which the auxiliary was apparently perceived as a bound affix (Fleischmann 1982:71). The auxiliary was eventually reduced from *habeo* to *ai*, and the infinitive marker *r* was interpreted as part of the tense-mood inflection. Thus, the once-phrasal *cantare habeo* became the single word *chanterai*. The first documentation of *chanterai* is found in the ninth century, indicating that the processes leading to this grammaticization may have taken up to eight hundred years. Though the new form might have been in colloquial use well before it was first documented, Fleischmann estimates that it could not have arisen before the fourth or fifth centuries (1982:69). Hence even under careful estimates, the processes required several hundreds of years. Clearly, young creole languages cannot

[7] We find an exception to this generalization in the use of reduplication, to which we turn below.

be expected to have developed complex and productive inflectional systems in their short lifetimes.

2.2. SIMILARITIES BETWEEN SIGN LANGUAGES AND YOUNG CREOLE LANGUAGES. Previous researchers (Fischer 1978, Gee & Goodhart 1988) have pointed out that the grammatical structure of American Sign Language exhibits striking similarities to that of young creole languages. According to Gee and Goodhart 'the amount of overlap between Bickerton's list and ASL grammar is impressive' (1988:56). These commonalities include: no distinction between tensed and infinitival clauses, no tense marking but a rich aspectual system, no pleonastic subjects, no true passives, the occurrence of transitive verbs with agent subjects as intransitives with patient/theme subjects as well, and pervasive topic-comment word order; both young creole languages and ASL make extensive use of content words as grammatical markers; neither young creole languages nor ASL use prepositions to introduce oblique cases; both use preverbal free morphemes to express completive aspect; and both rely heavily on prosodic cues like intonation for expressing certain syntactic relations (such as those encoded by relative clauses and conditionals in other languages).

Three factors likely contribute to these similarities: language origin, conditions of acquisition, and age. Sign languages, like pidgins, arise spontaneously when people who do not share a common language communicate. A recent and well-documented example of this is the sign language of Nicaragua, which arose among deaf children brought together for the first time in a state school (Senghas 1995, Kegl et al. 1999). ISL represents a somewhat different case, closer to that of young creoles. While Nicaraguan Sign Language emerged from contact among children who had only simple home sign systems and no established language, ISL was forged in the emerging Deaf community in Israel in the 1930s, some of whose members had brought other sign languages with them from elsewhere (Meir & Sandler 2004). Woodward (1978) argues that ASL is also the result of creolization of French Sign Language, brought to the United States by Laurent Clerc in 1816, with several indigenous sign languages that existed in some signing communities in the country. But detailed histories of the grammatical development of most sign languages are unknown. While there is evidence that sign languages existed in England in the seventeenth century (see Kyle & Woll 1985) and in France in the eighteenth century, we do not know how they were formed.

The conditions under which sign languages are typically acquired, however, are certain, and in this they clearly resemble the youngest creole languages. Most deaf children are not exposed to a full-fledged language in early childhood, and so develop a linguistic system on the basis of impoverished and inconsistent input. This is exactly the situation in which the first generation of creole speakers acquiring language from an ambient mix of other languages including a pidgin finds itself. Since the vast majority of deaf children have hearing parents, most signers are not exposed to a full-fledged language from birth or in early childhood. Deaf children born to hearing families may be exposed to no signing at all, or to a wide variety of types of signing, and at different ages. The signing to which they are exposed may range from a natural sign language (like ASL in the US and ISL in Israel) to various contrived signing systems (Signed English or Signed Hebrew) to some other kind of contact language. Both contrived sign systems and more spontaneous contact systems between deaf and hearing people differ dramatically from natural sign languages. In such systems, speaking and signing occur simultaneously, word order follows that of the spoken language, and the lexical items are mainly bare forms taken from the sign-language lexicon. What is likely to

be confusing about this hybrid input is that all ambient models share the same basic lexicon, while their morphological, syntactic, and even semantic structures differ greatly and are often inconsistent with each other (Gee & Goodhart 1988:54).

Deaf children born to deaf parents (typically less than 10 percent of all deaf children) are usually exposed to a sign language from birth. Even in such cases, though, they are also exposed to all the signing systems mentioned above. Additionally, as Gee and Goodhart point out, in most cases their parents have hearing parents themselves, and are therefore first generation signers. Thus, just as when young creole languages evolve from pidgins and other ambient languages, sign languages sprout from a language mix that is variegated but impoverished and inconsistent. They differ from young creole languages in that these conditions present themselves anew before each generation of deaf children. In this sense, sign languages are re-creolized with each and every generation of signers (Fischer 1978, Newport 1981).[8]

It is not only the conditions of language transmission that make sign languages young. The known sign languages are also of very recent origin. In order for a language to arise and last, it is necessary for a stable community of people to identify itself and meet regularly. In the case of sign language, these conditions are usually met only when the education system gathers deaf children together, when a critical mass of deaf people forms its own social and cultural institutions, or both, and both are recent societal phenomena. The establishment of schools for the deaf in Europe, for example, began in the late eighteenth century, with the development of large towns due to the industrial revolution (Woll et al. 2001). Woll and colleagues report that no known sign languages are more than three hundred years old. A relatively old sign language, American Sign Language, can be traced back about two hundred and fifty years, having emerged through contact between various indigenous sign languages with French Sign Language and its pedagogical variant developed by l'Abbé de l'Eppée and brought to the United States by Clerc in the early nineteenth century (Woodward 1978, Padden & Humphries 1988, Woll et al. 2001). In societies that do not provide special education or social organizations for deaf people, no social structure typically arises that would foster the development of a sign language. Instead, deaf people remain apart from one another, living among their hearing relatives, and developing a rudimentary gesture system of home sign. In rare cases of small, isolated communities with a genetic propensity for deafness, the social conditions for the development of a sign language may exist without the intervention of an education system. At any given time in history, tiny fledgling deaf groups may emerge, constituting flashes in the pan of language genesis, but their pristine languages disappear as soon as the fragile socio-genetic ecological niche that gives birth to them disappears. A few such communities have been identified around the world in recent years, but apparently none of them have existed for very long (Groce 1985, Lane et al. 2000) and none of their languages has been described in any detail. We conclude that at least all known sign languages are young.

As young languages acquired from impoverished and inconsistent input, then, sign languages are expected to manifest prototypical creole properties that are rooted in newness. Moreover, the creolization process recurs for each generation of signers, which means that sign languages are expected to retain these properties longer than spoken-language creoles.

[8] Creole languages typically arise under colonial conditions, with an accompanying power differential between the superstrate language of the colonizer and the substrate language or languages of the colonized and accompanying structural effects. Sign languages do not share this characteristic.

But there is an extensive part of sign-language grammar that radically departs from this expectation: their rich, complex morphology, including inflectional morphology. As we have explained, the evolution of inflectional morphology normally takes time, since it involves the formation of grammatical categories and the development of bound morphemes to express these categories. The existence of inflectional morphology in young sign languages is thus very surprising. Even more puzzling is the fact that this type of morphology or its underpinnings is characteristic of every sign language studied so far, irrespective of its age, including very young sign languages like Nicaraguan Sign Language (Kegl et al. 1999).[9] Furthermore, some of these structures seem to be quite similar across sign languages. For example, all sign languages studied to date have very similar systems of verb agreement, which we describe in detail below.

3. TWO MORPHOLOGIES IN ONE LANGUAGE. As we noted at the outset, sign-language morphology comes in two flavors. One is the complex simultaneous flavor, and the other is the seemingly less exotic flavor of sequential affixation. These two types of morphology differ with respect to the phonological means they employ, the grammatical categories they encode, their productivity, and their diachronic development. The first type has been likened to specific kinds of templatic and other nonconcatenative morphology that exist in some spoken languages (Sandler 1989, Sandler & Lillo-Martin 2005). For transparency, we use the term SIMULTANEOUS to refer to all nonsequential morphology in sign language. In this simultaneous type of sign-language morphology, grammatical features are realized by altering the direction, rhythm, or path shape of the base sign, and not by sequentially adding new phonological segments to the word. We provide examples below. Much of this simultaneous morphology is inflectional. It is productive and pervasive within and across sign languages. The concatenative or sequential type of morphology attaches an affix (prefix or suffix) to a base word. All sequential processes we have found in ASL and ISL are derivational and do not involve morphosyntactic categories; they are of limited productivity, they are very rare in both languages, and the specific processes differ. In addition, we found a significant amount of individual variation in their use. Finally, the affixes in question are related both in form and in meaning to free words that are semantically and syntactically affiliated with the base they attach to. On this basis, it is reasonable to conclude that these affixes are the result of processes leading to grammaticization in these languages.

3.1. WHAT IS SIMULTANEOUS ABOUT SIGN-LANGUAGE MORPHOLOGY? Even at the level of the monomorphemic sign, the words of sign language have a simultaneous appearance. For this reason, Stokoe's pioneering phonemic analysis of ASL took the three phonological categories he posited—hand configuration, location, and movement—to be simultaneously instantiated (Stokoe 1960). Later work demonstrated that sequential structure does exist (Liddell & Johnson 1986). The simultaneous 'feel' of signs was explained mainly by the fact that a single hand configuration typically characterizes an entire sign (Sandler 1986, 1987, 1989). Sandler treats the hand-configuration category (HC) as an autosegment with scope over a sequence that is typically two locations (L) separated by a movement (M), as shown in 1. This canonical structure, a hand configuration spanning an LML sequence, corresponds to a unit that many researchers refer to as a sign syllable. The model also represents the general place of articulation (P—e.g. the head, trunk, or other hand) as multiply associated, further contributing to

[9] Even in home sign, the gestural communication systems invented by deaf children who were not exposed to any sign language, the buds of this complex morphology can be found.

phonological simultaneity. Specific locations within the place of articulation (e.g. [hi, lo, contralateral, ipsilateral, distal, proximal]) are specified for each location segment.

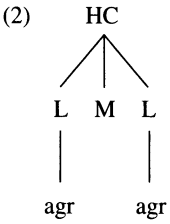
(1)

Figure 1 is the ISL sign QUESTION. The hand configuration is  ; the place of articulation is the head. The first location is specified as [+contact, +low, −ipsilateral, −contralateral]. Together, these features specify the chin. The second location is specified at a medial distance from the place of articulation ([−proximal, −distal]), indicating that the articulating hand moves from contact with the chin outward. The shape of the movement is [arc].

FIGURE 1. ISL sign: QUESTION.

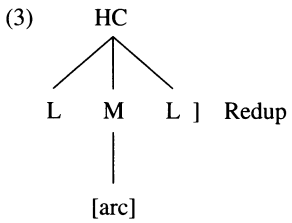
Many linguists, beginning with Coulter (1982), have observed that the signs of ASL have a strong tendency to be monosyllabic, that is, to involve only one movement. What is relevant for the present discussion is that this canonical monosyllable is very often the form taken by morphologically complex signs as well as simple signs (Sandler 1989, 1993a, 1999). Simultaneous morphology consists of the superimposition of morphological structure on the canonical LML unit. For example, the source and goal morphemes of verb agreement, to be analyzed in detail and illustrated below, can be described as superimposed on the first and last locations of the verbal sign, as we show in 2.

(2) Verb agreement as simultaneous morphology in sign language



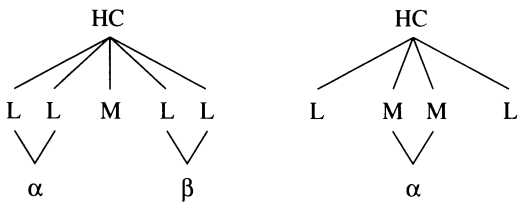
The form of a sign that is marked for verb agreement is still LML, just like the citation form of the verb or any simple sign. Similarly, the verbs of ASL can be inflected for durational aspect (3) by superimposing an arc-shaped morpheme on the movement of the LML sign, and then reduplicating, to create a circular movement (Sandler 1989, 1990).

(3) ASL durational aspect



One form of the Intensive in ASL is also created in a nonaffixal fashion, by increasing the length of time during which the hand is held static for the first and last locations, a process akin to gemination in spoken languages (Sandler 1993b). In ISL, the Intensive is formed by lengthening (slowing down) the movement portion (Sandler 1996b). Both intensives are shown in 4. We call processes such as the Intensive simultaneous, in the sense that all templatic morphology is simultaneous: it associates phonological material present in the morphological base to a prosodic template.[10] The Greek letters stand for the features of the first and second locations of the base sign.

(4) Intensive aspect in ASL and ISL



Intensive in ASL Intensive in ISL

The classifier construction is another type of morphology that involves simultaneous combination of morphemes.[11] In these structures, the hand configuration represents an

[10] In fact, neither the phonology nor the morphology of sign language is strictly simultaneous; each involves sequential elements, most perspicuously described as timing slots (Liddell 1984, Sandler 1989). But as with templatic morphology in spoken languages (McCarthy 1981), the association of morphological material to timing slots or other prosodic units is simultaneous and, in this sense, qualitatively different from concatenative processes. Here we use the terms TEMPLATIC and SIMULTANEOUS interchangeably.

[11] See Emmorey 2002, Aronoff et al. 2003, and Sandler & Lillo-Martin 2005 for recent discussions and analyses of classifier constructions.

independent classifier morpheme and it attaches to locations and movements that also have morphological status. In this sense classifier constructions differ markedly from other signs, in which each category has phonological status but no meaning. Since each hand may function as an independent morpheme and a single classifier may characterize a string of predicates, the resulting predicative structures can become extremely complex. The picture in Figure 2 is from a classifier construction glossed UPRIGHT-HUMAN-MOVE-FORWARD-(WHILE) LEGGED-CREATURE-DRAGS-BEHIND, translated roughly in context as 'a man proceeds, dragging a dog behind him'.[12]

FIGURE 2. Complex ASL classifier construction: 'A person walks forward, (dragging) a dog squirming behind.'

3.2. SEQUENTIAL MORPHOLOGY IN ASL AND ISL. The sequential morphology of the sign languages we have been studying is quite different. Normally, an identifiable affix is added to the beginning or end of a base sign. Even in cases where the resulting form further reduces to a monosyllabic (one movement) structure, this complex structure is clearly different from those of the simultaneous morphology. The most obvious difference is that the hand configuration and place of articulation of each of the two morphemes are usually retained, resulting in structures that have two of each of these categories instead of one. We can represent the suffixed ASL sign TEACH + AGENTIVE ('teacher') shown in Figure 3 as consisting of two LML syllables, each with its own hand configuration and place of articulation, as in the simplified and schematized representation accompanying the illustration.[13] Since each of the signs that make up the complex form of this word is symmetrically two-handed, each has its own root node above HC, associated with the same features (Sandler 1989, 1993c). The complex feature hierarchy of hand configuration is represented here with icons for simplicity.[14]

Both of the languages we have been studying productively employ compounding, by definition a concatenative process, though not one that involves affixes. But apart

[12] Though they differ in a number of ways from other signs, we mention these structures because the morphemes are combined simultaneously, and also because classifier systems are central to all sign languages. However, given their complex and in some ways anomalous nature within the simultaneous morphology of sign languages, we refrain from attempting to represent them, even schematically.

[13] Supalla (1998) provides evidence from old films of ASL that the agentive suffix evolved from a sign meaning 'person'.

[14] The representation is schematic, intended to give an indication of the morphological structure, and not to reflect a full phonological analysis. See Sandler 1989, 1993a for detailed representations in the same framework.

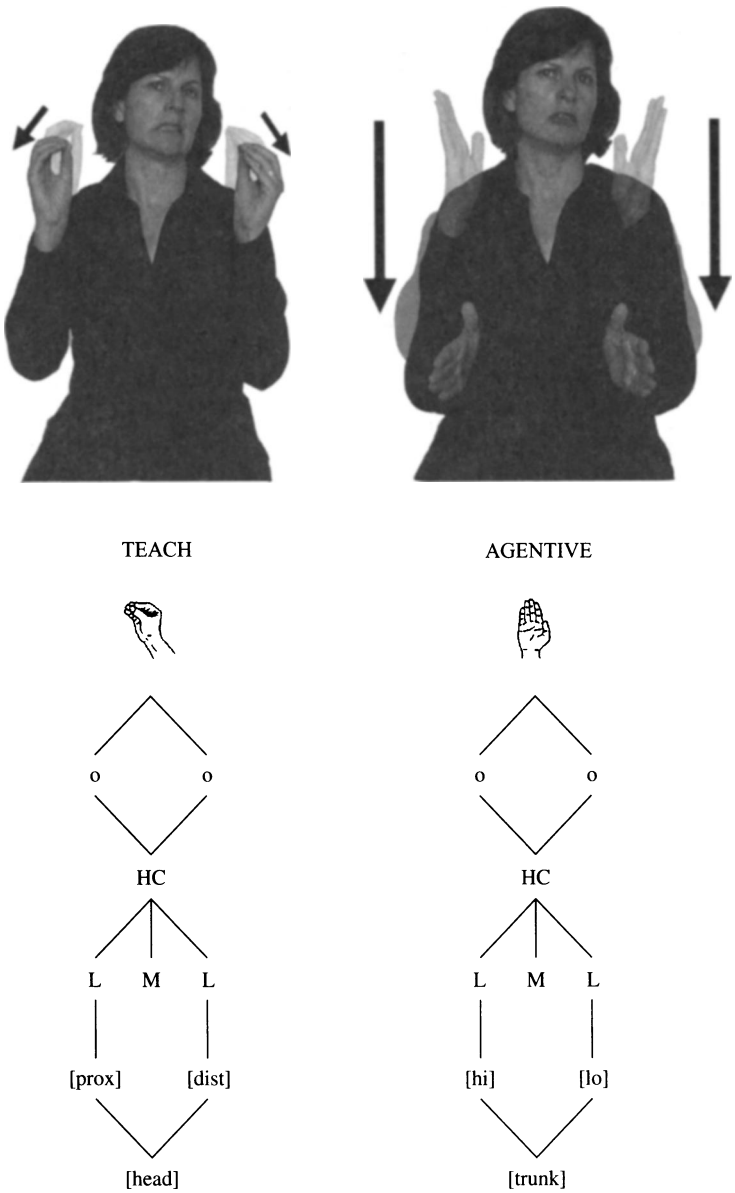


FIGURE 3. ASL suffixed sign: TEACHER.

from compounding, concatenation is very rare. About five affixes have been identified in ASL (Sandler & Lillo-Martin 2005), and two types of affixes in ISL (Meir & Sandler 2004).[15] Although this might not be an exhaustive list, it clearly indicates the dearth of concatenative affixes in these languages. When the sequential morphology of sign languages is considered alone, then, it is revealed to have much in common with the morphology of young creole languages.

[15] As we explain in §5.2, one of the affix types in ISL includes several different affixes, but we analyze the phenomenon as a single affixation process.

3.3. MODALITY CONSTRAINTS AS EXPLANATIONS OF SIMULTANEITY. The simultaneity of sign-language word structure has usually been attributed to production and perception factors. Emmorey has argued (1995, 2002) that seeing is different from hearing in that one can easily perceive in parallel fashion information that is spatially disparate. In other words, according to Emmorey, the visual processing system is not overburdened by the simultaneous presentation of distinct units of information. This may explain in part why the morphological formatives are simultaneously encoded: it is possible to perceive all of them at once. Bellugi and Fischer (1972) argue that the tension between the slowness of the manual articulators and constraints on short-term memory results in simultaneous encoding of information in signs.

Modality constraints, then, favor simultaneity in sign languages.[16] In fact, simultaneity of structure is found at every level of structure in sign languages, from phonology to morphology, and from prosody to discourse (e.g. Meier et al. 2002, Sandler 2005, Sandler & Lillo-Martin 2005). In morphology, it is reasonable to look to such modality constraints to explain the strong tendency for signs to adhere to a canonical LML template, whether they are simple or involve typical and prolific simultaneous morphological complexity. Modality may even be behind the reduction of certain (especially lexicalized) concatenative complex forms to the same monosyllabic form (Liddell & Johnson 1986, Sandler 1989, 1993a). But such constraints cannot tell the whole story. The morphological properties of sign languages can be fully understood only if the relationship between the spatial nature of the medium and visuo-spatial cognition is explicitly taken into account.

3.4. STILL TO BE EXPLAINED: PARTICULAR SIGN-LANGUAGE-UNIVERSAL MORPHOLOGICAL PROCESSES. Production and perception constraints do not address the existence of the two distinct morphologies of sign languages outlined above or the specific set of properties characterizing each of them. They do not predict which morphological categories are more likely to be encoded by simultaneous morphology, nor can they account for the fact that specific categories are encoded in a very similar way in all sign languages. Further, they cannot explain the fact that the same categories that occur universally across sign languages are precisely those that reflect visuo-spatial properties and relations in the real world in an iconically motivated way.

Our model addresses precisely these issues. The categories that are likely to be encoded by complex simultaneous morphology are those whose real-world simultaneity of occurrence can be represented iconically. The iconicity of these categories, made available by the modality, accounts for the crosslinguistic similarities among different sign languages, regardless of their ages, as well as for the differences between sign languages and spoken creoles. Two classes of phenomena, each specific to the visuo-spatial modality, together conspire to yield the morphological structures that characterize sign languages and sign languages only: production/perception/processing constraints, like those mentioned in the previous section, and the availability of iconically motivated representation of certain conceptual categories.

[16] Sam Supalla (1991) has presented interesting evidence supporting the naturalness of simultaneous encoding of particular kinds of linguistic information in sign languages. Supalla studied the language of Deaf children exposed only to Manually Coded English, an artificial manual language that represents the derivational and inflectional morphemes of English in a linear sequence. He found that the children spontaneously produce simultaneous modifications of verbs to mark verb arguments, though they have had no exposure to real sign languages.

To illustrate how our model works, we turn to an in-depth examination of representative phenomena of each type of morphology. The simultaneous type is represented by verb agreement and classifier constructions, the sequential type by negative and agentive suffixes in ASL, and by a set of 'sense'-prefixes and a different negative suffix in ISL.

4. SIMULTANEOUS MORPHOLOGY: VERB AGREEMENT. Agreement systems take time to develop, since they involve the development of morphosyntactic categories and specific morphemes to mark these categories. Verb agreement affixes may develop from cliticized personal pronouns (Givón 1976, Dixon 1982, Craig 1986, Grinevald 1999), but such processes take time, and indeed are absent from young spoken languages. Yet sign languages have complex agreement systems, despite their youth. The rudiments of agreement systems are found even in home sign (Goldin-Meadow 2003), as well as in very young sign languages, like the sign language of Nicaragua (Senghas et al. 1997, Kegl et al. 1999, Senghas 2000). In other words, visual languages demonstrate a predisposition toward an agreement system of a particular type. Moreover, the agreement systems of all mature sign languages investigated to date are very similar. These are robust generalizations in search of an explanation.

Although sign languages all have a system traditionally referred to as verb agreement, some researchers have recently claimed that 'agreement' is a misnomer, because it seems quite different from agreement in spoken languages. In order to maintain the comparison between signed and spoken languages in this domain, we need to demonstrate that we are indeed dealing with comparable systems. We show, relying on Meir 1998b, 2002, that the agreement system of sign languages is part of the grammar of these languages, but that it is also motivated. It is the ability of visual languages to have motivated yet grammatical structures that explains their rich simultaneous morphology.

4.1. WHAT IS AGREEMENT? AGREEMENT AS OBLIGATORY COPYING. We make a distinction here between syntactic and morphological agreement. We assume that SYNTACTIC AGREEMENT is obligatory in all languages, regardless of modality, and that syntactic agreement consists of copying referential indices freely under certain syntactic conditions.[17] Syntactic agreement, as opposed to morphological agreement, is covert or abstract (in the sense that it may have no realization as a pronounced form) and, we assume, universal, operating the same way in all languages. Consider the most common type of agreement, in which a verb agrees with its subject. We assume that this subject-verb agreement occurs syntactically in all human languages, even those in which it has no overt form, and that its conditions are the same across all languages (Aronoff 1999).

Syntacticians and semanticists assume standardly that each referring expression carries its own unique REFERENTIAL INDEX, which indicates what entity it refers to in a possible world. Two or more expressions that refer to the same entity in a world carry the same index (Fiengo & May 1995) and expressions that carry different indices must be referentially distinct. So, for example, the sentence *Mary wants Fran to respect her* may be interpreted in two different ways. Note first that *Mary* and *Fran* cannot refer to the same entity, and hence must bear different indices in any interpretation: $Mary_i$ vs. $Fran_j$. The pronoun *her* cannot refer to the same entity as *Fran* does, for structural reasons, but it may refer either to the same entity as *Mary* does or to some entirely different entity, so we give it two referential indices: $her_{i,k}$. The verb *wants* agrees syntactically with the subject, and hence carries the same referential index as *Mary*. We assume that all syntactic agreement is obligatory in all languages, because languages

[17] We could equally well say that agreement consists of checking freely assigned indices, but copying fits the facts of literal alliterative agreement, which we touch on below, more elegantly.

choose from a restricted and clearly delineated set of possible syntactic agreement relations when they mark agreement morphologically.

This covert abstract syntactic agreement must be distinguished from MORPHOLOGICAL AGREEMENT, which is far from universal. Not all languages manifest morphological agreement and among those that do show it, the morphological categories and their realization differ from one language to another, albeit within clear limits. Morphological agreement, as opposed to syntactic agreement, is overt by definition, since, as we have said, morphological categories can be posited in a given language only if there is some direct phonological evidence of their existence. Agreement morphology is the realization of the universally agreeing syntactic indices, but mediated by the partly arbitrary referential and classificatory morphosyntactic categories of the individual language (e.g. person, number, and gender; Aronoff 1999). Agreement morphology therefore differs, sometimes radically, from one language to another, because the morphological categories of each language are different. In the example *Mary wants Fran to respect her*, although the agreement of the verb with the subject *Mary* is always reflected abstractly in the syntax by means of *Mary*'s referential index, it is not marked at all in the morphology of a language that has no subject-verb agreement morphology (the majority of the world's languages). If the language has subject person and number agreement morphology on the verb, it is manifested (as it is in English in the present tense by the suffix *-s*). If, as in some languages (e.g. most Algonquian, Niger-Congo, Semitic, and Slavic languages), there is also overt morphological gender agreement between the subject and the verb, then the gender of the subject is reflected morphologically on the verb. In Semitic languages, the verb is marked as either masculine or feminine, in Algonquian as either animate or inanimate (for third person forms). This is illustrated in the Hebrew example in 5, in which the noun meaning 'stone' is feminine, though it bears no overt feminine marker, and the verb is marked with the third person feminine singular agreement suffix *-a*.

(5) ha- 'even hitgalgel -a
DEF.ART- stone.FEM.SG roll.past -FEM.SG
'the stone rolled'

In a very small number of spoken languages, under very unusual circumstances, index copying may be realized phonologically by LITERAL ALLITERATIVE AGREEMENT. Literal alliterative agreement depends on the phonological form of INDIVIDUAL NOUNS instead of on morphosyntactic categories. Literal alliterative agreement occurs only when the initial or final piece of a noun that is outside the categorial system of the language is copied under agreement, as in Arapesh (Dobrin 1998), Bainouk (Sauvageot 1967), and Wolof (McLaughlin 1997). We exemplify literal alliterative agreement, which we find bears significant similarities to the system found in sign languages, after a preliminary description of sign-language agreement.

4.2. REFERENTIAL INDICES IN SIGN LANGUAGE. We have defined abstract syntactic subject-verb agreement as the result of a universal copying procedure that copies the referential indices of the subject nominal onto the verb, resulting in two copies of the same index, one on the subject and one on the verb. Using standard terminology, we refer to the nominal from which the index is copied as the CONTROLLER and the element onto which the index is copied as the TARGET (Corbett 1991). In spoken languages agreement may be realized morphologically by means of inflectional marking on the target (the verb in this instance), which represents the particular morphosyntactic features of the language that are encoded in agreement morphology: the identical indices

of the subject and the verb, controller and target, are reflected in the fact that the verb carries a marker that reflects certain often arbitrary and abstract morphological features of the subject controller. As in the Hebrew example above, where the noun *'even* ('stone') is not morphologically marked as feminine, the controller itself need not bear any morphological markers.

Only rarely are referential indices directly detectable through agreement morphology in spoken languages. In contrast, as has often been noted, though not in these exact theoretical terms, in sign languages, the result of the abstract syntactic copying mechanism is not expressed indirectly through morphosyntactic categories, but instead the referential indices themselves are expressed directly. To understand verb agreement in sign languages, it is therefore necessary to see how referential indices are realized by means of REFERENTIAL LOCI.

In sign languages, referring nominals in a clause are associated with discrete locations in space, R(eferential)-loci (Lillo-Martin & Klima 1990). This association is often made by producing the sign for that nominal, and then pointing to or gazing at a specific location in space. If the referent is present in the signing situation, the actual location of the referent determines its R-locus. For example, the R-locus of the signer (first person) is the signer's chest; the R-locus of the addressee (second person) is the location of the addressee; and the R-locus of any third-person referent present in the signing situation is the actual location of that referent. If the referent is not present, it is assigned a point in the signing space (provided that other NPs have not already been assigned that point). For example, one can associate John with a point to the right of the signer, and Mary with a point to the left of the signer. Once an R-locus has been established for a specific referent, subsequent reference to that locus is equivalent to pronominal reference; that is, pointing again to that locus has the function of referring back to the NP associated with it.

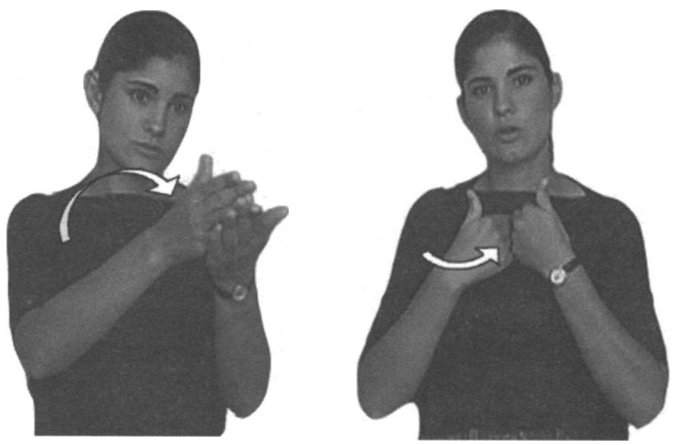
The procedure of establishing an R-locus for a referent lies at the heart of the pronominal system of sign languages. R-loci are used for anaphoric reference to the referents associated with them and are therefore regarded as the visual manifestation of the pronominal features of the nominals representing these referents (Klima & Bellugi 1979, Lillo-Martin & Klima 1990, Meier 1990, Janis 1992, Bahan 1996). This mechanism differs, however, from those found in spoken languages that show agreement, where nominals are categorized on the basis of shared morphosyntactic features (e.g. gender or noun classes) and pronominal reference to all members of a given category is made using the same pronoun: in English, we use *he* for all male referents and *she* for all females, with the resulting ambiguities that we don't find in sign languages. In sign languages nominals are not categorized in this way. Rather, as we have seen, each referent is paired with a unique location in space and so it can be uniquely identified. A pronoun or an agreement marker directed toward or away from a specific R-locus uniquely refers to the referent associated with that locus.[18] In that respect, sign-language verb agreement is very similar to literal alliterative agreement, where an individual noun determines the form of its agreement marker. In agreement systems with gender,

[18] Janis (1992) argues convincingly that the referential system of ASL is not altogether nonambiguous, but rather it is ambiguous in a different way. In ASL, an R-locus is ambiguous between a referent and its location. Thus, pointing to an R-locus could mean referring either to a referent, or to its location. Therefore, 'when discussing a referent as part of a spatial milieu, it is necessary for the locus of the referent and the locus of the referent's location to match . . . Thus, in these contexts, loci are obligatorily ambiguous' (1992: 120).

by contrast, each pronoun is reflective of a group of nominals sharing a specific feature (e.g. feminine or animate). Thus, R-loci are overt indices rather than gender classes, since the assignment of R-loci does not involve classification.[19] In other words, sign languages have agreement without gender.

4.3. VERB AGREEMENT IN SIGN LANGUAGE. Agreement verbs in ISL (and in all developed sign languages that have been well studied to this point) can be conceived of abstractly as having two open L(ocation) slots at the two end points of the verb, as shown above in Fig. 2.

These open slots are filled morphologically by copying the location specifications of the R-loci of the arguments of the verb into the slots. These R-loci then determine the direction of the path movement of the verb: the verb moves from an R-locus associated with one argument to an R-locus associated with another.[20] As an example of agreement, given in Figure 4, the verb HELP (ISL) agrees with its subject and object: the beginning point of the sign HELP is the location of the subject, and its end point is the location of the object. If the subject is the signer and the object is the addressee, the verb starts at the location of the signer (the signer's chest) and ends at the location of the addressee; the direction of the verb's path movement is then from the signer towards the addressee. If the subject is the addressee and the object is the signer, then the direction of the path movement is reversed: it moves from the addressee towards the signer.[21] In sign languages then, copying the referential indices of the arguments on the verb means that the direction of the path movement of the verb is determined by the locations in space associated with these arguments.



$_1$HELP$_2$ (I help you) $_2$HELP$_1$ (You help me)

FIGURE 4. Two forms of the ISL agreement verb HELP.

[19] Lillo-Martin and Klima point out that 'The difference between ASL and English, then, is that in many cases what are unspoken referential indices in English are overtly manifested in ASL' (1990:198).

[20] Movement itself is not especially particular to agreement or to agreement verbs, since virtually all lexical signs in sign languages have movement (Brentari 1990).

[21] This description of agreement in ISL is simplified. A more detailed analysis of the agreement facts is presented in §4.3.

The open-endedness of the inventory of referential indices in sign languages has led some linguists, notably Liddell (1998, 2000, 2003), to claim that sign-language agreement is not linguistic at all, a claim with which we firmly disagree. According to Liddell, the direction and end points of agreement verbs (his INDICATING VERBS) cannot be regarded as grammatical, since no grammatical category is involved. Rather, they are regarded as a gestural component of the sign, determined by nonlinguistic factors, such as the way in which the signer conceptualizes the referents in his/her mental space. As we show shortly, such a conclusion is unwarranted: even in spoken languages, agreement need not necessarily involve grammatical categories and a fixed set of morphemes. This type of agreement is found in literal alliterative agreement, in which the target simply alliterates or rhymes with its controller when the controller is outside the gender system of the language. We sketch some examples of literal alliterative agreement, in order to give the reader a taste of how it works. We then return to sign-language agreement and provide an analysis.

4.4. LITERAL ALLITERATIVE AGREEMENT. Literal alliterative agreement must be distinguished from the much more common apparently alliterative agreement found in Niger-Congo languages and certain languages of Papua New Guinea. In those languages, a number of the genders have overt affixes that are identical to the corresponding gender agreement markers found on the agreement target. Corbett (1991) cites the following Swahili example from Welmers 1973.

(6) ki-kapu ki-kubwa ki-moja ki-lianguka
7-basket 7-large 7-one 7-fell
'one large basket fell'

The noun for 'basket' falls into the 7 class, which has the prefix *ki-*. This same prefix then appears on all of the targets that agree with this controller. The major difference between this apparently alliterative agreement and LITERAL alliterative agreement is that what appears to be copied in these cases is not part of the noun radical, but a segmentable prefix. What is actually copied, however, is not the prefix but rather the class of the noun. Some nouns in these languages have no prefix but still get gender agreement based on their class, and some nouns are stipulated to have a prefix that is actually wrong for their class but receive agreement in terms of their class, not their prefix. Furthermore, in merely apparently alliterative systems, there is usually a fairly small fixed number of alliterative affixes. In literal alliterative agreement, as in sign-language agreement, there is no limit on the number of possible alliterative agreement markers except that imposed by the phonology of the language.

Default literal alliterative agreement appears clearly in Bainouk (Sauvageot 1967), an Atlantic (Niger-Congo) language, which has both prefixed and nonprefixed nouns. Prefixed nouns fall into eleven genders (each containing a matched pair of singular and plural prefixes) and show agreement through the prefix, which appears on pronouns, demonstratives, and adjectives (as a prefix or suffix, depending on the category of the target). Nonprefixed nouns, which are often loanwords, lie outside of this gender system; they show no singular marker and a plural suffix (a harmonic nasalized vowel) instead of a plural prefix. The agreement targets of individual nouns of this nonprefixed type take one of two sorts of gender agreement in both singular and plural, either a default prefix *a-* or a suffix copy of the first CV of the noun stem (Sauvageot can find no reason for which method a given noun chooses). Some examples are given in 7.

(7)

PREFIXED NOUNS	CLASS	SINGULAR	PLURAL
'tunic'	7/8	gu-sɔl	ha-sɔl
'papaya'	9/10	bu-domel	i-domel
UNPREFIXED NOUNS	CLASS	SINGULAR	PLURAL
'grass'	0/0	dapɔn	dapɔn-ɔ
'river'	0/0	kata:ma	kata:ma-ã

AGREEMENT ENVIRONMENTS

gu-sɔl gu-fɛr
7-tunic 7-white 'white tunic'

ha-sɔl-ɔ ha-ŋan
8-tunic-DEF 8-those.down.there 'those tunics down there'

kata:ma-ŋɔ in-ka
river-DEF this-CV 'this river'

kata:ma-ã ka-nak-ã
river-PL CV-two-PL 'two rivers'

Note that the unprefixed nouns trigger the same gender-agreement affix in both singular and plural, which is very unusual in Niger-Congo languages, where pairs of singular and plural agreement affixes are hallmarks of the gender system. The cooccurrence of this agreement affix with the plural agreement suffix is also very unusual in Niger-Congo. Finally, these same nonprefixed nouns may appear with a prefix in the diminutive or augmentative. The nonprefixed noun *saha* 'sheep', for example, may receive the diminutive prefix *ko-* or the augmentative prefix *da-*. In these cases it will 'enter' the normal gender system and show the regular plural prefix for the diminutive or augmentative and no alliterative agreement. Since regular nouns allow only one prefix, the fact that the stem does not lose its initial CV in the diminutive or augmentative shows that it is indeed nonprefixed.

Another spoken-language example comes from Arapesh (Dobrin 1998). In Fortune's original grammar (1942), there were some thirteen distinct phonologically based genders, each with its own set of target agreement markers. These were largely but not entirely alliterative. Fortune shows extensive evidence of a default gender, both for controllers and for targets. In Fortune's time there were no singular nouns ending in /s/, which is common as the final sound in plural markers. In recent years, however, singular nouns ending in /s/ have been borrowed from English and Tok Pisin, for example, *rais* 'rice', *kes* 'box', *glas* 'windshield', *opis* 'office'. These show no plural form and take *-s* as a singular target agreement affix. The examples in 8 are all from Dobrin 1998.

(8) Yek ye-ne skelim rais, aligɷ ye-yata-s.
I I-did distribute rice until I-finished-s
'I distributed rice until it was all gone.'

owiñ ahah-i-s opis
below over.there-POSS-s office
'the office down below there'

Bas sa-fiʔi a-ndaʔ pasim-as.
bus s-came I-did flag.down-s
'When the bus came, I flagged it down.'

Dobrin takes such examples as evidence that alliterative agreement is a default, running in the background and surfacing only in those instances where a language has

obligatory morphological agreement marking on the target, there is no gender on the controller, and the controller does not fall into the default category either.

Literal alliterative agreement, like sign-language agreement, reflects the universal syntactic nature of agreement as copying, but this universal normally does not surface in spoken languages because of the principle of lexical integrity, which entails that syntax cannot look inside a word's phonology (Zwicky & Pullum 1983). We see here that the principle can be violated in extreme circumstances and that when it is violated it reveals the basic state of language. Only in those rare cases in spoken languages where the obligatoriness of agreement meets a gap in the gender system does this copying mechanism surface. Literal alliterative agreement is therefore a paradigm case of what has been called in optimality theory the emergence of the unmarked (McCarthy & Prince 1994): the unmarked case is a default that emerges just in case nothing else does. For sign languages, this default is the norm. Literal alliterative agreement and sign-language agreement differ in one respect: the R-loci that nouns are associated with are not part of their phonological representations and are not lexical properties of the nouns in any way. Rather, they are assigned to nouns anew in every discourse. The copying mechanism that underlies agreement, though, is the same for both cases. The difference between the two kinds of copy (repetition vs. pointing again) arises out of the fundamental difference between the media of sound and sign: we cannot use speech to point to a spoken word or its referent or its position in a sentence after the word is uttered, but must be satisfied with repeating the sound of the word that we wish to point to. Furthermore, the discussion of literal alliterative agreement in spoken languages demonstrates, contra Liddell, that a finite list of agreement morphemes is not a necessary condition for a linguistic agreement system.

4.5. PROPERTIES OF SIGN-LANGUAGE VERB AGREEMENT. Sign languages have three verb classes (first identified and analyzed in ASL by Padden (1983)): plain verbs, spatial verbs, and agreement verbs.[22] They can be defined in two ways, morphologically and semantically. We begin with morphology.

Plain verbs have invariant beginning and end points; in particular, the form (movement path) of these verbs does not vary with the referential loci of the arguments. Some representative ISL examples are: BEGIN, CRY, EAT, LIKE, POSTPONE, THINK, and WAIT.

Spatial verbs are those whose beginning and endpoints are determined by spatial referents, rather than by grammatical arguments, that is, by locations rather than referential loci. For example, in the ISL sentence meaning 'John moved the cup from location A to location B' the verb MOVE-CUP agrees with locations A and B, not with the referential loci of the grammatical arguments *John* and *the cup*. That is, the verb's path movement begins at the location of A and ends at the location of B. The path of the verb is a direct representation of the trajectory of the moving object. Spatial verbs in ISL include: MOVE (transitive and intransitive), PUT, and HAND (over).

Agreement verbs agree with the arguments functioning as the syntactic subject and object. For example, in the ISL sentence meaning 'John gave Mary the cup', the verb

[22] Work on agreement and verb classes in various sign languages includes: ASL (Fischer & Gough 1978, Meier 1982, Padden 1983, Shepard-Kegl 1985, Brentari 1988, Lillo-Martin 1991, Janis 1992, Bahan 1996, Taub 2001), British SL (Deuchar 1984, Kyle & Woll 1985), Israeli SL (Meir 1998b), Italian SL (Pizzuto et al. 1990), Taiwan SL (Smith 1990), Japanese SL (Fischer 1996), SL of the Netherlands (Bos 1993, 1994), Danish SL (Engberg-Pedersen 1993), and Australian SL (Auslan; Johnston 1991). Though the analyses suggested in some of these works may differ from the analysis suggested here, the descriptions of verb agreement and verb classes nevertheless adhere to the general characteristics described below.

GIVE agrees with John and Mary: The path movement of the verb starts at the location of John and ends at the location of Mary.[23] In addition to the path movement, another mechanism is involved in the morphology of agreement verbs: the facing of the hands, that is, the direction towards which the palm or the fingertips are facing.[24] The two agreement mechanisms are determined by the following principles (Meir 1995, 1998a, 2002).

1. The direction of the path movement of agreement verbs is determined by the thematic roles of the arguments: it is from the R-locus of the source argument to the R-locus of the goal argument.
2. The facing of the hand(s) is determined by the syntactic role of the arguments: the facing is towards the object of the verb (indirect object in the case of ditransitive agreement verbs).

The combination of the two principles accounts for the actual form of the different agreement verbs.

The classification into plain, spatial, and agreement verbs is also semantically grounded.[25] Agreement verbs (those that agree with S and O) denote 'transfer' (in the sense of Gruber 1976 and Jackendoff 1990), whether concrete (SEND) or abstract (HELP). Spatial verbs denote 'motion' from one location to another (MOVE; PUT). Plain verbs are defined negatively, as denoting NEITHER transfer NOR motion.[26]

To summarize, all sign languages known to us have three verb classes, only one of which shows agreement with its grammatical arguments; these classes are based on the semantics of the verbs; and the morphological mechanisms of agreement encode both the spatial thematic roles (source and goal) and the syntactic structure of these verbs (by marking the object). These characteristics of verbs raise interesting challenges for linguistic theory.

Agreement in sign language is not a general property of all verbs in the language. Only one semantically defined class of verbs (verbs of transfer) displays agreement morphology. This is highly unusual, since agreement morphology is inflectional, and as such it should be obligatory in a language that has it. Cases of absence of agreement in otherwise agreeing systems are accounted for either on syntactic grounds or on morphophonological grounds (verbs with defective paradigms).[27] Argumentation along

[23] Liddell (1998, 2000) eschews the term AGREEMENT for these sign-language structures, arguing that the agreement system described here is gestural in nature, and not grammatical. We differ with Liddell, and find that many generalizations of the system can be accounted for only in linguistic terms. More explicit support for a linguistic analysis of verb agreement as opposed to a gestural account is offered in Aronoff et al. 2000, Lillo-Martin 2002, Rathmann & Mathur 2002, and Sandler & Lillo-Martin 2005.

[24] Our use of the term FACING is not equivalent to the more general term ORIENTATION. Facing refers to those orientation features that are determined by the R-loci of the arguments. In other words, facing is syntactically determined, while orientation features are part of the lexical representation of the sign and remain stable in the various inflected forms of a sign.

[25] The semantic characterization presented here is based on Meir's (1998a) analysis of ISL, but it is compatible with the descriptions of verb classes in the works on various sign languages mentioned above.

[26] This generalization is oversimplified. There are cases of verbs denoting transfer but displaying the morphology of plain verbs rather than that of agreement verbs (e.g. BUY (ISL)) because of their phonological structure. But the phonological constraints on agreement morphology can be stated explicitly, and it is therefore possible to predict which verbs will not be able to display the morphology of agreement verbs. See Meir 1998b for a comprehensive discussion.

[27] In the Celtic languages, for example, inflected forms of the verb and overt subjects are in complementary distribution. See McCloskey & Hale 1984, Doron 1988.

these lines, however, cannot explain the sign-language verb classification, since plain verbs do not differ syntactically from agreement verbs, and many of them are also not phonologically incompatible with agreement morphology. It is the semantics alone that determines the verb classes.

These facts return us to the typological puzzle outlined in the introduction. All sign languages we know of have this type of verb agreement and verb classification. Yet no spoken language we know of has the tripartite classification into plain verbs, spatial verbs, and agreement verbs, and none shows the peculiar sort of agreement that is found in sign languages. Must we conclude then that agreement in sign languages is a fundamentally different phenomenon from agreement in spoken languages, due to the differences in modality?

According to our understanding, agreement in both signed and spoken languages is basically the same in that it involves the copying of the referential indices of the arguments onto their head. What distinguishes the two modalities is the nature of the element that is marked for agreement, and the way in which spatial relations can be represented in the language. We attempt to reconcile the apparent differences between spoken-language and sign-language agreement with the similarities, using the same modality-based account that underlies our analysis of R-loci.

The two morphological mechanisms mentioned above—the direction of the path and the facing of the hands—are actual morphemes, expressed simultaneously in the morphology of the verb and encoding two different kinds of structures:

- The path movement is a directional morpheme, which we gloss as DIR(ectional), encoding the conceptual function of source-goal path.
- The facing of the hands encodes the argument structure of the transfer event. It is analyzed as a verbal affix assigning case to the affected object of the transfer event, that is, the nonagentive possessor.

Agreement verbs, then, are complex verbs comprising a predicate that denotes the core meaning of each verb and two additional morphemes, each related to a different facet of the transfer event. DIR is a spatial predicate, and as such it encodes the source-goal relations between the arguments of the verb. The case assigner is nonspatial, and it encodes the syntactic roles of the arguments. The distinction between these two morphemes can be expressed straightforwardly in terms of Jackendoff's thematic tiers. Jackendoff (1987, 1990) points out that the LEXICAL CONCEPTUAL STRUCTURE of a verb contains two thematic tiers: a spatial tier, and an action (affectedness) tier. DIR can be regarded as a realization of a semantic function on the spatial tier, while the case assigner is directly related to the semantic function AFFECT on the action tier. Crucially, the morphological properties associated with agreement—the direction of path and the facing—are linked to DIR and the case-assigning morpheme, not to the verbs per se.

By analyzing agreement verbs as complex verbs, and by isolating the basic components of agreement verbs, we can now explain the puzzles we raised above. The fact that agreement is not a general property of verbs in sign languages is predicted by our analysis. As pointed out, it is not the verb per se that is marked for agreement in sign languages, but rather the DIR and case-assigning morphemes. Only verbs that incorporate these morphemes inflect for agreement, since only these verbs contain the elements that trigger agreement morphology. Whether a verb contains these morphemes is determined by its semantics: only verbs denoting motion and transfer contain a PATH function in their semantic structure, which licenses the occurrence of the DIR morpheme in the verb's form. Since only verbs of transfer morphologically mark the recipient object (the affected possessor), only those verbs agree. This analysis enables us to

account for the fact that not all verbs in sign languages agree and at the same time to characterize precisely the semantic grounding of the verb.

We turn now to the typological puzzle, namely, that all sign languages and only sign languages have this type of verb agreement. The answer to that lies in the nature of the spatial agreeing element—DIR—and the way it is realized in the language. DIR is an iconic representation of its meaning, a unidimensional space with direction. Sign languages, as languages transmitted in space, can represent these spatial relations iconically, and they (all) seem to exploit this possibility. The result is a very similar verb classification in different sign languages. In spoken languages, it is physically impossible to express the DIR directly. The striking crosslinguistic similarity in both verb classification with respect to agreement and in agreement morphology itself among sign languages speaks to the power of iconicity: languages will use iconicity if they can.

Sign languages, unlike young creoles, have extensive complex verb inflection. But this inflection is an iconically motivated representation of general conceptual, and therefore universal, structures. Thus, the key to understanding the difference between creoles and sign languages is the ability of the latter to have iconically motivated representation of certain conceptual functions. Overall, we find that sign languages develop complex morphology early in their histories in case the morphology is an iconic representation of a conceptual category. The universality of these categories and the fact that they can be represented directly in manual-visual languages determine the similarity in form and structure among sign languages.

4.6. CLASSIFIER CONSTRUCTIONS. In this section, we describe another kind of complex sign-language morphology that is also iconically motivated. Sign languages generally have at least three types of classifiers, each represented by a set of handshapes: size and shape classifiers (SASSes), entity classifiers, and handling classifiers (Klima & Bellugi 1979, Supalla 1982, Schembri 2003). We deal here with the first two types.[28] SASSes are a set of handshapes that classify referents according to their size and shape. Examples of a few of these from Israeli Sign Language are pictured in Figure 5. These classifiers enter into complex constructions that represent not only the size and shape of objects but also the spatial relation among them. Figure 6, for example, shows the SASS classifier construction, CYLINDRICAL-OBJECT-NEXT-TO-FLAT-OBJECT, which may be translated as 'A cup is next to a piece of paper'.

Entity classifiers, classifying referents according to semantic category, such as upright human, seated human, vehicle, and so on, also enter into complex constructions, by combining with other classifiers (signed by the other hand) as well as with different movement roots indicating path shapes and manners of movement. A simple example is shown in Figure 7, in which each hand represents a seated person and the construction is translated, 'Two people sit opposite each other'.

A more complex example from American Sign Language was shown in Fig. 2. In that structure, each hand has a different configuration, representing a different entity classifier; the relation between the two entities is reflected in the spatial relation as well as the direction and timing of movement of the two hands; and each hand articulates a different movement pattern: the man treading straight ahead, and the recalcitrant dog squirming in zigzag fashion behind. The different classifiers, relative locations, and

[28] See Emmorey's (2003) collection for descriptions and analyses of classifier systems across different sign languages, and Sandler & Lillo-Martin 2005 for a theoretical analysis of these constructions.

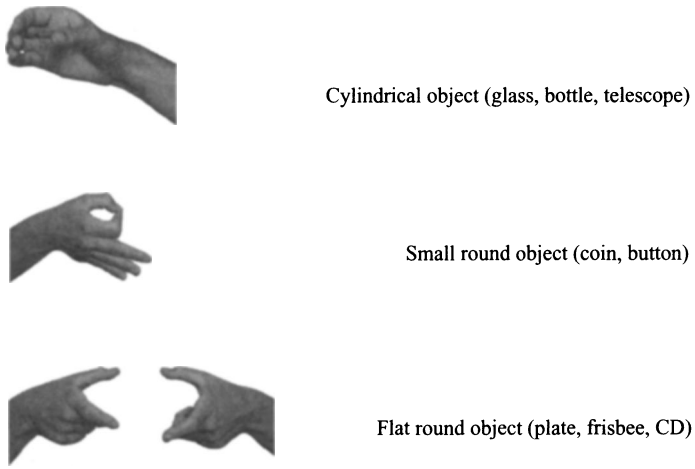


FIGURE 5. Some size and shape specifiers in ISL (from Meir & Sandler 2004).

FIGURE 6. Complex SASS classifier construction in ISL: 'A cup is next to a piece of paper.'

FIGURE 7. Entity classifier construction in ISL: 'Two people sit opposite each other.'

array of movement patterns productively enter into a potentially vast number of constructions. At the same time, these systems are conventionalized and constrained, and therefore grammatical (Supalla 1986), and there are differences from sign language to sign language (Aronoff et al. 2003). Nevertheless, all studied sign languages have the same three categories of classifiers, similar discourse contexts for their use, and similar types of combinatorial complexity.

While many spoken languages have verbal classifier affixes, the type of classifiers most like those of sign languages (Grinevald 2000, Senft 2000a, Aronoff et al. 2003), we have not encountered a single creole that has them. One explanation is that verbal classifier affixes often evolve from noun incorporation (Mithun 1984, Grinevald 2000)—and each of these two types of morphological complexity takes time to develop.[29] It is all the more striking, then, that all known established sign languages have them.

Sign languages, then, unlike young creole languages, have extensive complex verb inflection and polymorphemic classifier constructions. But these forms are iconically motivated representations of general conceptual, and therefore universal, structures. Thus, the key to understanding the difference between young creole languages and sign languages is the ability of the latter to have iconically motivated representation of certain conceptual functions. Overall, we find that sign languages develop complex morphology relatively early in their lives in case the morphology is an iconic representation of a conceptual category. The universality of these categories and the fact that they can be represented directly in manual-visual languages determine the similarity in form and structure among sign languages.

4.7. IMPLICATIONS FOR OTHER SIMULTANEOUS PROCESSES. The analysis presented above explains why sign languages, despite their youth, have complex morphology. The key point is that the manual-visual modality enables them to express certain visuospatial categories in a more direct manner than that available to spoken languages. Apparently, such direct representation can develop quickly. It can be recruited almost spontaneously, as evidenced by the appearance of the rudiments of agreement in home sign and in new sign languages. We emphasize that only direct representation is at the ready. The development of a complex, rule-governed grammatical system still takes time. Only the first rudiments are observable in home sign (Goldin-Meadow 2003). Even in the Nicaragua environment, where there is a community of signers, space is used systematically in a precursor to verb agreement only in the second 'cohort' of signers, those who were exposed to a group of older signers from before the age of ten (Senghas 2000). While verb agreement is completely systematic in ISL today, a study conducted about thirty years ago by Namir and Schlesinger (1978) reported difficulties in a picture-identification task that required production and comprehension of the arguments of verbs of transfer, that is, the use of verb agreement. In other words, we are not claiming that complex grammatical systems appear out of the blue just because they are iconically motivated. Rather, we argue that what enables sign languages that are only a few generations old to develop complex inflectional morphology is the fact that the categories the morphology encodes are not altogether arbitrary and may therefore allow a much more rapid course of development.

[29] See also Meir 2001 and Sandler & Lillo-Martin 2005 for detailed discussions of the relationship between classifiers and noun incorporation in the context of sign languages.

An explanation of sign-language morphology that relies exclusively on production, perception, and processing predicts that the complex simultaneous morphology of sign language must also result in monosyllabic, or at least in very short, morphological complexes. That form is predicted on the basis of the slowness of the articulators, the proclivities of the visual system, and general language-processing constraints involving short-term memory. And indeed, most of the simultaneous structures we have described conform to that prediction. But there is one pervasive morphological subsystem of sign languages that freely departs from that form: the subsystem of classifier constructions discussed in the last section. Fig. 2 gave an example of such a structure ('a man proceeds, dragging a dog behind him').

The system clearly involves the simultaneous combination of hand configuration, location, and movement morphemes. It is also a sign-language universal (Emmorey 2002), though a construction with a single classifier may span several predicates and several intonational phrases (Aronoff et al. 2003, Sandler & Lillo-Martin 2005), producing a morphological complex that is at once simultaneous and sequential. For example, a single VEHICLE classifier handshape may span a sequence of predicates to yield a string meaning 'a car drove over a bumpy hill and around a corner, and parked at an angle on a slope'. The string is interpreted as a single construction because the handshape represents the same argument throughout and there is no rearticulation of the handshape across predicates. In a sense, these constructions are simultaneous at the morphological level but may be sequential at the syntactic level.

Constructions like these are expected within a theory in which iconic motivation figures prominently. Because the classifier (represented by a handshape) participates simultaneously in an event involving a location and a movement, the three combine simultaneously. If the nominal element represented by the classifier handshape participates in a chain of motion and location events, then the same classifier remains in the signal, combining with a sequence of locations and movements.

Yet these interesting constructions present another twist. When classifier constructions are lexicalized, they immediately conform to the monosyllabic LML template (see Aronoff et al. 2003 for an analysis). This in turn provides further support for the production/perception/processing explanation, possibly accounting for a constraint on prosodic words. We must conclude that both pressures—production/perception/processing constraints and iconically motivated expression of visuo-spatial information—work together to forge the structure of sign language.

4.8. NONICONIC SIMULTANEOUS MORPHOLOGY. The preceding discussion of verb agreement and classifier complexes in sign languages might have given the impression that simultaneous morphology in manual-visual languages is necessarily iconic/motivated. But this impression is misleading. A survey of the various morphological processes described for ASL reveals some simultaneous processes that are not iconic, for example, characteristic adjectives (Padden & Perlmutter 1987), deverbal nouns (Supalla & Newport 1978), and idiomatic derivatives like PIOUS from CHURCH (Klima & Bellugi 1979).

Such examples, however, do not contradict our model, which suggests that morphological processes encoding visuo-spatial categories are manifested by simultaneous morphology if the physical form of the language allows it. But the inverse does not hold: not all simultaneous morphological structures encode visuo-spatial categories and are necessarily motivated. Rather, it seems that once a language employs a formal device to encode certain concepts, it can use this device for other purposes as well. Sign languages can quite readily exploit simultaneous morphology to represent certain

concepts iconically, as we demonstrated above. This formal device can then be used to encode other categories, which are not necessarily iconic or motivated, as is illustrated by the various ASL morphological processes mentioned above. Such an explanation implies that noniconic morphological processes take longer to develop, since they develop on the basis of morphological processes that are iconic.

If this explanation is on the right track, then two interesting predictions emerge. First, since noniconic simultaneous morphological structures take time to develop, they are characteristic of older sign languages and will not be found in very young sign languages. A more interesting prediction is that a sign language will not have noniconic simultaneous morphological structure if it does not also have iconic simultaneous processes. From what little is now known about morphological processes in sign languages, these generalizations hold. All of the noniconic morphological structures discussed above were attested in ASL, a language that has existed for at least two hundred years and has various iconic morphological structures. Other sign languages may also have noniconic simultaneous processes, but none have been noticed so far. These predictions can now be tested in comprehensive research of various sign languages.

This analysis addresses the first challenge we set for ourselves: the creole puzzle. The analysis explains why sign languages, though young, have complex morphology of a certain type. But another important challenge remains: the existence in sign languages of a different type of morphology. Only by considering this second type of morphology can the particular range and nature of the morphological systems of sign languages be understood.

5. SEQUENTIAL MORPHOLOGY IN SIGN LANGUAGES. We now turn to the sequential (or concatenative) morphology found in sign languages. This type is familiar from spoken languages but has not received much attention in sign-language research. The only nonsimultaneous word-formation process that has been duly recognized as indigenous to sign languages and written about at length is compounding (Stokoe et al. 1965, Klima & Bellugi 1979, Liddell & Johnson 1986, Sandler 1989, Brennan 1990).

Looking more closely at sequential morphology in the two sign languages under investigation, we find affixation in each of them, but it is rare. The paucity of such forms is due to two interrelated factors. First, since affixes can emerge through the processes leading to the grammaticization of free lexical items, they generally take time to develop, as we showed with the development of the French future tense. Second, several intermediate stages in these processes may coexist in a language at a specific point in time, making them more difficult to identify as such. Nevertheless, we have identified affixes in ASL and ISL, using some of the criteria in Zwicky & Pullum 1983, and we exemplify some of them in the next section.

5.1. THE ASL NEGATIVE SUFFIX. There are many ways to express negation in ASL, both manually and nonmanually. The negative suffix, which usually attaches to verbs (Sandler 1996a), has not been given much attention. This suffix is a one-handed sign in which the fingers form the shape of a zero, and the hand is moved outward from the signer; it most likely originates from an independent sign that is phonologically similar. The meaning usually associated with the free form is 'none at all' and with the suffix is 'not at all'. The signs SEE, ZERO, and the suffixed word SEE-ZERO (NOT-SEE-AT-ALL) are pictured in Figure 8.

While all signers we have consulted accept the suffix as ASL, the constraints on its occurrence and its phonological form show some variation from signer to signer. We address this individual variation below.

a. SEE (ASL)

b. NOTHING (ASL)

c. SEE + ZERO 'not see at all' (ASL)

FIGURE 8. ASL sign with grammaticized negative suffix.

One reason for considering the form a suffix (rather than an independent word) is that it must occur after, never before, its stem. This is significant in light of the fact that word order in ASL is relatively free, and that the related independent word can indeed occur before or after verbs. Two of the five consultants who use the suffix attach it to a limited set of verbs (including SEE, HEAR, LEARN, FEEL, SAY, EAT, TOUCH, SMELL, UNDERSTAND, USE, SLEEP, TASTE). For these consultants, the verb and suffix tend to fuse phonologically in the following ways: nonmanual markers such as facial expressions or head positions tend to span both the verb and the suffix; the path movements of both the verb and the suffix either are shortened or coalesce, depending on the underlying form of the stem; some of the meanings of the suffixed words are idiosyncratic. Examples of the last characteristic are SAME-ZERO 'can't find one like yours', SAY-ZERO 'not mention', and TOUCH-ZERO 'not use'.

There is a phonological constraint on the occurrence of the suffix: it can occur only with one-handed stems. This restriction supports our claim that the forms are complex

words rather than two independent words. ASL words are either one-handed or two-handed throughout. The few disyllabic monomorphemic words that exist in the language are two-handed in both syllables. Furthermore, lexicalized compounds tend to spread two-handedness from one member of the compound to the other (Liddell & Johnson 1986, Sandler 1989, 1993c, van der Hulst 1996). If there is a constraint on number of hands within a word, it is not surprising that the one-handed negative element under discussion occurs only with other one-handed forms: it is a suffix, and the resulting word must satisfy the constraint on handedness, whose domain is the word. The way in which negative suffixed forms satisfy this constraint is different from the way compounds do. The suffix avoids two-handed stems, while the compounds involve spreading of two-handedness to the one-handed member.[30]

The constraint on handedness holds over words. A different constraint holds over morphemes and distinguishes affixed words and compounds from monomorphemic words: there can be only one handshape on the dominant hand within a single morpheme, so that the entire LML sequence must be articulated with a single handshape if it is monomorphemic (Sandler 1989).[31] This is not true of words with the negative suffix (or with the agentive suffix). Regardless of the initial handshape of the word, the final handshape must be zero.

There is also a morphological restriction on the stem of the negative suffix: the suffix can occur only with plain verbs, and not with agreement verbs or verbs of motion. (See previous section on agreement.) None of these restrictions applies to the independent negative word, which can occur with either one- or two-handed verbs, as well as with either agreement or plain verbs.

We have found considerable individual variation in the use of this negative suffix, though it is accepted as ASL by all signers we have consulted. Two of the signers consulted reported that they do not use the suffix at all, though they regard it as a legitimate ASL form. Three others tend to use the suffix with the same limited set of verbs, often with phonological fusion of the kind described above. The other two informants (both under thirty-five years of age) accept the suffix with a larger group of stems, and one of them uses it productively with adjectives.

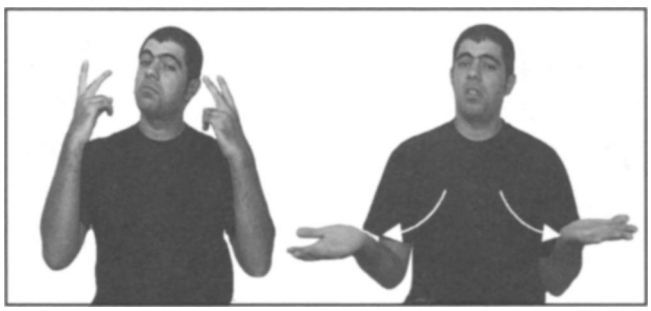
The agentive suffix in Fig. 3 has been known for some time, but has not received much attention in the literature; it was often attributed to influence from English, which also has an agentive suffix, *-er*. Linguists typically assumed that ASL has no indigenous sequential affixation, an assumption that we show here to be unfounded. Supalla's recent diachronic research (1998) lends added credence to our view. His study of ASL films from the early twentieth century indicates that the synchronic agentive suffix is descended from an independent ASL word meaning 'person' (see n. 13). Furthermore, the ASL suffix does not have the same distribution as the English *-er* agentive (Sandler & Lillo-Martin 2005). For example, alongside ASL OPERATE + agentive exists English *surgeon*, and not **operater*. Apparently, then, the ASL suffix evolved on its own and developed its own pattern of distribution.

[30] Interestingly, an ISL suffix also observes the handedness constraint, but in a different way (see §5.2). A two-handed negating suffix becomes one-handed when affixed to one-handed signs.

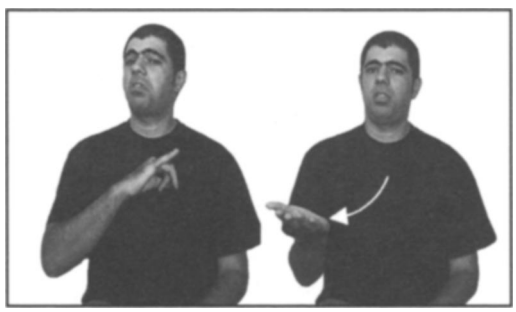
[31] To be more precise, it is the specification for selected fingers that must be constant within a morpheme. The position of the fingers (whether they are straight or curved, for example) may change, so that there may be more than one finger position in a morpheme (Mandel 1981, Sandler 1989).

The negative and agentive affixes just described are not the only affixes in ASL. Another form, glossed 'strong', attaches to some adjectives to give the meaning of 'habitually', 'addictively', or 'strongly'. There are reasons to believe that this form is also an affix (Sandler & Lillo-Martin 2005).[32] Comparative and superlative forms in ASL also behave like affixes, demonstrating that the view that ASL has no sequential affixation, expressed, for example, in Klima & Bellugi 1979, is mistaken: ASL does have some limited affixal morphology.[33]

5.2. ISRAELI SIGN LANGUAGE AFFIXES. ISL has many negating signs, one of which is a suffix. Glossed NOT-EXIST, this form attaches to adjectives and functions like the English suffix *-less* (Meir & Sandler 2004). As shown in Figure 9, this suffix has two allomorphs—one-handed and two-handed—depending on the form of the base. If the base sign is articulated with two hands, like IMPORTANT, then the suffix is also bimanual (Fig. 9a). If the base is one-handed (INTERESTING), then the suffix is one-handed as well (Fig. 9b).



a. IMPORTANT-NOT-EXIST ('of no import')



b. INTERESTING-NOT-EXIST ('of no interest')

FIGURE 9. Allomorphy in words with the ISL suffix: -NOT-EXIST.

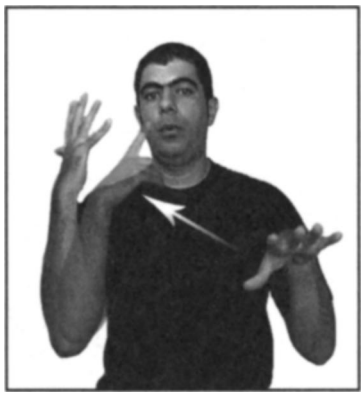
[32] Thanks to James McFarlane and Kevin McClellan for telling us about STRONG.

[33] Klima and Bellugi (1979:274) write: 'To our knowledge there are no intrinsic segmental affixes in ASL. Four such affixes are listed among the 2500 signs of the DASL [*Dictionary of American Sign Language*, Stokoe et al. 1965], but these are clearly loan translations from English and their usage in communication between deaf native signers has so evolved that they now have the status of independent lexical items.'

Another characteristic of derivational affixes is semantic drift, resulting in idiosyncratic meanings that are not predicted by merely combining the meanings of the two morphemes. Some of the words in -NOT-EXIST have idiosyncratic meanings. For example, the suffixed word SURPRISE-NOT-EXIST does not mean 'without surprise', but something more like the English expression *big deal*.

We have also discovered a set of prefixes in the language that is of quite a different nature from any of the affixes described so far. All of these prefixes, which we informally call sense prefixes, are glossed by native signers with words that involve either a sense organ—eyes, nose, or ears—or the head or mouth. Many of the complex words formed with them can be glossed 'to X by seeing (eye)/hearing (ear)/thinking (head)/intuiting (nose)/saying (mouth)'. But many have idiosyncratic meanings. So far, we have discovered over seventy prefixed forms of this type. An example is EYE-SHARP 'to discern visually', shown in Figure 10.

a. EYE (ISL)



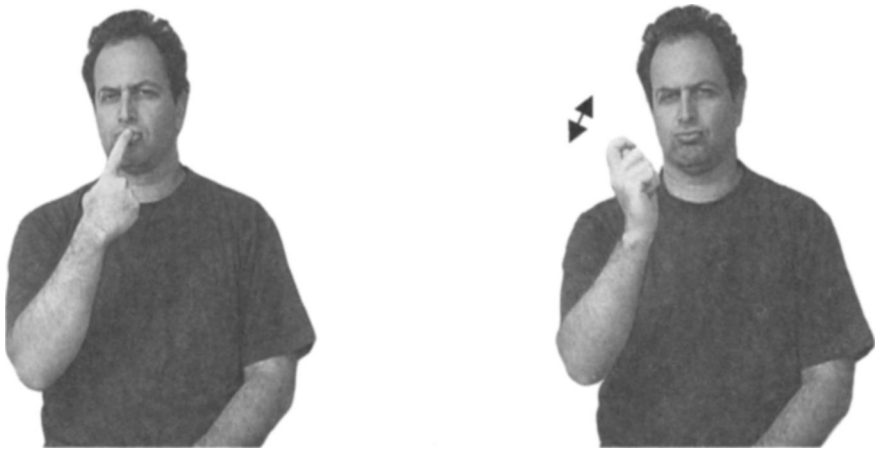
b. SHARP (ISL)

c. EYE + SHARP 'discern by seeing' (ISL)

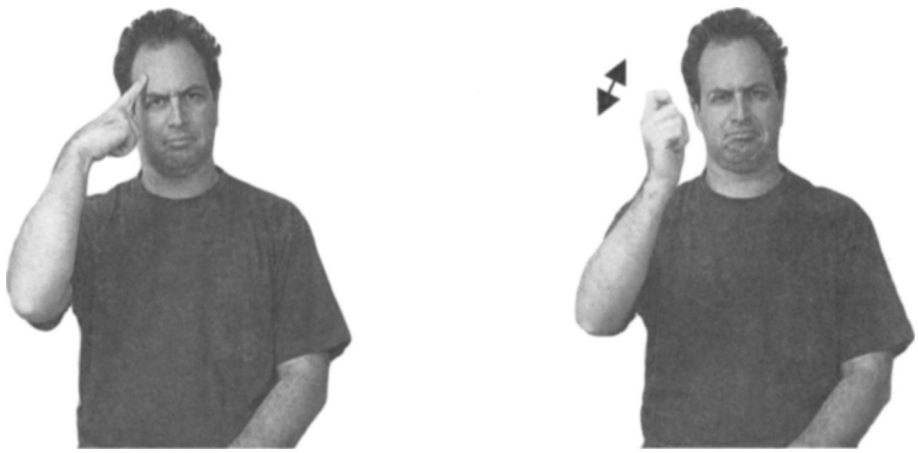
FIGURE 10. ISL sign with grammaticized sense prefix.

There are many reasons to believe that the first elements in these forms are not independent words. The first reason is semantic. Although many have transparently componential meanings, like EYE-SHARP 'to discern visually', most do not. The sign meaning 'cunning' has the mouth or nose prefix, though its meaning is not related to

smelling or saying.[34] In several words formed with these prefixes, the base has no independent meaning without the prefix, though phonologically the bases have the form of words. The signs CUNNING and SMART, for example, illustrated in Figures 11a and 11b, both use the same base sign, each with a different sense prefix. The base sign does not occur by itself in the language and does not have independent meaning.



a. CUNNING: MOUTH + (base which does not occur on its own)



b . SMART: HEAD + (base which does not occur on its own)

FIGURE 11. ISL signs with sense prefixes in which the base does not otherwise occur.

[34] Some additional examples of signs with noncomponential meaning: MOUTH + PROOF ('to admit'), MOUTH + ADVERTISEMENT ('to badmouth'), NOSE + REGULAR ('to get used to'), HEAD + GLUE ('to bear a grudge').

The second reason for believing that these forms are not independent words is that their first element is reduced phonologically and may be described as constituting the weak syllable of a binary iambic foot.[35] Like ASL negative suffixed forms, these words are bimorphemic, and, like them, they violate the morpheme structure constraint that prohibits a sequence of two handshapes in a single morpheme (Sandler 1989).[36] As with ASL suffixed forms, if these are words consisting of two morphemes, we expect a sequence of two handshapes to be permissible within them. Consistent with the claim that the sequence is a word and nothing larger, we find that the affixed forms may undergo regressive handshape assimilation, a process that also occurs in compounds but does not occur across independent words.[37] Finally, consultants are often uncertain of the lexical category of the first part of these forms, glossing them either as 'eye' or as 'see', for example. This indeterminacy would not be expected for words, but is not surprising for affixes. We may conclude, then, that we are dealing with complex words and not two independent words.

Since compounding is common in ISL (as it is in ASL), we must still demonstrate that the forms under discussion are prefixed words, rather than compounds. One reason we claim that we are dealing with prefixes is that only five forms recur in the first position, and these combine with a large number of stems. This is not true of compounds, in which, in principle, any word from the lexicon can occur in first or second position. Furthermore, the complex words formed with these prefixes are almost always verbs, regardless of the lexical category of the base. Affixes generally determine the lexical category of the complex words they form. English *-ity*, for example, regularly forms nouns from adjectives. Similarly, signers use most of the complex words as verbs, regardless of the lexical category of the stem, which may vary, as the example EYE-SHARP 'discern by seeing' demonstrates. In addition to the verbal glosses assigned to the complex forms by native signers, there is also distributional evidence that they are verbs: they can all be used with a particular ISL negative form that occurs only with verbs. The form in question is glossed as 'zero', and it is the negative counterpart of the perfect marker in the language (Meir 1999). Indeed we find that the complex words formed with the above prefixes can be negated by ZERO. In other words, the first elements of the words in question function as verb-forming prefixes.

Other properties lend added credence to the claim that we are dealing with prefixes. Although many of them may be understood as having a somewhat transparent meaning (EYE = 'visually', HEAD = 'mentally', NOSE = 'intuitively'), many others cannot be, and still others have taken on new nuances of meaning that are themselves becoming systematic. Many of the forms produced with EYE, for example, have taken on a hortative meaning ('let's do X') as an additional nuance. This indicates that the form is a coherent prefix, since the additional nuance belongs only to the EYE forms but

[35] We use this description impressionistically here, but it is compatible with other treatments of the syllable and stress patterns in sign languages. A syllable is roughly coextensive with a movement (Sandler 1989, Brentari 1990, 1998, Perlmutter 1992). Though most signs are monosyllabic (Coulter 1982), the bisyllabic compounds of ASL have been described as having stress on the second part (Klima & Bellugi 1979).

[36] This constraint was posited for ASL in Sandler 1989, but it also applies to ISL.

[37] Handshape assimilation may occur under cliticization, however (Sandler 1999). But the weight of the evidence presented here shows that the forms in question are affixes and not clitics. (See Zwicky & Pullum 1983 for criteria that distinguish the two.)

has nothing to do with sight. A different observation indicates that all of the prefixes belong to one class. In a few of the complex words, signers disagree or are uncertain about which prefix to use. The complex word meaning 'cunning' may occur either with the NOSE prefix or with the MOUTH prefix. (The base form has no independent meaning, but also combines with the HEAD prefix, to derive a word meaning 'smart'.) The complex word meaning 'suggest' may occur either with the MOUTH or the EYE prefix. This indeterminacy suggests that the forms are losing whatever meaning they may have had historically and now function formally simply as verb-forming prefixes.

Like the ASL ZERO suffix, the ISL sense prefixes show individual variation in use. Some signers have a larger repertoire than others and use them more often, and for some signers we have observed, the formation of complex verbs with sense prefixes is much more productive than for the others.

6. RESOLVING THE SIGN-LANGUAGE MORPHOLOGY PARADOX. We have examined two kinds of sign-language morphology. One kind, exemplified here by verb agreement, is simultaneous, while the other, exemplified by the -ZERO suffix in ASL and by sense prefixes in ISL, is sequential. Each type is characterized by a different cluster of properties, supporting the claim that these indeed represent two distinct types of morphology.

The simultaneous type is sign-language-universal; it is found in all well-studied sign languages. And though the agreement systems of various sign languages are not identical, they nonetheless share the same basic characteristics: the tripartite classification of verbs, and the phonological and morphological features for each class. This type is related to visuo-spatial cognition and can be regarded as a direct representation of certain spatial cognitive functions. Agreement markers are not related to free words in the language, and we found no individual variation in the structure of the system.

The concatenative type is different in all of these ways. It is sign-language-specific; the particular affixes mentioned above have not been attested in other sign languages. ASL (Carol Padden, p.c.) and British SL (Brennan 1990, Sutton-Spence & Woll 1999) also have complex words containing the signs EYE and HEAD/THINK. But these complex words are not as productive and systematic as their ISL counterparts. The affixed constructions we describe here represent the grammaticization of free words, and they all are derivational. Also, as we showed earlier, there is a considerable amount of individual variation in the use of these forms. These different clusters of properties are summarized in Table 1.

SIMULTANEOUS	SEQUENTIAL
Universal across sign languages	Specific to individual sign languages
Related to spatial cognition	Not related to spatial cognition
Motivated	Arbitrary
Not related to free words	Grammaticized from free words
Semantically coherent	Less semantically coherent
Productive	Limited productivity*
Less individual variation	Considerable individual variation

TABLE 1. Two types of sign-language morphology.

* The productivity of simultaneous processes apart from verb agreement (which is completely productive) still needs to be verified, but we have not found evidence of lexical or idiosyncratic restrictions on productivity in the simultaneous morphology, while we have found these with the sequential morphology.

6.1. ARBITRARINESS IN SIGN-LANGUAGE MORPHOLOGY. The cases of concatenative morphology we described are quite clearly traceable historically to free signs. They

seem to have arisen through a normal historical course by which affixes develop in spoken languages. Spoken creole languages are subject to the same normal historical processes, of course. In young languages, like sign languages, such morphology is present but limited. In Arends, Muysken, and Smith's (1994) survey of several pidgin and creole languages, for example, we find that Saramaccan (Bakker et al. 1994) and Sranan (Adamson & Smith 1994) each have agentive suffixes derived from the word meaning 'man'—comparable to the ASL agentive suffix. Fa d'Ambu (Post 1994) has two diminutive and several augmentative prefixes, all derived from independent words. But the morphological systems in these new languages are still certainly limited. And even those creole languages with several affixes like Sranan are lacking in inflectional morphology. In general, one feature that has been used to distinguish creoles is their 'minimal usage of inflectional affixes' (McWhorter 1998:792).

The development of inflectional affixes from free words takes time, and in fact the rather limited denominal affixes that we have found in sign languages are derivational. This state of affairs indicates, pace Klima and Bellugi, that the rarity of affixal morphology in sign languages may be as much the result of the youth of these languages as the result of their modality. We do not wish to ignore the strong tendency for morphological processes in sign languages to be simultaneous or prosodic, however, and we concur with Bellugi and Fischer (1972), Klima and Bellugi (1979), Meier (1993), and Emmorey (1995) that there are likely to be modality-driven reasons for this. That is, the phonological form of a language is not a trivial matter, and indeed influences linguistic structure at other levels. We therefore predict that the amount of both affixal and prosodic/simultaneous morphology will increase as sign languages get older and that both will be more arbitrary than the apparently instantaneous and sign-language-universal kind exemplified here by verb agreement and classifier constructions. It may be the case—and there is some evidence for this—that the arbitrary sequential morphology will come to look phonologically more like the simultaneous morphology over time, that is, that the affixed forms may reduce to the canonical LML monosyllable (Sandler 1993a).[38]

Contrary to common assumptions about sign-language morphology, which are based only on the simultaneous type, our results indicate that the affixal derivational morphology of sign languages is not unlike that often found in other young languages. It is derived from free words; it may be semantically opaque; it shows some individual variation; it is sequential; it is arbitrary; and it is rare.

6.2. ICONICITY IN SPOKEN LANGUAGES. The most complex morphology found in sign languages generally is iconically motivated and this motivation explains why we find such complexity even in young languages. Spoken languages also avail themselves of iconicity, though much less, because it is much more difficult to do so. One example is the rich system of Japanese mimetics, which represent physical sensations and impressions by sound (Hamano 1986, Kita 1997).

Of interest to the present discussion is the fact that even young creole languages apparently use iconicity in their morphology. The most outstanding example is reduplication, referred to by Sapir as a process with 'self-evident symbolism' (1921:79). Iconi-

[38] There is a small number of lexicalized forms in ASL that include a negative suffix different from the suffix described here (Woodward 1974). In these forms, the base sign truncates, yielding a morphologically complex word with the canonical LML form (Sandler 1993a, 1999).

cally motivated reduplication is common both in sign languages (e.g. Klima & Bellugi 1979 for ASL, Bergman 1983 for Swedish Sign Language, Sutton-Spence & Woll 1999 for British SL, Zeshan 2000 for Indo-Pakistani Sign Language, Meir & Sandler 2004 for ISL) and in creoles (Kouwenberg 2003, Kouwenberg & LaCharité 2003), though typically very rare in nonextended pidgins (Bakker 2003).

In sign languages, reduplication is typically used for verbal aspect, indicating iteration, duration, continuation, habituality, or distribution. The aspects are distinguished from one another by the shape and/or rhythm of movement. For example, the durational aspect in ASL shown schematically in 3 above is distinguished from the continuative aspect mainly by the rhythm (Sandler 1993b). In the continuative, the hand is held longer at the second location, creating a geminate. Both forms are then reduplicated.

Very many, perhaps most, creole languages also use reduplication iconically, marking various kinds of intensification, iteration, and distribution (Kouwenberg 2003).[39] Some of them also distinguish the grammatical functions of different reduplicative processes by different prosodic shapes, much as sign languages do. In Mauritian Creole, for example, the stress pattern distinguishes augmentative from attenuative, both of which involve reduplication (Baker 2003:212).

In sign languages, however, the potential for motivated morphology is far greater than it is in spoken languages, and so its adoption is more widespread within and across sign languages. While spoken languages take advantage of iconicity, they cannot do so easily for such morphologically expressed grammatical relations and categories as agreement or nominal classification. Such morphology must take arbitrary form in spoken language, and so it takes time to develop and is not universal. In sign languages, agreement is iconically motivated, and therefore widespread, though they are young.

6.3. ARBITRARINESS IN LANGUAGE. The overall findings that we report here enjoy a deceptively comfortable home among other studies of sign-language structure, which have emphasized the arbitrariness of lexical signs (e.g. Klima & Bellugi 1979). The arbitrariness of linguistic signs is taken by most linguists to be a defining property of natural languages (de Saussure 1959 [1916]), so that sign-language linguists have often felt an imperative to demonstrate the arbitrariness of sign languages as a way of proving that they are indeed languages. For example, it has been shown that many lexical signs in sign languages that are iconic to begin with become more arbitrary over time (Frishberg 1975, Meir & Sandler 2004). It has also been demonstrated (Supalla 1982) that the ASL classifier system, used especially for the depiction of physical properties, relations, and motion (as described in §4.6), is linguistically conventionalized and is not pantomimic as had previously been believed.

More recently, we have witnessed a trend in the opposite direction among some researchers. Such eminent pioneers of sign-language research as Stokoe himself (Armstrong et al. 1995) and Liddell (1998, 2000) have adopted the position that many of the properties of sign language should be understood on the basis of general cognitive principles and iconicity, rather than expressly linguistic ones. We believe that this position is just as wrong as the opposite extreme. Both views—that sign language is

[39] Both sign languages (Sandler & Lillo-Martin 2005) and creoles (Kouwenberg 2003) also have reduplicative processes that are not iconic. Our hunch is that iconic reduplication diachronically precedes the noniconic kind, the latter developing after a morphological function for reduplication has been established through iconicity. This hunch is on a par with our prediction that noniconic simultaneous morphology will develop later in sign languages than the iconic kind.

essentially arbitrary or that sign language is essentially iconic/nonlinguistic—obscure the interaction between language and cognition, rather than clarify it.

The work we have presented here provides a context for understanding both the iconic and the arbitrary aspects of sign-language structure and, by extension, of language in general. The types of spontaneously arising complex morphology that are common to (apparently) all sign languages are iconically based. At the same time, they are characterized by explicitly grammatical properties. They are systematic; they are conventionalized (not strictly analogical); they require reference to purely syntactic categories like object; and they are obligatory. These simultaneous morphological processes and their characteristics may be expected in sign languages DESPITE the fact that they are young, because sign languages are uniquely suited to reflecting spatial cognitive categories and relations in a way that is iconically motivated. This suggests that iconicity in grammar may be preferred, but may be largely absent in spoken languages because the modality of speech does not lend itself to iconicity in expressing grammatical relations. Sign language signs and grammatical systems are more iconic because they can be; spoken language signs and grammatical systems are more arbitrary because they can be only weakly iconic and not directly representational. The arbitrary morphology found in sign languages is what might be expected in any young language. The iconically based morphology is what is expected in any language that is capable of it. This line of reasoning leads to the interesting hypothesis that the arbitrariness of grammatical systems is a property of old languages, not of human language.

REFERENCES

ADAMSON, LILIAN, and NORVAL SMITH. 1994. Sranan. In Arends et al., 219–32.

ANDERSON, STEPHEN R. 1992. *A-morphous morphology*. Cambridge: Cambridge University Press.

ARENDS, JACQUES; PIETER MUYSKEN; and NORVAL SMITH (eds.) 1994. *Pidgins and creoles: An introduction*. Amsterdam: John Benjamins

ARMSTRONG, DAVID F.; WILLIAM C. STOKOE; and SHERMAN E. WILCOX. 1995. *Gesture and the nature of language*. Cambridge: Cambridge University Press.

ARONOFF, MARK. 1994. *Morphology by itself: Stems and inflectional classes*. Cambridge, MA: MIT Press.

ARONOFF, MARK. 1999. Gender agreement as morphology. *Proceedings of the first Mediterranean Conference on Morphology*, ed. by Geert Booij, Angela Ralli, and Sergio Scalise, 7–18. Patras: University of Patras.

ARONOFF, MARK; IRIT MEIR; and WENDY SANDLER. 2000. Universal and particular aspects of sign language morphology. *University of Maryland Working Papers in Linguistics* 10.1–34.

ARONOFF, MARK; IRIT MEIR; CAROL PADDEN; and WENDY SANDLER. 2003. Classifier constructions and morphology in two sign languages. In Emmorey 2003, 53–84.

BAHAN, BENJAMIN. 1996. *Non-manual realization of agreement in American Sign Language*. Boston: Boston University dissertation.

BAKER, PHILIP. 2003. Reduplication in Mauritian Creole, with notes on reduplication in Reunion Creole. In Kouwenberg, 211–18.

BAKKER, PETER. 2003. Pidgin inflectional morphology and its implications for creole morphology. *Yearbook of Morphology* 2002.3–33.

BAKKER, PETER; NORVAL SMITH; and TONJES VEENSTRA. 1994. Saramaccan. In Arends et al., 165–78.

BELLUGI, URSULA, and SUSAN FISCHER. 1972. A comparison of signed and spoken language. *Cognition* 1.173–200.

BERGMAN, BRITA. 1983. Verbs and adjectives: Morphological processes in Swedish Sign

Language. *Language in sign: An international perspective on sign language*, ed. by Jim Kyle and Bencie Woll, 3–9. London: Croom Helm.
BICKERTON, DEREK. 1981. *Roots of language*. Ann Arbor: Karoma.
BOS, HELEEN. 1993. Agreement and pro-drop in Sign Language of the Netherlands. *Linguistics in the Netherlands 1993*, ed. by Frank Drijkoningen and Kees Hengeveld, 37–48. Amsterdam: John Benjamins.
BOS, HELEEN. 1994. An auxiliary verb in Sign Language of the Netherlands. *Perspectives on sign language structure: Papers from the fifth International Symposium on Sign Language Research*, vol. 1, ed. by Inger Ahlgren, Brita Bergman, and Mary Brennan, 37–53. Durham: International Sign Linguistics Association.
BRENNAN, MARY. 1990. *Word formation in British Sign Language*. Stockholm: Stockholm University Press.
BRENTARI, DIANE. 1988. Backwards verbs in ASL: Agreement re-opened. *Chicago Linguistic Society* 24.16–27.
BRENTARI, DIANE. 1990. *Theoretical foundations of American Sign Language phonology*. Chicago: University of Chicago dissertation.
BRENTARI, DIANE. 1998. *A prosodic model of sign language phonology*. Cambridge, MA: MIT Press.
CAMPBELL, LYLE, and RICHARD JANDA. 2001. Introduction: Conceptions of grammaticalization and their problems. *Language Sciences* 23.93–112.
CHOMSKY, NOAM. 1995. *The minimalist program*. Cambridge, MA: MIT Press.
CORBETT, GREVILLE. 1991. *Gender*. Cambridge: Cambridge University Press.
COULTER, GEOFFREY R. 1982. On the nature of ASL as a monosyllabic language. Paper presented at the annual meeting of the Linguistic Society of America, San Diego, CA, December.
COULTER, GEOFFREY R. (ed.) 1993. *Current issues in ASL phonology*. (Phonetics and phonology 3.) New York: Academic Press.
CRAIG, COLETTE (ed.) 1986. *Noun classification and categorization*. Amsterdam: John Benjamins.
DE SAUSSURE, FERDINAND. 1959 [1916]. *Course in general linguistics*. New York: McGraw-Hill.
DEGRAFF, MICHEL (ed.) 1999. *Language creation and language change: Creolization, diachrony, and development*. Cambridge, MA: MIT Press.
DEGRAFF, MICHEL. 2003. Against Creole exceptionalism. *Language* 79.391–410.
DEUCHAR, MARGARET. 1984. *British Sign Language*. London: Routledge & Kegan Paul.
DIXON, R. M. W. 1982. Noun classes. *Where have all the adjectives gone? And other essays on semantics and syntax*, 157–84. The Hague: Mouton.
DOBRIN, LISE. 1998. The morphosyntactic reality of phonological form. *Yearbook of Morphology* 1997.59–81.
DORON, EDIT. 1988. On the complementarity of subject and subject-verb agreement. *Agreement in natural language,* ed. by Michael Barlow and Charles Ferguson, 201–18. Stanford, CA: CSLI Publications.
EMMOREY, KAREN. 1995. Processing the dynamic visual-spatial morphology of signed languages. *Morphological aspects of language processing: Crosslinguistic perspectives*, ed. by Laurie M. Feldman, 29–54. Hillsdale, NJ: Lawrence Erlbaum.
EMMOREY, KAREN. 2002. *Language, cognition, and the brain: Insights from sign language research*. Mahwah, NJ: Lawrence Erlbaum.
EMMOREY, KAREN (ed.) 2003. *Perspectives on classifier constructions in sign languages*. Mahwah, NJ: Lawrence Erlbaum.
EMMOREY, KAREN, and HARLAN LANE (eds.) 2000. *The signs of language revisited*. Mahwah, NJ: Lawrence Erlbaum.
ENGBERG-PEDERSEN, ELISABETH. 1993. *Space in Danish Sign Language: The semantics and morphosyntax of the use of space in a visual language*. Hamburg: Signum.
FIENGO, ROBERT, and ROBERT MAY. 1995. *Indices and identity*. Cambridge, MA: MIT Press.
FISCHER, SUSAN D. 1978. Sign language and creoles. In Siple, 309–31.
FISCHER, SUSAN D. 1996. The role of auxiliaries in sign language. *Lingua* 98.103–19.
FISCHER, SUSAN D., and BONNIE GOUGH. 1978. Verbs in American Sign Language. *Sign Language Studies* 18.7–48.

FISCHER, SUSAN D., and PATRICIA SIPLE (eds.) 1990. *Theoretical issues in sign language research, vol. 1: Linguistics*. Chicago: University of Chicago Press.
FLEISCHMANN, SUZANNE. 1982. *The future in thought and language: Diachronic evidence from Romance*. Cambridge: Cambridge University Press.
FORTUNE, REO. 1942. *Arapesh*. (Publications of the American Ethnological Society 19.) New York: J. Augustin.
FRISHBERG, NANCY. 1975. Arbitrariness and iconicity: Historical change in American Sign Language. *Language* 51.696–719.
GEE, JAMES P., and WENDY GOODHART. 1988. American Sign Language and the human biological capacity for language. *Language learning and deafness*, ed. by Michael Strong, 49–74. Cambridge: Cambridge University Press.
GIVÓN, TALMY. 1976. Topic, pronoun and grammatical agreement. *Subject and topic*, ed. by Charles N. Li, 149–89. New York: Academic Press.
GOLDIN-MEADOW, SUSAN. 2003. *The resilience of language: What gesture creation in deaf children can tell us about how all children learn language*. New York: Psychology Press.
GRINEVALD, COLETTE. 1999. Typologie des systèmes de classification nominale. *Faits de Langue* 14.101–22.
GRINEVALD, COLETTE. 2000. A morphosyntactic typology of classifiers. In Senft 2000b, 50–92.
GROCE, NORA ELLEN. 1985. *Everyone here spoke sign language: Hereditary deafness on Martha's Vineyard*. Cambridge, MA: Harvard University Press.
GRUBER, JEFFREY. 1976. *Lexical structures in syntax and semantics*. (North-Holland linguistic series 25.) Amsterdam: North-Holland.
HAMANO, SHOKO SAITO. 1986. *The sound-symbolic system of Japanese*. Gainesville: University of Florida dissertation.
HOCKETT, CHARLES F. 1958. *A course in modern linguistics*. New York: McMillan.
HOLM, JOHN. 1988. *Pidgins and creoles*. Cambridge: Cambridge University Press.
HOPPER, PAUL J., and ELIZABETH C. TRAUGOTT. 1993. *Grammaticalization*. Cambridge: Cambridge University Press.
JACKENDOFF, RAY S. 1987. The status of thematic relations in linguistic theory. *Linguistic Inquiry* 18.369–411.
JACKENDOFF, RAY S. 1990. *Semantic structures*. Cambridge, MA: MIT Press.
JANIS, WYNNE D. 1992. *Morphosyntax of the ASL verb phrase*. Buffalo: State University of New York at Buffalo dissertation.
JOHNSTON, TREVOR. 1991. Spatial syntax and spatial semantics in the inflection of signs for the marking of person and location in Auslan. *International Journal of Sign Linguistics* 2.29–62.
JOSEPH, BRIAN D. 2001. Is there such a thing as 'grammaticalization'? *Language Sciences* 23.163–86.
KEGL, JUDITH; MARIE COPPOLA; and ANN SENGHAS. 1999. Creation through contact: Sign language emergence and sign language change in Nicaragua. In DeGraff 1999, 179–237.
KITA, SOTARO. 1997. Two-dimensional semantic analysis of Japanese mimetics. *Linguistics* 35.379–415.
KLIMA, EDWARD, and URSULA BELLUGI. 1979. *The signs of language*. Cambridge, MA: Harvard University Press.
KOUWENBERG, SILVIA (ed.) 2003. *Twice as meaningful: Reduplication in pidgins, creoles, and other contact languages*. London: Battlebridge.
KOUWENBERG, SILVIA, and DARLENE LACHARITÉ. 2003. 'More of the same': Iconicity in reduplication and the evidence for substrate transfer in the genesis of Caribbean Creole languages. In Kouwenberg, 7–18.
KYLE, JAMES, and BENCIE WOLL. 1985. *Sign language: The study of Deaf people and their language*. Cambridge: Cambridge University Press.
LANE, HARLAN; RICHARD C. PILLARD; and MARY FRENCH. 2000. Origins of the American Deaf-world: Assimilating and differentiating societies and their relation to genetic patterning. In Emmorey & Lane, 77–100.
LEFEBVRE, CLAIRE. 1998. *Creole genesis and the acquisition of grammar: The case of Haitian Creole*. Cambridge: Cambridge University Press.

LIDDELL, SCOTT. 1984. THINK and BELIEVE: Sequentiality in American Sign Language. *Language* 60.372–92.
LIDDELL, SCOTT K. 1998. Grounded blends, gestures, and conceptual shifts. *Cognitive Linguistics* 9.283–314.
LIDDELL, SCOTT K. 2000. Indicating verbs and pronouns: Pointing away from agreement. In Emmorey & Lane, 303–20.
LIDDELL, SCOTT K. 2003. *Grammar, gesture, and meaning in American Sign Language*. Cambridge: Cambridge University Press.
LIDDELL, SCOTT K., and ROBERT E. JOHNSON. 1986. American Sign Language compound formation processes, lexicalization, and phonological remnants. *Natural Language and Linguistic Theory* 4.445–513.
LILLO-MARTIN, DIANE. 1991. *Universal grammar and American Sign Language: Setting the null argument parameters*. Dordrecht: Kluwer.
LILLO-MARTIN, DIANE. 2002. Where are all the modality effects? In Meier et al., 241–62.
LILLO-MARTIN, DIANE, and EDWARD KLIMA. 1990. Pointing out differences: ASL pronouns in syntactic theory. In Fischer & Siple, 191–210.
MANDEL, MARK A. 1981. *Phonotactics and morphophonology in ASL*. Berkeley: University of California dissertation.
MATTHEWS, PETER H. 1991. *Morphology*. 2nd edn. Cambridge: Cambridge University Press.
MCCARTHY, JOHN J. 1981. A prosodic theory of non-concatenative morphology. *Linguistic Inquiry* 12.373–418.
MCCARTHY, JOHN J., and ALAN PRINCE. 1994. The emergence of the unmarked: Optimality in prosodic morphology. *North Eastern Linguistic Society* 24.2.333–79.
MCCLOSKEY, JAMES, and KEN HALE. 1984. On the syntax of person-number inflection in Modern Irish. *Natural Language and Linguistic Theory* 1.487–533.
MCLAUGHLIN, FIONA. 1997. Noun classification in Wolof: When affixes are not renewed. *Studies in African Linguistics* 26.1–28.
MCWHORTER, JOHN. 1998. Identifying the creole prototype: Vindicating a typological class. *Language* 74.788–818.
MEIER, RICHARD P. 1982. *Icons, analogues, and morphemes: The acquisition of verb agreement in American Sign Language*. San Diego: University of California, San Diego dissertation.
MEIER, RICHARD P. 1984. Sign as creole. *Behavioral and Brain Sciences* 7.201–2.
MEIER, RICHARD P. 1990. Person deixis in American Sign Language. In Fischer & Siple, 175–90.
MEIER, RICHARD P. 1993. A psycholinguistic perspective on phonological segmentation in sign and speech. In Coulter 1993, 169–88.
MEIER, RICHARD P.; KEARSY CORMIER; and DAVID QUINTO-POZOS (eds.) 2002. *Modality and structure in signed and spoken languages*. Cambridge: Cambridge University Press.
MEILLET, ANTOINE. 1964 [1937]. *Introduction á l'étude comparative des langues indo-européennes*. 8th edn. Tuscaloosa: University of Alabama Press.
MEIR, IRIT. 1995. Explaining backwards verbs in ISL: Syntactic-semantic interaction. *Proceedings of the 4th European Congress on Sign Language Research*, ed. by Helene Bos and Trudy Schermer, 105–19. Hamburg: Signum.
MEIR, IRIT. 1998a. Syntactic-semantic interaction in Israeli Sign Language verbs. *Sign Language & Linguistics* 1.3–38.
MEIR, IRIT. 1998b. *Thematic structure and verb agreement in Israeli Sign Language*. Jerusalem: Hebrew University of Jerusalem dissertation.
MEIR, IRIT. 1999. A perfect marker in Israeli Sign Language. *Sign Language & Linguistics* 2.41–60.
MEIR, IRIT. 2001. Verb classifiers as noun incorporation in Israeli Sign Language. *Yearbook of Morphology* 1999.295–315.
MEIR, IRIT. 2002. A cross-modality perspective on verb agreement. *Natural Language and Linguistic Theory* 20.413–50.
MEIR, IRIT, and WENDY SANDLER. 2004. *Safa bamerxav: Eshnav lesfat hasimanim hayisraelit* [Language in space: A window on Israeli Sign Language]. Haifa: University of Haifa Press.
MITHUN, MARIANNE. 1984. The evolution of noun incorporation. *Language* 60.847–94.

NAMIR, LILA, and IZCHAK M. SCHLESINGER. 1978. The grammar of sign language. *Sign languages of the deaf*, ed. by Izchak M. Schlesinger, 97–140. New York: Academic Press.

NEWMEYER, FREDERICK J. 2001. Deconstructing grammaticalization. *Language Sciences* 23.187–230.

NEWPORT, ELISSA L. 1981. Constraints on structure: Evidence from American Sign Language and language learning. *Aspects of the development of competence* (Minnesota symposia on child psychology 14), ed. by W. Andrew Collins, 93–124. Hillsdale, NJ: Lawrence Erlbaum.

PADDEN, CAROL A. 1983. *Interaction of morphology and syntax in American Sign Language*. San Diego: University of California, San Diego dissertation.

PADDEN, CAROL A., and TOM HUMPHRIES. 1988. *Deaf in America: Voices from a culture*. Cambridge, MA: Harvard University Press.

PADDEN, CAROL A., and DAVID PERLMUTTER. 1987. American Sign Language and the architecture of phonological theory. *Natural Language and Linguistic Theory* 5.335–75.

PERLMUTTER, DAVID. 1992. Sonority and syllable structure in American Sign Language. *Linguistic Inquiry* 23.407–42.

PIZZUTO, ELENA; ENZA GIURANNA; and GIUSEPPE GAMBINO. 1990. Manual and nonmanual morphology in Italian Sign Language: Grammatical constraints and discourse processes. *Sign language research: Theoretical issues*, ed. by Ceil Lucas, 83–102. Washington, DC: Gallaudet University Press.

POST, MARIKE. 1994. Fa d'Ambu. In Arends et al., 191–204.

RATHMANN, CHRISTIAN, and GAURAV MATHUR. 2002. Is verb agreement the same cross-modally? In Meier et al., 370–404.

ROBERTS, SARAH JULIANNE. 1998. The role of diffusion in the genesis of Hawaiian Creole. *Language* 74.1–39.

SANDLER, WENDY. 1986. The spreading hand autosegment of American Sign Language. *Sign Language Studies* 50.1–28.

SANDLER, WENDY. 1987. Assimilation and feature hierarchy in American Sign Language. *Chicago Linguistic Society* 23.266–78.

SANDLER, WENDY. 1989. *Phonological representation of the sign: Linearity and nonlinearity in American Sign Language*. Dordrecht: Foris.

SANDLER, WENDY. 1990. Temporal aspects and ASL phonology. In Fischer & Siple, 7–35.

SANDLER, WENDY. 1993a. A sonority cycle in American Sign Language. *Phonology* 10/2.243–80.

SANDLER, WENDY. 1993b. Linearization of phonological tiers in ASL. In Coulter 1993, 103–29.

SANDLER, WENDY. 1993c. Hand in hand: The roles of the nondominant hand in sign language phonology. *The Linguistic Review* 10.337–90.

SANDLER, WENDY. 1996a. A negative suffix in American Sign Language. Paper presented at the fifth International Conference on Theoretical Issues in Sign Language Research, Montreal, September 19–22.

SANDLER, WENDY. 1996b. Phonological features and feature classes: The case of movements in sign language. *Lingua* 98.197–220.

SANDLER, WENDY. 1999. Cliticization and prosodic words in a sign language. *Studies on the phonological word*, ed. by T. Alan Hall and Ursula Kleinhenz, 223–55. Amsterdam: John Benjamins.

SANDLER, WENDY. 2005. Phonology, phonetics, and the nondominant hand. *Papers in laboratory phonology: Varieties of phonological competence*, ed. by Louis Goldstein, Douglas Whalen, and Catherine Best. Berlin: Mouton de Gruyter, to appear.

SANDLER, WENDY, and DIANE LILLO-MARTIN. 2005. *Sign language and linguistic universals*. Cambridge: Cambridge University Press, to appear.

SANKOFF, GILLIAN, and SUZANNE LABERGE. 1974. On the acquisition of native speakers by a language. *Pidgins and creoles: Current trends and prospects*, ed. by David DeCamp and Ian Hancock, 73–84. Washington, DC: Georgetown University Press.

SAPIR, EDWARD. 1921. *Language: An introduction to the study of speech*. New York: Harcourt, Brace.

SAUVAGEOT, S. 1967. Note sur la classification nominale en Bainouk. *La classification*

nominale dans les langues négro-africaines, ed. by Gabriel Manessy, 225–36. Paris: CNRS Editions.

SCHEMBRI, ADAM. 2003. Rethinking 'classifiers' in signed languages. In Emmorey 2003, 3–34.

SENFT, GUNTHER. 2000a. What do we really know about nominal classification systems? In Senft 2000b, 11–49.

SENFT, GUNTHER (ed.) 2000b. *Systems of nominal classification*. Cambridge: Cambridge University Press.

SENGHAS, ANN. 1995. *Children's contribution to the birth of Nicaraguan Sign Language*. Cambridge, MA: MIT dissertation.

SENGHAS, ANN. 2000. The development of early spatial morphology in Nicaraguan Sign Language. *Proceedings of the 24th annual Boston University Conference on Language Development*, ed. by S. Catherine Howel, Sarah A. Fish, and Thea Keith-Lucas, 696–707. Boston: Cascadilla Press.

SENGHAS, ANN; MARIE COPPOLA; ELISSA NEWPORT; and TED SUPALLA. 1997. Argument structure in Nicaraguan Sign Language: The emergence of grammatical devices. *Proceedings of the 21st annual Boston University Conference on Language Development*, ed. by Elizabeth Hughes, Mary Hughes, and Annabel Greenhill, 550–61. Boston: Cascadilla Press.

SHEPARD-KEGL, JUDY A. 1985. *Locative relations in American Sign Language word formation, syntax and discourse*. Cambridge, MA: MIT dissertation.

SIPLE, PATRICIA (ed.) 1978. *Understanding language through sign language research*. New York: Academic Press.

SMITH, WAYNE H. 1990. Evidence for auxiliaries in Taiwan Sign Language. In Fischer & Siple, 211–28.

STOKOE, WILLIAM C. 1960. *Sign language structure: An outline of the visual communication systems of the American Deaf*. (Studies in linguistics occasional papers 8.) Buffalo, NY: University of Buffalo, Department of Anthropology and Linguistics.

STOKOE, WILLIAM C.; DOROTHY C. CASTERLINE; and CARL G. CRONEBERG. 1965. *A dictionary of American Sign Language on linguistic principles*. Silver Spring, MD: Linstok Press.

SUPALLA, SAM. 1991. Manually Coded English: The modality question in signed language development. *Theoretical issues in sign language research, vol. 2: Psychology,* ed. by Patricia A. Siple and Susan D. Fischer, 85–109. Chicago: University of Chicago Press.

SUPALLA, TED. 1982. *Structure and acquisition of verbs of motion and location in American Sign Language*. San Diego: University of California, San Diego dissertation.

SUPALLA, TED. 1986. The classifier system in American Sign Language. In Craig, 181–214.

SUPALLA, TED. 1998. Reconstructing early ASL grammar through historical films. A talk presented at the sixth International Conference on Theoretical Issues in Sign Language Linguistics, Gallaudet University, Washington, DC.

SUPALLA, TED, and ELISSA NEWPORT. 1978. How many seats in a chair? The derivation of nouns and verbs in American Sign Language. In Siple, 181–214.

SUTTON-SPENCE, RACHEL, and BENCIE WOLL. 1999. *The linguistics of British Sign Language: An introduction*. Cambridge: Cambridge University Press.

TAUB, SARAH F. 2001. *Language from the body: Iconicity and metaphor in American Sign Language*. Cambridge: Cambridge University Press.

VAN DER HULST, HARRY G. 1996. On the other hand. *Lingua* 93.121–43.

WELMERS, WILLIAM E. 1973. *African language structures*. Berkeley: University of California Press.

WOLL, BENCIE; RACHEL SUTTON-SPENCE; and FRANCES ELTON. 2001. Multilingualism: The global approach to sign languages. *The sociolinguistics of sign language*, ed. by Ceil Lucas, 8–32. Cambridge: Cambridge University Press.

WOODWARD, JAMES. 1974. Implicational variation in American Sign Language: Negative incorporation. *Sign Language Studies* 5.20–30.

WOODWARD, JAMES. 1978. Historical basis of American Sign Language. In Siple, 333–48.

ZESHAN, ULRIKE. 2000. *Sign language in Indo-Pakistan: A description of a signed language*. Amsterdam: John Benjamins.

ZWICKY, ARNOLD M. 1985. How to describe inflection. *Berkeley Linguistics Society* 11.372–86.

ZWICKY, ARNOLD M., and GEOFFREY K. PULLUM. 1983. Cliticization vs. inflection: English *n't*. *Language* 59.502–13.

Aronoff
Department of Linguistics
Stony Brook University
Stony Brook, NY 11794
[mark.aronoff@stonybrook.edu]

Meir
Department of Hebrew Language and
Department of Communication Disorders
University of Haifa
Haifa 31905, Israel
[imeir@univ.haifa.ac.il]

Sandler
Department of English Language and Literature
University of Haifa
Haifa 31905, Israel
[wsandler@research.haifa.ac.il]

[Received 1 May 2003;
revision invited 20 December 2003;
revision received 15 March 2004;
accepted 30 June 2004]