PROSODY AND SYNTAX IN SIGN LANGUAGES

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ABSTRACT

Prosodic structure in sign languages is encoded by articulations of the hands, face, and body. Despite the different physical system, there are many similarities to prosody of spoken language, such as the existence of a prosodic hierarchy, alignment of intonational elements (conveyed by the face) with temporally marked prosodic constituents (conveyed by the hands), and a close relation between prosody and syntax. The latter relation is indirect, however, and does not imply isomorphism. As such, the distribution of intonational elements cannot reliably be used as a diagnostic for syntactic structure, nor can their occurrence be predicted by syntax alone. While the existence of prosody in sign languages underscores the 'naturalness' of prosody in human language, the prosodic system emerges gradually, both in children acquiring established sign languages and in new sign languages, underscoring both its complexity and its grammatical character.

1. INTRODUCTION

Prosody and syntax are intimately related but, as in romance, intimacy only happens between two separate entities. Sign languages present a particularly interesting domain for considering the relationship between prosody and syntax, in part because a consensus has not yet been reached on where to draw the line between the two. In a language modality that affords the use of a multitude of articulators on different parts of the body, it should not be surprising that sorting out the whole system is a non-trivial endeavour, resulting in certain indeterminacies. And an innocent romp through the literature reveals that one linguist's syntax may be another linguist's prosody and vice versa. The very fact that there are unresolved ambiguities here shows how closely linked prosody and syntax can be. This article makes an attempt to articulate the prosodic component in these visual languages, and to draw the lines more clearly where possible, laying some groundwork for future enquiry. A distinction is drawn between two approaches to the interpretation of certain ubiquitous facial expressions in sign languages – a direct syntax approach and a prosodic approach – and the latter will be supported here.

  In the research on sign language over the past half century, a good deal of evidence has been presented for linguistic properties that are shared between the auditory and visual modalities, functional properties, and – perhaps more interestingly because of the obvious differences in physical modality – formal properties as well (e.g. Sandler & Lillo-Martin 2006). And indeed, as will be argued here, certain key properties of prosody found in spoken languages are found in sign languages as well. The differences in structure that result from the differences in the physical modality of transmission serve to illuminate not only the nature of the sign language system, but also aspects of the spoken language system that may appear to be formal universals but that are actually modality-driven, such as the phonetic content and distribution of intonational tunes. The focus here is on prosodic constituents and on the intonational system of sign languages. As early as the l970s, researchers discovered that certain types of expression, such as interrogatives, relative clauses, and conditionals, are typically accompanied by

particular markers, conveyed not by the hands, but by the face, head, and body. This discovery attributed syntactic complexity to the sentences so marked in American Sign Language (ASL), such as embedding in the case of relative clauses, and led to treatments of the formal markers of this system as inherently syntactic entities. Others have proposed that the forms in question mark prosodic constituents and provide intonational meanings. We aim for a higher resolution of data and analysis in order to better understand the relation between the two.

In the theory of sign language prosody laid out here, prosodically marked constituents (demarcated by changes in timing, including pause, and manifested by the signing hands) bear the same relation to syntax in signed languages as they do in spoken languages, insofar as they interact with syntactic units but do not overlap perfectly. Intonational elements (conveyed primarily by facial expression and head position) are aligned with prosodic constituents, so that intonational patterns have only an indirect relation with syntax.[1] This view implies that assigning syntactic structural properties directly to intonational elements, and using their distribution as a diagnostic for underlying syntactic structure – an integral part of some sign language research programmes – is putting the cart before the horse. Conversely, attempting to predict the occurrence and distribution of intonational elements by syntax alone will also lead us astray.

The definition of intonation supported here has both functional and formal aspects. Functionally, intonation conveys particular kinds of (essentially pragmatic) meaning in utterances, such as illocutionary force, shared knowledge, and the like. Formally, intonation is realised suprasegmentally (simultaneously with the text) and distributed on the basis of prosodic constituency. The formal/distributional part of this definition distinguishes intonation from lexical particles that are represented in the syntactic string and provide intonational functions, such as those that have been found in some tone languages (e.g. Hyman & Monaka 2008; Wakefield 2010). The fact that sign language intonation shares both functional and formal characteristics with that of spoken languages, as demonstrated below, reveals the ubiquity of such a system in human language generally.

The treatment of sign language prosody presented here attributes particular roles to different articulators of the body in articulating prosodic structure. The hands, face, and body each play a role in shaping the prosodic system, even as each serves other grammatical functions as well. The physical form of language in the two modalities is quite different, but many key organisational principles are the same.

Some of the issues dealt with here are reminiscent of debates in the spoken language literature on prosody, as will no doubt be clear from the other papers in this special issue. Here, the goal is to demonstrate that the syntactic component and the prosodic component must be distinguished in sign languages, and to provide a theoretical framework for investigating the prosodic component, with details of the interaction between the two left for future research.

We begin in section 1 with an introductory description of some of the linguistic markers in question and the functions traditionally attributed to them. A prosodic hierarchy is introduced and its existence in sign languages argued for in section 2, based mainly on evidence from Israeli Sign Language (ISL). Intonation, which often conveys critical information, is conveyed primarily through facial expression on the upper face. Section 3 develops this theory of sign language intonation, showing that the facial intonation of sign language conveys pragmatic information, that it is compositional in content, and prosodic in its distribution. Taken together, sections 2 and 3 present the **prosodic approach** to the analysis of phonologically conveyed constituency and intonation in sign language.

The association, in early research, of particular markers of the face and head with syntactic constructions led later to more detailed analyses which claim that the distribution and role of

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[1]Since the intonation system might be thought of as having its own syntax (Gussenhoven 1984; 2004), it is worth pointing out at the outset that 'syntax' as used here refers to the traditional notion of phrase structure or sentence syntax.

these markers is part of the syntactic component of the grammar. These analyses have argued either (1) that the occurrence of these markers is predicted by syntactic configurations, (2) that the markers themselves manifest syntactic properties, or, recently, (3) that the articulations in question are intonational in nature but are an integral part of the syntax. In section 4 some of the analyses of the **direct syntax approach** to the interpretation and patterning of particular non-manual markers will be sketched as a point of reference. The principal argument against the direct syntax approach comes from non-isomorphism between prosody and syntax, demonstrated in section 5. In that section, the prosodic approach favored here, according to which the relation between the markers in question and the syntax is mediated by the prosodic component, is further supported. Additional evidence for the claim that intonation is separate from syntax in sign languages comes from acquisition research, briefly described in section 6.

Whatever the analysis, the literature very often presents a picture in which so-called non-manuals have a unified role, one that is different from that of the hands. Closer observation suggests that some of these assumptions are at best premature. The division of labour between the hands and the rest of the body is not so neat, and exploring the interaction between the physical articulators and the grammar promises to reveal important insight into the relation between the two. The hands, whose main function is to transmit words, also play an important role in prosody, while other – non-manual – articulators of the body play a number of different linguistic and paralinguistic roles in sign languages in addition to prosodic roles. Section 7 provides a kind of map, linking the various articulators of sign languages to particular linguistic roles, grammatical components, and paralinguistic functions, and suggesting that not all the links can be connected at this stage.

Although prosody is often considered to be somehow primal, present in all languages, and even assiduously attended to by infants, the prosodic elements of rhythm or timing, stress, and intonation constitute a linguistic system of some complexity. The study of sign languages offers us a rare opportunity to observe how prosody and syntax arise in a new language just forming. The emergence of prosody in a young sign language in a small village with many deaf people, Al-Sayyid Bedouin Sign Language, will be the topic of section 8. Section 9 is a brief summary and conclusion.

A caveat about generalisations across sign languages is in order. Certain aspects of the system to be explored here have been documented in a number of sign languages, though not necessarily in connection with prosody. Many of the examples here come from ASL and ISL, languages in which the linguistic elements in question have been explored in detail, and which have a good deal in common in their prosodic systems at the level of description that we have attained so far – although possible differences in this domain from language to language are allowed for in what follows. Most of the analyses and theoretical positions put forth here are proposed as hypotheses about the prosody of sign languages in general as currently understood.

2. BACKGROUND: CONSISTENT MARKERS OF CLAUSE AND SENTENCE TYPES

In the early decades of sign language research, following publication of William Stokoe's monograph *Sign Language Structure* (1960), linguists made it their business to discover what other aspects of grammatical structure could be found in the visually transmitted natural languages of deaf communities. A group of researchers at the Language and Cognition Lab at the Salk Institute identified a number of grammatical structures and processes for the first time (see Klima & Bellugi 1979). To account for the grammar of ASL, some of these researchers began to look beyond the words transmitted by the hands to actions of the face, head and body.

Certain configurations of facial expression and head and body posture were shown to co-occur with particular sentence and clause types. Yes∕no questions in ASL are associated with
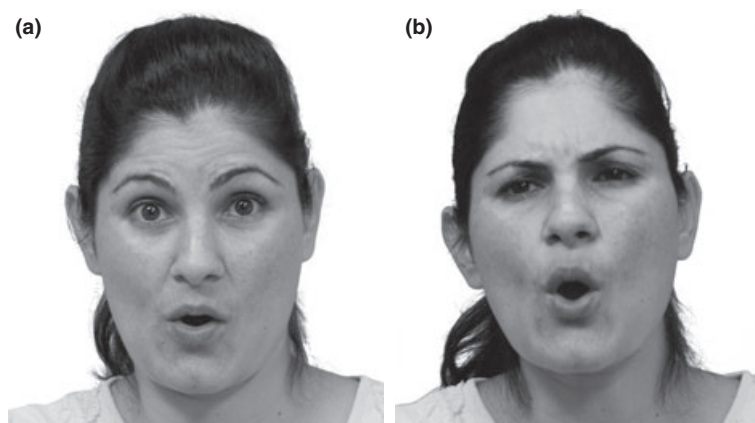
Figure 1. Typical ISL non-manual configurations for (a) yes/no and (b) *wh* questions

raised brows, head tilted forward, and widened eyes, and *wh* questions with furrowed brow and head forward (Liddell 1980; Baker-Shenk 1983). These two configurations, shown in Figure 1 for ISL, commonly mark these two sentence types in numerous sign languages (e.g. Coerts 1992, Sign Language of the Netherlands; Nespor & Sandler 1999, ISL; Sutton-Spence & Woll 1999, British Sign Language; Engberg-Pedersen 1990, Danish Sign Language; Bergman 1984, Swedish Sign Language; see Zeshan 2004; 2006 for a survey).

Topics are marked by raised brows and head slightly back in ASL, and negatives by a headshake (Liddell 1980).[2] By identifying fronted topicalised elements through these markers, Liddell's work helped to determine that the basic word order of ASL is SVO. Objects with no special non-manual marking occur after the verb, while objects at the beginning of an utterance have topic marking, indicating to Liddell that they were moved to that position. ASL conditional sentences also have typical marking: raised brows and head tilt across the antecedent or 'if' clause, head thrust at the end of that clause, and an eyeblink at the juncture between the two clauses (Baker & Padden 1978; Liddell 1986; Reilly, McIntire, & Bellugi 1990) – also similar across many sign languages that have been studied.

On the basis of these markers, Liddell argued that there are complex sentences in ASL. For example, strings interpreted as relative clauses are accompanied by a particular non-manual configuration: raised eyebrows, head tilted backward, raised cheeks and upper lip (Liddell 1978). This marking does not appear on coordinate structures, and was presented as evidence of embedding in ASL. In later work, purely syntactic tests of bi-clausal sentences distinguished subordinate from coordinate structures. For example, sentence-final negation negates the matrix clause in sentences with embedded clauses, but the last clause in coordinate structures. This and similar tests showed unequivocally that complex sentences with subordinate and coordinate clauses occur in ASL, and that the two can be distinguished (Padden 1988).

The elements of facial expression and head position introduced in most detail by Liddell (1980; see also Baker & Cokely 1980) were claimed to be syntactic marking, on a par with relativisers such as *that* in a language like English, a perspective that is integral to some syntactic analyses in later studies.

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[2]A study of ISL (Rosenstein 2001) found more variation in the facial expression and head position for topics in that language, but identified consistent timing breaks and changes of head position after this constituent. This is consistent with the prosodic approach put forward here, according to which facial expression is supplied by the pragmatics and aligned with prosodic constituents.

Other researchers began to investigate prosodic characteristics of the same markers, leading to claims that a cluster of non-manual elements like Brow Raise, head tilt, and others, aligned with timing elements such as holds and pauses, pattern like prosodic systems in sign languages. If they are indeed prosodic, then they must be related in some way to syntax. And it is not uncommon to find the markers called intonational and syntactic in the same study, with no further explanation.

However, prosodic and syntactic structure are not isomorphic, and the precise relationship can only be determined through rigorous investigation; that is perhaps the most important message to be conveyed here. The content of intonational tunes is removed from syntactic structure both distributionally, by aligning temporally with prosodic constituents, and semantically, where pragmatic considerations may trump syntactic structure, as we will see. The following two sections present a theory of prosodic constituency and intonation in sign languages based on a study of Israeli Sign Language (Nespor & Sandler 1999). Most of the examples here come from ASL and ISL, two unrelated sign languages that appear to have similar, though not identical, prosodic systems. After that, in section 4, certain syntactic analyses that appeal to some of the same markers are discussed.

3. THE PROSODIC HIERARCHY

Evidence from a wide range of languages shows that the prosodic component organises utterances hierarchically into constituents. Example (1) shows Nespor & Vogel's (1986) hierarchy.

(1)   mora > syllable > foot > prosodic word > clitic group > phonological phrase > intonational phrase > phonological utterance

Other proposals exist, and most of them assume the same or similar levels of constituency.[3] A large body of work has demonstrated that these prosodic constituents are related to syntactic constituents, but that they are not always isomorphic with them (e.g. Bolinger 1978; Selkirk 1984; 2002; Nespor & Vogel 1986). We adopt this view and present arguments from sign language in this section and in section 5.

In ISL, we find evidence for the hierarchy in Example (2), to be described in the following sections.[4]

(2)   prosodic hierarchy in Israeli Sign Language (Nespor & Sandler 1999)
       Syllable > prosodic word > phonological phrase > intonational phrase

3.1. Syllables

Rhythmic structure of relevance to prosody–syntax interaction in sign languages begins at the syllable.[5] Syllables are associated with movement (Coulter 1982; Liddell & Johnson 1989; Sandler 1989; 1993; Brentari 1990; Perlmutter 1992; Wilbur 1993). This movement can be a path movement of the hand from one location to another, either on the body or in

[3]Selkirk & Tateishi (1988) motivate a Minor Phrase level in the prosodic hierarchy, and a Focus Phrase level is proposed in Kanerva (1990). A principled difference in the prosodic hierarchy is made by Itô and Mester, who propose to collapse the phonological phrase and the intonational phrase into one recursive category (Itô & Mester 2007).

[4]Klima & Bellugi (1979) write that stress falls on the second member of a compound in ASL. In unreduced compounds, in which each member consists of one syllable, this can be seen as evidence for a foot in that language.

[5]See Perlmutter (1992) and Brentari (1998) for proposals based on ASL that there are lower levels of prosodic structure, the mora and the weight unit, respectively.

space; a change in the position of the fingers, such as opening or closing; a change in the orientation of the hand; or some combination of these. One movement or more than one simultaneously constitutes a syllable. Most signs have simple movement, but complex (i.e. more than one simultaneous) movement is present in 18 per cent of the signs in Stokoe's dictionary of American Sign Language (Stokoe 1960; Brentari 1998). An example of a simultaneous combination is opening the fingers from a fist position to an open hand, while at the same time moving the hand in a path outward from the body, as in the ISL sign SEND (Figure 2).

The words of sign languages have a strong tendency to be monosyllabic (Coulter 1982 on ASL). Even when more than one morpheme is involved, there is typically a single syllable in a sign, at least in ASL and ISL. For example, a verb that is inflected for agreement might have different beginning and ending locations (which mark subject and object), i.e. three morphemes, but there is still a single movement, one syllable. Lexical compounds, which combine two words, each typically monosyllabic, often reduce to monosyllables (Liddell & Johnson 1986; Sandler 1989; 1999a). Figure 3 shows the ISL compound THINK^STOP, 'be amazed'. Each member of the compound is monosyllabic and, when combined, the first movement is dropped, so that the compound is monosyllabic instead of disyllabic. Regressive assimilation of hand configuration (two-handed in this case) also occurs in this lexical compound, and is common under reduction in both ASL and ISL.

Despite this tendency toward monosyllabicity, the word, the morpheme, and the syllable are not isomorphic (Brentari 1990; 1998; Sandler 2008; Sandler & Lillo-Martin 2006), as Table 1 shows. As in spoken languages, in sign languages too, rules and constraints must refer to the syllable independently from the word or morpheme (Sandler 1989; 2008; Sandler & Lillo-Martin 2006).

Figure 2. ISL SEND, a monosyllabic sign with simultaneous path and hand internal movement

Figure 3. An ISL lexical compound reduced to a monosyllable: a. THINK b. STOP (c) THINKˆSTOP ('be amazed')

Table 1. The word, the morpheme, and the syllable are distinguished by their disjoint cooccurrence patterns. All the possibilities shown are attested, but those in bold are most common

ω	ω	ω	ω
|	|	∧	∧
μ	μ	**μ μ**	μ μ
|	∧	∨	| |
σ	σ σ	**σ**	σ σ
monomorphemic	monomorphemic	**bimorphemic**	bimorphemic
monosyllabic words	disyllabic words	**monosyllabic words**	disyllabic words

3.2. Prosodic words

The tendency toward monosyllabicity – one movement beat per signed word – motivates the proposal that monosyllabicity is a (violable) constraint on prosodic words in sign languages like ASL and ISL. Not all prosodic words are monosyllabic, as Table 1 shows, but there is a strong tendency in that direction. Evidence for the optimal monosyllabic prosodic word comes not only from reduction in lexical compounds of ASL and ISL, which, by reducing to monosyllables, satisfy the optimal form of the prosodic word, but also from cliticisation in ISL. Specifically, when a pronoun occurs in the final, strong position of a phonological phrase in that language, it can cliticise onto the preceding content word so that the two together are perceived as conforming to a monosyllabic envelope (Sandler 1999a). The data here and for the next two section s are from a study of 30 sentences elicited from three signers, 90 sentences in all (Nespor & Sandler 1999).

An example of cliticisation is taken from the sentence shown in (3).

(3)   [[SHOP-THERE] [AROUND-CORNER]] [BANKRUPT]
      'The shop around the corner went bankrupt.'

The sign THERE occurs at the end of the phonological phrase (discussed shortly), and cliticises with SHOP by a process of coalescence. The sign SHOP is a symmetrical two-handed sign, which means roughly that in citation form, the dominant (i.e. the preferred, and typically the moving) hand and the non-dominant hand are the same in shape and movement. In this example, both hands begins the two-handed sign SHOP, but in mid-path the handshape and
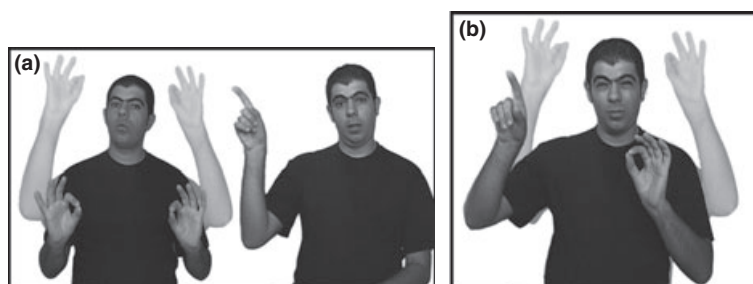
Figure 4. Cliticisation produces non-structure-preserving monosyllables. SHOP, THERE, and SHOP-THERE

direction of movement of the dominant hand change to sign THERE while the non-dominant hand co-temporally completes the sign SHOP. The change in handshape on the dominant hand would normally signal a new syllable; however, the non-dominant hand persists in the handshape from SHOP and completes the single movement of that sign, providing an envelope for the one syllable of the optimal prosodic word. The two signs in isolation and the coalesced form are shown in Figure 4.[6]

The cliticised form violates a lexical constraint on the type of two-handed signs in which both hands move, according to which the hands must be symmetrical in shape and movement (Battison 1978). This non-structure-preserving violation in favour of monosyllabicity is compatible with the fact that the prosodic coalescence we see here is post-lexical in the sense that it applies across morphosyntactic word boundaries, i.e. close to the surface (Sandler 1999a). SHOP-THERE is two morphosyntactic words but one prosodic word in ISL, just as *Sally's* (in *Sally's reticent*) is two morphosyntactic words, *Sally* and *is*, but one prosodic word in English. Non-isomorphism between prosody and syntax at higher levels figures in the argument for distinguishing prosodic from syntactic structure in section 5.

3.3. Phonological phrases

The Nespor & Sandler study found evidence for both phonological and intonational phrases in ISL. We begin here with the former. Phonological phrases, similar to intermediate phrases (Beckman & Pierrehumbert 1986) or MaPs (Selkirk 2002), are domains that correspond roughly to syntactic phrases projected from major lexical categories, such as noun phrases and verb phrases. There may be more than one phonological phrase (P) within an intonational phrase (the next level up), and more than one intonational phrase (I) in an utterance.[7] Example (4) shows a long sentence of the former type from Nespor and Vogel (1986).

(4)   [[The giant panda]$_P$ [eats] $_P$ [only one type]$_P$ [of bamboo] $_P$]$_I$] [in its natural habitat]$_P$] $_I$

Nespor and Vogel provide an algorithm for projecting phonological phrases from syntactic phrases. In addition to cues of rhythm and prominence delineating phonological phrase boundaries, the authors demonstrate that languages have phonological rules such as rules of external sandhi, i.e. segmental assimilation and other processes between the end of one word and the beginning of the next, which have the phonological phrase as their domain. For example, these rules apply across word boundaries but not across phonological phrase

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[6]See Brentari (1998) for phenomena related to prosodic words in ASL.

[7]Some recent work on spoken language posits a level of prosodic structure between the phonological phrase and the intonation phrase, but we will not deal with these levels here.

boundaries. In the French sentence divided by brackets into phonological phrases, [*les enfants*] [*sont allés*] [*à l'école*], liaison applies across words within phonological phrases, so that the 's' ([z]) is pronounced at the end of *les* in [*les enfants*], but is not pronounced at the end of *allés*, blocked by the phonological phrase boundary *allés*] [*à*. Such processes, which have the effect of binding phrases as phonological constituents, provide evidence for the existence of the domain, in this case, the phonological phrase.

In our study of ISL, we found consistent phonetic cues at phonological phrase boundaries as well as a sandhi rule within that domain (Nespor & Sandler 1999; Sandler 2006). The final boundary of a phonological phrase is consistently marked by either a hold (holding the hands in place), a pause (relaxing the hands), or a reiteration of the last sign. These are the timing cues that mark the domain.

The sandhi rule is observable where two-handed signs occur within a phrase. Most signs are made with one hand, the dominant or preferred hand, but many are two-handed. Of the two-handed type, the non-dominant hand may either be symmetrical in shape and movement with the dominant hand (as in SHOP above) or else it is stationary and functions as a place of articulation. Two-handed signs of either type may trigger an external sandhi rule within the phonological phrase. Under this rule, called Non-dominant Hand Spread (NHS), the non-dominant hand, configured and located according to the specifications of the triggering sign, stays in the signing space, beyond the sign that triggers it, up to the phonological phrase boundary. The spread may be either regressive or progressive. While the rule is optional, when it does apply, it respects the phonological phrase boundary in the corpus of elicited sentences studied by Nespor and Sandler.

Consider the ISL sentence in (5). Here, there are holds, pauses, or reiterations at the phonological phrase boundaries, and an intonational phrase break between the two intonational phrases (discussed below). In this sentence, the configuration and location of the non-dominant hand from the sign BAKE spreads to the end of the phonological phrase by remaining in the same configuration as in the source sign, BAKE, throughout the next sign, CAKE, which is a one-handed sign. As in the example of French liaison, NHS serves to bind together the signs in the phonological phrase as a phonological unit.

(5)   [I-TELL HIM]$_P$ [BAKE CAKE] $_P$ [TASTY] $_P$]$_I$ [[ONE FOR-ME] $_P$
      [ONE FOR SISTER] $_P$]$_I$
      'I told him to bake a tasty cake, one for me and one for my sister.'

The end of the phonological phrase BAKE CAKE is marked by a hold – holding the hand in position at the end of the last sign. As can be seen in Figure 5, the signs on either side of this boundary, HIM and TASTY, are not affected by NHS. On those signs, the non-dominant hand is in a configuration and position that are neutral for this signer. The retraction of the fingers to the neutral, closed position between CAKE]$_P$ and [TASTY] $_P$]$_I$, and lowering of the hand after CAKE]$_P$, though hard to discern in the still pictures, are very salient in the moving image.[8]

Note that, syntactically, a verb phrase with an object noun phrase containing an adjective phrase could in principle consist of three phonological phrases, and would be likely to do so if there were more words in each phrase. For example, if the string were 'He carefully baked a

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[8]The phenomenon of NHS was noted earlier in ASL lexical compounds (Liddell & Johnson 1986; Sandler 1987; 1989). Since the citation forms of lexical compounds always constitute phonological phrases, it was impossible to learn the extent of the spread from these isolated forms. The ISL prosody project revealed that, in ISL at least, the spread, though optional, is to the phonological phrase boundary. Brentari & Crossley (2002) found a similar phenomenon in ASL, but with somewhat different characteristics. Since the assumptions and methods differed in the two studies, it is not yet known whether the non-dominant hand behaves the same way in the two languages.
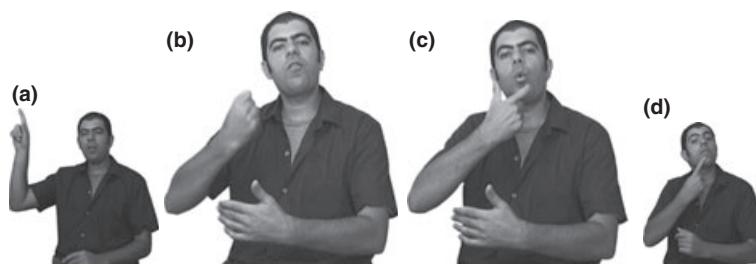
Figure 5. Non-dominant Hand Spread from BAKE to CAKE within a phonological phrase

huge layer cake', the object noun phrase would be more likely to be separated from the verb by a phonological phrase boundary. Instead, BAKE and CAKE are 'restructured' (Nespor & Vogel 1986) into a single phonological phrase. Here, as in the cliticised example above in which two morphosyntactic words combine to form one prosodic word, syntactic constituency cannot fully predict prosodic constituency.

3.4. Intonational phrases

The intonational phrase is the unit marked by clearly perceptible breaks, informally often called 'intonation breaks', setting off clauses and other constituents, most saliently in such structures as parentheticals, non-restrictive relative clauses, topics, and extraposed elements (Nespor & Vogel 1986). A unit of this kind has been studied in depth in ASL by Wilbur (see Wilbur 2000 and references cited there). The presentation here is from the ISL study (Nespor & Sandler 1999). As with other levels of the hierarchy, intonational phrase breaks often correspond to particular syntactic constituents, but not always.

In ISL, final Intonational Phrase (IP) boundaries are marked by the same cues as phonological phrase boundaries, often by greater size and slower articulation of the last sign. But there are two other salient signals at this boundary: a change in head and/or body posture, and an across-the-board change in facial expression. Nespor and Sandler interpreted the marking on the last sign of the phrase as contributing prominence phrase-finally. In the ISL study, all markers were coded, but their perception was by the human eye of the coder. Wilbur's careful instrumental study of stress in ASL (1999) shows prominence on the final sign of IPs in that language as well . Wilbur argues that ASL is a non-plastic language like Catalan (Vallduví 1992), which shifts focused elements into the prominent final position of the IP, rather than a plastic language like English, which instead shifts the stress in the phrase to mark focus.[9]

Judging by Wilbur's studies, it appears that the syntactic content and rhythmic form of Intonational Phrases in ASL are comparable to those of ISL, presented here (see Wilbur 2000 for an overview). In both languages, an eyeblink commonly occurs at the juncture between two IPs (see also Baker & Padden 1978). The blinks are optional but very common, and, if they occur, it is at the end of an IP. Just as speakers time the biological function of breathing to coincide with intonational phrase groupings in speech, so do signers time the biological function of blinking at those same boundaries during the transmission of sign language.

While it is difficult to demonstrate the manual effects (e.g. changes in size, speed, and timing) at the IP boundary in still pictures, the change in facial expression and head position are seen clearly in Figure 6, a (counterfactual) conditional sentence with two IPs,

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[9]Little is said here about stress/prominence. The reader is referred to Wilbur (1999), Nespor & Sandler (1999), van der Kooij, Crasborn, & Emmerik (2006), and Sandler (to appear a) for investigations and discussions of this issue in different sign languages.
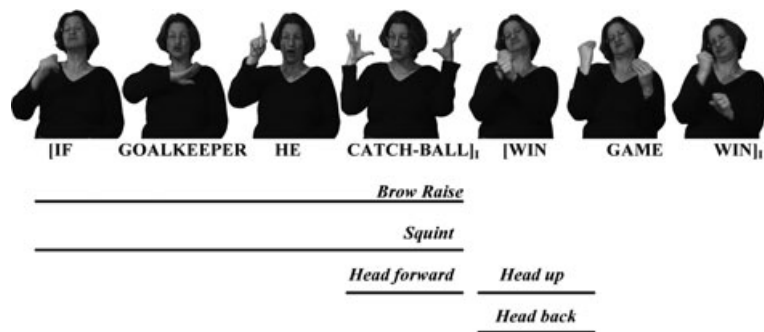
Figure 6. Counterfactual conditional sentence in ISL with intonation phrase break. Partial coding of prosodic cues show alignment

meaning, 'If the goalkeeper had caught the ball, (the team) would have won the game.' The figure and the coding beneath it reflect the typical distribution of the relevant non-manual markers: Brow Raise, Squint, Head Forward on the first IP, and Head Up and Back on the second IP. They are relatively constant across whole prosodic constituents, and all change at the intonational phrase boundary. These non-manual signals align with the manual timing signals: Hold and Slow at the end of the first IP and Hold at the end of the second.

The break between the two IPs is saliently marked by a change in head position and body posture, and in all aspects of facial expression, is shown in the close-up of the juncture in Figure 7. The functions of facial expression are shown in section 3 to correspond to those of intonation in spoken language. For the purposes of prosodic constituency, the relevant fact is its distribution. The IP is the primary domain for intonational tunes (Pierrehumbert & Beckman 1986), and this same constituent is the primary domain for linguistic facial expression in sign language.

Figure 7. Close-up shows change of facial expression and head/body posture at the IP boundary

Not all speakers and signers divide up strings in the same way. Prosodic constituency is determined not only by syntactic constituency but also by factors such as information structure, emphasis, rate of speech, and even personal style. In the ISL data, the string meaning 'The present for you disappeared', though signed in isolation, was divided up in two different ways by different signers, shown in (6). The cues that typically mark phonological and intonational phrases indicate that the string in (6a) has three separate IPs, while (6b) has two IPs, with two phonological phrases in the first one. The IP boundary is characterised by stronger prominence phrase-finally, as well as by a salient change in head position and facial expression. In (6a) the facial expression and head position, interpreted as part of the intonational array, change twice, once at each IP boundary. In other words, there are three facial expressions and head positions, one for each IP. In (6b) the intonation is constant over the whole first intonational phrase [PRESENT-THERE] $_P$ [FOR-YOU]$_P$] $_I$, changing on the second, [[DISAPPEARED]$_P$]$_I$, since this version of the utterance has only two IPs. The intonation aligns with prosodic structure, but is not a reliable indicator of syntactic structure, since the syntactic structure is the same in both versions.

(6) a. [PRESENT-THERE] $_P$] $_I$ [FOR-YOU]$_P$] $_I$ [[DISAPPEARED]$_P$]$_I$
     b. [PRESENT-THERE] $_P$ [FOR-YOU]$_P$] $_I$ [[DISAPPEARED]$_P$]$_I$

We see, then, that at all levels of the prosodic hierarchy, prosodic constituents correspond to (morpho)syntactic structure, but that there is not always a perfect fit. As argued in section 5, this nonisomorphism means that the distribution of a particular marker is not determined solely by syntactic structure, implying that its distribution cannot be used as a reliable diagnostic for syntactic structure.

4. INTONATION ON THE FACE: A COMPOSITIONAL ANALYSIS

The idea that sign language facial expression is comparable to intonation in spoken language has been in the air for some time (e.g. Reilly et al. 1990; Wilbur 2000; Nespor & Sandler 1999; Sandler 1999b; 2005), and continues to occupy researchers (e.g. Dachkovsky & Sandler 2009; Cecchetto, Geraci, & Zucchi 2009; de Vos, van der Kooij, & Crasborn 2009). Like the intonation of spoken language, which has both emotional (paralinguistic) functions and grammatical (linguistic) functions (Ladd 1996; Gussenhoven 2004), the facial expressions of sign language also serve both functions. Their distribution and physical characteristics are different in each system, however. For example, the onset and offset are sharper in linguistic facial expressions; they are aligned with prosodic constituents, unlike paralinguistic expressions; and linguistic expressions typically involve fewer facial articulators (Baker-Shenk 1983; Dachkovsky 2005; de Vos et al. 2009).

There are many muscles in the face, capable of creating numerous different expressions; Ekman & Friesen's (1978) Facial Action Coding System lists 52 facial actions of the brows, eyes, cheeks, nose, mouth, and chin, and another twelve head positions and gaze directions. However, it seems that only a restricted number of action units articulated by the brows and eyelids are involved in linguistic intonation in sign language, those involving the upper face, specifically, the brows and upper and lower eyelids (Wilbur 2000). Many accounts do not list individual action units (AUs), such as those involving the inner or outer brows, instead giving general descriptions, such as Brow Raise.

When linguists first began to turn their attention to facial expression in ASL, they described constellations of expressions and head positions that typically accompany particular structures, as explained in section 1. A closer look reveals that each of these articulations

Figure 8. Compositionality of facial intonation: (a) Brow Raise on a yes/no question, (b) Squint on a constituent about 'shared information', and (c) Brow Raise and Squint together on a yes/no question about shared information

can make a semantic contribution of its own. Wilbur & Patschke (1998) propose that head position in ASL makes an independent contribution to meaning: forward head position connotes inclusion/involvement and affirmation, while backward position signifies exclusion/non-involvement and negation.

It is not only the position of the head that contributes particular meanings to intonational configurations, but individual facial articulations as well. Brow Raise typically occurs on constituents such as topics, temporal and other adverbial phrases, and the 'if' clause of conditional sentences. It also occurs on yes/no questions. Constituents characterised by Brow Raise, in ISL and in ASL according to the literature, are followed by other material without Brow Raise, material signed either by the signer him/herself, or, in the case of yes/no questions, by the interlocutor. Coulter (1978; 1979) proposes that all structures with Brow Raise in ASL describe background information and can be considered various kinds of topic. Coulter's general intuition, that facial expressions have meanings reflecting information structure, is on the right track.

Research on ISL has shown further that linguistic facial expressions consist of components that combine compositionally to create complex meanings (Nespor & Sandler 1999; Sandler 1999b; 2005). The example first used in this line of investigation was a yes/no question about 'shared information' in ISL. Yes/no questions take Brow Raise (Figure 8a), constituents about shared information such as many relative clauses in ISL typically take Squint (Figure 8b), and a yes/no question about shared information like *Did you buy that car (that we were talking about)?* is characterised by Brow Raise and Squint together (Figure 8c).

Dachkovsky (2005) and Dachkovsky & Sandler (2009) look more deeply into the meaning of these articulations and arrived at a coherent semantic analysis of the facial articulations Brow Raise and Squint in ISL that accounts for the distribution of each independently and for their co-occurrence on a range of structures.

According to Dachkovsky's analysis, Brow Raise signals continuation and forward directionality, reflecting dependency relations between phrases and clauses.[10] It means that the phonological or intonational phrase marked by it is to be followed by another constituent, produced either by the same interlocutor or, in the case of yes/no questions, by another. In this way, Brow Raise corresponds to the meaning of the High boundary tone in many spoken languages (Bolinger 1978; Pierrehumbert & Hirschberg 1990; Bartels 1999). In her analysis of High boundary tones, Bartels explains that this general continuation dependency can via implicature have different, relatively more concrete semantic or pragmatic interpretations, depending on other properties of the utterance, and the same is true of Brow Raise.

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[10]A dependency relation is taken to mean a satisfaction-precedence relationship in the sense of Grosz & Sidner (1986).

Squint (narrowing of the upper and lower eyelids) is a common articulation in ISL. It is observed in other sign languages, but has only been discussed briefly for Danish Sign Language (Engberg-Pedersen 1990), where its meaning and use appear to be similar to those of ISL. In ISL, Squint marks restrictive relative clauses, and is often found on parentheticals, temporal clauses referring to the remote past, counterfactual conditionals, and certain topics, among other structures. It is associated with constituents whose status is negotiated between the interlocutors as retrievable, and is interpreted as an instruction to retrieve mutually accessible information that is not currently prominent in the discourse. The idea that intonation can signal shared knowledge between the speaker and the addressee is developed for English in Pierrehumbert & Hirschberg (1990). In ISL, Dachkovsky's interpretation of Squint explains its distribution both independently and in combination with Brow Raise.

This approach is compatible with research on spoken language, showing that the content of intonational tunes (Pierrehumbert and Hirschberg 1990; Gussenhoven 1984; 2004), and even minute details of their timing with respect to the words on which they occur (Gussenhoven 1984; 2004), depend on meaning and information structure within a discourse.

By understanding facial intonation of sign language in this way, we now understand why the same specific action unit may occur on a range of structures, and even why the same combination of articulations can occur on different sentence types. For example, Brow Raise and Squint can co-occur on yes/no questions, relative clauses, and certain conditionals, providing each has the requisite combined meanings: dependency/continuation plus mutually retrievable (but not easily accessible) information. Counterfactual conditionals are reliably marked by Brow Raise and Squint together, as they contain information that is not readily retrievable because it is false. Figure 6 above shows a counterfactual conditional, with a similar facial configuration to that in the yes/no question with information to be retrieved shown in Figure 8c above. There is surely a great deal more to learn about the facial intonation of sign languages, and the kind of analysis summarised briefly here is a promising direction to take.

The analysis shows that sign language intonation has compositional structure, a characteristic of spoken language intonation as well (Hayes & Lahiri 1991; Pierrehumbert & Hirschberg 1990). But there is a difference in the two modalities in the distribution of intonation. In spoken languages, intonational tunes consist of sequences of tones that cluster on stressed syllables and at prosodic boundaries. In sign languages, intonational arrays often characterise whole prosodic constituents, a possibility not available to spoken languages. Since the arrays are conveyed by different articulators (of the face and head) to those that transmit words (the hands), this simultaneity is available, and sign languages exploit it.

The 'prosodic approach' to the prosody–syntax relationship sketched above takes the view that prosodic constituents are related to a syntactic representation that is close to the surface, that these constituents may be altered due to various factors such as complexity of the syntactic constituent, information structure, and rate of speech, and that intonational patterns align themselves with those prosodic constituents. We now turn to the direct syntax approach.

5. THE DIRECT SYNTAX APPROACH

A number of studies on sign languages have linked non-manual markers to syntactic structure in a direct way. Brow Raise and Brow Furrow are examples to be dealt with here, in brief. The Brow Raise articulation discussed in section 3 receives a syntactic analysis in Wilbur & Patschke (1999). In their treatment, the marker itself is assigned neither intonational nor syntactic status inherently, but the authors argue that its distribution is determined on purely syntactic grounds, demonstrated in section 5.1.

Three analyses of *wh* questions – the basic position of wh phrases and constraints on their movement – rely heavily on the distribution of the furrowed brow facial expression that typically accompanies these structures. The problem to be accounted for in ASL is that the *wh* word, accompanied by the Furrowed Brow non-manual marker, can occur in situ, on the right, or on the left, and sometimes in more than one position in a sentence (examples follow in section 5.2), and the direction of movement is the focus of the debate. The two analyses to be described in 5.2 posit different base structures, but share the idea that the non-manual markers themselves are part of the syntax.

For Italian Sign Language (LIS, Cecchetto et al. 2009), the claim is made that *wh* movement is rightward, once again relying on the distribution of the non-manual marker. The authors attempt to explain why, in LIS, object *wh* words are never initial, this explanation relying crucially on the position and spreading or non-spreading of the non-manual marker. In the LIS study, the authors acknowledge that the marker itself is intonational but claim that its distribution marks explicitly syntactic constituents. They propose that sign languages as a group differ from spoken languages in this way, a proposal to which we return below.

Each proposal, though different from the others, shares the supposition that the markers in question are intimately related to syntactic structure, hence the label adopted here: 'the direct syntax approach'. The prosodic approach promoted here proposes that the relevant non-manual markers are intonational in function and prosodic in distribution, and are therefore connected to syntax only indirectly. On this view, intonational 'tunes' express meanings such as continuation or semantic dependency, or pragmatic notions such as illocutionary force and shared knowledge, and their distribution with respect to the text is determined by the factors that govern prosodic constituency. We return to the prosodic approach and the non-isomorphism that supports it in section 6.

5.1. *Brow Raise*

We begin with Brow Raise, a facial articulation that characterises a range of sentence types, some of them noted in section 3 and unified under the prosodic approach by the explanation that they all involve continuation and/or dependency. The Wilbur & Patschke (1999) analysis does not rule out the possibility that Brow Raise is intonational. However, their account rejects a pragmatic/semantic explanation of the meaning of Brow Raise as would be expected if it is intonational, and proposes instead that the distribution of Brow Raise makes direct reference to syntax, rather than indirect reference through prosody. Therefore, their treatment meets the criteria for inclusion as a direct syntax approach. The authors provide many examples of structures with Brow Raise in ASL, some of them shown in (7). In keeping with conventions in the sign language literature, the scope of the non-manual marking is indicated by a line over the text.

(7) Some ASL structures with Brow Raise (Wilbur & Patschke 1999)

     $\overline{\text{br}}$ $\overline{\text{br}}$
 (a) Topics: JOHN_i, VEGETABLE, HE_i PREFER ARTICHOKE
     'As for John, as for vegetables, he prefers artichokes.'

            $\overline{\text{br}}$
 (b) yes/no questions: THINK HAVE ENOUGH MONEY
      'Do you think we have enough money?'

           $\overline{\text{br}}$
 (c) Relative clauses: DOG BITE_1 [[CHASE CAT BEFORE$]_S$ $\text{THAT}_C]_{NP}$
      'The dog bit me that chased the cat before.'

                                                           br
(d) wh clefts: <u>SHE GAVE HARRY WHAT</u>, NEW SHIRT
                   'What she gave Harry was a new shirt.'

                                                              br
(e) conditionals: <u>(IF) RAIN TOMORROW</u>, WE CAN GO-TO MOVIES
                   'If it rains tomorrow, we can go to the movies.'

The authors give considered arguments against Coulter's pragmatic explanation (1979) according to which Brow Raise is found on structures providing background information. The authors argue convincingly that this is not always the case, and offer instead a direct syntactic analysis: that Brow Raise characterises material in A-bar positions associated with non-*wh* operator features. According to the syntactic theory that they assume, this means that material characterised by Brow Raise is syntactically outside the domain of the matrix sentence. The authors stipulate that the only constituents in an A-bar position that do not get Brow Raise are *wh* phrases, which are characterised by furrowed brow and other markers, and they are excluded on empirical (but not theoretical) grounds. The authors argue that their syntactic characterisation thus stated includes the relevant structures while correctly ruling out others.

   For a range of structures, either a syntactic or a prosodic account will do. For example, the distinction between the two sentences in (8) depends on whether the subject is also marked as the topic. Only if it is marked as the topic does it get Brow Raise. Under any analysis, the topic forms a separate syntactic and a separate prosodic constituent.

(8)   (a) DOG RAN-AWAY   'The dog ran away.'

              br
    (b) <u>DOG</u> RAN-AWAY   'As for the dog, it ran away.'

Wilbur & Patschke's treatment describes a wide range of structures, including various types of topic with subtly different non-manual marking (Aarons 1994), for which any comprehensive analysis of Brow Raise will have to account.[11] However, their treatment suffers from two problems, one empirical and the other theoretical.

   Empirically, the non-*wh* A-bar position proposal cannot explain why there is never sentence-final material marked by Brow Raise. For example, the so-called focus doubles analyzed by Petronio & Lillo-Martin (1997), exemplified in (9), though not dealt with in Wilbur & Patschke (1999), are in non-*wh* A-bar positions, and, according to their syntactic analysis, are therefore predicted to get Brow Raise, but they do not (see Sandler & Lillo-Martin 2006). The prosodic approach, which assigns the Brow Raise intonation to mark prosodic constituents for continuation regardless of the specific type of syntactic constituent they correspond to, explains this distribution.[12]

(9) (a) I CAN READ **CAN**
     (b) I WANT GO **WANT**
     (c) I BUY THREE BOOK **THREE**

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[11] A prosodic analysis which assumes that the non-manual markings in question are intonational will also have to account for the different kinds of topic described by Aarons. The notion of topic is a pragmatic one to begin with, and the topics discerned by Aarons are expected to lend themselves to an intonational treatment, which is left to future research.

[12] Brow Raise is found at the end of the sentence in yes/no questions, to be continued by the addressee.

The prosodic account of Brow Raise, though based on ISL, appears to be compatible with the ASL data provided in Wilbur & Patschke (1999) (e.g. (7) above), but has the theoretical advantage of providing a simpler explanation, and one that need not rely directly on syntactic structure, referring instead to structure that is closer to the surface realisation – the linearised bracketed structure that is the domain of prosody. On this view, the structures in question get Brow Raise because they are intended to be continued, similar to constituents that get High in many familiar spoken languages. The prosodic approach correctly rules out Brow Raise on focus doubles, since these forms, though in A-bar position, do not bear the meaning of continuation or dependency with respect to what comes next.

5.2. *Brow Furrow and* wh *questions*

Wh questions are characterised by a different intonational configuration from the one described above. Rather than Raised Brows, they are typically marked in ASL by a Furrowed Brow, as well as a head tilt and forward body position (Baker-Shenk 1983). The issue of *wh* movement in the syntactic approach has hinged on the role and distribution of non-manual markers in ASL and, more recently in Italian Sign Language (LIS). In ASL, the challenge has been to determine the basic syntactic position and movement properties of the *wh* phrase, since it appears in more than one position on the surface, as noted above and exemplified presently. The analyses cannot be properly evaluated in the space allotted here (see Sandler & Lillo-Martin 2006). However, there are particular problems connected to the syntactic approach that are worth noting in the present context.

   One analysis of the direct syntax type claims that the *wh* element found at the beginning of a sentence is the result of leftward movement to a particular syntactic position, as in spoken languages generally (Petronio & Lillo-Martin 1997), and those at the end are base-generated focus doubles, on a par with other doubled constituents in the language. Another analysis holds that *wh* elements found at the beginning are base-generated topics, while those found at the end have been moved rightward into a syntactic position marked for that feature (Neidle et al. 2000). Neidle et al. take the extreme view that 'non-manual syntactic markings are frequently associated with syntactic features residing in the heads of functional projections', and that these markers spread over syntactically defined domains, such as spec-head or c-command (p. 43). The authors proceed to provide a detailed account of the syntax of ASL which is in many instances explicitly motivated by the distribution of these markers. In both treatments, the distribution in the sentence of non-manual markers typically associated with *wh* questions is used to reveal the basic position of the *wh* element as well as the direction of movement to its surface position. The details of the analyses would take us too far afield here; we focus instead on empirical and theoretical problems inherent in such an approach.

   An important problem in arriving at the right analysis is differences of opinion over the nature of the data. Some sentences reported to be judged acceptable by one research team are reported to be judged ungrammatical by the other. One problem is the nature of the coding system and the generality and reliability of judgements.[13] But some discrepancies may well be

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[13]Since prosodic structure, and especially intonational patterns, reflect information and discourse structure, it is imperative to elicit the structures to be analysed in isolation at first, without any potentially confounding context, before looking at them embedded in discourse in later studies. Several examples of the same structures should each be collected from several subjects, to control for idiosyncrasies and unforeseen extraneous interpretations of the material by subjects. Finally, precise and detailed coding, though laborious, is necessary. Unlike studies of spoken language, sign language does not yet have the benefit of instrumental recording, so that meticulous coding of each articulation, including rhythmic behaviour of the hands, and its temporal distribution in each phrase, is essential.

better understood if the full prosodic structure is taken into account, rather than looking only at the lexical string and facial expression. For example, Petronio and Lillo-Martin (1997) report sentence (10a) to be acceptable, while Neidle et al. (2000) say that the similar string in (10b) is out.

(10)

                                    wh
(a) WHO YOU LIKE   'Who do you like?'

                                      wh
(b) * WHO JOHN HATE   'Who does John hate?

The team that rejects (10b) concedes that such sentences are accepted under two conditions: one if the position of the non-dominant hand in the two-handed generic *wh* sign is held throughout the utterance, and the other in which the Furrowed Brow facial expression is more intense at the end of the sentence, the basic position of the *wh* element. In both cases, Neidle et al. make the claim that the true syntactic position of the *wh* phrase is marked – either by the 'perseveration' of the non-dominant hand through to the end of the utterance or by intensity of the facial marker at the end of the utterance. But are these markers inherently part of the syntactic representation, as Neidle et al. assume, or are they intonational elements whose distribution is determined prosodically? And are the data better understood by choosing one over the other?

Here is how a prosodic analysis could offer an alternative explanation for the acceptability of (10b). Wilbur (1999) describes the final position in an Intonational Phrase in ASL as prominent, measured in terms of increased manual muscle tension, peak velocity and displacement. This observation motivates a hypothesis according to which the intensity of the facial expression in the Neidle et al. example is explained by prosodic position as well. In the analysis of ISL, both intensity and non-dominant hand spread are argued to be prosodically determined. Specifically, it was noted in the Nespor & Sandler (1999) study that facial expression often intensifies toward the ends of phrases (argued to mark phrase final prominence together with manual markers), and that the non-dominant hand may spread (NHS) within phonological phrases, as shown in section 3.3. If ASL has similar prosodic markers, then it is conceivable that phrases like (10b), when uttered in isolation, are simply judged more grammatical when they have the phonetic characteristics of more natural prosodic constituents, in this case, of phonological phrases. In other words, if (10b) shows phrase-final prominence and is unified by external sandhi in the form of NHS, then it looks like a proper phonological phrase and is judged to be grammatical. There is no way to know whether the form of (10a), judged grammatical, was prosodically identical to that of (10b), judged to be ungrammatical, because the studies do not provide the relevant prosodic descriptions and analyses. In the absence of a more detailed representation of the prosodic form in the data, we cannot evaluate these reports (see note 11).

The Neidle et al. group does occasionally make note of intonation breaks in their analysis, but comparison of their glosses to the videotaped examples, posted at http://www.bu.edu/asllrp/book, indicates that this is not done systematically, and the criteria are never spelled out. The group assumes a priori that syntactic structure is inherently manifested in non-manual markings, but since prosodic structure on the same syntactic string can take many different forms, their position cannot be confirmed without a prosodic analysis.

Cecchetto et al. (2009) also use the distribution of non-manual elements as a diagnostic for determining the syntactic position of the words with which they are associated. But the LIS team departs from the syntax-only conception in the sense that they attribute intonational status to the non-manual markers ('NMMs') themselves. For them, intonation

is directly connected to syntax. While the team notes that spoken languages occasionally also use intonation to mark syntactic structure, providing an example from Japanese, they suggest that sign languages do this much more. According to the authors, 'sign languages differ from spoken languages in the way they use prosodic devices to mark [syntactic/WS] dependencies' (p. 281). The dependencies they refer to are between abstract positions in tree structure, one of which is the proposed COMP position. But is such an abstract analysis supported? And are sign languages anomalous, as the authors' account forces them to claim?

In their analysis of LIS, the Furrowed Brow associated with *wh* words is an intonational element that is not part of a syntactic position, as the Neidle group stipulates, but rather is part of the lexical description of the *wh* words. It spreads over various stretches of the utterance, its scope reflecting syntactic structure. Specifically, they argue that the spreading of the NMM from *wh* phrases to other material marks syntactic dependency between the *wh* phrase and the complementiser position that they hypothesise, by analogy with common assumptions about spoken languages, to exist in the tree (LIS apparently does not have overt complementisers).

The analysis is internally coherent and empirically explanatory, and the data are straightforward – carefully elicited isolated target sentences from five native signers. However, potential problems arise from mixing prosody with syntax in an unconstrained way. This is because it can be demonstrated that the two are not one and the same, as we will see for both spoken and signed language in the following section. If this is the case, then assuming a direct link between intonation and syntax is an unreliable strategy.

6. Non-isomorphism as a challenge to the direct syntax approach

From spoken language research, we know that the interaction between syntax and prosody is actually very complex. On the one hand, the prosodic form of an utterance can reflect syntactic structure, so that the pairs of strings *No people will go* vs. *No, people will go* and *People will go happily* vs. *People will go, happily* have different syntactic structures reflected in different prosodic structures, and result in different interpretations (examples from Selkirk 2002). And since syntax and prosody are closely related, it is expected that some structures can be accounted for by either a direct syntax or a prosodic account. Neidle et al. (2000) give an example of an ASL sentence in which the *wh* question is interrupted by a topic, shown in Example (11) from Neidle et al. (2000: 116).

(11) $\overline{\text{wh}}$ $\overline{\text{t2-bg}}$ $\overline{\hspace{3cm}\text{wh}}$
         WHO,   VEGETABLE,   PREFER POTATO WHO

          'Who, as for vegetables, who prefers potatoes?

Under the authors' analysis, the distribution of non-manual markers seen here is expected, since VEGETABLE is analysed as a topic and outside the scope of the *wh* markers. Under a prosodic account, topics form their own intonational phrases, which could also receive a different intonational marking from the surrounding material. Perhaps the resumption of the intonational element on the other side of the interrupting constituent is an example of the 'bookmark effect', attributed to non-syntactic factors, described presently.[14]

On the other hand, some structures cannot be explained equally well by the two approaches. Two different kinds of non-isomorphism raise problems for the direct syntax approach: non-isomorphism between prosodic and syntactic constituents, and non-isomor-

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[14]This interpretation was suggested to me by Laszlo Hunyadi (p.c.).

phism between syntactic structures and intonational meaning. Let us look at some examples from spoken and sign language which underscore how the direct syntax approach can potentially go awry.

We begin with spoken language. In the two Bengali sentences in (5a,b) Hayes & Lahiri (1991) show that the same stretch can have two different prosodic constituent structures depending in this case on rate of speech, and that the different structures form domains for particular intonational and phonological patterns. Example (12) shows assimilation applying within phonological phrases (12b), but not across their boundaries (12a). The prosodic constituent boundaries are different depending on speech rate while the syntactic structure is the same in both examples. In the notation used in this example, H and L stand for high and low tones, the asterisk means that the tone is accented, and the % symbol indicates the end of an intonational phrase (following Beckman & Pierrehumbert 1986).

(12) (a) (ø^{L*}mor $^{H\text{-}}$) (tßa^{L*}dor $^{H\text{-}}$) (ta^{L*}ra-ke $^{H\text{-}}$) (díe^{L*}tß^{h}e $^{H\text{-}}$)$^{L\%}$
            [r]   [tß]   [r]   [t]
            Amor   scarf   Tara –to   gave
            'Amor gave the scarf to Tara.'

      (b) (ø^{L*}mor   tßador   tara-ke$^{H\text{-}}$) (díe^{L*}tßhe $^{H\text{-}}$)$^{L\%}$
            [tßtß]   [tt]
            'Amor gave the scarf to Tara.'

In the example, a L* tone marks the beginning of phonological phrases, and an H tone marks the end, while the final L% signals an assertion. The sequence corresponding to *Amor scarf Tara* has three L*H sequences in the slow version (12a), one for each word which constitutes its own phrase, but only one L*H sequence in the fast version (12b), which collapses the three phrases into one. The Bengali example shows, then, that the distribution of intonational elements alone might not be a reliable indicator of syntactic structure.

Furthermore, it is not always the case that structures such as *wh* questions have the same intonational marking. It is therefore not clear how either a direct syntax approach or a mixed approach of the kind proposed for Italian Sign Language would account for the distribution of *wh* words with a different intonation pattern. These possibilities call into question the reliability of analyses which derive syntactic structure directly from the distribution of intonation.

An example of non-isomorphism of this type is provided in the form of a choice question by Pierrehumbert & Hirschberg (1990). The interpretation of the question in (13) is that a piece of fruit and a piece of cake are being offered: *Do you want an apple (?) – or banana cake?*

(13)   Do you want an apple   or banana cake?   (fruit or cake)
                        H* H   H*   L L%

On the other hand, a different pattern leads to a different interpretation. In (14), the choices being offered are two kinds of ice cream. The difference is signaled by the intonation. In both examples, the final intonation contour differs from that of a typical interrogative, which is L* H H% according to the authors.

(14)   Do you like vanilla ice cream or chocolate?   (vanilla or chocolate ice cream)
                        L*   H* L L%

Figure 9. Choice question in ISL, 'Do you want vanilla ice cream or chocolate?' The question intonation spans only the first phrase of the question, though the whole string is a question syntactically

A similar pattern is found in choice questions in ISL, illustrated in (15) and Figure 9. If Raised Brows is akin to high tone, then the non-manual marking in (15) shows behaviour comparable to that of the English example in (13), in which the yes/no question H may characterise the end of the first conjunct but not the end of the second, and to both (13) and (14) in that there is no question intonation on the second constituent, although it is syntactically part of the question. A possible interpretation is one in which the part of the sentence with a question marker has the illocutionary intent of a real question, while the second part is declaratively offering another option.

(15)   ISL (Meir & Sandler 2008)

        _____y/n
        YOU WANT ICE CREAM WHITE INDEXa OR CHOCOLATE INDEXb
        'Do you want vanilla ice cream or chocolate?'

If the choice questions above are regarded as single sentences, they show clear distinctions between syntactic structure and prosodic domains. In the ISL example, the non-manual marking a question ends where the pitch accent is placed in the comparable English sentence, rather than at the end of the question. The ISL and English examples have much in common. Both are questions syntactically, and both are characterised by a rising intonation pattern. But in both, the rising intonation identifiable with a yes/no question does not characterise the whole question. Instead, the second choice is outside the scope of the yes/no intonation pattern. The point is that the intonational tune is not coextensive with the syntactic constituent in either language; the intonation and the syntax are non-isomorphic.

Not only can prosodic constituency be different from syntactic constituency, the nature of the intonational pattern – facial expression in the case of sign language – may vary on the same syntactic structure. As in English, in these languages, rhetorical questions, ironic questions, and exclamative questions do not have the intonational patterns associated with canonical *wh* questions.

This illustrates non-isomorphism between syntax and prosody at the level of the meaning of intonational patterns. Since it is meaning or pragmatic considerations, and not syntax, that

Figure 10. Intonational arrays vary according to meaning: (a) typical *wh* question intonation in ISL, and (b) atypical intonation on a *wh* question

determine the pattern, this disconnect is another argument against inferring a direct connection between intonational markers and syntactic structure. Figure 10a shows a canonical *wh* question marker in ISL, while 10b shows an atypical intonation on a *wh* question meaning, 'Who gave you that new Mercedes Benz as a present?'

In this example, the intonation that overrides the canonical *wh* question intonation may be paralinguistic, but it demonstrates that attempting to use an intonational element as a diagnostic for syntactic structure would be confounded in such a case (see also Lillo-Martin & de Quadros 2010).

We have seen, then, that the intonation may vary on the same syntactic structure. The converse is also attested: a high tone can mark many different kinds of syntactic structures in spoken language, and Brow Raise can do the same in sign language. A recent study on Hungarian and English shows that certain long-distance intonational relations are determined by information structure regardless of syntactic structure. Hunyadi (2010) shows that both centre-embedded clauses and parenthetical clauses trigger a 'bookmark effect', according to which the resuming phrase rises to the same pitch as that which precedes the interrupting material. For example, in the centre-embedded sentence *The cat that the dog that was rabid bit ran away*, the particular (high) F0 level on *cat* is resumed on *bit*, across the lower-toned embedded structure. Similarly but, crucially, in a different syntactic structure, the pitch level is resumed on the other side of the parenthetical in the sentence, *Could you tell me – my watch has stopped – what time it is?* In each case, the tonal pattern is aligned with some prosodic constituent, but the types of syntactic structures evoking this 'tonal continuity' – center-embedded clauses and parenthetical clauses – are quite different. It is the pragmatic function – signaling to the addressee the resumption of an interrupted constituent – that is the same. Clearly, attempting to use the resumptive high tone as a diagnostic for the type of syntactic structure it characterises would lead us astray. The same is true of Furrowed Brow (or other intonational articulations) in sign language.

Also attested are cases where the typical *wh* intonational marking occurs with no *wh* word anywhere in sight. Examples from ASL (Aarons 1994) and ISL (Meir & Sandler 2008) are shown in (16). The intonation is introduced by the pragmatic force of the utterance rather than by the syntax (Sandler & Lillo-Martin 2006).

(16) (a) ISL and ASL: TIME̲   'What time is it?'
           ⎺⎺wh

      (b) ISL: A̲G̲E   'How old is he?'
          ⎺wh

      (c) ASL: JOHN BUY YESTERDAY̲   'What did John buy yesterday?'
                 ⎺⎺⎺⎺⎺⎺⎺⎺⎺⎺⎺⎺⎺⎺⎺⎺⎺wh

Cases such as (16a,b) are easy to imagine in a language like English. For example, in interviewing someone in order to fill out a questionnaire, one might ask 'Age?' with a question intonation. Many contexts for questions like 'The time?' or 'His age?' can be imagined. Of course, it is always possible to supply an elaborate syntactic structure with mostly covert elements that bring such sentences in line with syntactically canonical questions, but such a structure does not seem warranted here. Let us illustrate this point by pushing the syntactic approach to its logical extreme. In response to a statement like *I think I'm going to flunk the driving test again*, one might respond, *Really?* or even, *mm?* The intonation is like that of a sentence such as, *Do you really think so?* – but is the syntactic structure of such a sentence really 'there' in *mm*? Occam's razor selects the simpler analysis according to which the pragmatics supplies both the questioning illocutionary force of the utterance and the intonation pattern to go with it.

The LIS study (Cecchetto et al. 2009) does attribute intonational status to the relevant non-manual markers. Yet the authors cite Neidle et al.'s (2000) claim that non-manual markers directly manifest numerous syntactic elements, and, like the ASL group, use the markers as diagnostics of syntactic structure. The authors of the Italian Sign Language study are forced to propose that sign language is different from spoken language in using intonational markers extensively in the syntax, and suggest that this is due to the options for simultaneity afforded by the modality. However, this explanation is not satisfactory, since intonation in spoken language is also 'simultaneous', in the sense of being suprasegmentally superimposed on the text. In principle, then, there is no physical obstacle to intonation manifesting syntactic elements in spoken language either, yet this is rarely the case. In any event, without a prosodic analysis to complement the syntactic analysis, we cannot know if an alternative explanation in terms of prosodic constituents and associated intonation can account for the same data, and this indeterminacy calls into question whether it is necessary or empirically justified to propose such a typological cleft.

Research on sign languages is only about half a century old, and researchers are certainly justified in gleaning whatever evidence they can for understanding the structure of these languages. Yet the direct syntax approach that stipulates unmediated identity between intonational markers and underlying syntactic structure ignores the meaning of intonation on the one hand and the non-unity of syntactic and prosodic constituent structure on the other. A more nuanced approach, one that attributes pragmatic meaning to intonation and respects prosody as an independent component of the grammar while seeking to understand its interaction with other components, is likely to be more illuminating and ultimately more explanatory.

7. EVIDENCE FROM ACQUISITION

Interesting support for the claim that the connection between syntax and intonation in sign languages is not direct comes from acquisition research. Studies on the acquisition of the intonational cues accompanying wh questions and conditionals in ASL show that syntactic and intonational markers are not acquired in tandem. Children acquire the syntactic structure

of these sentence types, including appropriate use of function words for different kinds of *wh* questions and the manual sign IF in conditionals, long before they command the articulation and scope of the grammatical non-manual marking (Reilly et al. 1990; Anderson & Reilly 1998; Lillo-Martin 2000). In fact, Reilly and colleagues show that the individual markers of ASL antecedent clauses of conditionals – Brow Raise, head tilt, head thrust clause-finally, and blink – are acquired component by component, i.e. that mastery of this intonational marking is gradual. This pattern shows a disconnect between intonation and syntax, and does not mesh with a grammar in which the markers themselves are part of the most basic syntactic structure.

8. NON-MANUALS ARE NOT A NATURAL CLASS

Certain non-manual signals have played an important role in the discussion so far, assigned either to syntactic or to intonational components of the system. However, in order to arrive at a comprehensive model of sign language grammar, it is necessary to acknowledge that the physical articulators themselves do not correspond directly to grammatical components. While the discovery that other parts of the body besides the hands are also recruited by the grammar of 'manual' languages was a breakthrough, this discovery has had the undesirable effect of grouping all signals that are not made with the hands into a single category, usually called non-manual markers (NMMs) or non-manuals. This lumping together of everything articulated by parts of the body that are not the hands is misleading, as it obscures genuine divisions made by the grammar.

We have seen, for example, that the prosodic system comprises signals by the head and body but also, crucially, by the hands. It is the hands that transmit the words in sign language utterances, and they convey the temporal changes that delineate prosodic constituents. Head/torso movements and facial expressions typically align themselves with the boundaries of these constituents. The hands, then, do the talking and the prosodic phrasing, while the head and face add intonational information.

Just as the configurations and movements of the hands play more than one role in the grammatical system of sign languages, body position and facial articulations also play roles that have nothing to do with intonation. For example, the upper body is mentioned in the present article as participating in the prosodic system, and it does so by shifting at major prosodic boundaries (not described here). In addition, the upper body may shift to express the point of view of different participants in a discourse (e.g. Lillo-Martin 1995; to appear) in a way that corresponds to the structure of higher levels of discourse organisation rather than to prosody *per se*.

While some facial expressions may be intonational, like Brow Raise, Brow Furrow, and Squint discussed above, others are better understood as adverbial or adjectival morphemes. Different configurations of the lower face (lips, cheeks, and tongue) convey meanings such as 'carelessly', 'with enjoyment and relaxation', 'meticulously', or 'for a long time', in ASL (Liddell 1980; Wilbur 2000), ISL (Meir & Sandler 2008), and other sign languages. These articulations tend to occur on predicates, which is a different type of distribution than we see for the intonational facial expressions described above which often characterise whole clauses. But their temporal distribution has not been investigated in detail, and it remains to be seen how they interact with syntactic and/or prosodic constituents.

The mouth has a variety of other functions associated with different components of the grammar of sign languages (see Boyes Braem & Sutton-Spence 2001 and Crasborn et al. 2008 for cross-sign-linguistic descriptions and analyses of mouth configurations and actions). One prosodic function of mouth action is observed when words from the spoken language are

mouthed during signing. The mouthing of content words may spread over clitics, to mark the domain of the prosodic word (Sandler 1999a; Crasborn et al. 2008). Certain (meaningless) mouth configurations or movements are obligatorily associated with specific lexical items (Anderson & Reilly 1998; Woll 2001; Meir & Sandler 2008); they are part of the lexical (not the prosodic) representation. The mouth may also articulate non-linguistic gestures corresponding to manual co-speech gestures of hearing speakers. These gestures iconically represent physical properties and sensations such as heaviness, fullness, types of textures, or sounds (air disturbances) like that of water escaping from a hose (Sandler 2009). The mouth, then, is decidedly non-manual, but it has a variety of different functions, linguistic and non-linguistic, in sign languages.

Another type of facial action is affective or paralinguistic facial expression, mentioned above. This system uses (some of) the same articulators as linguistic facial expression, but has different properties in terms of temporal distribution, number of articulators involved, and pragmatic function (Baker-Shenk 1983; Dachkovsky 2005; de Vos et al. 2009). It appears then that some facial configurations are intonational but, like affective intonation in spoken language, they are not part of the linguistic grammar (Ladd 1996), and any grammatical description must take this distinction into account.[15]

Negative headshake is another example of a non-manual action whose assignment to a component of the grammar is not yet fully determined, although aspects of its behaviour have been documented for many sign languages (e.g. ASL: Liddell 1980; German Sign Language: Pfau 2002; Catalan Sign Language and German Sign Language: Pfau & Quer 2007; Sign Language of the Netherlands: Coerts 1992; ISL: Meir & Sandler 2008; Chinese Sign Language: Yang & Fischer 2002; LIS: Geraci 2006; see Zeshan 2006 for a survey). Sometimes attributed to prosody generally or to intonation, the headshake at least sometimes performs as a non-linguistic gesture, as it does for hearing speakers in the ambient culture. Unlike linguistic intonation, it may occur without any signs for signers of some sign languages, but, like intonation, it may also perform its negating function in an utterance without a negative manual sign, also in some but not all sign languages. The distribution of negative headshake seems to show quite a bit of variation, and it may be that this variation has to do with scope-marking properties of the languages more than with prosodic constituency. In any case, more research is needed in order to understand whether it is indeed more closely tied to morphosyntax than are the intonational elements described above.

Eye gaze is also non-manual, but non-intonational, and there is no consensus on its role or roles. In our work on ISL, we have found that this element does not line up reliably with prosodic constituency. Instead, gaze may perform non-linguistic functions such as turn-taking (Baker 1977) and other forms of attention direction. Some have argued that gaze performs the syntactic role of marking agreement (Neidle et al. 2000), while others have refuted this claim, using eye tracking to show that gaze does not perform reliably as an agreement marker (Thompson, Emmorey, & Kluender 2006).

The issue of the range of functions served by non-manual articulations has not gone completely unnoticed. A recent paper provides a sophisticated survey of these forms and their role in sign language grammar, noting some prosodic functions as well (Pfau & Quer to appear). In short, it is a mistake to lump together all non-manual markers into a single category, whether syntactic or prosodic, assuming a priori that they belong to a single system. It is similarly inaccurate to keep the hands out of prosody; the timing and displacement of the hands in conveying the text are the primary cues to prosodic constituency. Sign languages are

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[15]Corina, Bellugi, & Reilly (1999) find neurological differences in the representation of linguistic and emotional facial expressions.

visual languages, and, as such, they recruit all articulators that are within the field of vision of interlocutors in the service of language. It is a compelling challenge to work out the contributions made by each of these elements and their articulations to the overall grammatical structure of sign languages – one that promises to pay off, but that is still in the early stages.

9. THE EMERGENCE OF PROSODIC COMPLEXITY IN A NEW SIGN LANGUAGE

Linguists and non-linguists alike share an intuitive feeling that prosody is a very basic property in language. Babies babble their pitch excursions in endearing yet meaningless intonational phrases. Pidgins are thought to use prosody to mark constituents and syntactic dependencies of different types before syntax has had a chance to develop (Givón 1979). Yet how primal – how 'automatic' – is prosody really?

One way to approach this question might be to look at the way a prosodic system develops in a new language. Pidgins are hard to find, and in any case their speakers already possess fully fledged prosodic systems in their native languages. In fact, there are no truly new spoken languages. But new sign languages do arise from time to time, whenever a deaf community first comes into being.

In the Al-Sayyid Bedouin village in the Negev Desert of present-day Israel, four deaf children were born in a single household about 75 years ago. Due to its insular social structure, consanguineous marriage patterns, and high birth rate, genetic deafness spread in the population (Scott et al. 1995), and today there are about 150 deaf people in a village of 4,000. An indigenous sign language arose among the deaf people and is used by many of the hearing villagers as well (Kisch 2000).

Over the past several years, our research team has learned that Al Sayyid Bedouin Sign Language (ABSL) functions as a fully fledged language, used for a range of social interactions, instructions, and plans, and to discuss such topics as personal histories, folk remedies, national insurance, childcare, or how to cajole a husband. The sentences of the second generation of ABSL signers are verb-final, with strict SOV word order in sentences with all three constituents, and noun phrases consistently have noun–modifier order (Sandler et al. 2005). Major intonational breaks separate propositions (Padden et al. 2009). Compounding is a common morphological process, and a particular type of noun-classifier compounding has developed (Meir et al. 2010). Certain types of structure commonly found in more established sign languages are not fully developed in ABSL, such as verb agreement (Aronoff et al. 2004; Padden et al. to appear), and phonological categories (Sandler, Aronoff, et al. to appear; Israel 2009).

A study of four ABSL signers of the second generation, two in their late 40s and two in their late 20s, reveals that a system of prosody also takes time to develop (Sandler, Meir, et al. to appear). While all four signers use pauses to separate constituents, only the younger signers align pauses with other prosodic cues such as head position and facial expression. In fact, the narratives of the older signers use linguistic facial expression much more rarely than the younger signers.

Interestingly, only the younger signers use prosodic cues consistently to signal dependencies between clauses, producing conditionals, temporal adverbial clauses, and other complex utterances. The older signers tend to string clauses together in a coordinating or listing fashion. Prosody provides the first indication of complex utterances in this new language.[16]

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[16]The authors do not attribute complex syntactic structure to the utterances rendered complex through intonational dependency, since there are no overt clues to syntactic complexity in the language. Apparently, it is not only new languages that signal complex expressions primarily through intonation without syntactic cues. Mithun's (2009) analysis demonstrates that the same is true in Mohawk. See Sandler, Meir, et al. (to appear) for discussion.
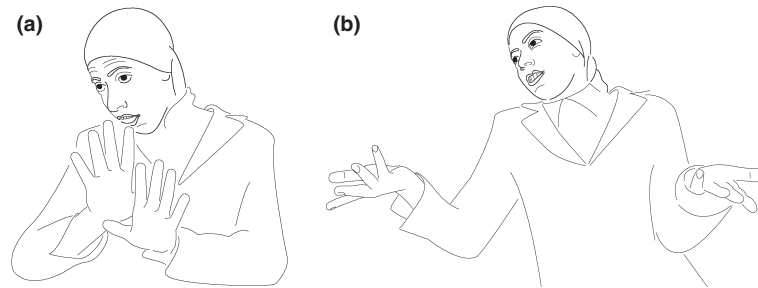
Figure 11. Conditional sentence prosody produced by a young second-generation signer of ABSL. 'If he says no, then there's nothing I can do.'

Other differences were observed that similarly suggest the gradual layering on of linguistic structure. The older signers sometimes use mimetic forms, which require movement of the hands, face, head, and/or body in such a way as to interrupt the prosody. Younger signers did not use mime in the short spans of narrative studied, and their utterances were more coherent syntactically, including pronouns as well as clearly related verbs and arguments.

An example of an utterance whose complexity is signalled by prosody is a conditional produced by one of the younger signers. The string means, 'If he says no, then there's nothing I can do.' The first prosodic constituent was characterised by raised brows, with pause and head forward at the end, and the second was marked by a change in head and body position and change to a neutral facial expression. This prosodic pattern is illustrated in Figure 11. The older signers' narratives did not synchronise prosodic and intonational structure to signal dependency relations between clauses. Their narratives were characterised by prosodic constituents separated mainly by pauses, but rarely by pragmatically determined facial expression, and where facial expression was present, it did not align with prosodic constituents as consistently as that of the younger signers.

Studying prosody in a new sign language confirms that it is important and basic, arising early but taking form gradually. It is a grammatical system, and as such, its self-organisation requires time and experience.

10. CONCLUSION

Nearly every movable body part is active in sign languages, and much progress has been made in understanding the structure of these languages at all levels by paying close attention to actions of its many articulators.[17] Yet nowhere is the challenge to understand the interaction between prosody and syntax more compelling than in these visually perceived languages. I have argued here that sign languages, like spoken languages, have a prosodic component of grammar. The body encodes the system by demarcating temporally delineated constituents with the hands and conveying intonational patterns with the face. There is a hierarchy of prosodic constituents that are related to morphosyntactic constituents but are not isomorphic with them. The presence of prosodic signals in a new sign language highlights the centrality of prosody in human communication. At the same time, the fact that the prosodic system emerges gradually in a new language, and in children acquiring an established sign language – that it is not in place as soon as words are strung together – bears witness to the complexity of the system.

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[17]A description and analysis of various kinds of movement in the phonology of sign language appears in Sandler (to appear b).

Prosodic organisation reveals itself directly in the realisation of a linguistic expression, while syntactic structure often has a less direct manifestation on the surface. Prosodic structure gives cues to syntactic structure, but it is necessary to posit a prosodic level of structure precisely because it is not identical to the syntactic structure. This is true of language generally, and sign language is no different.

The distinction between prosody and syntax elaborated here has been ignored in many sign language studies, by treating as inherently syntactic certain non-manual markers that others have argued are part of the intonational system, with demonstrably problematic results. The challenge is to recognise the relationship between syntax and prosody without losing sight of the difference.

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