A History of Sign Linguistics

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Abstract

In this chapter we provide a history of sign language linguistics, beginning with misconceptions about sign languages. Different stages in the development of sign linguistics are covered, starting with the pre-linguistic era, which includes different methods for deaf education. During the early linguistic period Bernard Tervoort's work was followed by influential work of William Stokoe and Edward Klima & Ursula Bellugi. The chapter reviews research in other countries than the US before turning to recent developments in the various areas of grammar, concluding with some special topics are such emerging new sign languages, gestures, diachronic change, typology, iconicity, and artistic expression.

Keywords: Compositional phonology; Compounds; Deaf education; Dual patterning (dual articulation); Fingerspelling; Generative Grammar; Gesture; Grammaticalization; Iconic phonology; Iconicity; Manualism; Mouthing; Myths (about sign languages); Non-manuals; Oralism; Phonetics; Prosody; Sign; Sign linguistics; Sign phonology; Transcription systems; Village languages

Key Points

- Clarifying the status of sign languages as human languages
- Establishing sign linguistics as a mature branch of linguistics
- Highlighting the contributions that the study of sign languages to our understanding of human language
- Providing a chronological development of sign linguistics
- Clarifying the role if iconicity in human language

Introduction

In this chapter, we provide a brief history of sign language linguistics. Today, sign languages are recognized as full-fledged human languages in terms of their grammatical organization, their use in daily life and in artistic expression, their emergence in deaf communities and their historical development. Given that speech and sign operate in very different production and perception channels, a central topic has always been to detect core grammatical properties in both types of human language, spoken and signed, because this could reveal a common cognitive (perhaps even innate) grounding for the human capacity for language, irrespective of modality. These efforts have been successful, while pinpointing obvious modality differences has also become a focus of interest. We begin with common misconceptions about sign language, and then go on to describe the development of the field. We discuss how sign languages began to conventionalize and to develop complex grammatical structures with the advent of deaf boarding schools starting about 350 years ago. One of the most important characteristics of human language is 'duality of patterning' – a meaningless (phonological) level and a meaningful (morphological and semantic) level of structure. Since this dual bifurcation is central to our concept of human language, and while sign languages often appear to the uninitiated as iconic and mime-like, the discovery that sign languages have dual patterning has been extremely important. For this reason, our chapter discusses work on the phonological level in more detail than other areas of grammar, which are of course no less important. To emphasize that sign languages are full human languages in every sense of the term, we turn to artistic forms of sign language at the end of this chapter.

Common Myths About Sign Languages

Many people still have difficulties recognizing sign languages as *full-fledged* human languages. The perception of sign languages as true and complete human languages has come a long way, although, as we will show here, many misconceptions still exist. Discussing such 'myths', will allow us to highlight important properties of sign languages, in terms of their structure, as well as their historical development, and the central role they play in Deaf education.

Myth 1. Deafness is a handicap. We start by clarifying a terminological point. When we write 'Deaf' (with a capital letter), we refer to a cultural property of people as belonging to a 'Deaf community', following **Padden and Humphries (1989, 2005)**. Such communities are predominantly made up of people who are deaf (as a physical condition) and who use a sign language to communicate. A Deaf community (with a capital 'D') comprises people whose identity is shaped by their use of sign language, which includes family members and friends who sign as well. The same applies to hearing people who are closely linked to the Deaf community. Only about 2–10% of deaf children acquire the language from Deaf parents; the rest acquire sign language from peers and teachers, sometimes several years after being born. People who are part of a Deaf community generally do not think that not being able to hear should be called a handicap, since they possess a perfectly good alternative: sign language. The opposite also occurs: people who are medically deaf often do not be-

long to the Deaf culture, especially when they have been raised in a hearing environment and have learned 'lip reading' and little or no signing. Such people are likely to experience hearing difficulties as a handicap. Hence not all people who are deaf participate in such Deaf communities, especially when deafness has arisen later in life, usually as a natural result of aging. This means that deafness and belonging to a Deaf community can come in degrees (especially when age related), depending on personal circumstances.

In this context we mention the fact that a common form of (hereditary) deafness is caused by malfunctioning of the cochlea which 'translates' the mechanical stimulation of the inner ear into nerve pulses that travel to the auditory cortex. A cochlear implant assumes the function of the cochlea and creates perception of sound, including spoken language. This medical intervention is usually seen as welcome when hearing parents learn that their baby is deaf, while it is controversial among many people in the Deaf community who do not regard deafness as something that has to be fixed (see **Mouvet et al. 2013**).[1]

Myth 2: There is one universal sign language. The idea that there is just one universal sign language has been very persistent due to the belief that sign language is a direct expression of meaning, guided by the iconic-pantomimic ability to express meaning through visual displays of the hands, face and body. However, we now know that the universality of one single sign language is a myth. The *Ethnologue: Languages of the World* (28th edition, **Eberhard et al. 2025**) cites 160 sign languages, and this number is likely to grow in subsequent editions. While often signs are iconically related to their meanings, conventionalization, culture and other factors also play a decisive role, so that **Klima and Bellugi (1979)** found that hearing people were unable to guess the meanings of iconic signs in the same culture. We discuss the role of iconicity in more depth in section Iconicity.

Myth 3: Sign languages have been consciously designed by people. Sign languages are natural languages that emerge spontaneously, not consciously. At the same time, there are also sign *systems* that are used by special groups of hearing people in specific circumstances. Such is the case of the order of Trappist monks who use a sign system as a result of their vow of silence (i.e., the agreement that spoken language cannot be used in many circumstances); see **Quay (2001)**. Another example comes from the practice among Australian aboriginals to avoid the use of speech in periods of mourning (especially among women). Again, a system of signs has emerged to allow the mourning parties to communicate; see **Kendon (1988)**. Finally, a system of signs has been in use among Native Americans to facilitate communication among populations that speak different languages. This system, called Plains Indian Sign Language (PISL), is quite rich and perhaps deserves to be included in the class of natural sign languages, with those that are used throughout deaf communities throughout the world and which are acquired by deaf children. In contrast with such natural sign languages, PISL was created and used by hearing adults to function as a shared communication system between different tribes who did not share a spoken language. However, cases of acquisition by children have been reported, which according to one view at least, qualifies PISL, as used by such children, as a natural sign language; see **Davis (2010)** and **La Mont West (1960)** section.

Myth 4: American Sign Language is an artificial language. **Power and Meier (2023)** report on how ASL came about after the founding of the American School for the Deaf in 1817 in Hartford, Connecticut, based on the signing of people living in the area as well as other areas attracting students to this school, notably the island of Martha's Vineyard, where a sign language had developed earlier; see **Groce (1985)**. In addition, Louis Laurent Marie Clerc, a Deaf French teacher who had been brought to the school when it was founded, introduced words and elements of French Sign Language (FSL). As a result, today there are still certain resemblances between ASL and FSL, but neither language was consciously created.

Myth 5: Sign languages are based on spoken languages. A clear counterexample is that ASL, BSL (British Sign Language) and Auslan (Australian Sign Language) are very different and not mutually intelligible, despite ambient spoken English in these countries. It is of course always the case that when several languages are used by people, these languages can influence each other. Hence, it is to be expected that spoken languages can influence sign languages, especially when deaf people know the spoken language reasonably well and use both. Influence can be found in the syntax, for example (see **Fischer, 2010**). Another form of such influence is the use of mouthing of spoken words, that we discuss below. However, these sporadic borrowings do not mean that sign languages are based on spoken languages.

Myth 6: Sign languages consist of fingerspelling the words of the spoken language. The misguided idea that signs somehow represent the sounds or letters of the words in spoken languages may stem from observing a part of ASL that is called *fingerspelling*. The ASL lexicon includes a set of handshapes that stand for the letters of the alphabet of the ambient spoken language. Sometimes a fingerspelled word 'freezes' and is compressed, so that it turns into an ASL word, losing its fingerspelling status and becoming just another sign in the language. In many cases, the form of such signs will betray their fingerspelling origin (**Battison, 1978**).

Myth 7: Sign languages are primitive languages that have no or little grammar. This is a rather dangerous misunderstanding. The truth of the matter is that Deaf people have the same kinds of minds that hearing people have. They are engaged in all human activities, including all kinds of scientific and creative work. There is no indication that there are forms of information that cannot be transmitted in sign, and there is plenty of evidence to the contrary, simply in the form of the contribution that deaf researchers make to the scientific enterprises that they are involved in (such as linguistics). In daily life, too, deaf people themselves never report any shortcomings of their languages and, on the contrary, they will say that no matter how fluent they are in a spoken language, their native sign language always feels better when it comes to the expression of subtle issues. The carefully acquired practice of simultaneous translation of spoken language into a sign language (and vice versa), which is now quite common in the public domain, is another clear demonstration of all this; see

[1]We recommend watching the award-winning documentary 'Sound and Fury' from 2002 and its sequel 'Sound and Fury: 6 years later', documenting discussions in a family about cochlear implants.

Guynes et al. (2024). Finally, as already indicated, there is a rich sign language culture, with various theatrical forms and poetry (see **Conclusion: Directions in Sign Linguistics** section). Nevertheless, signers may sometimes think that their sign language is not a real language because that is what hearing educators have told them many times!

Having studied sign languages in detail for the last 65 years, sign linguists have discovered that sign languages are based on mental grammars that have the same subsystems that we need for spoken languages. This fact follows from an abundance of studies that have been published since sign linguistics began in the 1960s; for comprehensive summaries we here refer to **Sandler and Lillo-Martin (2006)**, **Sandler (2025)**, **Pfau et al. (2012)**, and **Quer et al. (2022)**. There is a *lexicon* with conventionalized signs (i.e., signs shared by the members of a sign community), there are ways to form complex signs (*morphology*), there are ways to form sentences (*syntax*) and the signs themselves have an internal structure (in terms of meaningless building blocks, like handshapes, movements and locations) that is analogous to the *phonological* structure of spoken words. Sentences in sign language come with formal properties (often made on the face) that fulfill functions that spoken languages fulfill with intonational patterns, so that sentences in sign languages have both syntactic and *prosodic* structure. This does not mean that sign language grammars are entirely parallel to spoken language grammars. The fact that both kinds of language use different production and perception channels has an impact on their grammatical systems, a point that has received more attention after the phase of sign language research which focussed on parallels, in the latter part of the 20th century.

Myth 8: All signs are iconic (or pantomimic). The linguist Ferdinand de Saussure, the founder of modern linguistics and structuralism, argued that the form and the meaning of words in human language are independent of each other (i.e., the form is *not motivated* in terms of the meaning). In other words, the form is *arbitrary* with respect to the meaning. However, every spoken language has a certain number of words (called iconic words or *onomatopoeia*) where the form *does* seem to be inspired or motivated by the meaning (or, more precisely, by a typical noise made by the referent, the thing that the meaning corresponds to in the real world). Such examples include English words like *buzz*, *smash*, etc., and the Chinese word for cat: *māo* ◈. However, such words are the exceptions that just confirm the rule of arbitrariness; but see **Perniss et al. (2010)** and **Dingemanse et al. (2015)** for quite common use of iconicity in spoken languages. De Saussure recognized so-called onomatopoeic words, but he held that the relations involved do not belong to the internal linguistic system.

An extension of the misunderstanding that sign languages directly depict 'what is out there' in the form of iconic and pantomimic gestures is the misguided idea that sign languages are always about the visible 'here and now' and thus lack possibilities to talk about the past, the future or other places, even imaginary times and places. With spoken languages, people can do such things, and this property of spoken language is called *displacement* which is considered an essential property of human language. The denial of dual patterning and of displacement goes to the heart of misguided beliefs that sign languages are not real languages.

In conclusion, it has been a major contribution from sign linguistics to invalidate these, and other myths.

Different Stages in the Development of Sign Linguistics

The Pre-linguistic Era

This section outlines how scholars became interested in sign languages, even before the advent of precise tools for describing them. We refer to **McBurney (2012)** for an excellent historical account of both early and later work on sign languages and also to **van der Hulst (2022)** which has a focus on the history of sign phonology.[2]

L'Épée and Sign Language in Deaf Education

Numerous sources document the educational practices and controversies surrounding the educational systems for deaf people; see detailed accounts in **Lane et al. (1996)** and **Padden and Humphries (1989, 2005)**, but also **Sacks (1989)** and **Rée (1999)**. For as long as we can go back in the historical record, the view on human languages has been *phonocentric*. As a result, the earliest systematic methods for educating deaf people (as known in Europe at least, starting in the sixteenth century) aimed at teaching the deaf the spoken language of the ambient culture, which often accompanied suppression of attempts to sign. Debates regarding the use of a strictly oral method (*oralism*) and methods that employ spoken word-for-word signing (*manualism*) have been conducted for centuries and continue to the present day. We refer to **McBurney (2012)** for an informative overview of early practices, in 16th and 17th-century Italy, Spain and England, for educating deaf children, often by priests who were hired by rich parents.

A significant development is due to the French priest Charles-Michel de L'Épée (1712–1789) who is credited with being the first educator who understood that deaf people have some kind of language of their own. He decided that it would be beneficial to use *their* sign language to teach them *written* French, thus moving away from a focus on the oralist goal of speaking and lip-reading. We should note that L'Épée was *not* promoting the use of sign language as such. In fact, he deemed the language of the deaf as primitive, which is why he created an artificial sign language using the signs he learned from the deaf, while adding signs (called *methodical signs*) that he felt were missing, and that mirrored properties of French grammar (such as different tenses and articles). L'Épée's method was very successful and led many of his deaf students to master the French language, giving them access to further education and professions. Some of his stu-

[2]There are several short accounts of the history of sign linguistics such as **Fischer (2015)**, **Goldin-Meadow and Brentari (2017)**, **Vermeerbergen and Nilsson (2018b)**, and **Padden (2024)**.

dents became skilful writers who advocated for the rights of deaf people and defended L'Épée's manualist method against the oralist approach, which still had many proponents.

The seventeenth century produced an extensive number of polemic works in which the virtues of sign languages were either praised or denied. Interestingly, those who praised sign language would do so specifically with reference to seeing sign languages as manifestations of the 'natural, universal language'. Philosophers such as Étienne Bonnot de Condillac (1714–1780), Jean-Jacques Rousseau (1712–1778) and Denis Diderot (1713–1784) regarded sign language as a direct, universal expression of thought, and even as the 'original' form of human language, thus bringing the notion of language evolution into purview, which has remained an important theme within sign linguistics to the current day (**Arbib, 2005**; **Corballis, 2003**). For a philosopher's view on the study and perceived status of sign languages, see **Rée (1999)**. However, this line of thought was usually based on the mistaken philosophical (but not linguistic) assumption that there is only one 'universal' sign language. Another reason for philosophers' interest in sign language, was the notion that there could be a basic vocabulary of signs in terms of which all human concepts could be defined.

Meanwhile, recognition of the rights of deaf people to use their own language fit well within the ensuing Enlightenment and the dawn and aftermath of the French Revolution (1789), although those rights did not survive for long, as we will see below.

L'Épée's successor, Roch-Ambroise Cucurron Sicard (1742–1822), both controversial and revered during his career, became the head of the first school for the deaf in Paris, pursuing L'Épée's work and methods on a grander scale. Like his predecessor, he also believed that the sign language of the deaf needed 'correction' or 'enrichment', at least for the purpose of teaching French. L'Épée and Sicard deeply influenced the situation in France and other countries, including the United States, although controversies about oralism versus manualism continued to rage everywhere. In 1816, one of L'Épée's students, Louis Laurent Marie Clerc (1785–1869), accompanied the American Thomas Gallaudet (1787–1851), who had been sent to Europe by the father of a deaf girl to study the educational methods for the deaf, back to the US to help set up a school for deaf. **Lane (1984)** presents an account of this important period from Clerc's perspective. Gallaudet returned with the conviction that the manual approach was the best way to go. Upon his return, Gallaudet and Clerc founded a school for the deaf in Hartford, Connecticut (currently the American School for the Deaf in West Hartford, Connecticut) and later a college (to become a university) in Washington named after Gallaudet under the presidency of his son Edward Miner Gallaudet (1837–1917). Clerc's teachings used a mixture of French sign language and local, New England sign languages, converging to what we now call American Sign Language. Gallaudet's opponent in the United States was Alexander Graham Bell (1847–1922), who believed that deaf people should be educated exclusively in the oral tradition.

Bébian and Gesture Studies

L'Épée started compiling a dictionary of signs (which he did not finish), but his successor Sicard did publish his own dictionary. Here, like so many others before him who had made lists of signs, he used *verbal descriptions* of how the signs are made, presumably because making drawings (a common practice to this day) would be more cumbersome and costlier. A verbal description necessarily identifies parts of the sign, but this does not mean that we can regard these descriptions as proposing or even implying a submorphemic analysis of signs in terms of 'building blocks'. Signs were still thought of as holistic gestures, but because spoken or written language simply cannot render a sign in an analogue, holistic fashion, the verbal descriptions unintentionally suggested a partitioning of some sort which, then, presages a more formal partitioning that was later on made explicit in the use of notation systems. The use of verbal description to represent signs has a long tradition in the recording and promoting of both so-called monastic sign languages and rhetorical gestures that can or must be used in public discourse.[3]

One step closer to submorphemic structure is taken when signs are represented using a specific *notation system*, which in a sense results from more explicitly breaking up a holistic drawing into smaller parts. It was Roch-Ambroise Auguste Bébian (1789–1839) who, working as a hearing teacher during Sicard's tenure, recognized that signs can be analyzed using a finite set of smaller building blocks for which he designed a notation system, consisting of 200 symbols. The system was meant as the first *writing system* for a sign language (**Bébian, 1825**; see **Fischer, 1995**).[4] Bébian fully recognized the natural status of French Sign Language, in which he became fluent, and he felt that in order to describe the language (striving for standardization) it would be necessary to have a writing system; see Adam (2015) about standardization of sign languages. It is clear that, just like the first phonographic writing systems for spoken languages (like the International Phonetic Alphabet, IPA. and its predecessors[5]) implicitly acknowledge submorphemic phonological structure, Bébian's system anticipated the work by twentieth-century scholars which is discussed below.

McBurney (2012) documents how the approach to use sign language in the tradition that L'Épée had started was counterbalanced by ideas that promoted oralism that was practiced in Germany by Samuel Heinicke, possibly inspired by the Dutchman Johann Konrad

[3]See **Kendon (1982)** for a review of works on gestures and **Umiker-Sebeok and Sebeok (1987)** on monastic languages. In some works, reviewed by Kendon's book, formal notation systems were proposed. **Kendon (1982)** mentions some early works on gestures in which formal notation systems were proposed. Indeed, he shows that throughout history there have been formal notation systems for body movements of various kinds (dance, mime or gesture).

[4]Notation systems for bodily communication systems can be based on various principles. Usually, the symbols are iconic in some way, unless for practical reasons the use of alphabetic symbols is preferred. A discussion of notation systems is beyond the scope of this chapter; see **van der Hulst and Channon (2010)**.

[5]**Alexander Melville Bell (1867)** presents a notation system for spoken languages called "Visual Speech".

Amann. These proponents of oralism promoted the suppression of sign language. The opposing views (manualism and oralism) received different appreciations in various European countries, but oralism came to prevail after a notorious vote at a conference in 1880 in Milan. Apparently only one deaf person participated in the vote. In the US the influence of Alexander Graham Bell played a big role in promoting and spreading the oral method. Despite the initiative of Thomas Gallaudet, negative views on sign language got the upperhand during the scond half of the 19th century (see Baynton, 1996).

The Early Linguistic Era

The Pioneer Bernard Tervoort's Important Influence

The Dutchman Bernard Tervoort (1920–2006), a Catholic priest who had studied linguistics, while visiting an institute for the deaf children in the Netherlands, observed that the deaf pupils signed among themselves in spite of the fact that spoken language was the instructional language in the institute. Interested in the communication system of deaf children, he decided to make this the topic of his PhD research, which was published in 1953 (and in an English version in 1961 under the title *Esoteric Symbolism in the Communication Behavior of Young Deaf Children*; also see Tervoort (1961)). It offers a structural analysis of the visual language that was used within a group of deaf children. Tervoort did not label what he found as a *sign language*, but, echoing the approach of L'Épée, he did state that if you want deaf children to learn your spoken language, you first have to learn theirs. Tervoort became a professor in Amsterdam and founded the department of General Linguistics. He was instrumental in training a generation of young researchers in sign language research in the Netherlands. In 1964, Tervoort received an honorary doctorate from Gallaudet College in Washington D.C. for his research. During this visit he met William Stokoe who at that time had already embarked on his own research on the phonological building blocks of ASL signs.[6]

The Founding Father of Sign Linguistics: William Stokoe

The American structuralist Charles Hockett in an article about 'critical features of language' (**Hockett, 1960**) considered sign languages as marginal systems that lack critical design features of human spoken languages.[7] Nor did his mentors Edward Sapir and Leonard Bloomfield regard these systems as true languages. Up until 1960, sign languages were simply not seen as fully-fledged natural languages that possess morphological and syntactic structure, let alone an independent level of phonological structure.

Recognition within linguistics of phonological compositionality in sign languages only came after the ground-breaking work of William Stokoe (1919–2000), a professor of English literature at Gallaudet University. His breakthrough discovery was that signs are not holistic gestures, but instead can be partitioned into meaningless building blocks, just like words in spoken languages can be analyzed into meaningless phonemes and syllables (and ultimately phonological features). Focusing on the sign language that was used at Gallaudet (not in the classroom, but by the deaf students among themselves), he showed that a sizable inventory of signs can be analyzed in terms of finite sets of 'phonological' building blocks. This implied that sign languages display *duality of patterning* (**Hockett, 1960**; **Martinet, 1960**),[8] which for long had been identified as a pivotal property of spoken languages, and thus of human language, given the usual assumption that 'speech' and 'language' were synonymous. Since a meaning*less* level of structure together with a meaning*ful* level is considered a hallmark of human language, Stokoe's identification of meaningless phonological structure in signs was a turning point in the recognition of sign languages as true human languages, on a par with spoken languages. This realization initiated the discipline of sign linguistics, which today is a blossoming subfield of linguistics. Despite earlier work that was mentioned in preceding sections (and which was largely unknown at the time), sign linguistics in the modern age thus started with Stokoe's discovery of sign phonology in 1960.

When Stokoe arrived at Gallaudet, the educational systems had fallen victim to the rule of oralism, despite the fact that this institution was founded in the spirit of the manual methods that were promoted by Thomas Gallaudet and Laurent Clerc. The son of Thomas Gallaudet, Edward Miner Gallaudet, shared his father's views, but during the beginning of the twentieth century the pressure from proponents of oralism had eclipsed the educational philosophies of manualism. Students were trained in articulation and 'lip-reading' and teachers and professors (many of whom were hearing) used a version of *Signed English*[9] which was very unlike the sign language of the students.

To his credit, though he knew very little about sign language when he entered the school, William Stokoe noticed the difference between signed English and the language used by students among themselves and he decided to analyze the language of the deaf using the methods of modern (structuralist) linguistics. Following George L. Trager and Henry Lee Smith, two leading structuralist linguists whose

[6]For the work of Tervoort, see: **Tervoort (1953**, **1973**, **1986)** and **Owrid (1977)**.

[7]1960 was also the publication year of an influential book by Helmer Myklebust (see Myklebust, 1960), a work that promotes strict oralism and many ideas about the education of the deaf and sign language that would be unacceptable to many (one would hope: all) people today.

[8]Martinet referred to morpho-syntactic structure as the 'first articulation', and to phonological structure as the 'second articulation'.

[9]Signed English, like Signed French discussed in **Developments in Sign Phonology** section, can be thought of as using signs, borrowed from the real sign language or 'made-up', arranged according to English syntax.

ninety-page book (**Trager & Smith, 1957**) exemplifies their approach to linguistic analysis (applied to a portion of English grammar), Stokoe's work focuses for the most part on the phonological and 'morphemics' which inspired Stokoe to conduct a detailed investigation of what he started calling *American Sign Language* (ASL), focusing on the phonological structure of signs in that language. The results of this research were published in 1960 in a dense 78-page paper.[10]

Stokoe's approach replaced verbal descriptions of signs (and indeed pictures or drawings) by a segmentation of (monomorphemic) signs into three parts: the hand configuration (handshape plus orientation), the location (at or on front of the body where the hand is placed or moves) and movement (the movement of the hand along a path or 'hand-internally' by rotation or closing/opening of the fingers). Stokoe called these aspects *cheremes*, but later writers (such as **Battison, 1978**; **Klima & Bellugi, 1979**) started using the term *phoneme* or, more neutrally, *aspect* or *parameter*. Non-manual aspects are also very relevant to larger 'discourse' units, but Stokoe did not focus on those, making only brief remarks on non-manual aspects of signs, which are not covered by his notation system. Interestingly, he remarked that syntax is mostly 'on the face'.

A pivotal revelation that led to postulating a combinatorial phonological structure was that the meaningless building blocks function *contrastively*, which allowed so-called minimal pairs. We here illustrate that point with signs pairs from Israeli Sign Language (**Fig. 1**).

Stokoe acknowledges the work of Bébian. He also discusses the work of Bernard Tervoort observing that Tervoort does not regard the communication system of the deaf children that he had studied as a genuine linguistic system that is on a par with spoken languages. Stokoe explicitly argues that his own work is about a true signed human language.[11]

Another crucial part of the story is that Stokoe's idea to analyze signs into smaller parts necessitated the development of a *transcription system* for signs that could replace holistic drawings or photos and which would be used in *A Dictionary of American Sign Language on Linguistic Principles (DASL)*, co-authored with Dorothy C. Casterline and Carl G. Croneberg (**Stokoe et al., 1965**). It contains some 2500 signs, all presented in the notation system and provided with an English equivalent word. The dictionary entries are arranged in accordance with this notation system, which specified the three major aspects in the order: location (tab), handshape (dez) and movement (sig). Within each unit, the distinctions are ordered as specified in a pre-given list of symbols. The location list, for example, starts with '0' (for neutral space), and the handshape list starts with handshape 'A' (the symbol being derived from the fact that this handshape shape is also used to fingerspell the letter a/A). The dictionary thus starts with signs made in *neutral space* (the space in front of the signer) with the A-handshape. The dictionary contains a listing and explanation of all the notation symbols, as well as several essays that comment on ASL syntax and various cultural and educational issues. That the dictionary entries were written in notation (with no picture or drawings included) testifies to Stokoe's conviction that ASL is independent of, and not in any sense subordinate to English. In most other printed dictionaries that had previously been published (and also later dictionaries), signs are alphabetically ordered by the English translation and usually using pictures or drawings. Stokoe took a big risk, however, because in order for DASL to be usable, the user had to learn the notation system and know the signs to begin with, because the notation, which does not account for all phonetic details of signs, focusing on what is contrastive or phonemic, cannot be read as a fully specified instruction to know what the form of the sign is. Consequently, DASL was not useful to non-signers, and, over time, it also became very difficult to use for signers who did not learn the notation system. Despite this, DASL left a mark on the history of sign phonology because many subsequent sign phonologists used DASL. We refer to **Hochgesang and Miller (2016)** for a publication based on the 50th anniversary of DASL with many testimonies by sign linguists and educators.

Stokoe's system contains a finite number of symbols for what he perceived as separate parts of the sign: the handshape (19 symbols), the movement of the hand (24 symbols) and the location in front of or on the body (12 symbols). The symbols are partly iconic (for movement and location), but for handshape Stokoe used the letters ('A', 'B' etc.), when these handshapes were identical or very similar to the handshape used in the fingerspelling alphabet. We refer to **Wilbur (1987**: Ch. 1) for a complete listing and discussion of the symbols. Subsequent work (**Friedman, 1977**; **Battison, 1978**; **Newkirk, 1975**, among others) proposed slightly different inventories of transcription symbols.[12] The ideas of Stokoe were further developed in the sense that his major units were decomposed into distinctive features for each of the major units.[13]

[10]Stokoe's seminal work was not published in 1960 as a book. It appeared as "*Studies in linguistics: Occasional papers (No. 8)*", which were distributed by the Department of Anthropology and Linguistics of the University at Buffalo. Since then, it has been republished three times. In 1978 (**Stokoe, 1978**) (in a revised version), and in 1993 (**Stokoe, 1993**) and 2005 (**Stokoe, 2005**) (both in the original version).

[11]**Tervoort (1973)** is a review article of **Stokoe (1972)** in which he reflects on Stokoe's results. He expresses doubt that even Stokoe's work on ASL has delivered conclusive proofs that a sign language can be a 'true language'.

[12]A computer usable font, called *HamNoSys* (Hamburg Notation System) has been developed that revises Stokoe's system, moving it toward a universal transcription system for signs; see Prillwitz et al. (1989).

[13]**Friedman (1976)**, **Mandel (1981)** and **Battison (1978)** all provide reviews of Stokoe's proposals with various amendments and modifications. For a general discussion of notation systems, see Channon and van der Hulst (2010).

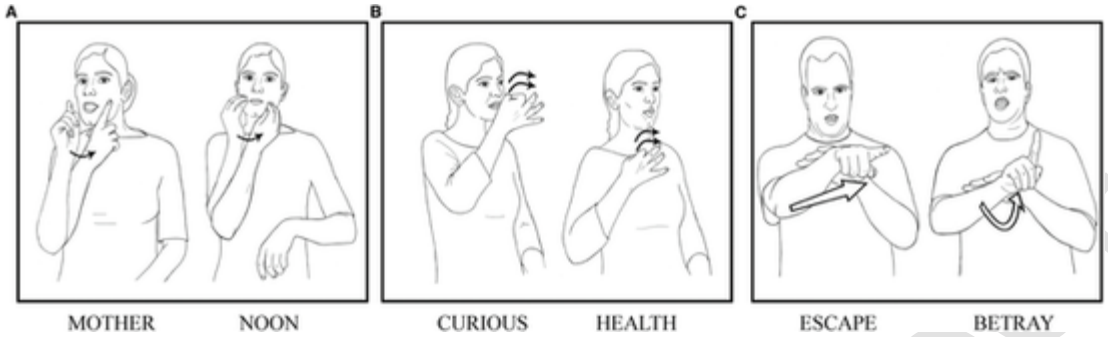

Fig. 1 Minimal pairs in Israeli Sign Language. (A) handshape only change; (B) location only change; (C) movement only change. Source: Sign Language Research Lab, University of Haifa.

From one angle, Stokoe's partitioning of the form of signs can be understood as a transcription system, designed for the practical purpose of allowing a compositional space-saving system of distinctive properties of signs that would replace holistic drawings. However, Stokoe clearly regarded the symbols as representations of the discrete and contrastive units that 'realistically' constitute signs, and, although he followed the views of Trager and Smith, he was not a mentalist.

After his ground-breaking 1960 publication (Stokoe, 1960), Stokoe received very little support or recognition. Even at Gallaudet, the reception of Stokoe's work remained largely negative. Even after the publication of DASL, a monumental work, attitudes changed very little. Unaffected by his critics, Stokoe continued his work during the sixties, and few publications emerged (but see **Stokoe, 1966**, **1969**). **Stokoe (1972)** presents a detailed updated book-length review of his 1960 work with chapters on phonology, lexicon, syntax, as well as general chapters, and a chapter on 'current sign language research'. He includes a paper by James C. Woodward outlining a 'transformational approach to the syntax of ASL'. In that same year, he started a publishing company, Linstok Press, and founded the journal *Sign Language Studies* that became—and is to the present day—an outlet for publications of all kinds on sign languages, including theoretical work.[14] The initial resistance to his work pales in comparison to the eventual broad recognition of the importance of Stokoe's work; see the **Edward Klima and Ursula Bellugi (1979)** section.

In his Linguistics Research Laboratory, founded in 1971, undisturbed by the lack of recognition of his work, Stokoe could devote all his time to sign language research. He invited several young researchers to join his lab, which led to a broadening of the topics being considered, such as sociolinguistic issues, which resulted in the first dissertation coming from this group (**Woodward, 1973**) and in work on non-manual aspects of sign language, on syntax, on acquisition, and on educational issues and Deaf culture.[15] Many publications appeared in *Sign Language Studies*. Work on phonology (by **Friedman, 1976**, **Battison, 1978**; **(Frishberg, 1975)**, **Frishberg, 1976**; **Boyes-Braem, 1981**; **Mandel, 1981**; **(Padden, 1988a)Padden, 1988b**) led to very important dissertations that significantly extended Stokoe's analyses. During the 1970s Stokoe also shows a strong and continuing interest in the question of language evolution and the role of gesture as a predecessor to spoken language; see **Armstrong et al. (1995)** and **Wilcox (2002)**. This broader perspective resulted from seeing language as a form of human culture, and, subsequently, Stokoe identified more and more with the field of anthropology. In one of his last publications (**Stokoe, 1991**), Stokoe takes a critical look at what sign phonology had become during the 1990s, opening his article with "Sign phonology can be as complicated as anyone wants to make it" (p. 107). He proposed an approach called *Semantic Phonology* which attributed the role of meaning in the formal structure of signs.

His students honored Stokoe in a Festschrift in 1980 (**Baker & Battison 1980**). A second honorary volume was published just after his death, based on a conference in 1999 that he was still able to attend (**Armstrong et al. 2002**). Both volumes make it abundantly clear that Stokoe's impact on generations of sign language researchers and the field of sign linguistics as a whole has been enormous.[16]

La Mont West (1960)

La Mont West (1930–2022), who later adopted the stage name Tan Cahil (for his performances of tribal music), was an anthropologist who wrote a dissertation about a sign language that had for centuries been used by various native American tribes (the Northern American

[14]Theoretical work following a generative approach was not so welcomed.

[15]There is also attention for the development of materials to teach ASL, which appeared only later (e.g. **Baker-Shenk and Cokely (1980)**.

[16]The journal *Sign Language Studies* 24/2 devoted a special issue to memories of 22 sign researchers who participated during the early years of sign linguistics, both in the US and in several European countries. These memories offer a very interesting perspective on the early history of sign linguistics.

Plains Indian Sign Language, PISL), who, speaking different languages, would communicate in sign.[17] The idea to investigate these systems linguistically (before they would become extinct) came from the anthropologist Alfred L. Kroeber (1876–1960). Charles F. Voegelin (1906–1986), another anthropologist, recognized the importance of this endeavor and he made it possible for West, a student of Kroeber, to do field work, which commenced in 1956. **Kroeber (1958)** discusses the urgency of describing the Plains Indian Sign Language, offering an extensive preliminary analysis that, among others, makes observations about the difference between one- and two-handed signs that have inspired later work by others on the phonology of American Sign Language (ASL). In his extensive, but sadly unpublished 1960 dissertation, West calls PISL "a natural language in every sense – a language amenable to analysis by the techniques of modern linguistic science" (see his page 1a). Al though recognizing that a phonological analysis of signs is possible, he also acknowledged that the building blocks of signs often occur with recurrent meanings. For example, he analyses the sign meaning EAT as the simultaneous combination of at least four morphemes (HOLD-IN-FINGERS+INSERT+REPEAT+MOUTH).[18] He then also recognized that these morphemes often change their form depending on what they are combined with and he formulates a sophisticated set of rules that account for "morpho-kinemic alternations" to account for such variation in form. We believe that La Mont's hardly known work deserves a place in the history of sign linguistics and should be published in an accessible format.[19]

Edward Klima and Ursula Bellugi (1979)

Ursula Bellugi and Edward Klima, who were interested in the biological foundations of communication systems broadly, founded The Salk Institute for Biological Science in La Jolla, California (what today is called the Laboratory for Cognitive Neuroscience). Well aware of Stokoe's work, Bellugi, Klima and a team of young researchers took the linguistic investigation of sign language in many new directions. The members of this group, in addition to analyzing the linguistic structure of ASL, also focused on the psychological reality and neurological basis of sign language. This work culminated in **Klima and Bellugi (1979)**, *The Signs of Language*, which is a must-read for sign language researchers.[20] This book contains various chapters that deal directly with the phonological organization of signs. While Stokoe had shown that the phonological form of signs is compositional, it simply does not follow automatically that these distinctions have a reality in the mind of the signer in terms of language processing and storage in memory. Not being a mentalist, Stokoe had not addressed this question directly, but groundbreaking work on these issues was done by the Klima & Bellugi research group at the Salk Institute during the 1970s. Performing recall experiments, as developed for spoken languages, they showed that percepts of signs in short-term memory *are* compositional. Studying 'slips of the hands', they argued for the likelihood of compositionality in the articulatory phase. By comparing ASL and Chinese Sign Language (CSL) they showed that ASL users can make judgments about what they considered well-formed or ill-formed ASL utterances in their respective languages. This supports compositionality in the lexicon, because such judgments likely presuppose knowledge of what the smaller units are, and how they can be combined. Such knowledge is captured in *phonotactic constraints* which state the basic units as well as their permissible combinations. *Signs of Language* also contains a chapter on historical change in the phonological form of signs and a chapter that proposes a feature analysis of handshapes. Klima and Bellugi's book did not deal with educational policies.

We have noted that Stokoe's work did not receive a lot of attention in the linguistic world for quite some time. In comparison, *Signs of Language* attracted a lot of attention and did much to bring sign language into 'the purview of linguistics' (which had of course been Stokoe's goal as well) and within the broader arena of cognitive science. To appreciate the difference in reception of Stokoe's and Klima and Bellugi's work, we have to take several factors into account. Perhaps most importantly, Stokoe's analysis was written for an audience of linguists, assuming familiarity with the structuralist method and the terminology of linguistics. Another factor was that Chomsky had just published *Syntactic Structures* (**Chomsky, 1957**) and generative grammar as a universal system was on the rise—the new thing to do. Structuralism was 'out'. Klima and Bellugi's book was informed by the new linguistics and thus fit right into the Chomskyan view and the cognitive approach that had firmly established itself.[21]

Klima and Bellugi generously refer in various places to the importance of Stokoe's work. This suggests that they had no doubts about the impact of his research and findings. It is clear that they added much to the work that Stokoe had done, in ways that made sign lan-

[17] See **Davis (2010)** for an introduction to the study of *Plains Indian Sign Language*.
[18] The highly complex morphological structure that results suggested to West that sign languages are 'polysynthetic' languages.
[19] West was not aware of Stokoe's work, but Stokoe knew about West's work which he thought as being rather different from his own pursuit. We believe that this overstates their differences.
[20] The authors of this book explain that most chapters are based on previous working papers and articles that were authored or co-authored by members of the Salk research team. See a list of their names in **McBurney (2001)** (pp. 171–172). Many of these, who had authored or co-authored papers that found their way in the book, were (and perhaps still are) not happy with their loss of authorship in the book.
[21] See **van der Hulst (2022)** for more details and especially **McBurney (2001)** for an in-depth analysis of the different reception of Stokoe's work and K&B's work.

guages and sign linguistics of interest to a more general audience of linguistics, psychologists, and other academics. This certainly justifies the wide praise and acceptance of their book. As **McBurney (1998)** convincingly argues, the difference in impact was due to 'the climate of opinion' during the 1970s, which favored *Signs of Language*; also see Stokoe (1980a, 1980b).

Over time, the historical 'injustice' of neglecting Stokoe's contribution has been corrected. Today there is no doubt that Stokoe is the father of sign linguistics, who showed the way to all who followed, with K&B's work, and that of their students, being a shining highlight in these developments, overshadowing not only Stokoe's work, but also much other work that was done in the 1970's, as documented in **Wilbur (1979)**.

Wilbur's work, also overshadowed by the widespread reception of *Signs of Language*, offers a comprehensive and detailed discussion of sign linguistics during that period, starting with Stokoe's work and continuing with the work of many others. Wilbur's book has a much wider scope than *Signs of Language,* reporting on the important results of the Klima and Bellugi group, and qualifies as the first comprehensive 'textbook' on sign linguistics. In a revised edition from 1987, Wilbur updates her state-of-the-art review by including the recognition of linear phonological structure in sign language, as discussed below.

Early Sign Language Research in Other Countries Than the US

Much of the work cited so far was done in the United States, on American Sign Language. **McBurney (2012)** provides a detailed account of sign language research in other parts of the world, starting with work in various European countries. We have already discussed Bernard Tervoort's pioneering work in the Netherlands, which stimulated significant work on Sign Language of the Netherlands (SLN) by a number of researchers (Trude Schermer, Jane Coerts, Beppie Van den Bogaerde and others). Tervoort's early work on sign language also had a big influence in other European countries.

Sign language research developed in the 1970s in Scandinavian countries (Sweden, Finland, Norway and Denmark) which delivered a comprehensive grammar of Danish Sign Language (DTS) in 1981, by Sørensen and Engberg-Pedersen; see Engberg-Pedersen et al. (1981). In Germany, a group in Hamburg developed a new transcription system (Hamburg Notations System, HamNoSys) and published a comprehensive bibliography of sign linguistics (**Joachim & Prillwitz, 1996**). England became another significant center with influential researchers such as Mary Brennan and Bencie Woll. France, Italy and the Soviet Union should also be mentioned, but we refer to **McBurney (2012)** for details. From the late 80s to the present, Wendy Sandler and Irit Meir developed sign language linguistics of Israeli Sign Language (see Meir and Sandler, 2008, 2020), and Sandler, Aronoff, Meir, and Padden worked for many years on the village sign language, Al-Sayyid Bedouin Sign Language, in Israel; see section Village Languages and the Emergence of New Sign Languages. Rose Stamp created a sociolinguistic database in Israel as well. In all these countries specific centers for the study of sign languages were founded, and many continue to exist. McBurney does an excellent job in surveying work in other parts of the world, such as Asia (including Gladys Tang's work in Hong Kong), South America, Oceania and Africa.

In earlier stages, much of the work in all these countries was primarily focused on dictionaries and descriptive grammars, thus servicing the Deaf communities and educational practices. This motivation for research has remained a major drive in the field. Nevertheless, most researchers were aware of theoretical implications and discussions that had been highlighted, especially in Klima and Bellugi's seminal book, and as a result, researchers all over the world participated in and made significant contributions to these broader issues. Over time, attention to the similarities between sign languages and spoken languages shifted toward a focus on the specific properties of sign languages in relation to properties of the visual modality (see **Sandler, 2025**).

As a result, and as described in McBurney (2011), today sign linguistics is an established subfield in linguistics with its own recurrent conference, several journals and specific organizations in many countries. Notably, there are also several comprehensive handbooks that contain detailed chapters on different aspects of grammar (**Bakken Jepsen et al., 2015**; **Brentari, 2010**; **Marschark & Spencer, 2015**; **Meurant et al., 2013**; **Perniss et al., 2007**; **Pfau et al., 2012**; **Quer et al., 2022**; **Zeshan and de Vos, 2012**). Handbooks that focus on topics in languages in general now commonly contain one or more chapters on sign languages, for example: Alexandra Y. Aikhenvald and Dixon (2017; also see **Oostendorp et al. (2011)** which contains various chapters on aspects of sign phonology.[22] Another sign of the maturity of sign linguistics is the availability of a growing number of specialized introductory textbooks (e.g., **Johnston & Schembri, 2007**; **Baker et al., 2016**; as well as shorter introductions such as **Hill et al., 2025**). Bibliographical resources for work in sign linguistics are Joachim and Prillwitz (1996), **Börstell et al. (2015)**, **Sandler & Meir (2020)**, and **Vermeerbergen and Nilsson (2018a)**.

Developments in Sign Linguistics

From early on, influential deaf researchers have been involved in sign linguistics and their numbers are increasing. **Bahan et al. (2024)** indicate that a greater involvement of deaf linguists is called for, and not just as informants.

As mentioned, the discovery that sign languages have combinatorial phonological structure, which implied that sign languages have duality of patterning, led to much work being devoted to the phonological side of sign languages. We therefore stress here developments

[22]For both these handbooks a second edition is in preparation.

in sign phonology. For more detailed overviews, see **van der Hulst (1993)**; **Brentari (2011**, **2012**, a monograph: **2019)**; **Sandler (2012)** and various chapters in **Sandler and Lillo-Martin (2006)**.

Developments in Sign Phonology

Wilbur (1987, p. 79) presents an approach to sign language structure that is truly embedded in the generative paradigm. She points out that Stokoe's analysis was emphatically phonemic (that is, focusing on contrastive properties of signs), treating various handshapes as 'allophonic' variants of a single handshape, since substituting one for another did not change the meaning of a sign (such as handshapes 'A' and 'S', a fist with the thumb next to the index finger and a fist with the thumb folded over fingers, respectively). Wilbur points out that a full-fledged generative analysis of such form variations can only be given if the major units of signs are analyzed in terms of (binary) features, and she reviews various proposals.

Stokoe's emphasis was on the simultaneous occurrence of sign units, which he contrasted with the linear, sequential structure of the phonemes in spoken languages. A major shift in phonological models of sign language occurred when researchers started drawing attention to linguistically relevant *sequential properties*. Toward the end of the 1970s and throughout the 1980s, various researchers argued that there are phonological and morphological reasons for distinguishing between the beginning point and end point of signs. A publication that first argued for the introduction of linear structure, was **Liddell (1984a)**, who offers a rigorous discussion of linear aspects of signs, providing additional arguments for such a move, involving, among other properties, the phenomenon of agreement. This led to a model that was developed in **Liddell and Johnson (1989)** that introduced a linear 'template' consisting of locations and movements to which sign features are associated. An extensive literature follows that proposes models for syllable structure in signs; see **Wilbur (1985**, **1987)**, **Sandler (1989)**, **Brentari (1998)**, reviewed in **van der Hulst (1993)**. Much of this work follows early proposals in **Chinchor (1978)** and **Coulter (1982)** who suggested that movement can be compared to a vowel, while the static elements of the sign (handshape, orientation and location) are comparable to consonants; see **Fenlon and Brentari (2021)** for additional arguments for syllables in signs.

Further developments in sign phonology were influenced by new theories about enriched phonological representations for spoken languages. With the rise of feature geometry in the mid–1980s in 'spoken phonology' (see Clements, 1985), **Sandler (1987b**, **1989)** extended this approach by proposing to group handshape and orientation under one common node. For handshape itself, based on **Mandel's (1981)** distinction between finger selection and finger position (bending, closing and opening), more detailed proposals were developed in **Sandler (1987a, 1987b, 1989)**, **Ahn (1990)**, **Wilbur (1993)**, **van der Hulst (1993**, **1995)**, **Brentari (1998**, **2011)**, Corina and Sandler (1993) and **Whitsworth (2011)**. **van der Hulst (1993)** reviews many of these proposals, introducing the notion of dependency into sign structure, and promoting the use of unary (or single-valued) perceptual-based features [one] and [all], following proposals in **Sandler (1995**, **1996)**; also see **van der Kooij (2002)**; this study was based on a database, called Signphon, of 3000 signs in Sign Language of the Netherlands that were encoded for phonetic and phonological properties as described in Crassborn et al. (2001). Various chapters in **van Oostendorp et al. (2011)** deal with specific aspects of sign phonology (syllable structure, movement, handshape, two-handed signs). **van der Hulst and van der Kooij (2022)** offer detailed review of several proposals for the phonological structure of signs. See Brentari (2019) for an general introduction to sign phonology. As we further highlight below, when discussing prosodic structure, the influence of other theories that were developed for spoken language phonology also led to innovative proposals for the analysis of sign phonology. Much later, in her study of handshape, **Eccarius (2008)** uses the model of Optimality Theory which has also been used in other studies since the inception of this theory in 1993.

Developments in Sign Phonetics

Arguably, the earliest work in sign phonology, including the 'pre-history', was primarily concerned with recording in notation systems what could be called *phonetic* properties of signs, although inevitably there was at the same time a sense of focusing on what is 'relevant' (i.e., contrastive). We can observe the same attention for phonetic detail in the early history of studying sound structure in spoken languages; see **Dresher & van der Hulst (2022)**.

As mentioned, while the phonological work of Stokoe focussed on what is contrastive, subsequent dissertations also reckoned with phonetic details. Following this development, especially starting with the work of Klima and Bellugi's group, *sign phonetics*, using instrumental techniques, developed as an independent specialization, studying articulation and perception. Interestingly, the sign phonology pioneers, taking issue with an overly 'abstract' phonemic approach, Robert Johnson and Scott Liddell have more recently published a series of articles that focus on a precise phonetic characterization of signs (**Johnson & Liddell, 2010**, **2011a**, **2011b**, **2012)**.[23]

Going beyond or rather broadening phonetic research, the Klima and Bellugi group used several instrumental methods, including *neurological* studies; see **Poizner et al. (1987)** and **Emmorey (2002)** for comprehensive reviews and much work by David Corina (e.g., **Corina et al., 2024**; **Corina & Lawyer, 2019**). Research on articulatory complexity (involving description of invisible joint and muscle activity) was done by **Ann (1993**, **2006)**. Several other studies focus on articulatory issues, while there are also studies that deal with perception and sign recognition (**Varadaraju, 2012**; **Vogler, 2003**; **Yin, 2010**), including categorical perception (**Baker, 2002**; **Baker et al., 2005**; **Emmorey et al., 2003**). **Cheek (2001)** is a dissertation about 'the phonetics and phonology of handshape in ASL' which studies co-articulatory effects producing handshape variation in detail, using quantitative methods; see also **Sevcikova**

[23] A detailed description of the articulatory phonetics of sign languages is given in sections 3.6–3.9 in **Anderson et al. 2022**.

(2013). Tyrone and Mauk (2012) study lowering of the articulation in the signing space instrumentally as phonetic reduction and variation in location, respectively. A call for paying attention to the phonetic properties of signs (to replace, rather than augment, a phonemic analysis) can also be seen in the work that is discussed in the next section. Over time sign *phonetics* has gained solid ground as evidenced by more recent research (see Crasborn, 2001, 2012, the latter for an overview).

Non-manual Aspects

The work on sign phonetics and phonology that has been reviewed thus far is mostly about the manual aspects of signs. It has long been known, however, that non-manual aspects of the face, as well as of the head and the upper body, also play an important role. Firstly, the lower face (lips, mouth, cheeks) can produce distinctions that can be lexically contrastive. A collection of studies devoted to such distinctions and possible feature systems is Boyes-Braem & Sutton-Spence (2001); also see Sandler (1999b). In the Boyes-Braem & Sutton-Spence's collection, Woll (2001) draws attention to what she calls "echo phonology" in British Sign Language, which refers to cases in which the mouth echoes the shape or activity of the hand(s).[24] Overall, sign researchers agree that some non-manuals are required because they have conventionalized meanings, while some are improvisational, with a range of meanings, determined by context (Sandler, 2025).

Importantly, signs that correspond to emotional states (anger, happiness) require a facial expression that corresponds to that emotion (which does not imply that the person signing the word 'angry' is necessarily angry). Another non-manual articulation that occurs is the 'mouthing' of spoken language words; i.e., gestures of the mouth that mimic spoken words. These may increase when signers address hearing people, but it is controversial in some circles because it is sometimes regarded as a distracting intrusion of the spoken language; see Nadolske and Rosenstock (2007), and Bank et al. (2016) for recent studies.

Developments in Sign Prosody

Some non-manual aspects can be qualified as 'paralinguistic', just like the pitch properties of the speech signal that express, for example, emotions. At the same time, pitch properties also convey information that is referred to as intonation, the sentence melody that, for example, indicates a difference between questions and statements or, in statements, which information is 'new' or whether the speaker intends to continue his utterance or is done. It is common to compare the linguistic relevance of several non-manual aspects, especially on the upper face, but also involving body and head movement, to intonation in spoken languages; it would indeed seem that non-manuals perform many of the same functions that are performed by intonation. Leaving aside the intonation ∼ non-manuals analogy, the question of how to analyze non-manuals that are linguistically relevant eventually became a topic of increasing interest and work.

In the earliest work, non-manuals were simply ignored, but soon proposals for their analysis were made. Pioneering work on prosody and stress was reported in Bellugi (1976) and Friedman (1977) and other early work by Padden (1988c), Liddell (1980), Baker-Shenk (1983), Wilbur and Patschke (1999), and Neidle et al. (2000). Many studies have been published by Wilbur (1990, 1999) and Wilbur and Schick (1987) on phonetic correlates of stress (and syllable structure). Rhythmic properties of sign utterances are studied in Allen et al. (1991), Lupton (1993), and Miller (1996).[25] In early works, properties of the upper face (eyes, eyebrows, nose) and head and body posture were often seen as markers of syntactic structure (Stokoe, 1966) or as part of the syntax (Liddell, 1980). Some work remains neutral on this issue, focusing on the identification of the non-manual markers and their function/meaning themselves. A historical discussion of different approaches can be found in Herrmann (2013), Wilbur (2012) and Sandler et al. (2011b); also see Fenlon and Brentari (2021).

During the 1970s came the advent of recognizing that words and larger units in spoken languages have a grouping organization, giving rise to the idea that such groupings are represented in terms of a hierarchical structure, called the prosodic hierarchy; see Nespor and Vogel (1986). Following this line of research, sign linguists provides arguments for a *prosodic word* (Brentari, 1998; Sandler 1999a, 1999b) and higher levels of phrasal prosody: the *phonological phrase* (corresponding roughly to the syntactic phrase), the *intonational phrase* (corresponding roughly to the clause), as well as higher, *utterance-level constituents*; see e.g., Nespor and Sandler (1999); Sandler (1999a, 1999b); Sandler et al. (2020); Boyes-Braem (1999); Sandler and Lillo-Martin (2006) and Wilbur (1999, 2000). In most of the work on prosody, grammatical facial expression continued to be understood as the sign language equivalent of linguistic intonation in spoken language (see Cecchetto et al., 2009; Dachkovsky & Sandler, 2009; Nespor & Sandler, 1999; Reilly et al., 1990; Sandler & Lillo-Martin, 2006).[26] Nespor and Sandler (1999) provide a prosodic analysis of Israeli Sign Language, followed up in more detail by Sandler (2010). Examples of visual prosodic markers are shown for Israeli Sign Language, in Fig. 2.

[24] Very few signs consist of non-manual properties alone; see Dively (1996), who refers to those as 'non-hand signs'.

[25] Boyes-Braem (1999) deals with the use of rhythmic torso movements as prosodic devices typical of early but not late learners of DSGS ("Swiss German Sign Language").

[26] The perception of prosodic structure is studied in Fenlon (2010) and Gonzalez (2011).

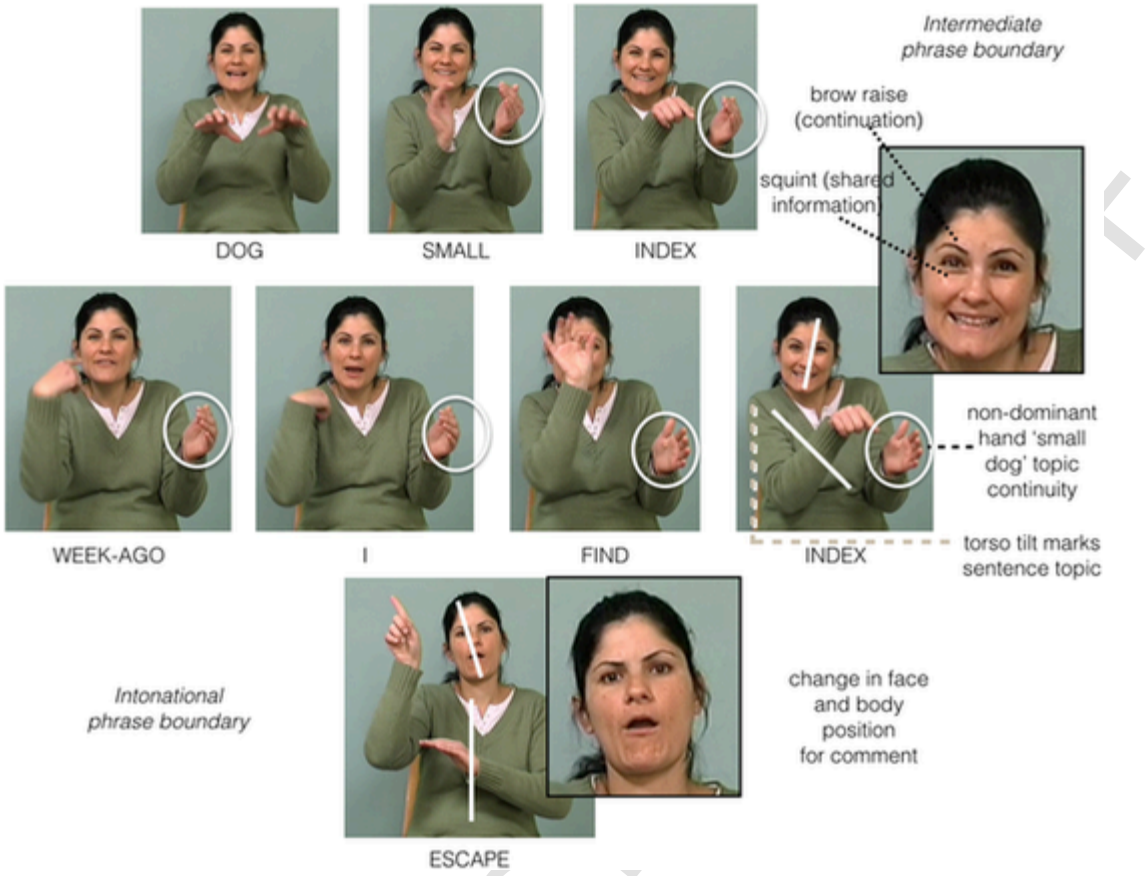

Fig. 2 The grammar of the body in Israeli Sign Language. Prosody of a complex sentence DOG SMALL INDEX A WEEK AGO I FIND ESCAPED which means, "The little dog that I found last week ran away." Source: Sign Language Research Lab, University of Haifa.

While prosodic markers can differ from sign language to sign language, **Fig. 2** presents a model of their constancy and expressiveness in one sign language, ISL.

Developments in Other Parts of Grammar

This chapter will not do proper justice to levels of linguistic structuring besides phonology, phonetics, and prosody. For reasons of space we will be brief regarding the study of other areas of grammar (morphology, syntax, and pragmatics which are now well-established subfields of sign linguistics). We will only mention the major topics of interest in these areas, mostly with reference to two important recent handbooks on sign linguistics (**Pfau et al., 2012**; **Quer et al., 2022**).

Starting with morphology, we must separate *word formation* (making new lexemes) from *inflection* (making words suitable for their syntactic context). With respect to both types, while in most spoken languages morphological operations concatenate morphemes (in some linear order, but also providing hierarchical organization), sign languages lean heavily on *non-concatenative* operations which make modifications of an aspect of the basic sign (its handshape, movement or location).

A type of word formation that is concatenative is compounding involves combining two signs. While both signs can keep their phonological properties, assimilations of various kinds can occur, which can lead to the apparent compression of both signs, mimicking phonological properties of monomorphemic words.[27] We will illustrate this with an example from Israeli Sign Language. The lexicalized ISL compound THINKˆSTOP=STUNNED changes from its original two-sign structure of THINK plus STOP, to form a compound meaning STUNNED. Recall that in two signs, there are two locations and two handshapes. Lexicalized compounds reduce to the form of a single sign: one handshape with a single movement from one location to another (**Sandler, 1989**, **2025**). One usually has to know the compound form in any sign language in order to understand it (**Fig. 3**).

[27] for a recent discussion of compounding in sign languages, see **Lepic (2023)**.

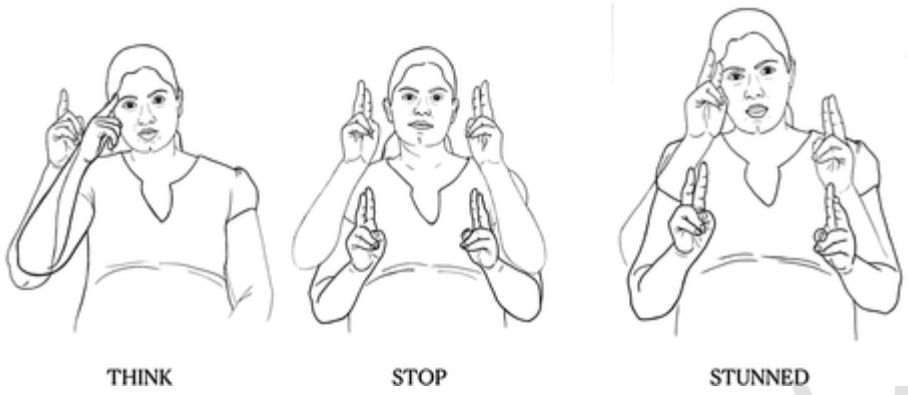

Fig. 3 Reduction in the ISL compound, THINKˆSTOP=STUNNED. The lexicalized compound reduces to a single handshape, and movement, but often with two locations (here, the head and the upper body), mimicking monomorphemic words in the lexicon. Source: Sign Language Research Lab, University of Haifa.

The boundary between word formation and inflection is sometimes disputed and there are certainly cases where we can see a transition from one to the other. A shift from lexical aspects (major category words such as nouns or verbs, or derivational affixes, which themselves may originate in independent words) to inflectional aspects of language falls under the heading of *grammaticalization*. Grammaticalization processes are very common in the history of spoken language, but they also occur in sign languages; see **Aronoff et al. (2005)** and **Pfau and Steinbach (2011)**.

A lot of attention has been given to inflectional processes, which mostly occur with verbs, with certain types of verbal inflection having been widely discussed, notably agreement, aspect and so-called classifier constructions. In the two recent handbooks mentioned above, many chapters are devoted to verbal inflectional morphology (under the broader category of syntax) and we refer to references therein. Especially prominent are discussions of classifier systems that play an important role in predicate formation. As for nominal inflection, pluralization of nouns has been studied for several sign languages. The formal mechanism is always some form of reduplication.

The semantic side of sign languages has always been central, especially in connection with the matter of iconicity (**Mandel, 1977**; **Taub, 2001**). In more recent times, formal methods for the representation of meaning have been developed (as they have been for spoken languages); see **Liddell (2003)**, **Davidson (2022)**, **Greenberg (2021)**, and **Schlenker (2018)**, **Schlenker et al. (2024)**. Schlenker's work has been especially important for identifying the overt expression of semantic notions that remain covert in spoken languages. For pragmatics, see **Davidson (2022)** and **Janzen et al. (2022)**. Also see 5 chapters in **Pfau et al. (2012)** about semantics and pragmatics.[28] For information structure see **Kimmelman and Pfau (2022)**.

Special Topics of Current Interest

We here single out some areas that have piqued interest in recent years, such as village sign languages, and the relation between signs and gestures, and iconicity.

Village Sign Languages and the Emergence of New Sign Languages

In the 1690s, a small group of English settlers moved to a village on Martha's Vineyard, an island on the coast of Massachusetts. Among them there were a number of deaf people, carrying a recessive gene that causes deafness. Marriages between relatives that are likely to occur in small communities allow such recessive genes to spread and be expressed in many people, producing a number of deaf people that is higher than the average number in large populations. It has been documented that in the course of the nineteenth century every village on this island had a very high percentage of deaf people, sometimes up to one out of four (25%). Under these circumstances, eventually all people would regard sign language as a normal language, and along with that deafness would hardly be regarded as an abnormality;

[28]While space limitations prevent us from going into detail, we must note that sign language research has benefited from establishing digital corpora of individual language or many different languages as well as programs for coding video material (see **Crasborn et al., 2024**; **Fenlon & Hochgesang, 2022**). Technology for automatic sign recognition and text-to-sign production is rapidly evolving (see **Alsolai et al., 2024**; **Kapoor et al., 2021**).

most hearing people would know how to sign and sometimes use sign language even in the absence of deaf people.[29] Martha's Vineyard Sign Language was probably a descendant of a sign language that was in use in the area in England where the settlers came from and that deaf settlers brought with them. Because of its limited usage, this sign language is called a *village sign language*. It is no longer in use today, but it was likely one of the sign varieties that entered into the mix that eventually led to ASL, because many of the deaf children from Martha's Vineyard enrolled in the school for the deaf that was founded in Hartford in 1817 by Thomas Gallaudet (now called the American School for the Deaf, located in West Hartford).

In recent years a number of other examples of village sign languages have been reported and studied, such as Adamorobe Sign Language or Adasl, a village sign language used in Adamorobe, an Akan village in eastern Ghana.[30] There are several other examples of village languages.[31] Village languages are minority languages that are at risk for extinction due to influences from other established sign languages.

For most sign languages the process of emergence is hidden in deep history, with no record of how exactly this happened. We have discussed that the founding of schools for deaf children creates the ideal context for the development of a sign language, based on *home sign* systems that the children bring with them; such systems have usually develop within families as a communication tool between a deaf child and other, hearing family members, in the absence of an already existing, accessible sign language. In Nicaragua in 1979, a school was opened in Managua for the formal education of deaf children. There was no common sign language of Nicaragua. Once children were together in the schools, the children quickly developed a kind of 'sign pidgin', with their various home sign systems as a base.[32] In 1986, a linguist and sign language expert, Judy Kegl, was invited to the school to study the situation and advise the teachers. She first analyzed the signing of teenagers, the first group of children who had come to the school in 1979, and who for the most part had been in the school for a number of years. Then she looked at a group of very young children, who had just entered the school and she observed a significant difference between the ways these two groups signed. Surprisingly, the young group signed much more fluently, and with a discernible grammatical structure, somewhat comparable to that of American Sign Language, a language that Kegl had also studied extensively. The explanation for this is likely that new incoming cohorts of children used their innate abilities to assign more and more grammatical structure to the meanwhile extended home pidgins that were used by the earlier cohorts. The emerging new sign language, which may have been influenced by ASL that hearing teachers sometimes used, now called Nicaraguan Sign Language (ISN; Spanish: Idioma de Señas de Nicaragua) gained more and more grammatical complexities, allowing linguists to study phases in the development of a sign language.[33] A team of sign researchers now continues to study this new sign language.[34]

A perhaps purer example of a newly emerging sign language was mentioned in **Early Sign Language Research in Other Countries Than the US** section, is Al-Sayyid Bedouin Sign Language (ABSL), which is a village sign language, used by deaf and hearing residents in the Bedouin village of Al-Sayyid, in the Negev region of present-day Israel; see Kisch (2008). This language has arisen during the past 100 years in an isolated community. There are now more than 150 deaf people in the village and hearing siblings and other villagers sign in order to communicate with the deaf people. ABSL is considered a second language of the village. Sandler and her colleagues have shown that the sentence structure of ABSL shows a systematic SOV word order (**Aronoff et al., 2005**).[35] This order is not due to influence from Arabic or Hebrew, which are both VSO languages. Nor can it be traced to ISL, because the generation studied had little or no exposure to ISL, nor does ISL have entirely systematic word order.[36] The youngest generation is exposed to Israeli Sign Language (ISL), now used by hearing teachers in the local schools. The analysis of prosody has been a crucial key to understanding the structure of this language.

[29] **Groce (1985)**. This case is also discussed in **Sacks (1989)** *which is a very readable and informative book about deafness and Deaf culture*.
[30] **Nyst (2007)** and **Kusters (2012)**.
[31] See **Zeshan and de Vos (2012)**.
[32] See **Goldin-Meadow (2003, 2012)** for home sign. Also see chapter 7 in **Hill et al. (2025)**.
[33] It is not customary to refer to a fully developed sign language as a creole, though.
[34] See **Kegl et al. (1999)**, **Meir et al. (2010)**, and **Senghas et al. (2005)**.
[35] **Meir et al. (2010)**. For a popular account: **Fox (2007)**.
[36] For further and deeper analysis, see: **Meir et al. (2017)**.

Much has been written on the emergence of grammatical structure, including phonology, in Nicaraguan Sign Language; see **Kegl et al. (1999)** and also **Fusellier-Souza (2006)**. In their studies on a Bedouin sign language, **Sandler et al. (2011a)** conclude that this language originated at a stage where there is 'no phonology', meaning no conventional, discrete and meaningless submorphemic organization in signs; rather, signs show considerable variability within and across signers, although the authors note that 'a kernel of phonology' can be observed in young signers.[37]

With an increasing interest in questions of language evolution, the study of emerging sign languages has had an impact on discussions about the evolutionary origins of human language by suggesting scenarios for how languages can gain complexity (through grammaticalization processes) and, recently, how human language always includes a gestural mode of communication, in both modalities, to which we now turn.[38]

Diachronic Change and Typology

Given the independent emergence of sign languages in signing communities, and despite the fact that sign languages change over time, the concept of language family (for a group of languages that have descended from a common ancestor) does not find straightforward usage in the domain of sign languages. Nevertheless, it is possible in many cases to group sign language together when a particular sign language has been 'imported' to other countries where it either came to be used as the sign language of that country (usually overriding a sign language or sign languages that were already in use) or heavily influenced and mixed with local sign languages. **McBurney (2012)** summarizes some grouping that have been thus identified; also see **Power (2022)**.

The question of how change in sign languages compares to change in spoken languages has recently been discussed with specific reference to potential correlates of sound change in sign languages. For relevant discussion see **Power (2022)**, **Law et al. (2025)**, and **van der Hulst (2025)**.

A discussion of sign languages in the context of phonological typology addresses two separate questions. On the one hand, we must ask how sign languages fit in the overall typology of human languages, which then focusses on resemblances and differences between sign language and spoke language at all levels of grammar. Another typological question regards differences and generalities with the group of sign languages; see **van der Hulst (to appear a)**.

Signs and Gestures

Like oral languages, sign languages recruit form/meaning units ('words') that have syntactic combinatorial properties that guide their combinations into complex words and sentences. As we have seen, the form of signing includes both manual and non-manual aspects. In this section, we return to an issue that was discussed in **Introduction** section which concerns the difference between signing and making gestures. We emphasized that signs are not gestures, even though they may have their origins in the latter. The first question we might now ask is whether sign languages have an analogue to co-speech gesture that accompanies spoken language utterances. **Sandler (2009)** suggests that the mouthing words of the surrounding spoken language that was discussed in **Non-manual Aspects** section could be seen as co-sign gesture.

Nevertheless, focusing on the manual aspects or signing, some sign linguists have argued that the boundary between signs and gestures is fluid. **Sandler (1999b)** explained that while some facial expressions are conventionalized and grammatical in sign languages, such as the yes-no (polar) question face, there are at the same time other ones which are gradient and dependent on context, so that they are best described as gestural in the approach of **McNeill's (1992)**, who described gestures as global, idiosyncratic and context-sensitive.

Here we include an example of the gestural contribution of the hands and the body. In **Fig. 4**A below, the facial expression is grammatical and marks a yes-no question in Israeli Sign Language with brows raised and head forward. The other two are facial gestures, with different meanings, regarding the cat in the Tweety Cartoon each person is describing. In C, the cat is squeezed into a confined space. In D, the cat is being thrown into the street. The only difference between C and D is in the position of the body; the facial gesture is the same. In comparison, in **Fig. 4**B and C, we find facial expression that is purely gestural. This expression conforms to McNeill's characterization of gestures. The same facial expression can convey very different meanings, here, either '*narrow fit*' in **Fig. 4**B or '*swoops across*' in **Fig. 4**C, depending on context.

In **Fig. 4**B and C the two facial expressions are very similar, but a closer look reveals that the body postures and hand configurations differ significantly. This shows that the whole body is simultaneously exploited for visual augmentation. Each simultaneous configuration represents the cat from different vantage points and in different activities.

[37] **Sandler et al. (2011a, 2011b)** discuss the emergence of complexity in prosodic organization. **Brentari et al. (2012, 2016)** link the emergence of phonological compositionality to an emerging linkage between phonological complexity and a type of classifier.

[38] For the gestural theories of language origin, see **Wilcox (2002)**. Stokoe had early on shown an interest in this issue; see **Stokoe (1972)**.

Fig. 4 (A) Conventionalized yes-no question. (B and C) Gestural facial expressions with different meanings. Source: Ebisu Theatre, Sign Language Research Lab, University of Haifa.

Iconicity

While iconic words are not frequent in spoken languages, sign languages have many iconic signs. In fact, as discussed in **Common Myths About Sign Languages** section (Myth 8) many naïve observers might conclude that signs are iconic replicas of their meanings. If dual patterning is regarded as a crucial property of human languages, and sign languages do *not* have this property, one might conclude that sign languages are not true human languages. However, as discussed in **Introduction** section, it is not the case that *all* words in sign languages are clearly iconic. There are many signs in ASL (and other sign languages) that one could not guess the meaning of. While early on iconicity was seen as a 'threat' to recognizing sign languages as true human languages, this is now an outdated view. After all, why not take advantage of the visual medium and common knowledge in creating a sign language?

Most often, the iconic form-meaning relationship, if present, is only clear only *after* their meaning has been revealed. Experiments have been done showing iconic signs to non-signers and asking them to guess what the meaning is.[39] The results show that meanings are hard if not impossible to guess, even when the signs are unmistakably iconic. Nevertheless, in some cases the meaning of iconic signs, when not revealed, is fairly transparent even to non-signers. We illustrate this for the signs for BOOK in ASL and in ISL, shown in **Fig. 5**. The two signs differ only slightly, and both look like opening a book.

However, despite such transparent cases, a closer study of how iconicity can be implemented in different ways in different sign languages reveals that a theory about the mapping of meaning to form has to reckon with various factors (see **Meir, 2010**; **Taub, 2001**, **2012**).

First, different aspects of meaning can be selected by the community in an iconic sign. The signs for HORSE in ISL and in ABSL are shown in **Fig. 6**. In ISL, it is the person's control of the horse by the reigns that is selected; in ABSL, it is the bit in the horse's mouth. Both iconically reflect domestication of horses, but aspects of the relation between humans and horses differ in each language.

What this shows is that despite taking advantage of iconicity, which is completely natural for visual languages, iconic words have arbitrary characteristics: the aspect of meaning selected to be represented and the interpretation of the sign's meaning are not fixed and perhaps somewhat arbitrary.

The signs for WOMAN in three sign languages in **Fig. 7** demonstrate the role of culture combined with iconicity. In American SL, the sign (BONNET-STRING-PERSON) is reminiscent of the bonnet historically worn by American women; in Israeli SL, the sign for WOMAN also means EARRING, historically adorning women only; and in Al-Sayyed Bedouin SL, the sign for WOMAN is reminiscent of the headdress once (but no longer) worn by Bedouin women. Each sign is iconic, and each is related to culture. In all three signs, there is one handshape, and the hand moves from one location to another, to produce the canonical form of a sign: Location, Movement, Location.

As a sign language matures, the distance between a sign's meaning and its iconic representation often becomes greater. As a result, the iconic origins can become unrecognizable. For example, the compound sign for WOMAN in ASL is thought to derive from the bonnet strings worn by early pioneer women, while the sign for WOMAN in ISL iconically represents an earring, once worn by women only, and the sign used in the Al-Sayyid Bedouin village in modern-day Israel, derives from the jeweled headdress no longer worn by Bedouin women. The origin of each sign is no longer transparent, and it is doubtful that children have any idea of the original iconicity – yet the signs persist.

[39]For such early experiments, see **Klima and Bellugi (1979)**. Several later studies have evaluated how signers and non-signers, including young learners, identify iconicity in signs; see **Ortega and Morgan (2015)** and **Pizzuto and Volterra (2000)**.

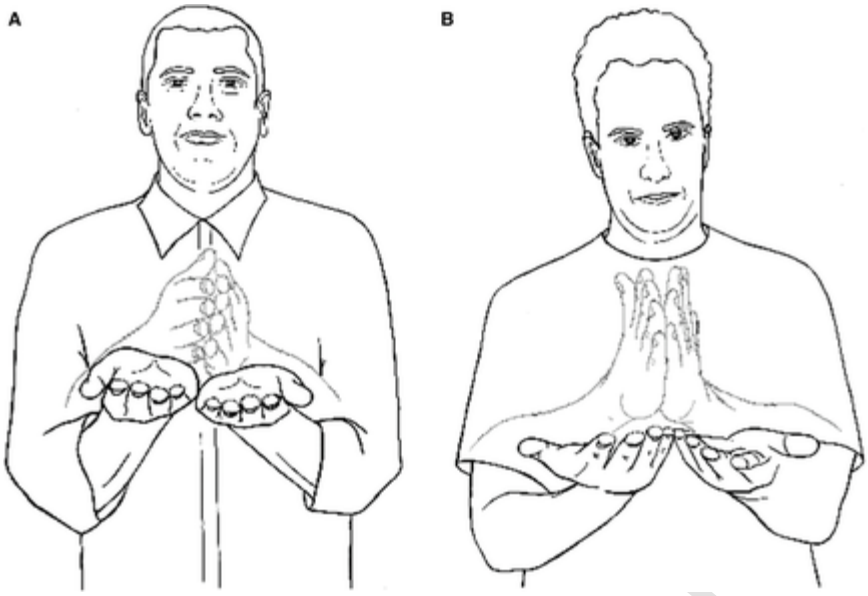

Fig. 5 The similar, iconic signs for BOOK in ASL (left) and in ISL (right). Source: Sign Language Research Lab, University of Haifa.

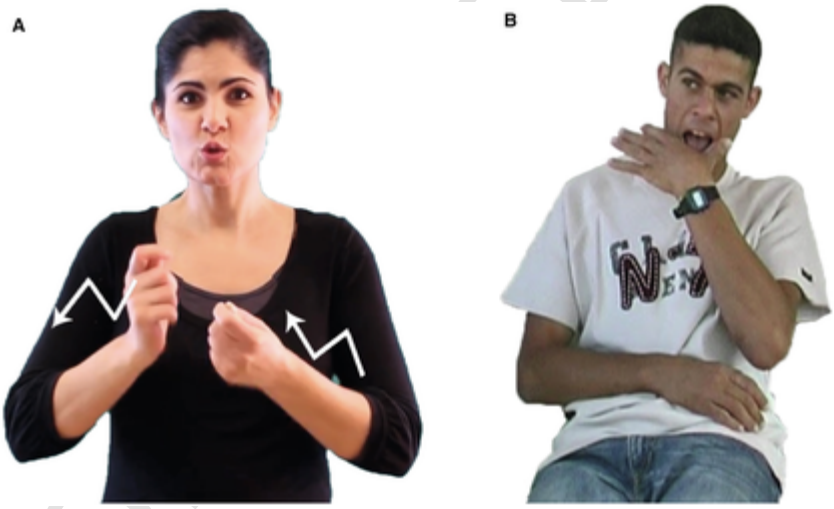

Fig. 6 HORSE in (A) ISL and (B) ABSL. Source: Sign Language Research Lab, University of Haifa.

One of the obvious characteristics that distinguish signs from spoken words is the presence of two identical articulators in sign languages: the two hands. The likelihood that a sign will be two-handed is much higher than chance, and relies on the meaning components of the sign (**Lepic et al., 2016**), typically reflecting the general property of plurality. The signs for EMPTY in three sign languages, ASL, ISL, and Swedish SL are illustrated below. They are all two-handed, reflecting both an object and its empty status. The nondominant hand (the left hand in all three examples) is a static location for the sign, assuming a default configuration. But each represents different aspects of plurality, either the surface or the container as a location, and either its bareness or internal emptiness conveyed by the active, dominant hand (**Fig. 8**).

In short, sign languages make ample use of iconicity, much more than spoken languages do, but that does not mean that the form of a sign is predictable or even similar across sign languages. We must also recognize that iconicity is a function of culture; the resemblance of a sign to its meaning arises in terms of the culture in which it arises.

The question remains: How do signers map meaning onto phonological form? Early important contributions to answering this question are **Boyes-Braem (1981)** ad **Brennan (1990)**. Taub's dissertation **(2001)** develops a systematic account of iconicity in sign lan-

Fig. 7 Three iconic signs for WOMAN, strongly influenced by culture. Source: Sign Language Research Lab, University of Haifa.

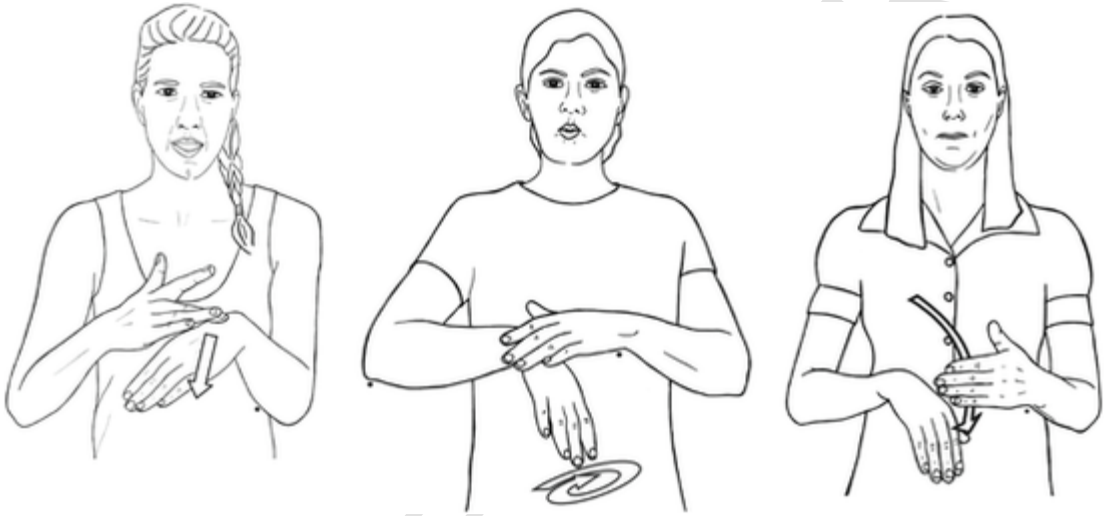

Fig. 8 Signs for EMPTY in three sign languages: ASL, ISL, and Swedish SL. Source: Sign Language Research Lab, University of Haifa.

guage.[40] Developing a theory of this mapping in relation to the brain can be found in **Emmorey (2014)**. Sign languages show us that the task of phonology cannot be limited to accounting for a compositional structure in terms of distinctive features/structures. We also have to explain how signers (or humans in general) are able to map a conceptual structure iconically onto a perceptible form. Arguably this is a task for phonology, which means that we have to broaden our idea of what phonological theories are about. Let us say that a complete theory of phonology comprises these two submodules:

(1) a. *Compositional phonology*: deals with the organization of signs in terms of meaningless units.
b. *Iconic phonology*: deals with the mapping from a semantic conceptual structure to phonological form.

We should not be surprised that iconic phonology precedes symbolic phonology in the emergence of a new language, especially in the visual domain. When seeking a form to represent a concept, people naturally come up with an iconic gesture whenever possible. Our point here is that phonology is about the perceptible form of mental, linguistic expressions. The bias toward symbolic, compositional phonology is the result of a long exclusive focus on spoken languages in which iconicity pays much less of a role than in sign languages, even though the role of iconicity in spoken languages has come to be recognized (see **Perniss et al., 2010**).

[40]This dissertation was published unmodified by Garland in 2001 and appeared, modified, in book form in 2001 with Cambridge University Press.

Sign Language and Artistic Expression

The languages of humans, unlike the communication systems of any other animals, are stretched in the service of artistic form. We see this in sign poetry (**Sutton-Spence, 2005**; **Sutton-Spence & Boyes Braem, 2013**) and deaf choirs. In this section we focus on sign language theater.

As part of a large research project, Sandler developed a sign language theater troupe, and chose as director Professor Atay Citron.[41] The troupe is called Ebisu, named after a deaf Japanese Shinto god. This project has persisted to this day, and the actors have traveled around the world, presenting their theater to mixed deaf and hearing audiences—typically *without* interpreting. The actors have developed their own 'language', which mixes iconic signs from Israeli Sign Language, with gestural, visual expressions intelligible to all, deaf and hearing.

An example of how a lexical sign can be extended with gestural aspects, consider (a) the lexical sign LEARN, broken down into (b) 'grasp' and 'put in head', with a pleased facial expression. Eventually the actress is overwhelmed with so much new information, iconically represented now with both hands, that she turns her head away from the input, in (c). Finally, there is too much information for her to grasp, shown in (d) with accompanying facial expression. The sequence begins with a real sign, LEARN, and allows the audience to break it down and interpret the rest of the representation. This sequence is natural in sign languages, and is intelligible to hearing and deaf audience members alike.

Notice that the puffed mouth shape in **Fig. 9**A is similar to the one in **Fig. 9**B, but the hands and body are different. This shows that the puffed mouth shape is gestural (not conventionalized), and is interpreted differently in a sign language, depending on what it is combined with (**Fig. 10**).

The creative use of signs and gestures by the Ebisu deaf and their understanding by deaf and hearing audiences provides evidence that a signed, visual language is natural for all humans.

Conclusion: Directions in Sign Linguistics

The linguistic study of sign languages is still relatively young; it can be traced back only about 65 years, compared with the study of spoken language that goes back a couple of millennia. Nevertheless, a tremendous amount of progress has been made in terms of showing the true human language nature of sign languages, in descriptive works (including grammars and dictionaries) of a large number of individual sign languages. The study of sign languages has had a major impact on our understanding of the nature of human language, irrespective of modality. Sign linguistics has also played a key role in re-establishing the importance of sign language in the development of children and recognizing that teaching deaf children a spoken language should come second place. From its beginning, sign linguistics has combined (practical or 'applied') work in the service of deaf education and developing a theoretical understanding of sign languages, combined with neuroscientific research. While early on sign linguists were cognizant of theoretical discussions about the proper analysis of spoken languages in phonology and syntax, and of late in semantics, it would seem that the rapidity of how sign linguistics developed was caused, at least in part, by sign linguists being less 'tied up' in controversies about theoretical disputes between generative linguists and linguists in other quarters, and internally to different theories of language. We have reviewed developments (especially in phonology) that have led to the current mature state of sign linguistics , which continue to expand their scope in terms of descriptive and theoretical work in all areas that are also covered by the study of spoken languages.

[41] https://gramby.haifa.ac.il/index.php/2016-03–13–14–30–57/sign-language-theatre-laboratory

Fig. 9 Separating the elements of the sign LEARN to create intelligible visual images in signed theater. Source: Ebisu Theatre, Sign Language Research Lab, University of Haifa.

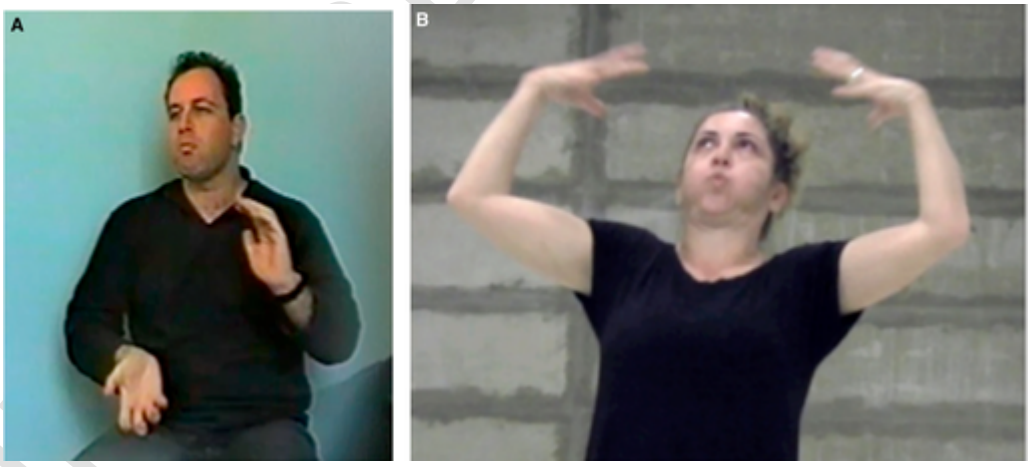

Fig. 10 Puffed mouth shape for both (A) the bowling ball, and for (B) too much information (TMI). Distinguishing features include those of the head and body (upright for bowling ball; back for TMI) and the hands (the lexical sign BOWLING BALL in (A) and the theatrical mimed hand expression for 'too much' in (B). Source: Ebisu Theatre, Sign Language Research Lab, University of Haifa.

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