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From gestures to grammatical non-manuals in sign language: A case study of polar questions and negation in Hong Kong Sign Language

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Abstract

Previous studies propose that eyebrow raise in polar questions and headshakes in negations in sign languages arose from the incorporation of hearing speakers' gestures in similar contexts into sign language grammar via grammaticalization. This paper reviews these proposals in light of Wilcox's theory on gesture grammaticalization. According to Wilcox, there are two routes for gestures to enter sign language grammar: Route I, via lexicalization, and Route II, via prosody/intonation. Based on Cantonese and Hong Kong Sign Language (HKSL) data, we argue that eyebrow raise in polar questions in HKSL evolved from a paralinguistic gestural element into a grammatical marker via a language-internal process because eyebrow raise in question contexts is universal. Negative headshakes in Cantonese, though prevalent, are not incorporated into HKSL grammar. Instead, HKSL adopts backward head movements as optional negation markers. These findings support previous claims that headshakes are culture-specific. Both eyebrow raise in polar questions and backward head movements in negations in HKSL can be subsumed under Route II in Wilcox's theory, along a language-internal evolutionary path. For sign languages that employ headshakes as negation markers, the headshakes are likely to have been borrowed from the hearing communities. This grammaticalization path fits neither Route I nor Route II of Wilcox's theory because cross-modal borrowing is involved without an intermediate lexical stage.
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1. INTRODUCTION

The exact relationship between hearing people's gestures in communicative contexts (e.g., co-speech gestures, facial expressions, emblems) and sign languages has intrigued researchers for decades. Recent studies suggest that eyebrow raise in polar questions and headshakes in negations in sign languages have arisen from the incorporation of

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hearing speakers' gestures in similar contexts into sign language grammar via grammaticalization (Janzen, 1999, 2012, Janzen and Shaffer, 2002, Pfau, 2015, Pfau and Steinbach, 2011, Van Loon et al., 2014). These proposals appear to suggest that such incorporations are an outcome of language contact, with the spoken languages of the wider hearing communities serving the role of the 'donor language' from which eyebrow raise and headshakes are borrowed. This paper aims at reviewing these proposals in light of Wilcox's theory on gesture grammaticalization in sign languages (Wilcox, 2004, 2009, 2014a, 2014b, Wilcox et al., 2007, 2010). Wilcox argues that gestures can enter sign language grammar along two distinct grammaticalization routes—one via lexicalization (Route I) and the other via prosody/intonation (Route II). With evidence from Cantonese and HKSL conversations, we argue that eyebrow raise in polar questions in HKSL is likely to have evolved from a paralinguistic gestural element into a grammatical marker via a language-internal process due to the universal nature of eyebrow raise in questioning contexts. In contrast, despite their prevalence in Cantonese conversations, negation-related headshakes are not systematically recruited to mark negation in HKSL. Instead, backward head movements have been grammaticalized to become optional markers for negation. We argue that these findings support the previous claims that headshakes are culture-specific rather than universal. In addition, the frequent occurrence of a non-manual gesture in the hearing community does not appear to be a sufficient condition for it to enter the linguistic system of a sign language. Eyebrow raise in polar questions and backward head movements in negations in HKSL can be subsumed under Route II proposed by Wilcox, along a language-internal evolutionary path. On the other hand, we will propose that, for sign languages that employ headshakes as markers for negation, the headshakes are likely to have been borrowed from the surrounding hearing speakers. This borrowing is 'cross-modal' in nature because sign languages and spoken languages adopt different language modalities. Besides, this grammaticalization path of negative headshakes fits neither Route I nor Route II of Wilcox's theory because cross-modal borrowing is involved without an intermediate lexical stage.

This paper is organized as follows: Section 2 is the literature review. It begins with an overview of non-manuals in sign languages and spoken languages. This is followed by a review of the grammaticalization of eyebrow raise and headshakes in the contexts of polar questions and negation respectively, and how these two non-manuals can be integrated into Wilcox's theory of gesture grammaticalization in sign languages. Section 3 presents the research questions and methodology. Section 4 discusses the findings from the Cantonese and HKSL conversation data. Specifically, we will compare how eyebrow raise and headshakes are used in HKSL and Cantonese in the target (i.e., polar questions & negations) and non-target contexts. Section 5 is the general discussion and conclusion.

2. LITERATURE REVIEW

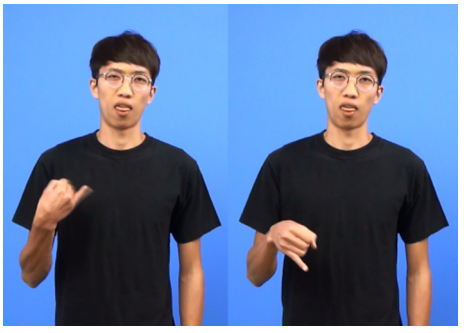
2.1. Non-manuals in sign languages and spoken languages

2.1.1. Non-manuals in sign languages

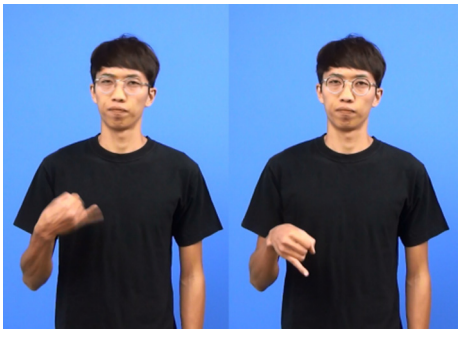
Sign languages are visual-gestural languages regulated by complex linguistic principles, and they display linguistic universals found in spoken languages (Emmorey, 2002, Sandler and Lillo-Martin, 2006). Due to the difference in language modality, however, certain grammatical aspects are unique to sign languages, and non-manuals are one such case in point. Non-manuals cover a wide range of signals conveyed by articulators other than a signer's hands, hence the term 'non-manual signals'. Examples of non-manuals include movements or configurations of different facial features (brows, blinks, cheeks, mouth, nose, gaze pattern, tongue, etc.), head movements, shoulder movements, and torso movements. Non-manuals can show a signer's emotions (e.g., a signer may frown and open his/her eyes widely when expressing anger, or put on a smiley face to signal happiness), or serve linguistic functions at different grammatical levels in sign languages (Benitez-Quiroz et al., 2014, Herrmann and Steinbach, 2013, Liddell, 1980, Mohr, 2014, Reilly and Bellugi, 1996, Reilly et al., 1990, Pfau and Quer, 2010, Tomaszewski and Farris, 2010, Wilbur, 2000). On the phonological level, non-manuals are one of the parameters that make up a sign, and some lexical signs are formally distinguished only by a difference in non-manuals. In HKSL, CANNOT (ability) (Example 1) and CANNOT (permission) (Example 2) constitute a minimal pair—they only differ in mouth gestures (protruded tongue vs. pressed lips).[1]

[1] Apart from Examples (1) and (3), tongue protrusion is also observed in lexical signs such as LACK-KNOWLEDGE, DON'T-KNOW, IMPOSSIBLE, STUPID, MISSING, BAD-IN-TASTE, UNSUITABLE, etc. These signs provide preliminary evidence that tongue protrusion may be semantically linked to the concept of 'lacking certain attributes' in HKSL.

Example (1). CANNOT (ability)



Example (2). CANNOT (permission)



Example (3) shows the manner adverb 'haphazardly' in HKSL, which involves side-to-side head tilts, half-closed eyes, and tongue protrusion. On the morphological level, non-manual signals can function as morphemes. In Example (3), the non-manuals are overlaid simultaneously with the verb WRITE, resulting in the meaning 'to write haphazardly'.

Example (3).

Side-to-side head tilts
Half-closed eyes
Protruded tongue

ELDER-BROTHER WRITE

'The elder brother wrote haphazardly.'



ELDER-BROTHER WRITE-HAPHAZARDLY

Examples (4) and (5) illustrate how eyebrow raise and forward head thrust can distinguish a conditional sentence from a statement in HKSL on the syntactic level.

Example (4).

forward head thrust
eyebrow raise

TOMORROW RAIN PICNIC CANCEL

'If it rains tomorrow, the picnic will be canceled.' (Conditional sentence)

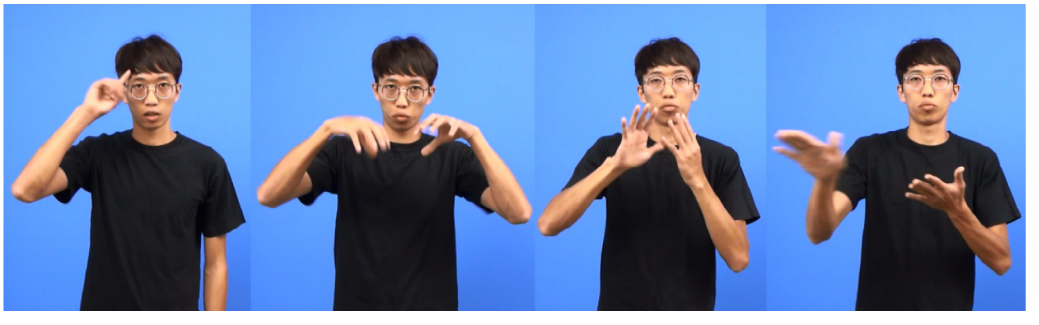


TOMORROW RAIN PICNIC CANCEL

Example (5).

TOMORROW RAIN PICNIC CANCEL

'It will be raining tomorrow, and the picnic will be canceled.' (Declarative sentence)



TOMORROW RAIN PICNIC CANCEL

Non-manual signals that bear grammatical functions can be obligatory, e.g., eyebrow raise in polar questions in American Sign Language (ASL) (Example 6), or optional, e.g., eyebrow raise that serves as a topic marker (Example 7) in ASL, and negative headshakes that accompany negation in Japanese Sign Language (JSL)(Example 8).

Example (6).

_____q

MAN HOME

'Is the man home?' (ASL, Valli and Lucas, 2000:139)

('q' represents eyebrow raise, eyes open wide & forward head tilt)

Example (7).

__t

CAT DOG CHASE

'As for the cat, the dog chased it.' (ASL, Liddell, 1980:30)

('t' represents the non-manuals for topics in ASL, which include eyebrow raise and forward head tilt)

Example (8).

___top		___neg
FATHER	BROTHERS	NOT.2

'My father doesn't have any brothers.' (JSL, Morgan, 2006:116)

('top' represents eyebrow raise as the topic marker; 'neg' represents the negative headshakes; NOT.2 is the two handed version of the negator NOT in JSL.)

Non-manuals in sign languages are claimed to be functionally similar to prosody or intonation in spoken languages (Dachkovsky and Sandler, 2009, Pfau and Quer, 2010, Sandler and Lillo-Martin, 2006). Furthermore, some of them bear a strong resemblance to the facial expressions or body gestures commonly seen among hearing people in similar linguistic contexts. As such, it has been proposed that some non-manual markers originated from the gestures of hearing people and have been integrated into sign languages via grammaticalization. Two examples have been put forward in the literature. First, hearing people sometimes raise their eyebrows when asking questions, and these eyebrow raises have been grammaticalized into the non-manual marker of polar questions and topic constructions in ASL (Janzen, 1999, 2012, Janzen and Shaffer, 2002). Second, headshakes in negation in sign languages originated from the same gesture used by hearing speakers in a negation context (Pfau, 2015, Pfau and Steinbach, 2011). These two non-manuals will be discussed in more detail in Sections 2.1.2 and 2.2.

2.1.2. Use of eyebrow raise and headshakes in spoken languages

It is now well-established that non-verbal gestures such as body/hand movements (i.e., gesticulations, head movements) and facial displays (e.g., eyebrow raise for emphasis, puzzled looks) contribute to face-to-face verbal communication for hearing speakers (Bavelas and Chovil, 2006, Kendon, 1988, McNeill, 1992, McClave, 2000). Relevant to our discussion here are the eyebrow raises and headshakes used by hearing people in communicative events.

Previous studies suggest that hearing speakers raise their eyebrows when they ask questions (Chovil, 1991/1992, Darwin, 1872, Eibl-Eibesfeldt, 1972, 1979, Ekman, 1979, 2004) and emphasize certain words or phrases (Ekman, 1979, 2004). Furthermore, some studies report that eyebrow raise frequently accompanies the stronger pitch accents (Flecha-García, 2010, Swerts and Krahmer, 2010) and hand batons that accent a word in speech (Eibl-Eibesfeldt, 1972), thus offering empirical evidence in support of the link between emphasis and eyebrow raise. In a study that analyzes English conversations, Chovil (1991/1992) observes that some eyebrow movements, particularly eyebrow raise, are related to the announcement, continuation, and ending of a topic (1991/92:178). Aside from accompanying specific linguistic structures, people may raise their eyebrows when they are surprised (Darwin, 1872, Eibl-Eibesfeldt, 1979, Ekman, 1979), or when they want to alert the listeners to pay special attention to some crucial speech content (Ekman and Friesen, 1969, Kim et al., 2014). When doing a word search, a speaker may raise the eyebrows with the eyes looking up as a potential signal to ask the listener not to interrupt or take over the floor. In addition, eyebrow raise can be found in greetings and indications of approval (Ekman, 1979).

Several researchers have pointed out the innate and universal nature of eyebrow raise underlying the different emotional and conversational functions mentioned above. Following Darwin (1872), Ekman (1979) proposes that eyebrow raise is initially a natural response when people encounter a surprising or unexpected event because raising the eyebrows can lift the upper eyelid quickly, thus increasing the upper portion of the visual field. A similar view is put forward by Peck (1987). Fridlund (1997) argues that raised eyebrows mean 'Something has happened. I am going to find out'. In a similar vein, Wierzbicka proposes that the universal implied message of eyebrow raise should be 'I want to know more' (1999:189), which can sensibly link up the two different interpretations of eyebrow raise, namely, 'surprise' and 'question', in a unified way (1999:192). In a more recent discussion, Elliott and Jacobs (2013) state that facial expressions can have either universal meanings or culture-specific meanings, and they argue that eyebrow raise belongs to the first type. Specifically, eyebrow raise retains the universal meaning 'I want to know more', even though contexts may offer additional meaning on top of this (2013:2). In sum, it can be seen from these studies that the universal nature of eyebrow raise is relatively well-established in the literature.

Like eyebrow raise, headshakes have been a focal area of research in gesture and language for decades. In American culture, head nods are used to signal affirmation, whereas headshakes indicate negation. As these two head movements signal the same affirmative and negative meanings in the absence of speech, they are considered emblems (McClave, 2000). An emblem is a gesture that has a conventionalized form, a well-understood meaning, and is known by all members of a group, class, and culture (Ekman and Friesen, 1969:63, Kendon, 2002). Besides negation, McClave (2000) suggests that headshakes may co-occur with concepts that indicate inclusivity (e.g., words such as 'everyone', 'everything'), intensifications (e.g., words such as 'very", 'great", 'exactly') and uncertainty (e.g., words such as 'I guess',

'whatever'). Small lateral head movements are occasionally observed during word repairs. Kendon (2002) agrees with McClave that headshakes can be found in contexts other than negation, yet these non-negation contexts can always be interpreted as expressing the "theme" of negation (2002: 148). Eight types of headshake are identified in Kendon (2002): (i) Headshakes that occur in the absence of speech to mean 'no'; (ii) Headshakes that occur with the verbal expression of 'no'; (iii) Headshakes that occur in a statement that contains a negation of some sort; (iv) Headshakes that indicate a negative attitude or negative response of the speakers; (v) Headshakes that occur when the meaning of negation is implied; (vi) Headshakes used to indicate a universal meaning (i.e., 'no exception is allowed', equivalent to 'inclusivity' in McClave's sense); (vii) Headshakes that accompany superlative (i.e., cannot be exceeded by others) or intensified expressions (i.e., 'could not have been more', equivalent to 'intensification' in McClave's sense) and (viii) Headshakes that accompany a speaker's comment on his own utterance, including self- corrections (i.e., the speaker is not sure about what he is saying, equivalent to 'uncertainty' in McClave's sense). Kendon argues that all eight types are related to negation/negative meaning in one way or another.

Although headshakes are utilized in negative contexts in many cultures, in certain geographical regions, the meaning of headshakes and head nods are reversed, or negations are not expressed by headshakes at all. For example, in Bulgaria, horizontal sideward head movements mean 'yes', whereas head nods (up-and-down movements) mean 'not' (Andonova and Taylor, 2012). In the southern part of Italy, Greece, and Turkey, a large backward head tilt (around 45°) is utilized in negation (Morris et al., 1979). In his seminal work on gestures (Darwin, 1872), Darwin admits that 'if we look to the various races of man, these signals (i.e., nodding for affirmation and headshakes for negation) are not so universally employed as I should have expected' (1872:274). In his survey, for example, the Arabs on the Nile never use headshakes to express negation. In Esquimaux, people use a wink but not headshakes to mean 'no'. In Gipps' Land, a negative is expressed by a backward head tilt plus tongue protrusion. The natives near Torres Straits do not express negation with headshakes. Instead, they would hold up the right hand, shake it by turning it half round and back again two to three times. The Abyssinians express negation by jerking the head to the right shoulder together with a slight cluck and the mouth closed (1872:275). Darwin proposes that negative headshakes stem from infants' natural gestures to turn their faces away from milk when they are full. The diverse head movements observed in negation across languages can all be interpreted as head movements by which one shuns food. As such, there exists some degree of uniformity throughout the world in the possible gestures for negation (1872:277). Given this cross-linguistic evidence, Elliott and Jacobs (2013) regard negative headshakes as culture-specific rather than universal.

2.2. Grammaticalization of (non-manual) gestures in sign languages

2.2.1. Grammaticalization of eyebrow raise and headshakes in sign languages

Since questioning eyebrow raise and negative headshakes are found in both spoken and sign languages, some studies have argued that these non-manual markers in sign languages originate from the same gestures used by hearing people and explained this incorporation process under the framework of grammaticalization.

In the study of language change in spoken languages, grammaticalization is concerned with how lexical items and constructions change and serve grammatical functions in certain linguistic contexts, or how grammatical items develop new grammatical functions. As grammaticalization refers mostly to the steps by which particular items become more grammatical through time, it is considered part of the wider linguistic phenomenon of structuration—the process through which combinations of forms come to be fixed in certain functions over time (Hopper and Traugott, 2003).

Janzen (Janzen, 1999, 2012, Janzen and Shaffer, 2002) suggests that eyebrow raise in polar questions is commonly observed in the North American community, and it has been grammaticalized to become a question marker in ASL. According to him, this grammaticalization phenomenon 'may show some universality' (Janzen and Shaffer, 2002:213) as eyebrow raise is also reported in polar questions in many other sign languages (Zeshan, 2004, 2006). In addition, this polar-question eyebrow raise has undergone further grammaticalization to become a marker for topic constructions in ASL:

Generalized questioning gesture > polar questioning marking > topic marking

Janzen postulates that the second stage of grammaticalization was motivated by the fact that topic constructions imply the polar question 'Do you know X?' as a means to confirm the basic information of the topic with the interlocutors (cf. Haiman, 1978). As the polar question non-manual marker was first grammaticalized from a general facial expression and then further evolved into a topic marker without being mediated by a lexical use of the same marker, this process is arguably different from the grammaticalization phenomena in spoken languages (Janzen, 2012, Janzen and Shaffer, 2002).

In line with Janzen's proposal, Pfau and his colleagues propose that headshakes used by hearing people when expressing negative meaning were grammaticalized to become the non-manual marker of negation in sign languages

(Pfau, 2015, Pfau and Quer, 2010, Van Loon et al., 2014), and this phenomenon exists in all sign languages known to this date (Pfau, 2015:9). According to them, the most robust evidence for the grammaticalization of headshakes is (i) that they are synchronized with respect to the manual negative signs they co-occur with, and (ii) that their scope of spreading is subject to language-specific constraints (see Zeshan, 2006 for details). In addition, in some sign languages, headshakes alone can negate a sentence without an overt manual negator (Example 9):

Example (9).

hs
WOMAN FLOWER BUY
'The woman does not buy a flower.' (German Sign Language; Pfau and Steinbach, 2011:692)
(hs = headshake)

These observations provide evidence that headshakes are linguistically regulated once they become a grammatical marker. Pfau (2015) further attempts to theorize the evolution of headshakes and manual negators in sign languages with the concept of Jespersen's Cycle. Put simply, Jespersen (1917, quoted in Larrivée et al., 2011) argues that negation in Early French only involved a single negator *ne* in a preverbal position. The noun *pas* ('step') was added postverbally in a negative sentence to mark emphasis. As time went by, *pas* lost its emphatic meaning and became a negator as well. At a later stage of development, *ne* underwent phonological reduction and became a clitic (*n*'), and it subsequently disappeared from negative constructions in Colloquial French, leaving *pas* as the only negator (See Example (10) below, Pfau, 2015:43).

Example (10).

			___hs		___hs	___hs		___hs
a.	NEG_{adv}	→	NEG_{adv}	→	VERB	NEG_{adv}	→	NEG_{adv}
b.	*ne*	→	*ne*. . .pas_{emph}	→	*ne*. . .*pas*		→	*pas*
		Stage I		Stage II			Stage III	

Pfau (2015) hypothesizes a similar evolutionary path for headshakes in sign language negation as follows. At the emerging stage of a sign language, deaf signers only use a manual negative sign to perform a negating function, and headshakes are occasionally used for emphasis. As headshakes become more frequent, they are grammaticalized to become a negative morpheme that co-occurs with the manual negator. In some sign languages, the manual negators are weakened over time, and their functions are gradually replaced by the headshakes, rendering the former's presence unnecessary. However, not all sign languages reach this final stage of development (Pfau, 2015:43).

2.2.2. Wilcox's theory on gesture lexicalization and grammaticalization in sign languages

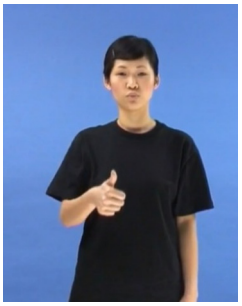
Regarding the questioning eyebrow raise and negative headshakes in sign languages, do they really involve cross-modal borrowing, as previous studies suggest? Can they arise from a language-internal evolution process instead? After all, if one adopts a gestural theory of language origin (Armstrong and Wilcox, 2007; Corballis, 2003), eyebrow raise and headshakes could have been part of deaf signers' innate gestural repertoire, and as such, the possibility of language-internal evolution cannot be ruled out. How do we determine which approach is correct? What would be the necessary conditions for cross-modal borrowing or language-internal evolution to take place? To what extent are these non-manuals similar to other manual gestures that are incorporated into sign languages? Van Loon et al. (2014) suggest that eyebrow raises and headshakes are grammaticalized via Route II in Wilcox's theory on gesture grammaticalization (Wilcox, 2004, 2009, 2014a). Wilcox (2014b) also states that eyebrow raise, as a grammatical marker of interrogatives, topics, and conditionals in ASL, is an example of Route II grammaticalization, and it originated from the 'surprise gesture' that was documented by Darwin (1872). Nonetheless, limited discussions are provided in Van Loon et al. (2014) and Wilcox (2014b) to illustrate how the two non-manuals fit into Wilcox's framework. To address these issues, we review Wilcox's theory on gesture grammaticalization (Wilcox, 2004, 2009, 2014a, Wilcox et al., 2007, Wilcox et al., 2010), and discuss its implications for the possibility of cross-modal borrowing and language-internal evolution of the two non-manuals under question.

Previous studies on the relationship between gesture and sign languages fall into two broad categories: synchronic studies that aim at finding out how gestures and signs can be differentiated, and diachronic studies that examine how gestures used by the wider hearing community are incorporated into the linguistic systems of sign languages through

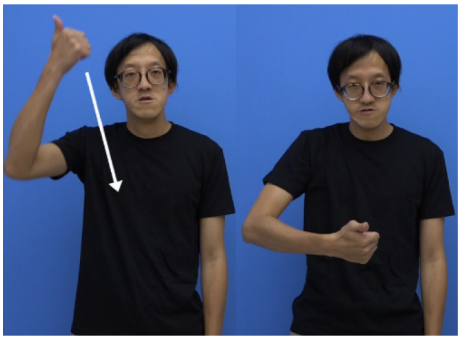
lexicalization and grammaticalization (Wilcox, 2014a: 2170–2171). Concerning the diachronic approach, Wilcox (2004) proposes two distinct routes (i.e., Route I and II) for gestures to enter the grammatical systems of sign languages. Route I involves a gesture from the surrounding hearing community being incorporated into a sign language as a lexical item, which may further acquire grammatical functions via grammaticalization (Wilcox, 2009, Wilcox et al., 2010). Such gestures are either quotable or improvised. Both quotable and improvised gestures have specific forms and meanings but differ in the degree of conventionalization. Quotable gestures are more conventionalized – they are widely shared and known to be shared among the hearing community. Improvised gestures are less conventionalized, but they are similar to quotable gestures in using bodily actions to express lexical concepts and are potentially quotable (Wilcox, 2004: 49-50).

Examples of Route I have been reported in different sign languages (e.g., Janzen, 2012, Janzen and Shaffer, 2002, Shaffer, 2000, Wilcox, 2004, Wilcox et al., 2007, Wilcox and Wilcox, 1995, Zeshan, 2000). For example, the sign THANK in Indo-Pakistani Sign Language (IPSL) originated from a similar gesture used by hearing people, which shares the same meaning but is restricted in use to beggars (Zeshan, 2000). The departure gesture used in France in 18thC was lexicalized to become PARTIR ('leave') in French Sign Language (LSF). Due to its historical link with LSF, ASL also used the same sign to mean 'to depart' in the early 20th century, which eventually became the future marker (Janzen and Shaffer, 2002, Shaffer, 2000).

Similar examples of cross-modal borrowing of hearing people's manual gestures can be found in HKSL as well. In Hong Kong, as in many other places globally, the thumb-up emblem is used widely as a signal of approval.[2] Cantonese speakers typically use it to mean 'good', 'great' or 'correct'. This static gesture has been borrowed and lexicalized to carry the same meanings in similar contexts in HKSL (Example 11). It has further evolved morphologically into lexical words such as ALWAYS (Example 12), SUCCEED (Example 13), and functional words such as CAN (modal - possibility, ability, permission)(Example 14).

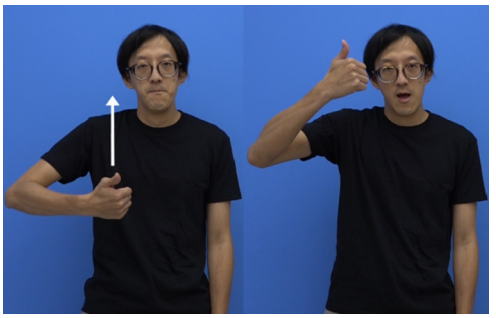


Example (11). GOOD (Adj., HKSL)

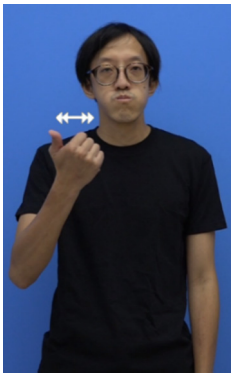


Example (12). ALWAYS (Adv., HKSL)

[2] The thumb-up gesture is not universal, however. For example, in the Middle East, this gesture carries an offensive meaning of 'up yours, pal' (Koerner, 2003). Similar derogatory meaning of this gesture can be found in Iran, West Africa, Russia, Greece, and Sardinia (Axtell, 1997).



Example (13). SUCCEED (V., HKSL)



Example (14). CAN (Modal, HKSL)

Unlike Route I, Route II does not involve a free-standing gesture going through the stage of lexicalization (Wilcox, 2004). For this route, the source gesture can be 'a particular manner of movement of a manual gesture or a sign, and various facial, mouth, and eye gestures' (Wilcox, 2004:48). Notably, this route takes a developmental path from gesture to prosody/intonation to grammatical morphology, bypassing any lexical stage (Wilcox et al., 2010:332). Gestures following this route are not conventional, and they depend on other more autonomous components (i.e., this type of gesture presupposes the existence of other components for its manifestation) (Wilcox, 2004:59). In the writings of Wilcox and his colleagues (e.g., Wilcox, 2004, 2005, 2009, 2014b, Wilcox et al., 2010), the discussions of Route II focuses mainly on the manner of movement as a source gesture, without much elaboration on facial gestures. Wilcox argues that in different sign languages, manners of movement are employed to modify the meaning of manual signs. For instance, in Italian Sign Language (LIS), the sign IMPOSSIBILITY can be produced with modifications to the location, dynamic contour (e.g., tenseness, speed), and facial expressions to express a varying degree of 'impossibility'. In ASL, the difference between YELLOW and DEEP-YELLOW can be distinguished by the intensity of movement. Similarly, the manner of movement is used to differentiate the degree of obligation/necessity expressed by modal signs in ASL (Wilcox quoting Frishberg's study in 1972). Wilcox (2004) proposes that manner of movement is a paralinguistic gestural element in the first place, analogous to intonation in spoken languages (2004:65) (i.e., similar to the paralinguistic use of intonation as proposed by Bolinger, 1986). As these elements are incorporated into the linguistic systems in sign languages via Route II, they become less gradient in their meaning and more restricted in their functions in grammar. Wilcox (2005) argues further that manner of movement and facial articulation perform similar functions across unrelated sign languages because of 'their deep link with Bolinger's proposed gestural complex that is the primitive ancestor of intonation used to signal emotion' (2005:38). Wilcox's arguments appear to suggest that Route II is a language-internal process through which primitive gestural elements employed in signing communications enter the linguistic system and acquire grammatical functions. Hence, Route II is different from Route I, which involves cross-modal borrowing of a highly conventional gesture from the hearing community into a sign language.

Wilcox states in his 2014a paper that, as facial gestures and manner of movements grammaticalize, 'they take on grammatical functions, for example as markers of interrogatives, topics, conditionals, verb aspect, and intensification' (Wilcox, 2014a:2174). In another paper (2014b), Wilcox proposes that "the grammatical markers (i.e., eyebrow raise) of interrogatives, topics, and conditions (in ASL) are an example of the second route" (2014b:18) and that these gram-

Table 1
Information of the 11 episodes of TV shows in Cantonese.

TV shows	Host (gender)(age)	Guest (gender)(age)	YouTube Links	Data Source Code
aTV 100 Celebrities (亞視百人)	KAM Kwok Leung (M)(62)	IP Tak Han Deanie (F)(65)	https://www.youtube.com/watch?v=gtGnnelj4kE	Set 1
		PAW Hee Ching Nina (F)(63)	https://www.youtube.com/watch?v=7ywI8e5BFAw	Set 2
		YIP Yuk Ping (F)(50)	https://www.youtube.com/watch?v=uT20Qwkn658	Set 3
		TONG Ning (F)(31)	https://www.youtube.com/watch?v=iGoOL6jQ274	Set 4
		MAK Kit Man Connie (F)(58)	https://www.youtube.com/watch?v=ek82vxz6_4U&t=783s	Set 5
		CHAN Tin Wai Nathan (M)(51)	https://www.youtube.com/watch?v=82GYMlQBKHE	Set 6
		TAO Michael (M)(49)	https://www.youtube.com/watch?v=NWZLpyXoeZk&t=317s	Set 7
		KEUNG Ho Man Philip (M)(46)	https://www.youtube.com/watch?v=bfQCVwIRoOo&t=922s	Set 8
		Albert AU Sui Keung (M)(67)	http://www.youtube.com/watch?v=uzodTgFnr3U&t=897s	Set 9
On Air at Broadcast Drive 廣播道開咪	LAM Shan Shan Sandy (F)(55)	WONG Christopher (M)(57)	https://www.youtube.com/watch?v=-vGkNiAFgtA&t=51s	Set 10
		CHENG Tan Shui Lawrence (M)(67)	https://www.youtube.com/watch?v=LSlIVeE3iog	Set 11

*'Age' indicates the age of the host/guest at the time of the broadcast.

matical uses of eyebrow raise arose from the 'surprise gesture' first documented by Darwin (1872). In other words, in Wilcox's theory, eyebrow raise for polar questions began its life as a paralinguistic gestural element in questioning contexts, which became a prosodic/intonational element and finally evolved into a grammatical marker for polar questions in sign languages. If the grammaticalization path of eyebrow raise is similar to that of manner of movements (i.e., Route II), it will follow that such a process is language-internal rather than involving cross-modal borrowing. Yet this inference would diverge from the proposal by Janzen (Janzen, 1999, 2012, Janzen and Shaffer, 2002).

Whether the grammaticalization path of eyebrow raise is language-internal or involves borrowing from hearing speakers leads to a series of interesting theoretical and empirical questions, e.g., How do we know if a non-manual grammatical marker arises within a sign language itself or originates from the surrounding hearing community? What would be the pre-requisite condition(s) that trigger(s) cross-modal borrowing? Does the frequency of occurrence of the hearing people's gestures matter? What kind of empirical evidence is required to argue for or against language-internal evolution or cross-modal borrowing? The answers to the above questions would undoubtedly offer us invaluable insights for understanding the evolutionary path of other non-manual markers, such as headshakes in negation, in the broader theoretical framework that attempts to explicate the relationship between gesture, spoken language, and signed language in a unifying manner (e.g., Wilcox, 2012).

In fact, a closer look at Wilcox's theory reveals several dimensions for us to consider when investigating if the questioning eyebrow raise and the negative headshake arise from cross-modal borrowing or language-internal evolution. In his explanation of Route I, Wilcox explicitly points out that the gestures, be they quotable or improvised, need to have specific form and meaning in the source spoken language. In addition, the gestures need to be widely shared and known to be shared among the hearing community, though the degree of conventionalization may vary. To us, Wilcox's suggestion makes perfect sense. After all, even in the presence of extensive language contact, deaf people can never fully understand the content of hearing people's speech. Deaf people can probably only understand those gestures that are widely used by the hearing people and those with more consistent form and meaning. Based on this, we would like to put forward the following hypotheses:

(a) A non-manual gesture used by hearing people needs to be widely used in a specific context (i.e., high frequency of occurrence) and have a specific form and meaning (i.e., the form and meaning can be recognized easily without much reliance on the speech contents or contexts) in order to be a potential candidate for cross-modal borrowing;



Fig. 1. Snapshots of the Cantonese conversation data (11 individual talk shows).

Table 2
Background information of the HKSL Deaf signers.

Signer (gender)(age)	Background	Education background	Data Code
Signer 1 (F) (22)	Having deaf parents and 1 deaf sibling	Graduated from The Hong Kong School for the Deaf	Set 1
Signer 2 (M) (27)	Having deaf parents and 1 deaf sibling		
Signer 3 (M) (24)	Having deaf parents		Set 2
Signer 4 (F) (27)	Having deaf parents		
Signer 5 (M)(31)	Having deaf parents and 1 deaf sibling		Set 3
Signer 6 (F) (37)	Having deaf parents and 1 deaf sibling		

(b) If a non-manual marker in a sign language resembles a gesture that is universal to human beings regardless of cultures, it is more likely to have evolved via a language-internal grammaticalization process because cross-modal borrowing is not necessary;
(c) In contrast, if a non-manual marker in a sign language involves a culture-specific gesture in the hearing community, cross-modal borrowing would be more likely; and
(d) Finally, if a non-manual marker in a sign language has no equivalence in the surrounding hearing community's gestural repertoire, it is likely to have evolved via a language-internal process because cross-modal borrowing is not possible.

If our hypotheses above are correct, the eyebrow raise is more likely to be a candidate for language-internal grammaticalization for two reasons: (a) it is suggested to be an innate facial gesture for questioning in the literature; (b) it is not 'quotable' enough for cross-modal borrowing. Regarding the second point, although eyebrow raise is an innate gesture associated with questions, it serves a wide range of other functions. If it is used alone without speech, it is rather difficult for the perceiver to figure out the intended meaning unless obvious contextual cues are available.[3] On the other hand, we would like to suggest that the negative headshake is a potential candidate for cross-modal borrowing for two reasons: (a) it is culture-specific; (b) it is a 'quotable' emblem for negation (in language communities where headshakes mark negations), meaning that people can recognize its negative meaning even in the absence of speech. Note that none of Wilcox's papers has discussed the possible grammaticalization path of negative headshakes, though Van Loon et al. (2014) suggest that negative headshakes follow Route II of Wilcox's theory. However, if our hypothesis about negative headshakes is correct, their grammaticalization path would fit neither Route I nor Route II of Wilcox's theory because negative headshakes are conventional and involve cross-modal borrowing on the one hand (i.e., do not fit Route II) and do not involve an intermediate lexical stage (i.e., do not fit Route I).

[3] We have not found any studies to back up our claim here. This is entirely based on our metalinguistic judgment as native speakers of Cantonese.



Fig. 2. Snapshots of the HKSL conversation data (3 pairs).

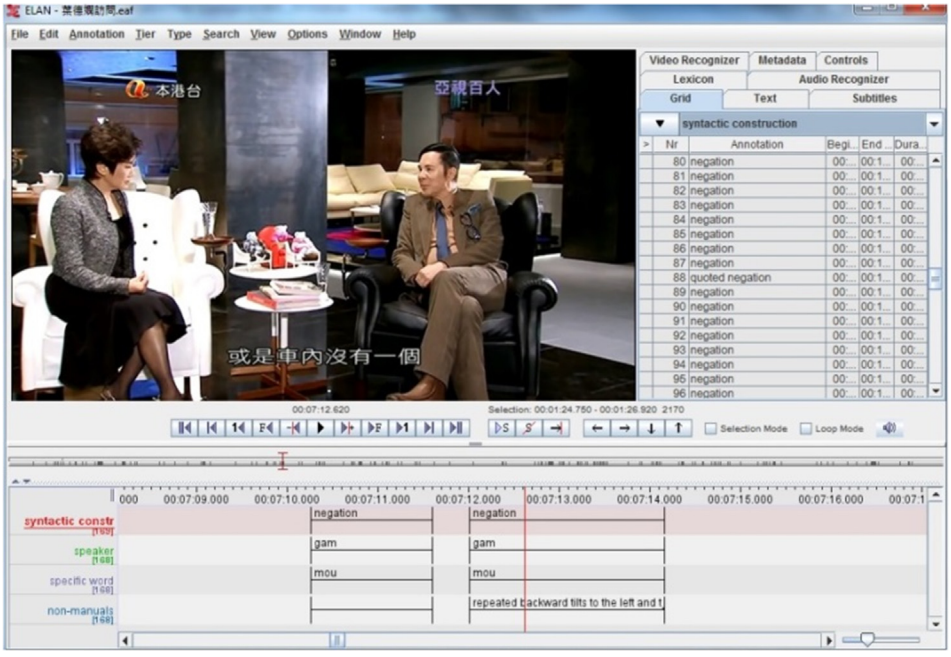


Fig. 3. Snapshot of Cantonese data in ELAN.

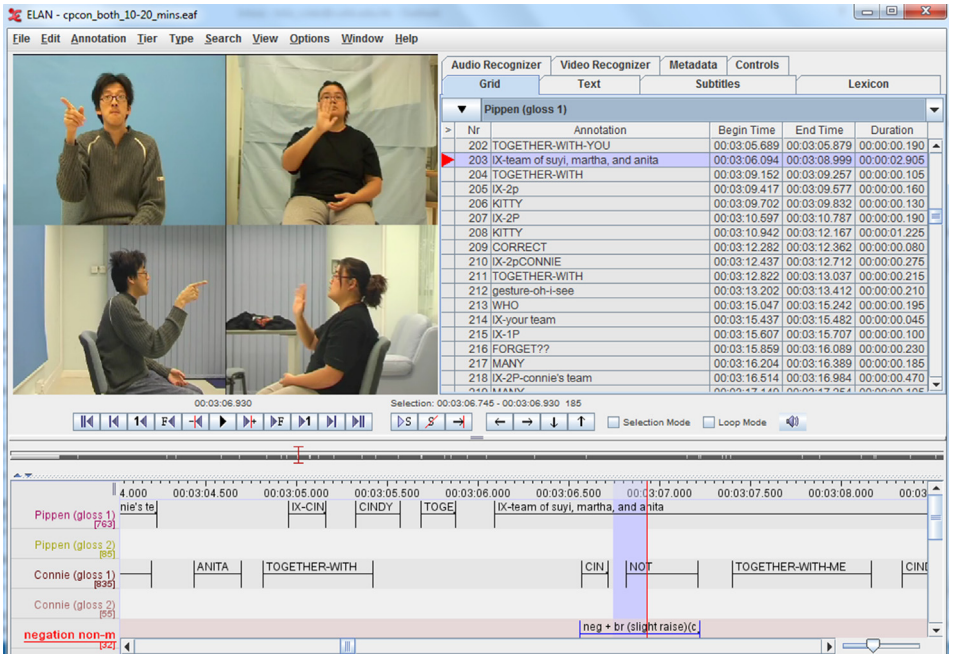


Fig. 4. Snapshot of HKSL data in ELAN.

Table 3
Eyebrow movements co-occurring with polar questions in Cantonese and HKSL.

	Cantonese data N = 170	HKSL data N = 91
Eyebrow raising	39 (22.9%)	76 (83.5%)
Eyebrow lowering	3 (1.8%)	15 (16.5%)
No eyebrow movements	128 (75.3%)	0

The two languages showed a significant difference. Fisher Exact Test, $p < 0.01$, $p = 1.2053078063409935e\text{-}38$.

Our suggestions above are entirely based on what have been reported in the literature. However, nearly all of the studies reviewed above concern Western spoken and signed languages, and very few of them are based on discourse data/corpus data. An empirical study is needed to find out whether and how the two non-manual gestures in Cantonese are incorporated into HKSL to serve as grammatical markers.[4] In what follows, we will report on our study on Cantonese and HKSL conversation data. We have the following research questions in mind:

(a) How often are polar questions marked by eyebrow raise in Cantonese? How often is eyebrow raise used for other functions in Cantonese?
(b) Has eyebrow raise been grammaticalized to become a non-manual marker of polar questions in HKSL? If yes, is the grammaticalization likely to involve a language-internal process or cross-modal borrowing?
(c) How often are negations marked by headshakes in Cantonese? How often are headshakes used for other functions in Cantonese?
(d) Have headshakes been grammaticalized to become a non-manual marker for negation in HKSL? If yes, is the grammaticalization likely to involve a language-internal process or cross-modal borrowing?

[4] Cantonese is a variety of Chinese widely spoken by the majority of hearing people in Hong Kong. Hong Kong Sign Language (HKSL) is the natural sign language used by the Hong Kong deaf community.

Table 4
Head movements co-occurring with polar questions in Cantonese and HKSL.

	Cantonese data N = 170	HKSL data N = 91
Forward head tilt	5 (2.9%)	49 (53.8%)
Forward head thrust	10 (5.9%)	7 (7.7%)
Head + body leaning forward	22 (12.9%)	15 (16.5%)
No specific head movements	133 (78.2%)	20 (22%)

The two languages showed a significant difference. $X^2(3, N = 261) = 107.0596$, $p < 0.00001$.

Table 5
Possible Functions of non-polar-question eyebrow raise in Cantonese conversation.

Possible functions	Counts (%)	
Emphasis/highlighting • accompanied with a variety of potential 'emphasis/highlighting' markers	346	(71.3%)
Facial expressions associated with a particular emotion • e.g., surprised, excited, exclamatory, amazed, curious, angry, happy (with laughing)	50	(10.3%)
Focus • existential focus (i.e., introducing a new referent) • Information focus (i.e. answer to a wh question) • Contrastive focus (i.e., explicitly contrasting two entities/concepts) • Specific focusing structure: e.g., right dislocation, cleft sentences • Provision of additional information in the form of an epenthetic clause/phrase	51	(10.5%)
Expressing agreement/confirmation/answering 'yes' to a polar question	15	(3.1%)
Recalling information/hesitation/word search	7	(1.4%)
If-conditional clause	5	(1.0%)
Self-correction	2	(0.4%)
Function unclear	9	(1.9%)
Total:	**485**	

3. METHODOLOGY OF THE STUDY ON CANTONESE AND HKSL CONVERSATION DATA

3.1. Data sources

Our Cantonese conversation data (around 300 minutes in total) came from nine episodes of the talk show 'aTV 100 Celebrities' released in 2012 and two episodes of the Radio Television Hong Kong program called 'On Air at Broadcast Drive', which started in August 2018. In each episode of 'aTV 100 Celebrities', the host, a well-known male celebrity who has been active in the entertainment industry over the past four decades, invited another celebrity whom he knew well to the show, and they chatted freely in a relaxing environment. Each episode lasted for about 22–25 minutes. Nine episodes (approximately 200 minutes in total) were picked at random, with five female and four male celebrities being the guests in the shows. The host of 'On Air at Broadcast Drive' is famous for her experience as a disc jockey, singer, and actress. For each episode, she invited one or two of her former colleagues or close friends to share their experience in the radio broadcast industry, and the conversations lasted for about 50 minutes. Two episodes, each featuring one male guest speaker, were chosen for analysis (approximately 100 minutes in total).[5] In total, there were six female and seven male native speakers of Cantonese. All of the conversations were non-scripted. All episodes were subtitled in written Chinese and were downloaded from YouTube.[6] Table 1 presents the information for each of these episodes. Fig. 1 shows snapshots of these episodes.

The HKSL conversation data (about 190 minutes) came from three female and three male native deaf signers aged between 22 and 37 at the time of shooting. They were all born to deaf families and acquired HKSL as their first language since infancy. They grew up in the same deaf school and have known each other for years. These signers can be con-

[5] By mid-October 2018, eight episodes were released. These episodes had either one or two guest speakers. Two episodes with a single guest were chosen because they contained more close-up views of the host and the guest.

[6] Written Chinese is based on Mandarin, the official language in China. There are some discrepancies between the Cantonese sentences and the subtitles. Our analysis was based on the Cantonese speech content.

sidered the first generation of native HKSL users as their deaf parents were among the early cohorts of students studying in deaf schools in the 1950s and 1960s.[7] The signers were paired up and asked to converse freely without any topic restrictions for about an hour. Table 2 shows the background information of these six signers.

For each pair, two cameras were placed between the two signers, each capturing one person's front view. Two additional cameras were placed next to the signers to capture a side view of their head and torso movements. The four video clips were digitally synchronized. Fig. 2 shows snapshots of these three pairs of conversations.

3.2. Data coding

For the Cantonese and HKSL conversation data, we used the ELAN software (a software specifically designed for processing multi-modal data) for coding the non-manuals (i.e., eyebrow movements, head movements) and sentence types (i.e., polar questions, negative sentences, other contexts). For negation, we focused on the Cantonese negators *m4* 'not'(唔) and *mou5* 'not have'(無) and the corresponding manual negators NOT and NOT-HAVE in HKSL.[8,9]

In the Cantonese talk shows, the shooting of the conversation alternated between close-ups and distant shots. In most cases, when a person spoke, the front view of his/her face was captured by the camera, with a few exceptions (i.e., only the listener's face but not the speaker's was captured). Negations and yes–no questions without a direct view of the speakers' faces were not included in the analysis.

Figs. 3 and 4 are the snapshots of the ELAN coding of the Cantonese and HKSL data:

The notation conventions for the Cantonese and HKSL examples in this paper can be found at the end of this paper.

4. FINDINGS

4.1. Polar questions in Cantonese and HKSL: Eyebrow movements and head movements

In our data, 170 polar questions in Cantonese and 91 polar questions in HKSL were found. Tables 3 and 4 show the occurrence of eyebrow and head movements associated with polar questions in Cantonese and HKSL, respectively:

Tables 3 and 4 show that eyebrow raise (22.9%), forward leaning of head plus body (12.9%) and forward head tilt/thrust (8.8%) may co-occur with polar questions in Cantonese, but they were infrequent.[10]

Example (15).

					head lean forward body lean forward eyebrow raise
paak3	zo2	gei2do1	bou6	din6jing2	aa3
shoot	aspect-	how-many	CL	movie	sentence-final-particle

'How many movies were produced?' (Set 8)

[7] Between 1948 and the early 1960s, several schools were established in Hong Kong (Sze et al., 2013). Some of these schools adopted the signing variety from Nanjing/Shanghai as the medium of instruction. In contrast, the others were strictly oralist though the students created their own signs, which were used extensively outside the classrooms and in dormitories. These signing varieties gradually mingled in the deaf community and evolved into the current form of HKSL (Sze et al., 2013).

[8] In both data sets, polar questions and negations in embedded clauses, direct quotes, or marked by role shift were excluded from the analysis because the use of facial expressions and head movements may be different from the non-embedded/quoted counterparts. Moreover, the negators found in polar questions and wh-questions were excluded as the two interrogatives may confound the non-manuals of negation.

[9] NOT in HKSL is sometimes accompanied by the mouthing of the Cantonese negators *m4* or *m4hai6*, and its meaning is also fairly close to the latter two negative forms in Cantonese. NOT-HAVE in HKSL is sometimes accompanied by the mouthing of the Cantonese negator *mou5* and occurs in more or less similar semantic and pragmatic environments. For the details of these two negators' semantics and syntactic properties in HKSL, see Lee (2006) and Tang (2006).

[10] In a head thrust, the head is pushed forward without a substantial change in the orientation of the face (Puupponen et al., 2015). It is produced with the neck muscles moving the lower jaw or chin forward (Wilbur, 2000).



In Example (15), the polar question was marked with eyebrow raise, forward leaning of the head and upper body. The three non-manuals scoped over the entire question.

As for forward head thrust, a closer look at the data reveals that it was typically found when the Cantonese speakers wanted to express emphasis or surprise. In Example (16), a female celebrity mentioned that her father (who was also a famous actor when he was young) was not happy that her employer did not give her sufficient performance opportunities. The male host was surprised about this, and he asked a polar question with eyebrow raise and forward head thrust. The intonation in this question was more emphatic than a usual question. The eyebrow raise and head thrust appeared to bear the function of adding emphasis to the question.

Example (16).

						forward head thrust eyebrow raise
nei5	aa3baa4	jau5	gam2	waa6	gwo3	me1
you	father	have	like-this	say	finish	sentence-final particle

'Did your father really say that?'(Set 2)



In contrast, all polar questions in HKSL were accompanied by eyebrow movements and head movements, which were significantly more frequent than those in Cantonese. Among the 91 polar questions, 76 (83.5%) were marked with eyebrow raise (Example 17) and 15 (16.5%) with eyebrow lowering. From our preliminary observation, eyebrow lowering usually occurred when the signers felt suspicious of the content being questioned (Example 18). This observation corroborates the general findings in the studies of gesture, which suggested that eyebrow lowering is a sensitive indicator of disagreement, doubt, or uncertainty (Givens, 2002, Ricci Bitti et al., 2014).

As for head movements, 49 questions (53.8%) were marked with a forward head tilt, 7 (7.7%) with a forward head thrust, 15 (16.5%) with a forward head and body lean, and 20 (22%) without any noticeable head movements. Forward head thrusts mainly occurred when signers were puzzled/surprised (Example 19). Hence, it is apparent that eyebrow

Table 6
Possible Functions of non-polar-question eyebrow raise in HKSL conversation.

	Possible functions	Count (%)	
Functions similar to those in Cantonese	Emphasis/highlighting • Degree-modifying function • Contextual evidence	187	(38.0%)
	Facial expressions associated with a particular emotione.g., surprised, amazed, upset, disgusted, happy, puzzled	37	(7.5%)
	Focus# Existential focus (i.e., introducing a new referent)Information focus (i.e., answer to a wh-question)Contrastive focus (i.e., explicitly comparing two entities/concepts)Specific focusing structures: e.g., wh-cleft constructionProvision of additional information in the form of an epenthetic clause/phrase	83	(16.9%)
	Expressing agreement/confirmation/answering 'yes' to a polar question	8	(1.6%)
	Recalling information/hesitation/word search	3	(0.6%)
	*if-conditional clause	16	(3.3%)
Functions unique to HKSL	#Constituents preceding negator (possibly a negation scope marking device)	47	(9.6%)
	*Relative clause	3	(0.6%)
	#Topic (scene-setting)	88	(17.9%)
	#Wh-questions	11	(2.2%)
	Functions unclear	9	(1.8%)
	Total:	492	(100%)

Note: '*' indicates that eyebrow raise is an obligatory marker of the concerned linguistic structure in HKSL; '#' indicates that eyebrow raise is an optional marker but occurs frequently with the concerned linguistic structure.

movement, either raising or lowering, is an obligatory non-manual marker of polar questions in HKSL. Head movements were frequently used as well, though they were optional. This finding corroborates Tang's analysis of interrogation in HKSL (Tang, 2006).

Example (17).

				forward head tilt eyebrow raise
IX [=you]	KNOW	MATTER	KNOW	IX [=you]

'Do you know about this matter?' (Set 1)



(before question)	IX[=you]	KNOW	MATTER	KNOW	IX[=you]

Example (18).

forwardheadthrust
eyebrow lowering
DRUG-TAKING SMELL HAVE?
'Does drug-taking have any smell?' (Set 2)



(before question) DRUG-TAKING SMELL HAVE

Example (19).

forward head thrust
eyebrow raise
DIVORCE
'(They) have divorced?' (Set 1)



(before question) DIVORCE

Table 7
Headshakes co-occurring with *m4* and *mou5* in the Cantonese conversations.

	m4 'not' n = 422	*mou5* 'not have' n = 125
No head movements observed	**189 (44.8%)**	**50 (40%)**
Headshakes (3 sub-categories)	**233 (55.2%)**	**75 (60%)**
Side-to-side headshakes	*(193)*	*(57)*
One-off sideward movement	*(24)*	*(13)*
Others	*(16)*	*(5)*

In sum, eyebrow raise, eyebrow lowering, and head movements (forward tilt or thrust) are not common in polar questions in Cantonese, but they have been grammaticalized to become markers of polar questions in HKSL.[11] Eyebrow movements have become obligatory grammatical markers, while head movements remain optional. Although forward head thrusts are not as frequent as eyebrow raises in HKSL, they occur in the same Cantonese questioning environment (i.e., in contexts where speakers feel puzzled or surprised).

4.2. Eyebrow raise in non-polar-question contexts in Cantonese and HKSL

An even more intriguing observation was that many more instances of eyebrow raise were found in contexts outside of polar questions in Cantonese. Altogether we found 485 instances of non-polar-question eyebrow raise. Table 5 below shows their possible functions:

[11] Although forward head movements are optional for polar questions in HKSL, we would still like to propose that they have been grammaticalized to be one of the polar question markers. Non-manual markers reported in the sign language literature are either obligatory or optional. For instance, the raising of eyebrows for polar questions and conditional clauses is typically obligatory, while headshakes for negation and eyebrow raise for topic constructions are optional. Hence, non-manual gestures, when grammaticalized in sign languages, are not necessarily obligatory. However, to confirm whether our conjecture is correct or not requires further extensive, cross-linguistic comparisons.

In line with what has been reported in the literature, most cases of non-polar-question eyebrow raise were likely to serve an emphatic/highlighting function (346 instances, 71.3%).[12] These instances of eyebrow raise were accompanied with at least one of the following linguistic or gestural markers, which provided evidence of the emphatic/highlighting functions of eyebrow raising (the number of occurrences are indicated in parentheses):[13]

- Manual gestures (233): beats (138), iconic gestures (43), deictic pointing (34), holding arms/palms up (4), listing buoys (4), hand(s) reaching out to the listener (4), metaphoric gestures (3), hands clapping (3), fist closing (2), finger wiggling (1)[14]
- Stressing of words: vowel lengthening (30)[15] or produced more loudly (8)
- Adverbials that serve a degree-modifying/intensifying function: *hou2* 'very' (50); *dou1* 'so'/'even', universal quantification (22); *zan1* 'really' (8); *zeoi3* 'most' (3); *gam3* 'so' (2); *taai3* 'excessively' (2)[16]
- Words that tend to carry an emphatic meaning (26) (e.g., *dat6bit6* 'especially', *jyun4loi4* 'no wonder', *koeng4* 'strong', *jing6zan1* 'serious (in attitude)', *zing3ming4* 'prove', *jat1ding6* 'certainly', *gan2jiu3* 'important', *gin1ding6* 'determined')
- Gaze shifting back to the listeners (92)[17]
- Some form of obvious head movements (69): head nods (42), forward head movements (tilt/thrust/lean)(17), sideward/downward/backward tilts (10)

Apart from emphasis/highlighting, non-polar-question eyebrow raise could be part of the facial expressions related to emotions such as being surprised, amazed, excited, etc. Some of the instances co-occurred with if-conditional clauses, or focus-marking structures, e.g., existential constructions that introduced a new referent, answer to a question, the focused constituent in a cleft sentence, the fronted constituent in a 'right dislocation' (cf. Cheung, 1997), an epenthetic clause/phrase.[18] Some co-occurred with sentences that explicitly contrasted two different entities/concepts. A few instances were used by the speakers when expressing agreement or answering 'yes' to a polar question. Occasionally, the speakers raised their eyebrows when trying to recall information or correct their own speech errors.

Examples (20), (21), and (22) illustrate how eyebrow raise was used in different non-polar-question contexts in Cantonese. In Example (20), eyebrow raise was likely to perform an emphatic function, as the speaker was telling the host that a tour to the South Pole could be costly. Her eyebrow raise co-occurred with a gaze shift back to the host. In Example (21), the speaker mentioned his sworn mother, Miss Fei Fei, for the first time and then continued to talk about her for several more utterances. An eyebrow raise was used to mark the noun phrase that introduced this new referent. A co-occurring gaze shift to the host and a deictic pointing to the assumed, conceptual location of the referent were observed. In Example (22), the speaker compared the population size of Hong Kong and overseas countries. He raised his eye-

[12] Although 'emphasis' constituted the largest category in our findings, we actually singled out the categories other than 'emphasis' first as they could be identified more consistently. After that, we analyzed the remaining 300+ instances to see if there was any other potential linguistic/gestural marker that could prove that these instances of eyebrow raising were associated with emphasis. There were nine cases that did not fall into any categories (i.e., Function unclear). They could be marking emphasis, too, but we did not have any secondary evidence to prove it.

[13] These linguistic and gestural markers also occurred in other contexts, e.g., when showing a surprised facial expression, a speaker may use a beat gesture plus a degree-modifying adverb.

[14] Beats, also known as hand batons, are synchronized with speech rhythm and used for marking emphatic speech units (McNeill, 1992). According to Streeck and Knapp (1992), an iconic gesture typically foreshadows the speech unit to which it is associated. Together with an accompanying gaze shift to the listener, an iconic gesture alerts the listener to attend to the visual aspect of the speech unit. Cienki (2017:83) suggests that while iconic gestures highlight the visual aspect of the referents, deictic pointings emphasize their locations. Chui (2011) argues that metaphoric gestures can provide salient, additional information about an aspect the speaker focuses on in his/her conceptualization. Hence, in this study, we regard beats, deictic pointings, iconic and metaphoric gestures, and other consciously-made manual gestures (e.g., reaching out one's hands to the listener) as potential markers for emphasizing/highlighting.

[15] Cantonese is a syllable-timed language in which each syllable lasts for more or less the same amount of time under usual circumstances. A word can be stressed by one of the three linguistic means: (i) higher pitch; (ii) more loudly and (iii) vowel lengthening (Li and Luk, 2017:37). Due to the time constraint and quality of the internet data, we did not attempt to check the pitch patterns of the sentences marked with eyebrow raising.

[16] One of the functions of 'dou1′ in Cantonese is universal quantification (Lee, 2003). It can also mean 'even' or 'so'.

[17] Following Streeck and Knapp (1992), we assume that gaze shift to the addressee during a conversation serves as a 'pointer' to alert the listener to pay attention to the content of a certain speech unit.

[18] According to Cheung (1997), a 'right dislocation' construction in Cantonese such as 'duk6gan2syu1 aa3 keoi5′ (read aspect-marker book sentence-final-particle, he, 'Reading a book, he (is)') involves the fronting of all the constituents before the subject 'he', thus serving a focusing function.

brows and tilted his head forward and then backward when saying the word *siu2* 'small'. Note also that deictic pointing gestures were used to indicate the assumed conceptual locations for the two places.

Example (20).

				eyebrow raise
naam4gik6	hou2	gwai2	gaa3	gam1sang1
South Pole	very	expensive	sentence-final particle	Mr. Kam

'(Touring in) the South Pole is very expensive, Mr. Kam.' (Set 1)



Example (21).

		eyebrow raise	
ngo5	tong4	fei4fei2	kai3maa1
I	together-with	FeiFei	sworn-mother

'I, together with my sworn mother Miss Fei Fei. . .' (Set 6)



Table 8
Headshakes co-occurring with the negator NOT and NOT-HAVE in the HKSL conversations.

	NOT (n = 139)	NOT-HAVE (n = 107)
No headshakes	**127 (91.4%)**	**101 (94.4%)**
Headshakes (2 sub-categories)	**12 (8.6%)**	**6 (5.6%)**
Slight/barely noticeable headshakes	*(10)*	*(5)*
Obvious headshakes	*(2)*	*(1)*

Example (22).

									eyebrow raise
Hoeng1gong2	jan4hau2	gam3	do1,	nei5	heoi3dou3	ngoi6dei6,	jan4hau2	gam3	siu2
Hong Kong	population	so	many,	you	go-to	overseas	population	so	small

'The population is so large in Hong Kong. When you go to overseas places, the population is so small.'



(Set 10)

Similar to Cantonese, eyebrow raise was found in a variety of contexts/linguistic structures other than polar questions in HKSL. Altogether, 492 instances were observed in our HKSL data (compared with 76 polar questions marked with eyebrow raise out of 91). Table 6 below shows the possible functions of these instances of eyebrow raise. They are grouped into two types—functions similar to those in Cantonese, and functions unique to HKSL—to facilitate our comparison of the two languages.

Among the 492 instances of eyebrow raise, 187 instances were likely to have an emphatic/highlighting function: 86 of them intensified the degree of the co-occurring adjectives or modals (Example 23), and the remaining were judged to mark emphasis according to the context (Example 24). In Example (23), the eyebrow raise has a degree-modifying function, indicating that the kitten was very tiny and cute. In Example (24), the signer complained that she needed to work alone, and the boss asked her to do all the tasks. Given this context, we interpreted the eyebrow raise as bearing an emphatic function.

Example (23).

			eyebrow raise
CL[=bring back]	TINY	BABY-LIKE	LOVELY

'(We) brought the kitten back (home). It was very tiny, just like a baby, and very lovely.' (Set 3)



Table 9
Headshakes co-occurring with stand-alone negators and negators in declarative clauses in HKSL.

	With headshakes	No headshakes	Total
NOT-HAVE (stand-alone)	2	5	7
NOT-HAVE (with other signs in a declarative clause)	4	96	100
NOT (stand-alone)	7	27	34
NOT (with other signs in a declarative clause)	5	100	105

Example (24).

		widened eyes eyebrowraise
ALONE	IX[=me]	ALL-WORKS-ON-MY-SHOULDERS

'I (work) alone. (The boss) gave all the works to me.' (Set 2)



(before) ALONE IX[=me] ALL-WORKS-ON-MY-SHOULDERS

Aside from the emphatic/highlighting functions, HKSL is similar to Cantonese in using eyebrow raise to mark certain emotions, several types of focus, if conditionals, and agreement/affirmative answers to polar questions. Nonetheless, eyebrow raise was also found in a few other linguistic structures in HKSL which were not observed in Cantonese. These linguistic structures include: constituents preceding the clause-final negator/negative sign, relative clauses, scene-setting topics, and wh-questions. In HKSL, scene-setting topics (Sze, 2011) and relative clauses (Li, 2013) are marked by eyebrow raise. Negators, negative modals, or words that bear a negative meaning, are usually found at the end of a clause. Eyebrow raise is frequently used to mark the words that precede these negative signs, presumably serving a negative scope marking function. These negative signs include typical negators such as NOT, NOT-HAVE, NOT-YET, or words with a negative meaning like CANNOT, DON'T-KNOW, LACK-KNOWLEDGE, WON'T.

Example (25).

		<u>eyebrow raise</u>	
SEEM	HEAR	SEPARATE	NOT-YET

'Seems like, I heard (from others that)(they) have not separated yet.' (Set 1)



SEEM HEAR SEPARATE NOT-YET

In Example (25), eyebrow raise only accompanied SEPARATE, indicating that the negation scope of NOT-YET only covered SEPARATE and not the two preceding signs.

Furthermore, a subset of wh-questions was accompanied by eyebrow raise instead of lowering. In HKSL, non-manual markers for wh-questions are optional (Tang, 2006). In our current set of data, there were 57 wh-questions,

among which 17 did not have any accompanying brow movements, 29 were marked with eyebrow lowering, and 11 with eyebrow raising (Example 26).

Example (26).

		eyebrow raise
CAT	HOW	IX[=you]

'How is your cat?' (Set 3)



CAT HOW IX[=you]

In summary, although eyebrow raise was found in only a small percentage of polar questions in Cantonese, it has become an obligatory non-manual marker for polar questions in HKSL, except for a minority of cases where signers adopted eyebrow lowering instead to express doubt. In Cantonese, eyebrow raise was far more frequent in contexts other than polar questions and potentially bore a diverse range of functions.

4.3. Negation in Cantonese and HKSL: Headshakes

In the Cantonese data, we found 422 instances of the negator *m4* 'not' (406 in declarative sentences, 16 as stand-alone negative responses) and 125 instances of the negator *mou5* 'not-have' (119 in declarative sentences, six as stand-alone negative responses). In the HKSL data, there were 139 instances of NOT (105 in declarative sentences, 34 as stand-alone negative responses), and 107 instances of NOT-HAVE (100 in declarative sentences, 7 as stand-alone negative responses).[19] Table 7 shows the occurrence of headshakes with *m4* and *mou5* in the Cantonese conversations.

Among the instances of *m4* 'not', 55.2% were accompanied with headshakes, which could be further classified into three sub-types: (i) side to side headshakes which ranged from one cycle of movement to several repetitions (193 instances)(Example 27); (ii) a one-off sideways horizontal movement (24 instances)(Example 28); and (iii) other headshake-like head movements (16 instances) (e.g., a one-off side-to-side movement which is slightly diagonal (Example 29), movement of the head diagonally down to the left and returning to the original position (Example 30)).

[19] In general, the negator *m4* 'not' in Cantonese is far more productive than NOT in HKSL. For many commonly used expressions in Cantonese that involve *m4*, their equivalent expressions in HKSL do not use the negator NOT. For example, Cantonese speakers use *m4* when expressing meanings such as *m4hoi1sam1* 'not happy', *m4zi1* 'not know', *m4ho2ji3* 'not allow' and *m4wui5* 'will not'. However, the equivalent signs in HKSL are monomorphemic signs that do not involve a separate negator. This can possibly explain the relatively low occurrence of NOT in the HKSL conversation. Since the non-manual signals associated with NOT in our current data are the same as the findings of Lee (2006), which was based on a different set of conversation data with different signers, we are confident that our current data can reliably reflect the use of non-manual signals in negation in HKSL in general despite the lower frequency of occurrence.

Example (27).

slight side-to-side headshakes

ngo5	dou1	m4	zi1	aa3
I	focus particle	negator	know	sentence-final particle

'I don't really know.' (Set 6)



Example (28).

single sideward horizontal head movement

zik1hai6	ngo5ge3tyun5bou6	dou1	m4	hai6	hou2	daai6	gaa3zaa3
that-is	my-buttocks	focus particle	not	be	very	large	sentence final particle

'That is, my buttocks is not that large after all.' (Set 1)



Example (29).

One-off side-to-side diagonal head movement

keoi5dei6	ning4jyun2	m4	zou6
they	prefer	not	work

'They prefer not to accept the job.' (Set 2)



Example (30).

Head moves diagonally down to the left and returns

m4	nang4gau3	ling6dou3	gun1zung3	gam2dung6	dou3	keoi5	...
not	can	make	audience	touch	achieve	him/her	...

'(if an artist) cannot succeed in moving (the heart) of the audience...' (Set 7)



For the existential negator *mou5* 'not-have', 125 instances were observed, among which 60% were marked with headshakes (Example 31).

Example (31).

slight headshakes — slight headshakes

mou5	gaa3,	mou5	fan3lin6baan1	soeng5	gaa3
not-have	SFP	not-have	training-course	attend	SFP

(The host asked the speaker if there was any training course provided.) 'No, there was no training course for us to attend'. (Set 8)



As shown in Table 8, HKSL is strikingly different from Cantonese in using headshakes for marking negations. Out of 139 instances of NOT and 107 instances of NOT-HAVE, only 12 and 6 instances (8.6% and 5.6%) of headshakes were observed, respectively. A comparison of NOT in HKSL and *m4* in Cantonese ($\chi^2(1, N = 561) = 92.2230$, $p < .00001$) and a comparison of NOT-HAVE in HKSL and *mou5* in Cantonese ($\chi^2(1, N = 232) = 75.0582$, $p < .00001$) reveal that the two languages were significantly different in using headshakes in negative contexts.

Another noteworthy difference between HKSL and Cantonese concerns the form and amplitude of headshakes. In Cantonese, the headshakes associated with negators typically involve noticeable lateral/diagonal head movements, as our previous examples have shown. In HKSL, however, all except 3 of the headshakes involved relatively minimal side-to-side movements. In Example (32), the sentence-final NOT was accompanied by a slight headshake. Its movement amplitude was a lot smaller than those observed in Cantonese. In fact, most of these headshakes were barely noticeable, to the extent that we had to rely on the movement of the signer's hair to confirm if there was a headshake.

Example (32).

			slight headshakes
IX[=me]	DRIPPY-NOSE	THEN-THROAT	NOT

'It was not the case that I had drippy nose first and then started to have a sore throat'. (Set 1)



IX[=me] DRIPPY-NOSE THEN-THROAT NOT

One of the 'obvious' headshakes is observed on the second NOT-HAVE in Example (33). What makes this example interesting is that the signer signed the clause with NOT-HAVE twice, and only the second NOT-HAVE, which preceded an utterance boundary, was marked with a headshake.

Table 10
Co-occurrence of head movements with negators in HKSL.

	NOT n = 139	NOT-HAVE n = 107
No head movement	**63 (45.3%)**	**67 (62.6%)**
Backward head tilt	**50 (36.0%)**	**24 (22.4%)**
Backward lean of head and upper body	**15 (10.8%)**	**13 (12.1%)**
Other head movements	**11 (7.9%)**	**3 (2.8%)**
Face turning aside	*5*	*1*
Forward head tilt	*4*	*2*
Sideward head tilt	*2*	*0*

Table 11
Non-manual markings in polar questions and negations in the Cantonese and HKSL conversation data.

	Cantonese	Hong Kong Sign Language
Eyebrow raise	• Only appeared in 22.9% of the polar questions (39 tokens out of 170). • Frequently appeared in other linguistic contexts with a variety of functions (485 tokens).	• Appeared in 83.5% of the polar questions (76 tokens out of 91) • Eyebrow lowering marked the remaining 16.5% (15 tokens) of the polar questions. • Eyebrow raise was frequently utilized in other linguistic contexts (492 tokens). Some of these contexts overlap with those in the Cantonese data. Some of these are unique to HKSL, e.g., scope of negation, relative clauses and scene-setting topics.
Headshakes	• Appeared in 55.2% of the negator *m4* 'not' (233 tokens out of 422) and 60% of *mou5* 'not have' (75 tokens out of 125). • Sometimes appeared in other linguistic contexts (55 tokens).	• Appeared in 8.6% of the negator NOT (12 tokens out of 139) and 5.6% of the negator NOT-HAVE (out of 107). • Headshakes were more likely to co-occur with negators that were followed by an intonational or utterance boundary. • A small number of headshakes without overt negators (14 instances) were found. They were either related to subjective feelings or signs with a negative meaning. • Backward head movements marked 46.8% of NOT (55 tokens out of 139), and 34.5% of NOT-HAVE (37 tokens out of 107).

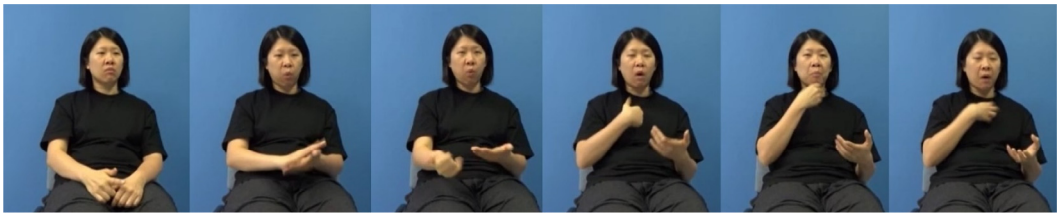
Example (33).

IX [=cat] CLEAN IX[=me] TRY IX[=me] CL[=hold & smell] STINK NOT-HAVE

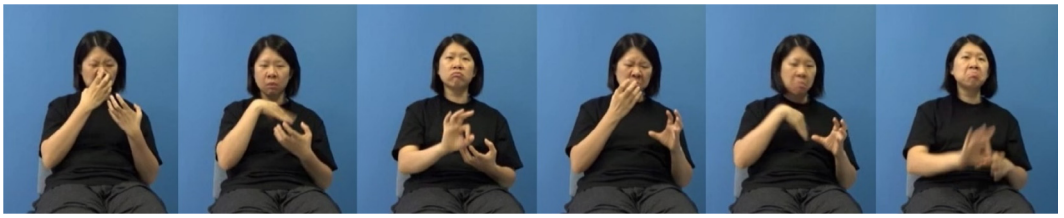
slight headshakes

CL[=hold & smell] STINK NOT-HAVE

'That cat was clean. I tried picking it up and smelled it. It was not smelly. I picked it up and smelled it. It was not smelly.' (Set 3)



IX [=cat] CLEAN IX[=me] TRY IX[=me]



CL[=hold & smell] STINK NOT-HAVE CL[=hold & smell] STINK NOT-HAVE

To find out if the presence of a prosodic boundary is related to the occurrence of headshakes in negation, we separated the HKSL negators that stood alone (i.e., were followed by an intonational/utterance phrase boundary) from those that occurred in combination with other signs in declarative sentences. The result is shown in Table 9.

A Chi-square test was performed individually on the NOT-HAVE data and the NOT data. Both results indicate that when a negator stands alone as an intonational phrase, there is a significantly higher chance for headshakes to occur (NOT-HAVE, (χ^2(1, N = 107) = 7.4623, p = .006301, p < .01)(NOT, (χ^2(1, N = 139) = 8.1556, p = .00429, p < .01).

In Example (34), the signer disagreed with the other signer by signing NOT and her explanation. The negator NOT formed its own intonational phrase and was accompanied by a large headshake, probably due to emphasis. In Example (35), the signer corrected herself by signing NOT with a headshake.[20]

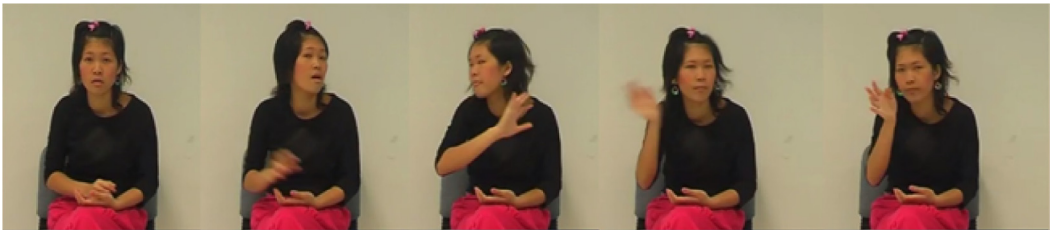
Example (34).

(Context: The other signer said their friends decided to get married because their parents asked them to.)

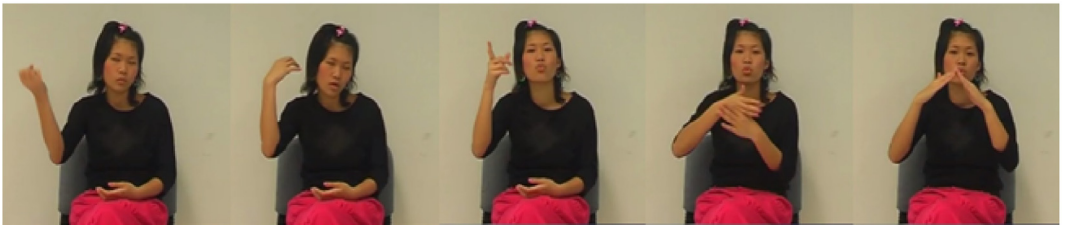
headshakes

NOT. TELL-ME IX[=friends] FOR-THE-SAKE-OF HOUSE

'No, she told me (they married) in order to apply for public housing.' (Set 1)



NO



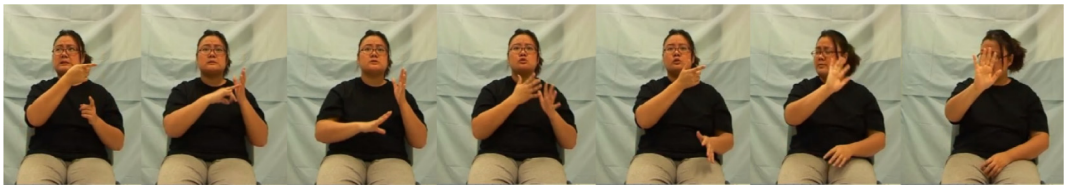
TELL-ME IX[=friends] FOR-THE-SAKE-OF HOUSE

Example (35).

headshakes

IX[=team] LIGHTENING TEAM IX[=team], NO. . .(followed by hesitation)

"It (the team) was called LIGHTENING. No no no. . .." (Set 2)



IX[=team] LIGHTENING TEAM IX[=team] NO...

[20] Apart from appearing in sentential negation, NOT can be used as an interjection as a negative response to a polar question. In this case, it is translated as 'No' in the English translation. Both types of NOT are given the same gloss because they share the same manual form.

An even more fascinating observation was that, within a single utterance, a signer might use a headshake without a manual negator and then follow that with a negator without a headshake (Example 36).

Example (36).

IN-FACT OTHER DOG IX[=all the other dogs] gesture [=headshake], IX [=friend] BUY NOT.

'In fact, as for all the other dogs, my friend did not buy them himself.' (Set 3)

(Context: The dogs of the signer's friend were either stray dogs or were given to him by other people)



IN-FACT OTHER DOG IX[=all the other dogs]



[headshake] IX [=friend] BUY NOT

Example (36) and our earlier examples suggest that HKSL signers *do* have headshakes in their gestural repertoire for negative meanings. However, they only use them occasionally, particularly when the negators form their own intonational phrases, rather than incorporating them consistently as a grammatical marker for negation. When headshakes co-occur with a negator in a sentence, they are drastically reduced in their amplitude and duration. The headshakes remain with the negators, and do not spread to other signs in the sentence.[21]

[21] Our findings of headshakes in negation in HKSL partially corroborate Tang (2006), who states that headshakes may co-occur with a sentence-final negator but do not spread to the other preceding signs in a sentence in HKSL. Tang's analysis was based on direct elicitation and judgment. Our data confirmed that headshakes could co-occur with negators in HKSL, but they are highly infrequent and should not be analyzed as a grammatical marker of negation.

4.4. Headshakes in non-negation contexts in Cantonese and HKSL

As pointed out in the literature review, headshakes may be used in sentences without overt negators in spoken languages. We found similar phenomena in our Cantonese and HKSL conversations. In the Cantonese data, 55 instances of headshakes without the negator *m4* 'not' and *mou5* 'not-have' were observed. Preliminary analysis suggested that they served the function of emphasis/intensification, as all except two instances co-occurred with linguistic or gestural markers associated with emphasis/intensification. The linguistic markers included:

- degree-modifying adverbs (32) (e.g., *hou2* 'very much', *soeng1dong1* 'considerably', *taai3* 'excessively', *bat1dak1liu5* 'terribly/incredibly', *gang3gaa1* 'even more', *dou1* 'even'/'so'/universal quantification)
- adverbs that stress the truth of the proposition (16) (e.g., *zan1* 'really', *sat6zoi6* 'actually', *kei4sat6* 'in fact'
- Stressing of words: vowel lengthening (6)
- Adverbs that tend to carry an emphatic meaning (3)(e.g., *jat1ding6hai6* 'certainly', *wing5jyun5* 'forever', *dat6jin4zi1gaan1* 'all of a sudden')

The gestural markers include a forward leaning of head/body (13), co-occurring manual gestures (7), co-occurring eyebrow raise (2), and sighing (1). Our findings are in line with what has been reported in the literature on the use of headshakes in non-negation contexts. Two Cantonese examples are provided below as illustrations.

In Example (37), the speaker said he did not want to be a movie director because it was too harsh, and he had seen many directors falling ill, especially at the final stage of production. When he said this, a headshake was used, which appeared to reflect his reluctance to accept this kind of hectic life:

Example (37).

						headshakes
go3go3	ngo5	tai2gin3	keoi5	dou1	beng6	ge3
everyone	I	see	they	focus particle	sick	sentence final particle

'Every director I met, they got sick.' (Set 6)



In Example (38), the speaker shared how she reflected on herself in times of adversity, and she used headshakes to emphasize her intense emotion:

Example (38).

		headshakes		
ngo5	zan1hai6	wui	si4si4hak1hak1	nam2haa5
I	really	would	all-the-time	reflect

'I would really reflect on myself all the time.' (Set 2)



In the HKSL data, only fourteen instances of headshakes without the negator NOT or NOT-HAVE were observed. Among them, nine instances represented the signers' subjective feelings (e.g., amazement, disapproval, helplessness) without any accompanying manual signs. These headshakes appeared to serve an intensifying function for these emotions. The five remaining instances of headshakes co-occurred with a manual sign: four with DIFFERENT(not the case), and one with CANNOT (See Example (39)). What these signs had in common was that they carried a negative meaning.[22] These five signs either stood alone, or occurred with a pronominal subject, rendering the whole sentence relatively short in duration.

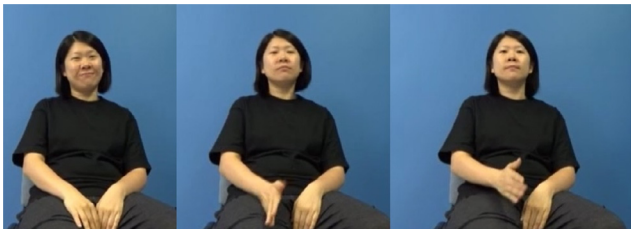
Example (39).

headshakes

DIFFERENT (not the case)

'No, it's not the case.' (Set 3)

(Context: the other signer was asking, 'It was not the case that the cat owner set up a company.'



DIFFERENT

4.5. Backward head/body movements in negation in HKSL

If headshakes are not grammaticalized to become negation markers in HKSL, what non-manual markers are used instead? It turns out that HKSL signers use backward movements of their heads and upper body as an optional marker for negation.

[22] In HKSL, the sign DIFFERENT can occasionally appear clause-finally to mean 'not the case'. Under this circumstance, the sign functions more like a negator than an adjective. In Example (39), the other signer actually asked a question 'It was not the case that he (the cat owner) set up a company, right?' (IX[=cat owner] SET-UP COMPANY DIFFERENT (not the case)?). The signer replied by repeating the sign DIFFERENT (not the case), with headshakes. However, since this kind of use is infrequent, and we have not yet done empirical research on the exact nature of this negator-like function of DIFFERENT, we decided not to treat it as a regular negator for the time being. Furthermore, in Cantonese, 'different' is *m4tung4*, which means 'not same', while 'cannot' is *m4ho2ji3*, which is 'not allow'. Both Cantonese expressions involve the negator *m4*. In HKSL, DIFFERENT and CANNOT can be accompanied with either mouth gesture or mouthing. In the latter case, the mouthing will always be '*m4tung4*' and '*m4ho2ji3*' respectively. Hence we may argue that in the eyes of signers who have some Chinese knowledge, both DIFFERENT and CANNOT would carry some negative meaning.

As shown in Table 10, among 139 instances of NOT, 65 (46.8%) were marked with backward head movements – either the head and the upper body leaned backward together (15 instances, 10.8%), or just the head tilted backward (50 instances, 36%). As for NOT-HAVE, 34.5% of the examples were accompanied by a backward head movement. This frequent use of backward head movements corroborates Lee's findings (2006) that backward head movements are an optional non-manual marker of negation in HKSL. Below are two examples from HKSL:

Example (40).

Backward head tilt

IX[=that] COMPUTER OPERATE SLOW NOT

'That computer is not slow.' (Set 2)



IX[=that] OPERATE SLOW NOT

Example (41).

backward head movement

IX[=I] FLY-TO U.S.A. START STUDY START COMPUTER DESIGN NOT

'I did not start studying computer design right away when I flew to the States.' (Set 2)



IX[=I] FLY-TO U.S.A. START STUDY



START COMPUTER DESIGN NOT

5. DISCUSSION AND CONCLUSION

In this paper, we first reviewed the proposals of the grammaticalization of eyebrow raise in polar questions and headshakes in negation in sign languages in light of Wilcox's theory on gesture grammaticalization. We have argued that eyebrow raise in polar questions is likely to have arisen via a language-internal evolutionary path similar to manner of movements because eyebrow raise is considered a universal facial gesture for questioning by previous scholars. We have further argued that headshakes for negation in sign languages are likely the result of cross-modal borrowing

since headshakes are culture-specific rather than universal. To verify our claims, we have conducted a detailed analysis of eyebrow raise and headshakes in Cantonese and HKSL conversations. Table 11 below summarizes our findings:

Based on our findings, as well as the four hypotheses we made in Section 2.3 about the grammaticalization of non-manuals, we would like to propose the following:

First, in HKSL, eyebrow movements (mostly eyebrow raise and occasionally eyebrow lowering) and forward head movements (forward tilt or thrust) have been grammaticalized to become the non-manual markers of polar questions. However, the nearly obligatory use of eyebrow raise for polar questions in HKSL is unlikely to have been borrowed from Cantonese. In Cantonese, eyebrow raise is not that frequent in polar questions, but it is ubiquitous in other linguistic contexts. As such, eyebrow raise for polar questions in Cantonese is not a 'quotable' gesture in the sense of Wilcox (2004). Even though it has a specific form, it does not have a specific meaning, and its function cannot be easily recognized unless it is interpreted with reference to the speech content, which is not immediately accessible for deaf signers. In fact, as native speakers of Cantonese, we find it difficult to interpret the intended meaning of eyebrow raises when they do not co-occur with speech. Hence, the possibility of deaf people borrowing this facial gesture from Cantonese speakers through language contact seems unlikely.

If cross-modal borrowing is not a tenable explanation, how can we explain the fact that eyebrow raise has become a grammatical marker for polar questions in HKSL, and that it is also found in several overlapping non-polar-question contexts in both languages (e.g., focus, emphasis)? One logical possibility, we would like to argue, is that eyebrow raise is an innate facial expression for surprise, questioning and emphasis in the gestural repertoire of both hearing and deaf people. In HKSL, eyebrow raise, which was originally a paralinguistic gestural element, has been incorporated into the grammatical system via a language-internal path. This could also explain why HKSL uses eyebrow raise in several other linguistic structures (e.g., scene-setting topics, marking scope of negation, relative clauses) when no corresponding use exists in Cantonese. That is, it is because no cross-modal borrowing is involved at all.

Compared to eyebrow raise in polar questions, headshakes in negation in Cantonese are far more frequent and prominent. Although headshakes can be found in non-negative contexts in Cantonese, these headshakes are much less frequent (=55 instances) and are arguably related to the meaning of negation, following Kendon (2002). When headshakes are used alone without speech, both hearing and deaf people can easily recognize the negative meaning. Hence, negative headshakes used by Cantonese speakers are 'quotable' gestures in Wilcox's framework. Somewhat unexpectedly, they have not been systematically recruited and grammaticalized to become a nonmanual marker of negation in HKSL. This finding suggests two things. First, negative headshakes are not likely to be universal. Had they been universal markers for negative meaning, we would have expected HKSL signers to use them far more frequently in negation. This corroborates previous findings in the spoken language literature that negative headshakes are culture-specific. Second, the frequency of a gesture among hearing people does not necessarily determine the likelihood for its grammaticalization into sign languages.

Recall that HKSL signers shake their heads to convey negative meaning without a manual negator (Example 36) and occasionally use headshakes with negators, particularly when they are followed by an intonational or utterance boundary (Example 33). We would like to argue that these negative headshakes remain gestural in nature, and they may stem from language contact with Cantonese, as negative headshakes are abundant among Cantonese speakers.

Instead of using headshakes, deaf HKSL signers adopt backward head movements, particularly backward head tilts, as optional markers for negation. From where did this backward head movement originate? In the Cantonese data, we did not observe a single instance of backward head movement associated with the negators *m4* and *mou5*. However, according to Calbris (2011:224), backward torso movement is one of the gestures commonly adopted to express refusal and negation. Wilbur and Patschke (1998) pointed out that, pragmatically, backward body leans in ASL can indicate negation or denial of the truth of proposition. In fact, backward movements of one's head and body are natural responses to undesirable situations such as a foul smell or danger. Moving the head or body backward would increase one's physical distance from the entity/situation he/she wants to deny or reject. Hence, we would like to propose that this backward movement of the head/body, which began as a paralinguistic gestural element, has been incorporated and grammaticalized by HKSL signers to mark negation. It could be the case that in the course of this language-internal grammaticalization process, the backward head and body movements were distalised, moving from the trunk to neck, in a way similar to the distalization of sign movements commonly observed in sign language phonology.[23] This is our conjecture only, and this may be verified by comparing the signing from older signers (first generation of HKSL users, now in their 70 s) and the current data contributed by the second generation of HKSL signers. We will leave this for future research.

[23] This is somewhat similar to Jakobson's (1972) suggestion that head nodding is a 'visual representation of bowing before the demand, wish, suggestion or opinion of the other participant in the conversation' (1972:92).

We would like to argue that both eyebrow raise in polar questions and backward head movements in negation in HKSL can be considered examples of gesture grammaticalization along Route II in Wilcox's model. Both started as paralinguistic, gestural elements in signing communications and were later incorporated as intonational/prosodic units. Eventually, they became grammatical markers of the two linguistic structures. This language-internal grammaticalization account can be extended to other non-manual signals in sign languages, particularly those gestures that do not have a corresponding form among hearing people.

Having said that, we are not arguing against possible cross-modal borrowing of hearing people's non-manual gestures into sign language grammar. Given that negative headshakes are not universal, the grammatical use of negative headshakes in some sign languages is likely to have arisen through borrowing from the surrounding hearing communities. However, this grammaticalization path does not entirely fit Route I or Route II of Wilcox's theory. Regarding Route I in Wilcox's theory, the source gesture, which is quotable or potentially quotable, is first borrowed from the hearing community into a sign language as a lexical sign, and then it becomes a grammatical morpheme at a later stage. Although negative headshakes are quotable and are borrowed into sign languages, no lexical stage is involved in the grammaticalization path. This makes negative headshakes an unsuitable candidate for Route I. As for Route II, a non-conventional paralinguistic gestural element enters into the prosody/intonational system of a sign language via a language-internal path. However, negative headshakes are conventional and involve cross-modal borrowing. This makes them different from the other paralinguistic gestures subsumed under Route II.

Seen in this light, we would like to propose an additional route under Wilcox' s framework to account for the grammaticalization of negative headshakes in sign languages. This new route can account for other conventional non-manual gestures of hearing people that may have undergone cross-modal borrowing. The backward head tilt in negation in Turkish Sign Language (Gökgöz, 2011) was likely borrowed from the Turkish hearing community (Morris et al., 1979). Another possible candidate for this kind of cross-modal borrowing is the use of head nods in Japanese and Japanese Sign Language. Hearing Japanese speakers are known to frequently use head nods in their verbal communications, and preliminary comparisons of head nods between hearing Japanese speakers and JSL signers reveal some interesting similarities as well as differences (Shimotani, 2015). The repeated side-to-side head tilts used to express affirmation among hearing Sri Lankans have also been incorporated into Sri Lankan Sign Language.[24] All of these are interesting cross-modal borrowing phenomena that warrant further documentation and research.

The findings discussed in this paper offer some new insights into the grammaticalization of non-manual gestures in sign languages. First, sign languages differ in whether and how far they incorporate and grammaticalize non-manual gestures used by the surrounding hearing communities. Assuming our hypotheses about the cross-modal borrowing of negative headshakes are correct, some sign languages have borrowed negative headshakes, and turned them into grammatical markers for negation with language-specific rules that govern the scope of spreading (Zeshan, 2004, Pfau, 2015). These sign languages have incorporated the headshakes and used them frequently enough to trigger the process of grammaticalization. Some of these have even been found to allow the use of headshakes to negate a sentence without a manual negator. In contrast, we found only minimal evidence of incorporation of headshakes in HKSL. Undoubtedly, HKSL signers know that headshakes bear a negative meaning among Cantonese speakers in Hong Kong, as HKSL signers use headshakes to express negative meanings as well. However, these headshakes are sporadic, reduced in movement amplitude, and do not spread across sentences. This indicates that headshakes in HKSL remain gestural: they have not been fully incorporated into the linguistic system of HKSL, and no grammaticalization has taken place. Australian Sign Language (Auslan) appears to be mid-way between full grammaticalization and minimal incorporation of headshakes. According to Johnston (2018), Auslan signers produce headshakes with manual negators about half of the time, rarely use headshakes to negate a sentence without a manual negator, and do not show consistent patterns in the spreading of the headshakes. Hence, Johnston argues that the grammaticalization of headshakes has not occurred in Auslan. At this stage of research, it remains unknown what leads to this interesting variation across sign languages. That HKSL signers have developed their own non-manual marker for negation despite the prevalence of negative headshakes among Cantonese speakers is extremely intriguing, given that Hong Kong has the highest population density in the world and deaf people are surrounded by lots of hearing people in their daily lives. Large-scale empirical studies on different language pairs would be needed to fully understand the triggering mechanism involved in this kind of cross-modal borrowing and grammaticalization.

Janzen (1999, 2012) proposes that the polar-question eyebrow raise underwent further grammaticalization to become a marker of topic constructions in ASL. Under our proposed analysis, however, these successive stages of development may no longer be necessary. Since eyebrow raise is an innate facial expression, and hearing speakers are found to use eyebrow raise to mark topics [as shown in our Cantonese data and Chovil's previous study in English

[24] This is based on the author's own experience in working with the Sri Lankan Deaf community.

(Chovil, 1991/1992)], there exists a possibility that eyebrow raise is directly grammaticalized to become a topic marker in ASL and HKSL, without the grammaticalization of the polar-question eyebrow raise necessarily constituting a preceding stage in the process. Janzen's argument for an evolutionary link between the eyebrow raise in polar questions and topic constructions was based on Haiman's study (1978), which documented the morphological link between topics, interrogatives and conditionals across spoken languages. Interestingly, in ASL and HKSL, conditionals, topics and polar questions are all marked with eyebrow raise. In fact, Wilcox (2014b) argues that the eyebrow raise in these three constructions in ASL are all examples of Route II grammaticalization and they share the same gestural origin. That is, the 'surprise gesture' documented by Darwin (1872). Our Cantonese data provide preliminary evidence in support of Wilcox's proposal: a few tokens of topics and conditionals were indeed marked with eyebrow raise. Although our data points are too few to be conclusive, this possibility exists and warrants further empirical investigation.

6. SIGN LANGUAGE EXAMPLE

Link for sign language example videos: http://www.cslds.org/polar_questions_negations/.

7. NOTATION CONVENTION

Hong Kong Sign Language:

Following the notation conventions in the sign linguistics literature, the signs in HKSL in this paper are shown by English glosses in capital letters. If more than one English word are needed to translate the meaning of a sign, these English words will be connected by hyphens. In addition, the types of non-manual markers and their spreading scope are indicated by the descriptions and an extended line respectively above the sign glosses.

8. CANTONESE:

Cantonese words are represented by the Romanization system known as Jyutping. Cantonese is a tonal language with six lexical tones contrasted by pitch height and/or pitch shapes (See Wong and Chan (2018) for the description of the acoustic properties of Cantonese tones):

Tone 1: High level tone.
Tone 2: High rising tone.
Tone 3: Mid level tone.
Tone 4: Low falling tone.
Tone 5: Low rising tone.
Tone 6: Low level tone.

Each syllable in Cantonese is expressed by the Romanized alphabets plus a tone number.

The occurrence of a brow or head movement is indicated by a line above the Cantonese words. The extent of the line corresponds to the timing of these gestural features in relation to the words.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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References

Andonova, E., Taylor, H.A., 2012. Nodding in disagreement: a tale of two cultures. Cogn. Process. 13 (Supplementary 1), S79–S82. https://doi.org/10.1007/s10339-012-0472-x.

Armstrong, D.F., Wilcox, S., 2007. The Gestural Origin of Language. Oxford University Press, Oxford.

Axtell, R.E., 1997. Gestures: The Do's and Taboos of Body Language Around the World. Wiley, US.

Bavelas, J.B., Chovil, N., 2006. Nonverbal and verbal communication: hand gestures and facial displays as part of language use in face-to-face dialogue. In: Manusov, V., Patterson, M. (Eds.), Handbook of nonverbal communication. Sage, Thousand Oaks, CA, pp. 97–115.

Benitez-Quiroz, C.F., Gökgöz, K., Wilbur, R.B., Martinez, A.M., Stamatakis, E.A., 2014. Discriminant Features and Temporal Structure of Nonmanuals in American Sign Language. PLoS ONE 9 (2), e86268. https://doi.org/10.1371/journal.pone.0086268.

Bolinger, D., 1986. Intonation and its parts: Melody in spoken English. Stanford University Press, Stanford, CA.

Calbris, G., 2011. Elements of meaning in gesture. John Benjamins Publishing Company, Amsterdam/Philadelphia.

Cheung, Y.L., 1997. A Study of Right Dislocation in Cantonese. The XXX University of XXX, https://repository.lib.cuhk.edu.hk/en/item/cuhk-322261.

Chovil, N., 1991. Discourse oriented facial displays in conversation. Res. Lang. Soc. Interact. 25 (1–4), 163–194. https://doi.org/10.1080/08351819109389361.

Chui, K., 2011. Conceptual metaphors in gesture. Cogn. Ling. 22 (3), 437–458. https://doi.org/10.1515/cogl.2011.017.

Cienki, A., 2017. Ten lectures on spoken language and gesture from the perspective of cognitive linguistics: Issues of dynamicity and multimodality (Distinguished Lectures in Cognitive Linguistics). Brill, Leiden.

Corballis, M.C., 2003. From hand to mouth: The gestural origins of language. In: Christiansen, M.H., Kirby, S. (Eds.), Studies in the evolution of language: Language evolution. Oxford University Press, pp. 201–218. https://doi.org/10.1093/acprof:oso/9780199244843.003.0011.

Dachkovsky, S., Sandler, W., 2009. Visual Intonation in the Prosody of a Sign Language. Lang. Speech 52 (2/3), 287–314. https://doi.org/10.1177/0023830909103175.

Darwin, C., 1955. 1872. The Expression of the Emotions in Man and Animals. New York, Philosophical Library.

Eibl-Eibesfeldt, I., 1979. Ritual and ritualization from a biological perspective. In: Cranach, M.V., Foppa, K., Lepenies, W., Ploog, D. (Eds.), Human ethology: Claims and limits of a new discipline. University Press, Cambridge, pp. 3–55. https://doi.org/10.1002/1098-2337(1981)7:3<280::AID-AB2480070316>3.0.CO;2-Q.

Eibl-Eibesfeldt, I. 1972. Similarities and differences between cultures in expressive movements. In: Hinde, R.A., (Ed.). Non-verbal communication. Cambridge U. Press.

Ekman, P., Friesen, W.V., 1969. The Repertoire of Nonverbal Behavior: Categories, Origins, Usage, and Coding. Semiotica. 1 (1), 49–98. https://doi.org/10.1515/9783110880021.57.

Ekman, P., 1979. About brows: emotional and conversational signals. In: Cranach, M.V., Foppa, K., Lepenies, W., Ploog, D. (Eds.), Human ethology: Claims and limits of a new discipline. Cambridge University Press, Cambridge, pp. 169–202.

Ekman, P., 2004. Emotional and conversational nonverbal signals. In: Larrazabal, J.M., Perez-Miranda, L. (Eds.), Language, Knowledge, and Representation. Kluwer Academic Publishers, Netherlands, pp. 39–50.

Elliott, E., Jacobs, A., 2013. Facial Expressions, Emotions, and Sign Languages. Front. Psychol. 4, 115 https://www.frontiersin.org/article/10.3389/fpsyg.2013.00115.

Emmorey, K., 2002. Language, cognition, and the brain: Insights from sign language research. Lawrence Erlbaum Associates, Mahwah, N.J..

Flecha-García, M.L., 2010. Eyebrow raises in dialogue and their relation to discourse structure, utterance function and pitch accents in English. Speech Commun. 52 (6), 542–554. https://doi.org/10.1016/j.specom.2009.12.003.

Fridlund, A.J., 1997. In: The Psychology of Facial Expression. Cambridge University Press, pp. 103–130. https://doi.org/10.1017/CBO9780511659911.007.

Frishberg, N., 1972. Sharp and soft: Two aspects of movement in sign. Unpublished manuscript, The Salk Institute for Biological Studies.

Givens, D.B., 2002. The Nonverbal Dictionary of Gestures, Signs and Body Language Cues. Center for Nonverbal Studies Press, Spokane, Washington, DC.

Gökgöz, K., 2011. Negation in Turkish Sign Language The syntax of nonmanual markers. Sign Language & Linguistics. 14 (1), 49–75. https://doi.org/10.1075/sll.14.1.04gok.

Haiman, J., 1978. Conditionals are topics. Language, 564–589.

Herrmann, A., Steinbach, M., 2013. Nonmanuals in Sign Language. John Benjamins, Amsterdam, Philadelphia.

Hopper, P.J., Traugott, E.C., 2003. Grammaticalization. Cambridge University Press, New York.

Jakobson, R., 1972. Motor signs for 'Yes'and 'No'. Lang. Soc. 1, 91–96.

Janzen, T., 2012. Lexicalization and grammaticalization. In: Steinbach, M., Pfau, R., Woll, B. (Eds.), Sign Language: An International Handbook. Mouton de Gruyter, Berlin, pp. 816–840 http://ebookcentral.proquest.com/lib/cuhk-ebooks/detail.action?docID=1031950.

Janzen, T., Shaffer, B., 2002. In: Modality and Structure in Signed and Spoken Languages. Cambridge University Press, pp. 199–223. https://doi.org/10.1017/CBO9780511486777.010.
Janzen, T., 1999. The Grammaticization of Topics in American Sign Language. Stud. Lang. 23 (2), 271–306. https://doi.org/10.1075/sl.23.2.03jan.
Jespersen, O., 1917. Negation in English and Other Languages. A.F. Høst, Copenhagen.
Johnston, T., 2018. A corpus-based study of the role of headshaking in negation in Auslan (Australian Sign Language): Implications for signed language typology. Ling. Typol. 22 (2), 185–231.
Kendon, A., 1988. How gestures can become like words. In: Poyatos, F. (Ed.), Cross-cultural perspectives in nonverbal communication. Hogrefe & Huber Publishers, pp. 131–141.
Kendon, A., 2002. Some uses of the head shake. Gesture. 2 (2), 147–182. https://doi.org/10.1075/gest10.1075/gest.2.210.1075/gest.2.2.03ken.
Kim, J., Cvejic, E., Davis, C., 2014. Tracking eyebrows and head gestures associated with spoken prosody. Speech Commun. 57, 317–330. https://doi.org/10.1016/j.specom.2013.06.003.
Koerner, B.B.I., 2003. What Does a " Thumbs Up " Mean in Iraq?. Slate Magazine 1–6. 28 March 2003 https://slate.com/news-and-politics/2003/03/what-does-a-thumbs-up-mean-in-iraq.html.
Larrivée, P., Larrivée, P., Ingham, R., 2011. In: The Evolution of Negation: Beyond the Jespersen Cycle. DE GRUYTER, Berlin, Boston, pp. 1–22. https://doi.org/10.1515/9783110238617.1.
Lee, J., 2006. Negation in Hong Kong Sign Language. The XXX University of XXX, Hong Kong (M.Phil thesis).
Lee, T., 2003. Two types of logical structure in child language. J. Cogn. Sci. 3, 155–182.
Li, D., Luk, Z., 2017. Chinese-English Contrastive Grammar: an introduction. Hong Kong University Press, Hong Kong.
Li, J., 2013. Relative Constructions in Hong Kong Sign Language. Unpublished M.A, Thesis, The XXX University of XXX.
Liddell, S.K., 1980. American Sign Language syntax. Mouton, The Hague.
McClave, E.Z., 2000. Linguistic functions of head movements in the context of speech. Journal of Pragmatics. 32, 855–878. https://doi.org/10.1016/S0378-2166(99)00079-X.
McNeill, D., 1992. Hand and mind: What gestures reveal about thought. University of Chicago Press, Chicago.
Mohr, S. 2014. Mouth Actions in Sign Languages: An Empirical Study of Irish Sign Language. Boston/Berlin: De Gruyter. www.jstor.org/stable/j.ctvbkjx0v.
Morgan, W.M., 2006. Interrogatives and negatives in Japanese Sign Language (JSL). In: Zeshan, U. (Ed.), Interrogative and Negative Construction in Sign Languages. Ishara Press, Nijmegen, pp. 91–127.
Morris, D., Collett, P., Marsh, P., O'Shaughnessy, M., 1979. Gestures, their origins and distribution. Stein and Day, New York.
Peck, S., 1987. Atlas of Facial Expression: An Account of Facial Expression for Artists, Actors, and Writers. Oxford University Press.
Pfau, R., Steinbach, M., 2011. Grammaticalization in sign languages. In: Narrog, H., Heine, B. (Eds.), The Oxford handbook of grammaticalization. Oxford University Press, Oxford, pp. 683–695. https://doi.org/10.1093/oxfordhb/9780199586783.013.0056.
Pfau, R., 2015. The grammaticalization of headshakes: From head movement to negative head. In: Trousdale, G., Waltereit, R., Smith, A. (Eds.), New Directions in Grammaticalization Research. John Benjamins, Amsterdam, Philadelphia, pp. 9–50. https://doi.org/10.1075/slcs.166.02pfa.
Pfau, R., Quer, J.Q., 2010. Nonmanuals: their grammatical and prosodic roles. In: Brentari, D. (Ed.), Sign languages (Cambridge Language Surveys). Cambridge University Press, Cambridge, pp. 381–402.
Puupponen, A., Tuija, W., Burger, B., Jantunen, T., 2015. Head movements in Finnish Sign Language on the basis of Motion Capture data. A study of the form and function of nods, nodding, head thursts, and head pulls. Sign Lang. Ling. 18 (1), 41–89. https://doi.org/10.1075/sll.18.1.02puu.
Reilly, J.S., Bellugi, U., 1996. Competition on the face: affect and language in ASL motherese. Journal of Child Language 23 (1), 219–239. https://doi.org/10.1017/s0305000900010163.
Reilly, J.S., McIntire, M.L., Bellugi, U., 1990. Faces: The Relationship Between Language and Affect. From Gesture to Language in Hearing and Deaf Children.. Springer, Berlin, Heidelberg.
Ricci Bitti, P., Bonfiglioli, L., Melani, P., Caterina, R., Garotti, P., 2014. Expression and communication of doubt/uncertainty through facial expression. Ricerche di Pedagogia e Didattica. 9. https://doi.org/10.6092/issn.1970-2221/4296.
Sandler, W., Lillo-Martin, D., 2006. Sign language and linguistic universals. Cambridge University Press, Cambridge, https://doi-org.easyaccess2.lib.cuhk.edu.hk/10.1017/CBO9781139163910.
Shaffer, B., 2000. A Syntactic, Pragmatic Analysis of the Expression of Necessity and Possibility in American Sign Language PhD Dissertation. University of New Mexico, Albuquerque.
Shimotani, N., 2015. Head Nod as a Prosodic Cue in Japanese Sign Language and Its Use by Native Signers and Non-native Interpreters Unpublished M.A. Thesis. The Chinese University of Hong Kong.
Streeck, J., Knapp, M.L., 1992. Interaction of visual and verbal features in human communication. In: Poyatos, F. (Ed.), Advances in non-verbal communication: sociocultural, clinical, esthetic and literary perspectives. John Benjamins Publishing Company, Amsterdam/Philadelphia, pp. 3–24. https://doi.org/10.1075/z.60.06str.
Swerts, M., Krahmer, E., 2010. Visual prosody of newsreaders: Effects of information structure, emotional content and intended audience on facial expressions. J. Phon. 38 (2), 197–206. https://doi.org/10.1016/j.wocn.2009.10.002.
Sze, F., 2011. Non-manual markings for topic constructions in Hong Kong Sign Language. Sign Lang. Ling. 14 (1), 115–147.

Sze, F., Lo, C., Lo, L., Chu, K., 2013. Historical development of Hong Kong Sign Language. Sign Language Studies 13 (2), 155–185.
Tang, G., 2006. Questions and negation in Hong Kong Sign Language. In: Zeshan, U. (Ed.), Interrogative and negative constructions in sign languages. Ishara Press, Nijmegen, pp. 198–224. https://doi.org/10.26530/OAPEN_453832.
Tomaszewski, P., Farris, M., 2010. Not by the hands alone: functions of non-manual features in Polish Sign Language. In: Studies in the Psychology of Language and Communication. Matrix, Warsaw, pp. 289–320.
Valli, C., Lucas, C., 2000. Linguistics of American Sign Language. Gallaudet University Press, Washington D.C..
Van Loon, E., Pfau, R., Steinbach, M., 2014. The grammaticalization of gestures in sign languages. In: Müller, C., Cienki, A., Fricke, E., Ladewig, S., McNeill, D., Bressem, J. (Eds.), Body - language - communication, vol. 2. De Gruyter Mouton, Berlin, Boston, pp. 2133–2149. https://doi.org/10.1515/9783110302028.2133.
Wierzbicka, A., 1999. Emotions Across Languages and Cultures. Cambridge University Press, Cambridge, https://doi-org.easyaccess2.lib.cuhk.edu.hk/10.1017/CBO9780511521256.
Wilbur, R.B., 2000. Phonological and Prosodic Layering of Nonmanuals in American Sign Language. In: Lane, H. (Ed.), The Signs of Language Revisited. Lawrence Erlbaum, Hillsdale, NJ, pp. 215–244.
Wilbur, R.B., Patschke, C.G., 1998. Body leans and the marking of contrast in American Sign Language. J. Prag. 30, 275–303.
Wilcox, S., 2004. Gesture and language: Cross-linguistic and historical data from signed languages. Gesture. 4 (1), 43–73. https://doi.org/10.1075/gest10.1075/gest.4.110.1075/gest.4.1.04wil.
Wilcox, S., 2009. Symbol and Symptom Routes from Gesture to Signed Language. Ann. Rev. Cogn. Ling. 7 (1), 89–110. https://doi.org/10.1075/arcl.7.04wil.
Wilcox, S., 2012. Language in motion: A framework for unifying spoken language, signed language, and gesture. Anuari de Filologia Estudis de Lingüı´stica. 2, 49–57. https://doi.org/10.1344/AFEL2012.2.4.
Wilcox, S., 2014a. Gestures in sign language. In: Müller, C., Cienki, A., Fricke, E., Ladewig, S., McNeill, D., Bressem, J. (Eds.), Body - language - communication, vol. 2. De Gruyter Mouton, Berlin, Boston, pp. 2170–2176. https://doi.org/10.1515/9783110302028.2170.
Wilcox, S., 2014b. Moving beyond structuralism: Usage-based signed language linguistics. Lingua de Señas e Interpretación 5, 97–127.
Wilcox, S., Wilcox, P., 1995. The gestural expression of modality in American Sign Language. In: Bybee, J., Fleischman, S. (Eds.), Modality in Grammar and Discourse. John Benjamins Publishing Company, Amsterdam, pp. 135–162. https://doi.org/10.1075/tsl.32.07wil.
Wilcox, S., Rossini, P., Pizzuto, E.A., 2010. In: Sign Languages. Cambridge University Press, pp. 332–354. https://doi.org/10.1017/CBO9780511712203.016.
Wilcox, S., Rossini, P., Pizzuto, E., 2007. Routes from gesture to language. In: Antinori, E.P., Pietrandrea, P., Simone, R. (Eds.), Verbal and Signed Languages: Comparing Structures, Constructs and Methodologies. Mouton de Gruyter, Berlin/New York, pp. 107–131.
Wilcox, S., 2005. Routes from Gesture to Language. Revista Da ABRALIN. 4 (1), 11–45. https://doi.org/10.5380/rabl.v4i1/2.52651.
Wong, P., Chan, H.Y., 2018. Acoustic characteristics of highly distinguishable Cantonese entering and non-entering tones. The Journal of the Acoustical Society of America 143, 765–779. https://doi.org/10.1121/1.5021251.
Zeshan, U., 2000. Sign language in Indo-Pakistan: A description of a signed language. John Benjamins Pub, Philadelphia, PA https://ebookcentral.proquest.com/lib/cuhk-ebooks/detail.action?docID=623104.
Zeshan, U., 2006. Negative and interrogative constructions in sign languages: A case study in sign language typology. In: Zeshan, U. (Ed.), Interrogative and negative constructions in sign languages. Ishara Press, Nijmegen, pp. 28–68. https://doi.org/10.26530/OAPEN_453832.
Zeshan, U., 2004. Interrogative Constructions in Signed Languages: Crosslinguistic Perspectives. Language. 80 (1), 7–39.