

9. Aspect in sign languages – theoretical and experimental perspectives

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1. Theoretical foundations of aspect

The variety of the world's languages, including sign languages, has resulted in the need for multiple ways to describe the temporal structure of the sentences: tense and aspect. Tense is the easier one to understand: it describes the temporal location of an eventuality in relation to some other point in time (often, another eventuality, which might both be referenced in one sentence). Aspect, on the other hand, refers to the way in which the eventuality itself unfolds in time – how long it takes, whether it is dynamic or static, etc. – from the point of view of the speaker. Linguistic means to encode aspect can vary across languages – the same abstract concept might be denoted by grammatical means in one language, and lexical in another; sign languages use both manual and non-manual means to express aspect. This chapter is concerned with a variety of means of encoding aspect across sign languages, and the ways to precisely express aspectual meaning in relation to the verb's event structure using spatial means. We will start with lexical aspect – i.e., temporal properties of an event that are implied as part of the verb's lexical entry. We will then consider systems for denoting grammatical aspect in the languages where these exist, and the relationships between event structure and potential means of aspectual modification, as revealed by empirical research across a variety of sign languages.

1.1. Lexical aspect (*Aktionsart*/event structure)

Lexical aspect (also known as *Aktionsart*, or event structure) describes inherent temporal properties of an eventuality denoted by the verb. Several systems of describing these temporal properties exist. For example, Vendler (1969) identified four types of lexical aspect according to an event's durativity (necessary occurrence over a period of time), and presence of identifiable temporal reference (start- or end-state). The verbs containing a temporal reference to change of state (inchoative verbs) were subdivided into *accomplishments* (those which included a durative component, e.g., *develop*) and *achievements* (verbs of instantaneous change, e.g. *break*). Verbs without a temporal reference were subdivided into durative *actions* (e.g., *walk*) and *states* (e.g., *know*), which do not require duration. Analyses of event structure also often include *semelfactives* (punctual events that often occur in sets of multiples, e.g., *knock* or *blink*); for conflicting analyses, see Smith (1997) and Rothstein (2004). The structure of an inchoative event, as introduced above, is typically assumed to have a temporal reference to the time of change (onset, an end-point, or a punctual change).

The events that do have such a time-point as part of their semantics are termed *telic* (from Greek *telos* ‘goal’); those that do not are called *atelic*.

The term *event structure* has also been applied to the analysis of full predicates, including arguments, rather than single lexical verbs (cf. English ‘to eat fish’ – an atelic predicate with a non-delimited argument, vs. ‘eat the fish’ and ‘eat up’ – telic predicates with a delimited argument). The problem of limitation (the fact that the semantics of limitation can be conveyed both by the verb itself, as well as by the verb’s arguments) resulted in introduction of the notion of ‘measuring out’ of events, by way of using an additional argument and/or action quantification, and in using compositional semantics (Jackendoff 1996; Krifka 1992) to analyse argument- or adjective-based event modifiers. Temporal and measure-based approaches to defining event structure are not mutually contradictory; the difference lies in viewing the event as defined by the lexical verb only, or by the entire verbal phrase.

In feature-based descriptions of event structure, verbs of different event types have been analysed for presence of the features +/- dynamic, +/- durative, and +/- telic (resultative) (Smith 1997). Using this system, Rathmann (2005) provides the following classification of American Sign Language (ASL) verb signs: states are [-dynamic, +durative, -telic], activities [+dynamic, +durative, -telic], semelfactives are [+dynamic, -durative, -telic], accomplishments are [+dynamic, -durative, +telic], and achievements are [+dynamic, +durative, +telic].

Finally, Ramchand’s (2008) nano-syntax model for cross-linguistic analysis of event (and argument) structure must be mentioned, which subsumes both feature-based and syntactic accounts. Figure 1 presents an extended version of this formal model. The three phrases (assumed to be merged within the lexical entry for the verb, but inferable from the verb’s semantic and syntactic behaviour) represent all features used by previous models of event structure with regard to temporal and argument-related properties of verbs. Presence of Initiation Phrase in the verbal entry allows for the representation of [+dynamicity] and an Agent argument; Undergoer Phrase can represent the [+duration] feature of the verb, as well as an Undergoer or a Theme argument; presence of the Result Phrase renders the verb [+telic], and allows for the third argument (a recipient/location) in ditransitive verbs (e.g., *Bob gave Mary the book*). Since the Merge operation is verb-internal, the same argument can occupy multiple positions in the structure (e.g., in verbs that describe psychological states, such as *amuse*, *appeal*, which conflate the Undergoer and the Recipient); the model provides maximal explanatory power for cases such as multiple classes of verbs of psychological state, or systemic combinability of noun Case with verbal event structure. The model also allows to predict the behaviour of verb classes that are not well-described by feature-based accounts¹ or taxonomies, such as verbs of psychological state (*know*, *decide*, *amuse*, *marvel*), verbs of gradual change (e.g., *melt*), or predicates in sign language (see Malaia & Wilbur 2012a, b, c; Malaia & Wilbur 2010a,b; Wilbur & Malaia 2008b). For example, Grose et al. (2007) demonstrate that this system can capture the difference in syntactic behaviours between handling and instrument classifiers in ASL, which are a challenge for other accounts (Grose et al. 2007: 1282).

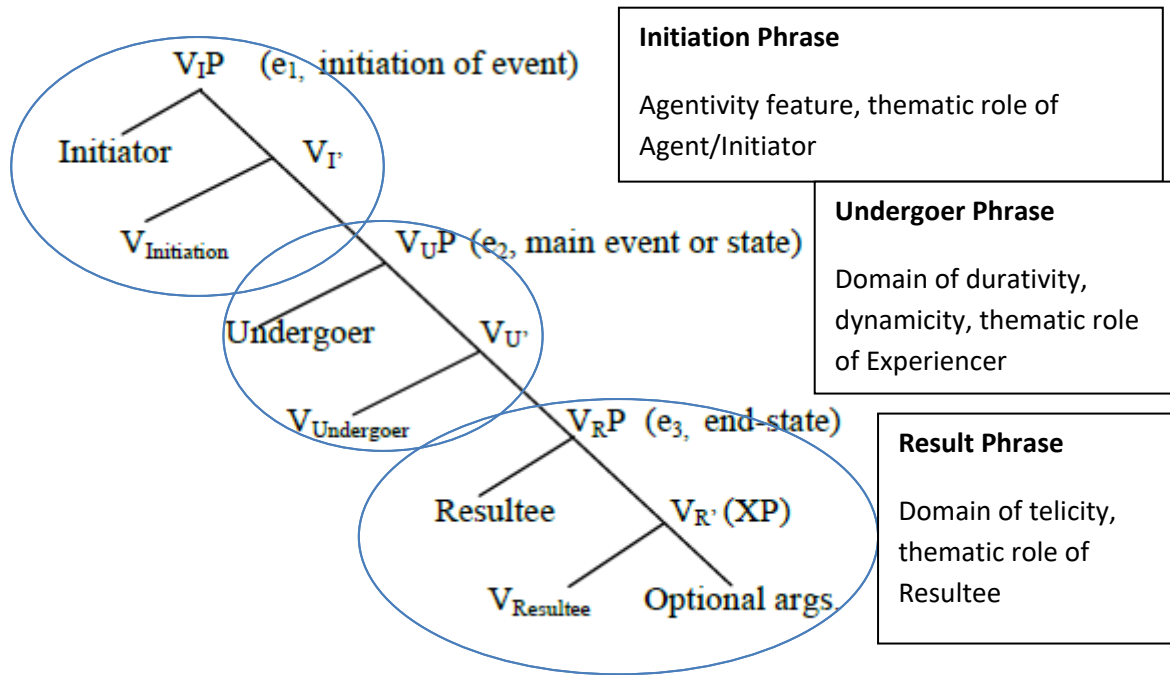


Figure 1. Full representational model of possible event structure according to Ramchand (2008)

Components of event structure are identifiable by means of semantico-syntactic tests. Because event structure interacts with the syntax of each language, there can be variations as to the implementation of the tests, and some might not work in a given language. Here, we present parallel examples from English and ASL (from Rathmann 2005) to illustrate the process of adapting the tests to sign languages.

1. Combinability with verbs of perception. This test is used to distinguish permanent states (individual-level predicates) from temporary, or stage-level states, as the former do not combine with perception verbs:

- (1) a. #I SEE JOHN KNOW HISTORY
(Intended: ‘I see John knowing history.’) (ASL, Rathmann 2005: 67)
- b. I SEE JOHN BE-SICK
‘I saw John sick.’ (ASL, Rathmann 2005: 72)

2. Combinability with modifiers of duration (either temporal adverbials, or continuative morphemes), or manner/intensity adverbials and/or non-manuals (CAREFULLY, SLOWLY). This test is used to check for the [+durative] feature (absent in states).

- (2) a. #HISTORY I KNOW_{+continuative}
(Intended: ‘History, I knew continuously.’) (ASL, Rathmann 2005: 68)
- b. JOHN BE-SICK_{+continuative}
‘John was sick continuously.’ (ASL, Rathmann 2005: 72)

3. Combinability with imperatives as test for agentivity. This test distinguishes between states and activities, as states do not combine with imperatives (for ASL, Rathmann (2005) uses imperatives such as GO-AHEAD, DO YOU MIND, I ORDER YOU):

- (3) a. *GO-AHEAD BE-SICK
'Go-ahead and be sick!' (ASL, Rathmann 2005: 72)
b. GO-AHEAD EXPLAIN HISTORY IX_I [MY SON]
'Go ahead, explain history to my son.' (ASL, Rathmann 2005: 75)

4. Combinability with verbs of termination vs. verbs of completion. Achievements [-durative, +telic] are incompatible with verbs of termination, such as 'stop' (cf. (4a) vs. (4b)); states and (some) activities [-telic] are incompatible with verbs of completion (cf. (4c) vs. (4d)).

- (4) a. * I stopped arriving.
b. I stopped driving.
c. * I finished knowing.
d. I finished writing.

In some languages, such as English, the interpretation of the test is made more difficult by coercion (Smith 1997), or typecasting. As a result of this operation, activities can combine with 'finish', but only when they are typecast as achievements (e.g. 'I finished running' assumes a pre-determined time or distance for the event of running). Rathmann (2005) provides ASL examples of coercion of activities into achievements, where the addition of a measure to the activity (e.g., drinking water out of a glass until the glass is empty) effectively turns an activity, which cannot combine with temporal adverbials (5a), into a resultative accomplishment, which can (5b). In (5b), adding [+hold] morpheme provides the measuring-out feature to the verbal phrase:

- (5) a. #DRINK WATER NEED 5 MINUTE
(Intended: 'Drinking water takes 5 minutes.') (ASL, Rathmann 2005: 110)
b. DRINK WATER EXTENT_{+hold} NEED 5 MINUTE
'Drinking this much water requires 5 minutes.' (ASL, Rathmann 2005: 110)

5. Combinability with durative 'for an hour'-type vs. delimiting 'in an hour'-type adverbials (no ASL equivalent is available, as the temporal adverbials do not differ consistently along delimiting/durative dimension).

- (6) a. NORA SLEPT FOR AN HOUR.
b. # NORA SLEPT IN AN HOUR.

As with the previous test, [+durative] verbs (in (6a) the state verb ‘sleep’) combine with ‘for an hour’, but are somewhat infelicitous, though not strictly ungrammatical, with ‘in an hour’ (sentence (6b) could mean ‘it took an hour for Nora to fall asleep’, interpreting the adverbial as measuring out time to the onset of state). On the other hand [-durative] verbs, such as achievement ‘fall’, are infelicitous (pragmatically unlikely) with ‘for an hour’-type adverbials, although some informants can interpret the sentence as coerced (in *Alice in Wonderland*, Alice kept falling for a long time!).

6. Entailment test for temporal reference (either telicity or initiation time-reference). The original version of the test (Dowty 1979) relied on different entailments licensed for past tense by atelic (cf. (7a)) and telic verbs and verb phrases (cf. (7b)) used in the continuous/progressive (viewpoint aspect):

- (7) a. SEAN WAS DRIVING THE CAR. → SEAN DROVE THE CAR.
 b. SEAN WAS RUNNING A MILE. -/→ SEAN RAN A MILE.

In languages where continuous/progressive and past are not clearly marked, entailments resulting from predicate combinability with temporal adverbials such as ALMOST (Smith 2004), or STILL (Rathmann 2005) can be used:

- (8) a. # JOHN WIN GAME. STILL WIN
 (Intended: ‘John won the game. He is still winning it.’)
 b. JOHN-COUGH-ONCE. STILL COUGH-REPEATED
 ‘John coughed. He is still coughing.’ (ASL, Rathmann 2005: 85)

While the semantic entailment’s combinability with ALMOST can distinguish between reference time at the beginning or end-point of the event, STILL only allows for a distinction between inchoative (accomplishments, achievements) and non-inchoative (states, activities, semelfactives) event types. Example (8a) demonstrates that STILL does not combine with inchoative verbs such as WIN (as the entailment of durativity would be impossible); in (8b), combinability of STILL with semelfactive COUGH-ONCE yields a reasonable entailment of repeated semelfactive, and durative scope over multiple events.

Lexical aspect is an inherent property of a verb. While a single lexical entry may, in a specific language, denote several types of eventualities with different intrinsic temporal properties (e.g., *to blink* can refer to either to a singular event, or to a process with multiple singularities in English), those meanings are distinguishable based on semantic tests.

1.2. Grammatical aspect

Grammatical (viewpoint) aspect is a regularized way by which languages can describe the range of time in which the eventuality (event) is viewed. For example, a durative event with

an inherent end-point (e.g., an accomplishment) might be viewed as not having been completed within the time range of a continuous viewpoint. The term *grammatical aspect* is also somewhat of a misnomer: the notion of temporal viewpoint in the description of an event does not necessarily have to be regularized in a language as a grammatical category, or be represented by a morpheme. However, the grammatical, or viewpoint, aspect is secondary to *Aktionsart*: the internal temporal structure of an event affects the inventory of possible viewpoint aspect representations of the event. In other words, not every *Aktionsart* is expected to combine with all viewpoint aspects.

It is important to note that both the type inventory and the encoding of event and aspect typology (e.g., lexical vs. morphological vs. phonological implementation for either viewpoint aspect or *Aktionsart*) can vary across languages. For example, ASL employs a phonotactic method in expressing verbal telicity: telic signs have a syllabic structure that is different from that of atelic ones (Malaia & Wilbur 2010a, b; Malaia & Wilbur 2012a, b, c; Malaia et al., 2015), and are processed as having a phonological distinction (Malaia et al. 2012). Some languages allow for substantial modification of the verb's inherent temporal semantics by what appear to be productive affixes or arguments, such that the semantics of the event structure is not restricted to the single lexical entry of the verb. For example, the verb systems of Russian and Bengali make use of event-onset time, which is denoted by a morpheme (examples (9) and (10)); the use of the morpheme is, however, restricted by the semantics of the root verb (lexical prefix and suffix, respectively; see Malaia (2004); Basu & Wilbur (2010)).

(9) Cherez pyat' minut Artem za-pel.

after five minutes Artem PERF.ONSET-sing.PAST.MASC.3SG

'After five minutes, Artem began to sing.' (Russian, Malaia & Basu 2010: 5)

(10) Ram du minit-er moddhe kotha-ta bol-e uth-lo.

ram two minute-GEN within word-CL say-PERF rise-PAST.3.3SG

'Ram said those words within two minutes.' (Bengali, Malaia & Basu 2010: 5)

Similarly, ASL can have 'delayed onset' (hold at the beginning) in verbs that contain onset semantics (Brentari 1998).

The inventory of both lexical and grammatical aspects is also language-specific. Across sign languages, both viewpoint aspect and *Aktionsart* have been shown to use free and bound morphemes, as well as non-manual markers. The marking for the two types of aspect - viewpoint and *Aktionsart* - can co-occur in one sign, or even be conflated (e.g., velocity-based aspect marking in Croatian Sign Language (HZJ); see Milković (2011)). Aspect-denoting morphemes can develop from verbs with full semantics (such as 'finish', or 'continue'), or adverbs; the distribution of the verb when it has full semantics is different than the distribution of the related form when it is used as an aspect marker. In general, the analysis of the role of a morpheme in the aspectual system of a (sign) language requires use of the following criteria:

1) Distributional properties: Can the morpheme of aspectual modification occur with any verb? Are there phonological, phonotactic, syntactic, or semantic restrictions in its distribution? Can it co-occur with markers for tense and event structure? Is it in complementary distribution with another aspectual marker (either free, bound, or non-manual)? If the language has several markers for a specific aspect (e.g., perfective) in its inventory, they are typically found in complementary distribution due to phonological or event structure-based restrictions.

2) Consistency of correspondence between form and meaning in the specific language/interpretation across signers. In sign languages that are continuously changing, grammaticalization of a morpheme can occur over the course of 20-40 years (cf. the analysis of Al-Sayyid Bedouin Sign Language (ABSL); Sandler et al. (2005)).

2. Viewpoint aspect in sign languages

Viewpoint aspect describes the speaker's perspective, or her intent as to how to view the event. Comrie (1976: 4) has formulated the two aspectual options available simply as: "the perfective looks at the situation from outside..., the imperfective looks at the situation from the inside." The important component here is the optionality, or the speaker's choice – i.e., the same event can be presented either from outside (using perfective aspect), or from the inside (using imperfective/continuous aspect). These options are, however, constrained by the lexical aspect: e.g., the internal quantification of the event determines the possibilities of the external viewpoint.

The relationship between tense and aspect can be difficult to describe outside the tense-aspectual system of a specific language. Reichenbach (1947) developed an abstract system that could characterize the relationship between the time of event occurrence and the time of speech (making the utterance), and characterized aspectual relationships using the concept of reference time – the time the speaker intends to refer to as an 'anchor' in the utterance. Reference time of an event is subjectively determined, in contrast with speech time and event time (both of which are objective). The use of this system allows to distinguish, for example, between simple past and present perfect in English, as in *I saw the cat* vs. *I have seen the cat*. In both sentences, event time is in the past, in relation to speech time. However, in the simple past the event is considered from some moment in the past; in the present perfect, however, the event (of seeing) is considered in its reference to the present – the speech time. We will need to use this system as we consider use of markers of viewpoint aspect in sign languages.

2.1. Free aspectual markers

Free aspectual markers of perfective and continuous aspect are the two most often noted across sign languages. This does not necessarily mean that viewpoint (grammatical) aspect is restricted to these two meanings. It is more likely that this inventory is a reflection of the most typical paths of grammaticalization for aspectual morphemes with these meanings: from a verb such as FINISH, or from an adverb like ALREADY for perfective aspect, and from verbs such as TRY, CONTINUE or from an adverb such as NOT-YET for continuative. The exact aspectual meaning of the marker is, however, language-specific, and cannot be inferred from the (prior) lexical meaning of the morpheme (cf. use of NOT-YET as a negative perfective marker in Greek Sign Language (GSL)). Use of such markers has been described in Italian Sign Language (LIS, Zucchi et al. 2010), Hong Kong Sign Language (HKSL, Tang 2009), Israeli Sign Language (Israeli SL, Meir 1999), ASL (Fischer & Gough 1978), Croatian Sign Language (HZJ, Milković 2011), Greek Sign Language (GSL, Sapountzaki 2007), Sign Language of the Netherlands (NGT, Hoiting & Slobin 2001), Turkish Sign Language (TİD, Zeshan 2003a; Dikyuva 2011; Karabüklü 2016), British Sign Language (BSL, Brennan 1983), Swedish Sign Language (SSL, Bergman & Dahl 1994), German Sign Language (DGS, Rathmann 2005), and Indo-Pakistani Sign Language (IPSL, Zeshan 2003b). In the following, examples are presented of the use and distribution of these morphemes for several unrelated sign languages.

LIS. Zucchi et al. (2010) report aspectual use of the verb DONE. Note that in example (11a) the position of DONE as the full lexical verb is before the main verb EAT, whereas in its aspectual use in (11b) it follows the main verb.

- (11) a. GIANNI CAKE DONE EAT
 ‘Gianni has finished eating the cake.’
 b. GIANNI HOUSE BUY DONE
 ‘Gianni has bought a house.’ (LIS, Zucchi et al. 2010: 200)

HKSL. Tang (2009) shows that aspectual FINISH, which encodes termination or completion of an action, is constrained in its use by event type of the main verb: specifically, it occurs with event types that have dynamic or durational components (activities, achievements, accomplishments, semelfactives), as in (12a), but notably not with states, as the ungrammaticality of (12b) shows.

- (12) a. IX-DET BOY CRY FINISH, GO HOME
 ‘After the boy had cried, he went home.’
 b. *IX WOMAN DISLIKE DOG FINISH
 ‘The woman has disliked dogs.’ (HKSL, Tang 2009: 26)

Israeli SL. Meir (1999) analysed the use of ALREADY as a perfective marker in ISL, as opposed to that of tense, because of co-occurrence of ALREADY with adverbials denoting past,

present, and future time. The aspectual meaning of ALREADY is that of viewing an event as fully completed, as illustrated in (13).

- (13) a. BOOK INDEX_A I ALREADY READ THREE-DAY
‘It took me three days to read this book.’
b. INDEX₁ ALREADY WRITE LETTER SISTER POSS₁
‘I have written a letter to my sister.’ (Israeli SL, Meir 1999: 52, 49)

ASL uses the lexical verb FINISH, a head nod, or their combination to mark perfective aspect (Fischer & Gough 1999).

- (14) a. INDEX₁ PAST WALK SCHOOL
‘I used to walk to school’
b. YOU EAT FINISH, WE GO SHOPPING
‘After you have eaten, we’ll go shopping.’ (ASL, Fischer & Gough 1999: 68)

HZJ. Milković (2011) describes a rich system of verb pairs differentiated by aspect, such that one has telic/perfective, and the other atelic/imperfective meaning. The morphemes that distinguish verbs in the pair depend on the morpho-phonological and syntactico-semantic properties of the root. The most typical way to create the telic and perfective form from the atelic and imperfective form of the same verb is by speeding up the root movement. This, however, is a bound morpheme, and as such it is described in Section 2.2. For the verbs that do not allow morphemic change by motion acceleration, either compositional formation (use of a combination of morphemes that is not productive outside of a short list of verbs), or suppletive formation (different lexical roots in semantic/aspectual pairing – also detailed in the following section) are possible.

As an example of compositional formation of perfective aspect, in (15a), GOTOVO/FINISH, comes after the atelic/imperfective verb HAVE-BREAKFAST, as a marker of perfectivity, indicating the completion of an action. Similarly, in (15b), the adverb VEĆ/ALREADY, comes before the same imperfective verb, rendering the verb phrase telic/perfective.

- (15) a. NEVER HAVE BREAKFAST_{ipfv}...TODAY HAVE-BREAKFAST_{ipfv} FINISH
‘I almost never have breakfast. Today I had breakfast.’
b. ...TODAY ALREADY HAVE- BREAKFAST_{ipfv}
‘Today I had breakfast.’ (HZJ, Milković 2011: 59, 60)

GSL. For *GSL*, Sapountzaki (2007) describes the inventory of perfective markers as consisting of aspectually used BEEN, and two negative markers, namely, verbal NOT-BEEN, and adverbial NOT-YET.

NGT. Hoiting & Slobin (2001) describe a system in which a free aspectual marker occurs in complementary distribution with a bound inflection for continuous/habitual aspect. The complementary distribution of the free vs. bound aspectual morpheme is determined by phonological constraints: signs that contain internal lexical motion or include body contact cannot undergo aspectual inflection, and therefore occur with the free sign THROUGH, as illustrated in (16).

(16) INDEX₃ TRY THROUGH+++++

‘He tried continuously / tried and tried and tried.’

(NGT, Hoiting & Slobin 2001: 129)

TİD. Dikyuva (2011) and Karabüklü (2016) identified a rich system of manual and non-manual aspectual markers in *TİD*. Manual markers include the signs GO (GITMEK), which can be modified to reflect the continuative aspect and the completive aspect Dikyuva (2011: 53), and completive aspect marker BİT 'finish'. In their use, both manual and non-manual markers of aspect in *TİD* interact with the internal event structure of verb signs (see Section 2.2. on bound markers for details).

2.2. Bound markers of aspect

The use of dynamic and spatial means for the expression of grammatical aspect has attracted substantial interest at least since Fischer (1973). Klima & Bellugi (1979) describe 15 different productive (morphemic) modulations in ‘dynamic qualities and manners of movement’ in ASL, including reduplication, rate of signing, tension, pauses in cycles, etc. The difficulty, however, arose in identifying purely aspectual vs. non-aspectual inflectional morphemes on the verbs. Further analyses focused on identifying overlaps in form and meaning, separating dynamic expression of event structure/*Aktionsart* expressed by dynamic means, from viewpoint aspect, and identifying phonological and syntactic restrictions on the distribution of these markers (Anderson 1982; Rathmann 2005; Wilbur 1987; Wilbur 2009; Wilbur 2005; Warren 1978). Due to the richness of inflectional possibilities in sign languages (Emmorey 1996; Malaia & Wilbur 2014) there is a debate as to the inventory of bound aspectual markers. The inflectional markers that have been attested across multiple sign languages include continuous, iterative², and perfective marking. Like the free markers, bound aspectual morphemes (inflections) have been noted to combine with non-manuals, and their distribution is typically restricted by phonological properties of verb signs. A number of them in different sign languages are presented next.

ASL. In ASL, reduplication is frequently used as a bound marker of aspect. The base of reduplication (the part of the sign that is then copied), and the copy (or reduplicant, in speech), are typically similar in the overall form, although particular spatial/temporal features of the copy (e.g., its shape and stress, as compared to the base sign) can differ. Both the form

and the meaning of potential reduplication in ASL verbs are determined by the interaction of verbal event structure (i.e., telic vs. atelic), and the phonological form of the base. Wilbur (2009) provides the following classification based on the interaction between the prosodic prominence of base and copy and (a)telicity of the root in aspectual reduplication in ASL:

1. If the prosodic prominence of the copy is equal to that of the base, the aspectual inflection is interpreted as habitual for telic roots, and durative for atelic ones.
2. If the prosodic prominence of the copy is less than that of the base, the aspectual inflection is interpreted as incessant for telic roots; there is no evidence for use of atelic roots with a less-prominent copy.
3. If the prosodic prominence of the copy is greater than that of the base, the aspectual inflection is interpreted as iterative for telic roots, and continuative for atelic ones.

BSL. Sutton-Spence & Woll (1999) note the use of an extended hold to express continuative aspect in signs that do not have path movement in BSL, such as LOOK and HOLD. Iterative aspect is expressed by reduplication of path movement.

NGT. Hoiting & Slobin (2001) note that the elliptical modulation functioning as inflection marker of continuative aspect is combined with non-manual markers in NGT, namely, puffed cheeks and/or pursed lips, with a slight blowing gesture.

SSL. Bergman (1983) notes that continuous ('durative') aspect can be denoted with cyclical arc movement of the head, while the hands do not move. Iterative aspect is described by Bergman & Dahl (1994) as marked by repeated short movements (fast reduplication). Similar inflectional markers of aspect have also been noted in Spanish Sign Language (LSE, Cabeza Pereiro & Fernández Soneira 2004), IPSL (Zeshan 2003), Nicaraguan Sign Language (ISN, Senghas 1995) and HZJ (Milković 2011).

HZJ. The most productive way to create telic and perfective form from the atelic and imperfective form of the verb is by speeding up of the root movement; verb pairs such as ČITATI/PROČITATI (*to read/to have read*) or BRISATI/OBRISATI (*to erase/to have erased*) differ in the speed of hand motion (see Figure 2; details for quantitative motion capture analysis in Malaia, Wilbur & Milković (2013)).



(a) BRISATI 'erase'



(b) OBRISATI 'to have erased'

Figure 2. HZJ aspectual verb pair: BRISATI_{ipfv} - OBRISATI_{pfv}

Atelic/imperfective can be also formed from a telic/perfective form of the verb by using reduplication, such as in KUPITI/KUPOVATI 'to have bought/to buy', or DAROVATI/DARIVATI 'to have given, to donate/to be giving, to donate/to be giving' (Milković 2011) – for illustration of this process, see Fig. 3.



[extension]

(a) DAROVATI 'to have given, to donate'



[extension]

repeat: [extension]

(b) DARIVATI 'to be giving, to give'

Figure 3. HZJ aspectual verb pair: DAROVATI_{ipfv} - DARIVATI_{pfv}

A small group of verbs use different root morphemes (i.e., signs differing in handshape, location, orientation, and kinematics) to convey contrasting telic-aspectual meanings with similar semantics, such as TRAŽITI/NAĆI 'to seek/to find' (cf. Fig. 4), and PUTOVATI/STIĆI 'to travel/to arrive'.

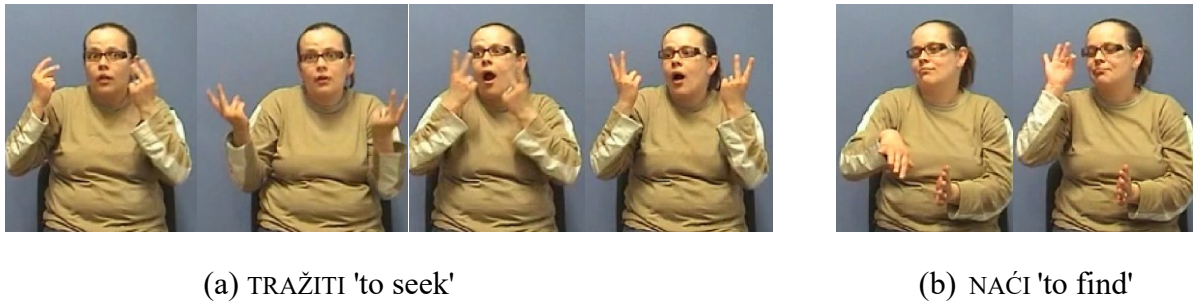


Figure 4. HZJ aspectual verb pair: TRAŽITI-NAĆI

In the general context of HZJ, where telicity is denoted by a productive morpheme, these pairs can be considered suppletive versions of telic-atelic verb pairs. In other sign languages, where telicity marking is not a productive morpheme (e.g., ASL), these are considered independent lexical items.

TİD. TİD has a well-described system of bound non-manual markers of aspect, which have complex interactions both with the internal event structure of verb signs, as well as manual (free) markers of aspect (cf. Dikyuva, 2011; Karabüklü 2016). Non-manuals include markers of completive aspect ('bn', performed by sticking the tongue out slightly through the centre of the mouth), the continuative aspect ('lele', which consists of protruding the tongue slightly between the teeth and flicking it up and down repeatedly and quite rapidly) and inceptive aspect ('ee', performed by gritting the teeth and pulling back the corners of the mouth). For example, the non-manual marker of continuative aspect 'lele' does not appear to be used with telic verbs (Dikyuva 2011: 52). Manual aspect marker BIT 'finish', on the other hand, cannot be used with achievement verbs such as WASH, SLICE, READ (Karabüklü 2016: 129). Interestingly, in this case the manual and non-manual completive markers in TİD differ in scope, such that non-manual 'bn' is compatible with the meaning of termination (of an activity – cf. 17b and d), while BIT requires an event to be completed (cf. (17a) and (impossible) (17c)):

- (17) a. IX₁ BABY WASH BIT
 'I (have) washed the baby'
 _____bn
 b. IX₁ BABY WASH
 'I (have) washed the baby.'
 c. *IX₁ BABY SWING BIT
 (Intended: 'I (have) swung the baby.')

(TİD, Karabüklü 2016: 129)

3. Event structure and reference time representation in sign languages

Segmentation of continuous reality into separate events is the basis of everyday cognition. The use of dynamic (object velocity) and scene-changing cues in visual event segmentation and memory retrieval is well-described in perceptual and cognitive psychology (Zacks, Speer & Reynolds 2009; Malaia et al. 2015a, b). However, the link between perceptual event segmentation and linguistic events has only recently come into the main arena of linguistic research. Linguistically, presence or absence of temporal reference in the event description (verb's *Aktionsart* or event structure) is the primary determinant as to how an event can be further described using viewpoint aspect. Experimental evidence suggests that the processing of visual segmentation of events and determination of linguistic event structure/*Aktionsart* are rooted in similar psychological mechanisms (Malaia et al. 2008b, 2009; Strickland et al. 2015). The connection between predicate semantics and kinematics (dynamics of hand motion) in sign languages was first formulated as the Event Visibility Hypothesis (Wilbur 2008: 229): “in the verbal domain, the path movement of the predicate signs indicates elapsed time (t) of an event (e), [...] and [...] phonological end-marking of the movement reflects the final state of telic events (e_a). Furthermore, the predicate stops at points (p) in space to indicate individual semantic variables (x)”³. Most of the earlier analyses of predicates in sign languages did not make a distinction between temporal structure of the eventuality and viewpoint aspect. This partially accounts for the high number of aspectual distinctions in ASL noted in the earlier literature, which deemed as ‘aspectual’ all spatial-dynamic means of modifying the basic temporal makeup of eventualities.

3.1 Markers of event structure

As proposed in the Event Visibility Hypothesis, the event and argument structure of the verbs in sign languages can be modified by means of changes in movement path, duration, pauses, and parameters of reduplication (speed, path, etc.), as well as changes in velocity and acceleration to portions of motion in the sign. Modifications of the verb sign that affect its event structure would lead to changes of how the sign can be used in syntactic structures (application of viewpoint aspect and agreement markers). The difficulty in identifying a cross-linguistically applicable physical inventory of event structure modifiers is that the same physical marker can be recruited to fulfil different roles in the phonological-semantic systems of different sign languages. For example, ASL and HZJ differ in the ways that *Aktionsart* is expressed in the structure of the language. In ASL, telic events are marked at the semantics-phonology interface. Atelic and telic verb signs in ASL differ in whether the two timing slots in sign-syllables contain the same (atelic) or different (telic) setting, orientation, aperture, and directionality of the movement path, as shown in Figure 5, based on Brentari's (1998)

prosodic model. The change in velocity – i.e., acceleration-deceleration pattern within the sign – results in bipartite structure of the sign. In ASL, the change in motion profile is part of the lexical root, and is not productive. HZJ, on the other hand, has grammaticalized expression of verbal telicity in a productive (suffix-like) acceleration of dominant hand motion, which is generally productive (with a few exceptions). In HZJ telicity is also merged (although not for all verb signs) with aspect, in the manner typical of the surrounding Slavic languages (Milković & Malaia 2010; Milković 2011).

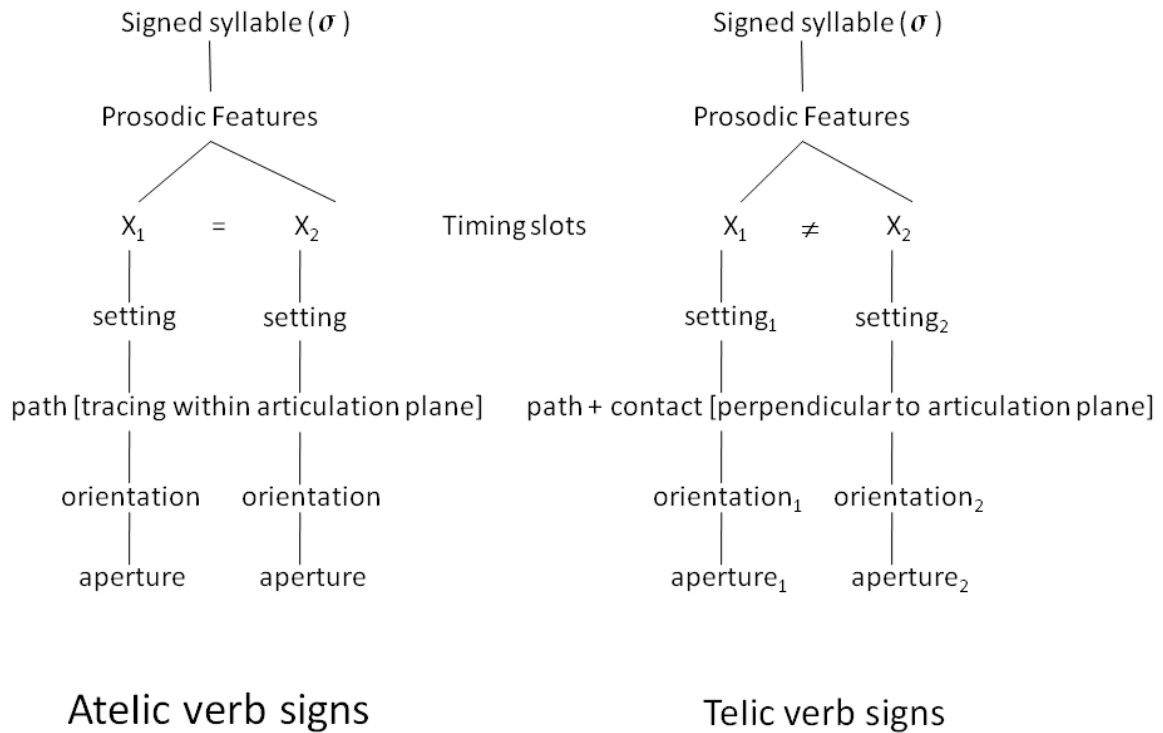


Figure 5. Representation of telic and telic verb signs in ASL based on Brentari's (1998) prosodic model)

ASL. Rathmann (2005) suggested that multiple sign-internal inflections, which had been typically viewed as grammatical aspect due to their productivity in sign language (e.g., Klima & Bellugi 1979), should be considered event structure-internal modifiers. Those include 'unrealized inceptive' (Liddell 1984), 'delayed completive' (Brentari 1998), and 'resultative' (Wilbur 2003). Grose (2008) further developed a feature-based taxonomy of event and argument structure in ASL verbs, which includes an account of syntactic and phonological behaviours in classifier, agreeing, and plain predicates (see Grose (2008) for details).

Austrian Sign Language (ÖGS). Schalber (2006) shows that ÖGS, like ASL, uses morphemes to mark telic and atelic event structures, but phonological realizations of these morphemes are language dependent. In ÖGS, mouth non-manuals are sensitive to the event structure. These non-manuals divide into two types: (1) continuous non-manuals (NMs), composed of a single facial posture which functions as an adverbial modifier of the event (positional NMs), and (2)

discontinuous transition, composed of a single abrupt change in the position of the articulator, which appears to emphasize the initial or final portion of the event structure (transitional NMs). While transitional NM use in ÖGS is restricted to telic events (example (18), Figure 6), positional-mouth NMs may occur with both telic and atelic events (example (19), Figure 7, with an atelic event):

- (18) _____ pf
 KATHARINA IX AMERIKA FLY:[direction]
 ‘Katharina flew to the USA.’ (ÖGS, Schalber 2006: 225)



Figure 6. Transitional NM (discontinuous mouth gesture of abrupt exhaling, pf) with telic event structure (used with permission from Schalber (2006))

- (19) _____ ph
 WOMAN IX PLANE GO-BY-PLANE:[tracing]
 ‘The woman is going by plane.’ (ÖGS, Schalber 2006: 225)

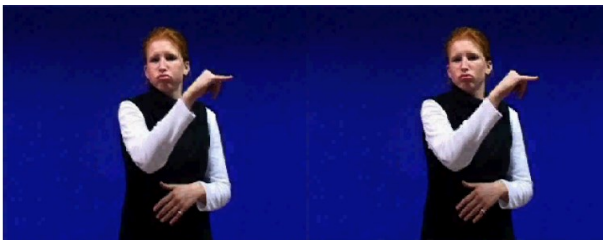


Figure 7. Positional NM (continuous mouth gesture, ph) with atelic event structure (used with permission from Schalber (2006))

Similar use of non-manuals has been identified in both ASL and HZJ (Dukić et al. 2010).

TiD. Zeshan (2003a) describes a single accentuated movement, sometimes accompanied by a head nod or forward movement of the torso, which appears to be a morpheme that can occur simultaneously with free perfective aspect markers in *TiD*. The morpheme has a phonological restriction: it does not occur with verb signs that have no path movement, and is possibly an equivalent of a telicity marker in *TiD*.

3.2. Experimental investigations of aspect and event structure in sign languages

There is a dearth of research in acquisition of reference time and aspect in sign languages, although in spoken languages the ability to infer telicity from visual and linguistic data has been identified as crucial for normal language acquisition (Leonard 2015). An account of two children learning HKSL indicates that they appear to first acquire a conflated notion of telic-perfective-past (Tang 2009), before learning the full sign-language specific system of event structure and viewpoint aspect.

Motion-capture investigations of dynamic representation of event-structure and aspect in sign languages indicate that signers do recruit physical properties of visual motion to convey verbal telicity (Wilbur & Malaia 2008a; Malaia & Wilbur 2012a, b). Analysis of motion capture data for verbal predicates in two unrelated sign languages, ASL and HZJ, has shown that signers of both languages systematically use velocity of hand motion, as well as the derivative of velocity – deceleration of the dominant hand - for distinguishing telic vs. atelic verb classes during sign production (Malaia et al. 2008a; Malaia & Wilbur 2008a, b; Malaia et al. 2013). Signers in both ASL and HZJ appear to rely on the perceptual ability inherent to the psychological mechanism of event segmentation, i.e., evaluation of comparative speed and acceleration of biological motion. Strickland et al. (2015) further demonstrated that non-signers are also capable of inferring the basic temporal makeup of events from visual observation of individual signs. Since sign languages do recruit physical properties of events for linguistic purposes, they can regularize (or grammaticalize) and incorporate those features in different language modules, as illustrated by comparisons of event structure markers in ASL, HZJ, and ÖGS. Moreover, while it is clear that some physical properties of overt events are recruited by signers of different sign languages, the full inventory of dynamic properties (so far including sign duration, velocity, and acceleration of the dominant hand) requires further investigation. Mathematically, the complexity of motion in ASL has been shown to contain more information than everyday human motion across the full range of recorded speeds of motion (from 0.1 to 15 Hz; Malaia 2014; Malaia et al. 2016; Malaia et al. 2017; Borneman et al. 2018). Thus, analyses of motion in sign languages in general, and application of event visibility to both *Aktionsart* and aspect, are far from complete.

4. Conclusion

In this chapter, we have reviewed existing research on the means of expressing various types of aspect across a variety of unrelated sign languages. The temporal properties of an event in sign languages (lexical aspect) tend to be represented as visually overt (Strickland et al. 2015; Blumenthal-Dramé & Malaia 2019; Malaia 2017), and are implied as part of the verb's lexical entry. The systems for denoting grammatical aspect, and the relationship between utterance time, reference time, and event time are less researched, and present a fascinating ground for further investigations. While empirical research on the relationship between types of aspect is complicated by the variability of representations among sign languages, the

spatial means of representing aspectual-temporal relationships in sign languages provide rich ground for cross-linguistic research into human capacity for conceptualizing time and space.

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Notes

- ¹ The difficulty for feature-based approaches lies in the taxonomic representation of multiple conflated and non-conflated argument roles that can be occupied by the argument in the same syntactic position.
- ² Iterative aspect can be considered a sub-category of continuous aspect, or an aspect by itself – the relative taxonomy often depends on whether iterativity is represented grammatically or semantically in the language under consideration. In turn, iterative aspect is sometimes viewed as subsuming a distinct subcategory of habitual aspect, although the semantics of the two are distinct: the habitual aspect “describes a situation which is characteristic of an extended period of time” (Comrie 1976: 27), while the iterative aspect’s meaning conveys “repeated occurrences of the same situation” (Declerck 1991: 277). Habitual aspect, in its turn, might include ‘frequentative’ and ‘incessant’.
- ³ See Wilbur (2005) for the analysis of the complex predicate (distributive embedded in the iterative), illustrating the use of spatial/dynamic means to express the components of event-internal structure, such as reference time and argument roles).

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