If they accept us, add head bob up and down for translocation in DGS

https://www.sign-lang.uni-hamburg.de/meinedgs/html/1177640_en.html#t00041326

Depicting Translocating Motion in Sign Languages

Cornelia Loos and Donna Jo Napoli

Abstract

Visual manifestations of an object that moves from one place to another are common in sign languages. Here we offer an overview of techniques for conveying motion of an entity based on an examination of storytelling and poetry in six sign languages. The signer can use embodiment and/or classifiers to show translocating movement of an object, or they can adjust the dynamic properties of signs themselves, including the size of the signing space, rate of movement, trilled motion of manuals and nonmanuals, repetition, and adding a zig zag component to the movement path. Additionally, we found one technique in the sign language of Germany that uses a manual sign to indicate great speed or movement covering a large distance.

Keywords: translocation, motion, distance, speed, sign languages, sign language literature

Introduction

Sign languages use space both for grammatical purposes (e.g., to encode grammatical or thematic relations via agreement verbs, see Mathur & Rathmann, 2012) and to talk about spatial relations and the movement of objects. Indeed, visual representations of an object moving from one location to another are common in sign languages. The present work is part of a larger study of the multiple techniques employed to convey the displacement of an entity in space in sign language narratives and poetry – what we call sign language literature (SLL).

In this paper, we focus on techniques that convey the translocation of an entity via movement (articulation) of a body part that represents (parts of) that same entity, where the translocation is a result of self-propulsion rather than the result of an external force (Liddell 1977; Padden 1988; and many since). We call this factive motion (equivalent to "veridical" motion in Talmy, 1996). Factive motion contrasts with fictive motion, by which one conveys the displacement of an entity via moving a part of the body that represents a different, backgrounded entity, which is factively immobile. For example, to represent an airplane speeding along the runway before take-off, one might use a ILY-classifier for the airplane on one hand and a B-classifier for the tarmac on the other hand. In a fictive motion construction, the hand representing the tarmac repeatedly moves underneath the static hand representing the plane, even though what is signified in this way is the plane's motion (for more examples and discussion see Liddell 2003, pp. 294-301; Lucas and Valli 1990; and Müller 2018, pp. 78-79 and 256). In this paper, we focus on factive motion, i. e. representations that indicate movement of an entity that does, in fact, move.

Why look at factive motion in sign languages? It would seem that any language must be able to communicate details about translocation, including motion across large distances and/or at great speed. In spoken languages those details are easily handled via the addition of lexical items to the sentence, typically within the syntactic phrase. This is generally not the case in sign languages, probably because of the great temporal cost of articulating additional lexical items in a given sentence. The rate of spoken language production of individual words is greater than twice that of sign language production of individual signs, yet the amount of time it takes to express a proposition in speech and in sign is the same (Bellugi and Fischer 1972; Yan 1993). In fact, all human languages appear to have comparable information rates (Coupé et al. 2019). Sign languages manage to meet this apparently universal requirement by generous use of layering (vertical processing); that is, simultaneous delivery of multiple bits of information (Wilbur 2000).

A large chunk of the existing literature on motion in sign languages is devoted to determining how much information about complex motion events can be expressed simultaneously and where the limits to simultaneity are (e.g. for ASL, see Supalla 1990; Taub & Galvan, 2001). While this literature tends to focus on the simultaneous vs. sequential expression of the Figure and Ground components of a motion event, as well as the Manner of movement and the Path traversed, our focus here is on two further properties of a translocating motion: speed and distance traversed.

In addition to pressures to express details of the motion event in a compact manner, sign languages face modality-specific issues regarding the encoding of distance and speed. Spatial relations highly favor iconic representation in visual-gestural languages, but iconic representations of moving across a great distance or at great speed are constrained by physical limitations of the signing space and of the signer's manual movements. In other words, there is only so much distance that an arm's length can convey. Sign languages rise to this challenge with extraordinary resourcefulness, as we will show.

Thus, we offer this study as a contribution to phonetics and semantics research on sign languages: We want to know how sign languages express translocating movement, especially if it covers large distances or unfolds at great speed. However, we have two additional hopes. One is to enhance understanding and appreciation of SLL. Another is to uncover areas of potential application to machine translation.

This paper is structured as follows. First, we provide some background on the types of signs and constructions we examine and present our data sources and methodology. Next, we detail depictions of fast and/or far movement via embodiment, different types of classifier constructions and two lexical signs, and via modulations to the path movement of a sign. Finally, we offer conclusions for linguistic analysis and point out areas of applied linguistics which the current findings may inform.

Background on the signed constructions under investigation

The creative sign language examined here for its encoding of translocating motion encompasses both lexical signs and the productive signs called classifier constructions (for more on lexical verbs that express motion, see Supalla, 1982, and many since, for motion in classifier constructions, see e.g., Brennan, 1992; Russo, 2004; among many). In addition, the technique of embodiment or role shift/constructed action (Emmorey and Falgier 1999; Cuxac and Sallandre 2007; Cormier, Smith, and Sevcikova-Sehyr 2015; Hodge and Ferrara 2014among many) is heavily used in SLL to show a character's movement (Asmal and Kaneko 2020; Bauman 2003, 2006; Bragg 1995; van Brandwijk 2018; among many). With embodiment, a character's body parts are mapped onto the analogous body parts of the signer and the space in which an event takes place is projected onto the signing space relative to the point of view and size of the character whose actions are portrayed. Embodiment is common in narratives, but also found in other genres (de Beuzeville, Johnston, and Schembri 2009; Quinto-Pozos 2007; Quinto-Pozos and Mehta 2010). In a study of Israeli Sign Language that used Kinect motion tracking technology, Stamp and colleagues (2023) found that lexical signs, classifier constructions, and embodiment (what they label CA for constructed action) significantly differ kinematically in a number of ways. Regarding manual movement those differences include:

- Lexical signs are shorter in duration, cover a smaller distance, are articulated closer to the body, and take up a smaller volume of space than classifier construction and embodiment. However there are no significant differences on these characteristics between classifier constructions and embodiment.
- Lexical signs have faster movement than classifier construction. However, there are no significant differences in speed between lexical signs and embodiment and between classifier constructions and embodiment.

In sum, lexical signs stand apart kinematically from classifier constructions and embodiment, which are kinematically similar. Stamp et al. suggest that their findings support the claim that the movement parameter in classifier constructions is gestural in nature (see also Schembri et al. 2005), and, in fact, that classifier constructions are gestural in nature, as is embodiment. The latter has properties typical of gesture, not language, according to the criteria of McNeill (1992), including being gradient, idiosyncratic, and not entering into compositional expressions with one another. Therefore, in order to confirm that the behaviors we illustrate in this study are part of sign language grammars (regardless of what their original source might have been), whenever we illustrate a technique for conveying translocation of an entity with classifier constructions and/or embodiment, we also list examples of lexical signs that employ the same technique.

Data set and methodology

We examined SLL from seven different sign languages. The data set we draw from includes those sign languages for which we have a large number of videos available, including American Sign Language (ASL), German Sign Language (DGS), and sign languages of several other European countries. This allows us to present examples with confidence that they are representative rather than exceptional. The preponderance of ASL and DGS sources is an artifact of how we went about doing our research: we first noticed many techniques in ASL and DGS, then went searching to see if they were found in the literature of other sign languages we had some familiarity with. However, a quick perusal of children's videobooks on the RISE website[1], which includes sign languages in many other areas of the world, including Asia, Africa, South America, and the Middle East, reveals these same types of techniques. For this reason, we talk of techniques in sign languages in general. On the other hand, we are not claiming the list of techniques studied here is exhaustive of SLL in general, but only of our data set.

The videos that form our data set are listed in Table 1 with the names of the artist (where available) and the name of each video. In most instances, the videos are available online, as indicated in Table 1. Note that we draw examples from a small selection of the sources, but we could have drawn examples from all sources if we had wanted to give multiple examples of each technique.

<TABLE 1 GOES AROUND HERE>

In the discussion below, we distinguish classifier constructions and embodiment from established lexical items in a given sign language by using our own familiarity with these sign languages and by drawing upon the data on spreadthesign.com, as accessed on 1 March 2023.[2] The database contains entries for 42 national sign languages plus International Sign, which we do not consider here.[3] Not every concept has an entry in every sign language on spreadthesign.com, e.g. DISTANCE has entries for 33 different sign languages, while TIPTOE only has entries for 24.

[1] https://riseebooks.wixsite.com/access

[2] Scholars at the Università Ca' Foscari Venezia vouch for spreadthesign, as indicated here: https://www.disabili.com/aiuto/articoli-qaiutoq/lis-on-line-il-primo-video-dizionario-delle-lingue-dei-segni

[3] All our counts treat "Hindi" and "English (India)" as one sign language, since both the signer and the signs are identical for the two entries on spreadthesign.com.

Where appropriate, we indicate how many entries a given concept has in the database. We also cross-checked entries on spreadthesign.com with (corpus-based) dictionaries or lexical databases whenever possible, including the following:

- ASL: https://www.signingsavvy.com/
- BSL: https://bslsignbank.ucl.ac.uk/
- DGS: https://www.sign-lang.uni-hamburg.de/meinedgs/overview/start.html
- LIS: https://pcmac.download/app/917187457/dizionario-lis
- LSF: http://www.sematos.eu
- NGT: https://signbank.cls.ru.nl

In some instances of videos in LIS and LSF, one author had worked with the deaf signers as they made the videos and discussed their intentions with them at that time. With regard to BSL, NGT, and ISL, one author consulted with signers of those languages, including in one instance, the artist himself.

For a detailed quantitative phonetic study of sign languages, the ideal situation would be to examine high quality, multi-camera video data, recorded using a motion-sensing input device such as *Kinect*, with its accompanying software (Puupponen et al. 2014). Data collected and analyzed in this way can be precisely measured for duration and size, among other things. Most of the videos we analyze, instead, are available on the Internet and, with the exception of the dictionaries, were not created for linguistic study, thus many factors are variable, including camera angles and lighting. We used our unaided eyes to detect the articulations we discuss below, where we separately annotated them and then checked for consistency. We found no discrepancies between us, which is unsurprising given that the factors we note involve relatively large articulations (in contrast to the nonmanual articulations studied in Puupponen et al. 2014). While we mention nonmanual articulations that stand out to us and that we expect an audience would easily see, perhaps a study done under the ideal conditions would reveal additional ones. Since our hope here is to present an initial sketch of factive motion techniques in SLL, we believe our method is adequate to the task.

Techniques for indicating factive motion through space

Here we consider techniques in SLL for indicating motion of an entity through space. We usually illustrate each technique with only a single example from SLL, but the data set contains multiple examples of each type of technique, though they may not necessarily be identical in structure. We further indicate use of each type of technique in the established lexicon to the same effect (whether or not we found any such lexical items in our data set). We start by describing the different types of classifiers that can represent the motion of an entity (including the body classifier or embodiment), and then the use of two manual markers that indicate distance and/or speed in DGS. Last, we turn to adjustments of dynamic qualities of articulation of a given sign that can indicate an entity's motion.

Motion of a whole entity

There are two major ways of presenting a whole entity in a sign language: embodiment and classifiers. Each of these methods has two major techniques for conveying translocation of that whole entity, as we show in the subsections below. Signers frequently use embodiment and classifiers simultaneously (Aarons and Morgan 2003; Dudis 2004; Metzger 1995; Perniss 2007; Sallandre 2007, Sallandre and Cuxac 2002; Slobin et al. 2003.) In this way they create a blended viewpoint – the character viewpoint in the embodiment and an observer viewpoint in the classifier (see a particularly clear discussion in Kurz, Mullaney, and Occhino 2019).

Embodiment with whole-body displacement

One way to convey that an entity translocates is by embodying that entity and displacing the torso through articulation of (parts of) the lower limbs.

However, locomoting the entire body is a rare option in our data set. We find it in works by *The Flying Words* duo Peter Cook and Kenny Lerner, as in *Charlie* [10:57] and the *Baseball* piece [17:34], where signers jump or run across a stage to depict jumping or running. Such whole body movements are likely limited to SLL; we have come across no lexical items that use this strategy. This is not surprising given that the phonology of established/ mature sign languages does not include lower-limb movement (regarding ASL, see Supalla 1990; but see Nyst, 2007 on leg movement in a village sign language). In this vein, Mineiro and colleagues (2021) have pointed out recent data on an emergent sign language where the movement of leg articulators decreased by 20 per cent over the span of two years. Translocating via whole body movements may thus form part of the gestural repertoire that characterizes embodiment rather than a part of sign language grammar.

A second way to show translocation via embodiment involves articulation of parts of the lower limbs without locomotion of the signer. Again, this strategy is predicted to be rare under the assumption that lower limb movement does not form part of the phonology of established sign languages. In Figure 1 we see an ASL example from *Black Hole: Colors ASL*. The poet Debbie Rennie embodies a character that climbs a ladder. She goes up on the balls of her feet to indicate climbing– moving her entire torso up and down (starting around 0:24). We capture from the bottom of the frame to the very top, so that the change in the height of the top of her head is easily noted.

<FIGURE 1 GOES AROUND HERE>

In contrast to whole-body movements, we do find a few examples of lower-limb movement in established sign languages. Bear in mind that dictionaries of the established lexicon in sign languages tend to film only the torso and up of a signer (and often the signer is seated), therefore it is difficult to find examples of displacement of the torso to convey translocation of the entire entity via going up on the balls of the feet. However, judging from the changing level of the top of the head, we can point out two examples from spreadthesign.com: BALLET in the sign languages of China, Mexico, and Portugal; TIPTOE in the sign languages of China, France, and Russia. Whether embodiment forms part of the lexical entry of these signs or was added by the sign models to illustrate the meaning of the sign, we cannot determine here. We simply note that going up on the balls of the feet is one – seldomly used – option for portraying upward movement of an entity in SLL and that it may also support lexical signs in at least some sign languages.

Embodiment without whole body displacement

When a signer embodies a character in a narrative, the signer's movements become the character's movements, but signers can also move only parts of their body to indicate that the entire character is moving - without displacing their own bodies or even just their torsos in space (Fekete 2017; Liddell 1990; Sallandre 2007; among many). Our LSF example of this is shown in Figure 2: Edwige Ratagne indicates that the character she embodies (the gingerbread man) is running fast and far by holding 5-handshapes facing each other in front of either side of the mid-chest. The hands shake quickly via elbow flexion that is out-of-phase, i.e. one hand is moving upward while the other is moving downward (see 1:53 for example). Her arms represent the gingerbread man's arms as he runs; each shake of the hands is understood to coordinate with a step of the foot opposite the hand. Thus the runner's arm movement metonymically stands in for their entire body's translocation. Here the rapidity of articulation plus the smallness of the space it covers suggests that a great distance is covered in a small amount of time.

<FIGURE 2 GOES AROUND HERE>

This metonymic technique for showing translocation is common in SLL and is reflected frequently in the established lexicons of sign languages. For example, embodiment can be used for encoding concepts that typically imply translocation, such as 'swim', where motion of the body through water is represented only via the arms' movement. SWIM in all but one of the 32 national sign languages presented for this lexical item on spreadthesign.com uses embodiment in this way. The strategy is not limited to verbal signs; nouns expressing a concept that is associated with translocation can also use embodiment: consider LADDER, for which 13 sign languages use embodiment and 12 use classifiers, instead), and one (that of Chile) uses both. Here, an upward grabbing movement of the hands metonymically stands in for upward displacement of a character.

Classifiers that change size/ Changing handshapes

Translocation of an entity can also be represented with the help of whole entity or tracing/extension classifiers (the latter are also known as size-and-shape or perimeter classifiers, see e.g., Zwitserlood 2012). We discuss tracing/extension classifiers in this section and entity classifiers in the next. Tracing/extension classifiers may consist of multiple-articulator handshapes which allow showing that a character is moving farther away from or closer to a given reference point (see general discussion of multiple-articulator handshapes in Napoli and Ferrara 2021, Section 4.5). Typically, the signer starts with an L-handshape that changes to a G-handshape (or even a flat-O-handshape), as the hand moves away from the body. The idea is that the two fingertips represent the top-most and bottom-most edges of a character. As the character moves into the distance, it appears smaller to the viewer; accordingly, the fingertips move closer together as the hand moves away from the body. This tracing/extension classifier, then, traces not only an entity's size at a given point in time, but across a given period of time. In a way, translocation is shown metonymically here too, via the change in perceived size of a character at different locations of the movement path. The technique is common in many languages, including those of Western European origin, but does not appear in others, including at least three of West African origin (Nyst 2018). Figure 3 shows an example from ASL; Vienna Procopio uses a multiple articulator handshape to indicate that one of the three little pigs ran away from the big bad wolf really fast (see 2:44-2:45).

<FIGURE 3 GOES AROUND HERE>

Our focus is on movement, in particular, rather than on how far away a given object is. The distinction is not always clear, however, since movement covers distance, so the resultant position of the moved object can be near, or at a moderate distance, or far. The mouth and eye articulations that go with great distance in ASL are the ones employed in Figure 3 (see Wheeler n.d.).

Likewise, one can start with the fingertips close together and then move them apart (G/Flat-O to L-handshape) as the hand moves toward the body to show that a character is coming from the distance to a point closer to the signer (or another relevant point of reference). In Figure 4, Ella Mae Lentz uses a multiple articulator in ASL to indicate that the Road Runner is coming up fast on a motorcyclist from behind (see 0:45-0:46). We found this technique only once in our data set and one of our reviewers noted that it is far less common than that shown in Figure 3.

<FIGURE 4 GOES AROUND HERE>

Regarding the established lexicon, we find multiple-articulator handshape change used to indicate distance covered in the sign for ACCELERATE in Icelandic SL on spreadthesign.com, where diminishing size from increasing distance is associated with acceleration. Further, the L-handshape moving outward while changing to a flat-O is lexicalized in the DGS sign (GO)-AWAY.

Classifiers that do not change size

A more common way to show translocation of an entity (and one found throughout our data set) is to use whole-entity classifiers for characters in a narrative and move those classifiers in a certain direction at a certain speed, conveying direction and speed of motion of the character (Sutton-Spence 2010, 51 ff.). This is famously illustrated in ASL with Ben Bahan's *Ball Story* (Bahan 2006), where a number of different characters follow a ball on its complex trajectory. Each character is represented by a different classifier – for example, an old man (X-handshape), a girl on roller blades (1-handshape), or a boy on a bicycle (3-handshape). In Figure 5, Richard Carter moves the 1-handshape whole-entity classifier forward to show a little boy racing off to school (see 4:55 for example) in this BSL story. His hand moves forward so fast that his torso jerks when the hand stops. (And, as in Figure 3, the character's facial expressions are mapped onto the signer's face. We will not keep remarking on this, since the reader can easily note it.)

<FIGURE 5 GOES AROUND HERE>

Regarding the established lexicon, fossilized classifiers indicating translocation are common. The lexical item SWIM in the sign language of Japan (the only national language for this lexical entry on spreadthesign.com that did not use embodiment) uses a whole-entity classifier (V-handshape) which shows the moving legs - that is, the legs are metonymic of the whole body. We also see fossilized whole-entity classifiers in the lexical entries for MEET in all but three of the 35 distinct national sign languages presented on spreadthesign.com (mostly using the 1-handshape, some with a V/H-handshape and one with a B-handshape).

Manual markers of distance and speed

In the data from the DGS Corpus, we noticed a technique for marking distance and/or speed of factive motion that did not occur in the SLL videos of other sign languages that we examined: a manual sign that, so far as we know, has not been remarked upon in the linguistic literature, does not occur in dictionaries (that is, it hasn't been recognized as part of the established lexicon), and occurs exclusively simultaneously with a classifier on the other hand.

The sign in question has the B-hand perform repeated flexion at the wrist and we will therefore refer to it as B-flap. We exemplify its use with an episode of *Canary Row* cartoons, *Tweety Bowling Ball*, as retold by the signer from Stuttgart. In one scene, the cat Sylvester has swallowed a bowling ball and is rolling quickly along a street and straight into a bowling alley. The signer represents Sylvester's movement path via a 1-handshape with the palm facing down that moves horizontally and diagonally to the left, while the non-dominant hand assumes a B-handshape and performs repeated flexion of the wrist with the fingertips pointed towards the signer (38:12, see Figure 6c).

<FIGURE 6 GOES AROUND HERE>

The DGS Corpus also contains at least one token of a variant of the B-flap that has finger fluttering instead of wrist flapping. In Figure 7, a DGS signer from Cologne re-telling the *Canary Row* cartoons[4] shows Sylvester being catapulted up into the air with a 1-classifier on the dominant hand while the non-dominant hand flutters its fingers (min. 20:04).

<FIGURE 7 GOES AROUND HERE>

The flutter seems to indicate that Sylvester goes high up into the air at great speed, an impression confirmed for us by a deaf native signer of DGS. The same signer in Figure 7 also applies the flutter when the cat descends, seen in Figure 8 (min. 23:10). As we discuss below, finger fluttering instantiates trilled movement, which is a common modulation of the movement dynamics of a sign to show speed of movement and/or great distance.

Coming back to the B-flap and its linguistic status, the sign at first glance seems to instantiate a fictive motion construction in that it represents a series of static background objects that are moved past Sylvester. However, what those background objects may be is difficult to construe for the viewer: As the pictures of the relevant scene from the cartoon in Figures 6a and 6b illustrate, no part of the background corresponds to a series of uniform entities that might be represented by a B-hand whose fingertips point towards the narrator. A native signer of DGS we consulted suggests that the sign generalizes over different types of objects that Sylvester passes on his way to the bowling alley, confirming the sign's fictive motion motivation but, at the same time,

[4] The original cartoon can be watched at https://looneytunes.fandom.com/wiki/Canary_Row?file=Sylvester+and+Tweety+E19+%E2%80%93+Canary+Row.

its current more lexical status. If it were a classifier, we would not expect it to be able to group objects of such dissimilar shapes as the houses, telephone poles, cars, etc. that Sylvester passes by (see Figure 6b). Instead, B-flap has evolved to contribute the meaning that the motion of the entity represented by the 1-classifier on the right hand (Sylvester) covers a great distance at great speed, an impression confirmed for us by our DGS consultant.

This suggests that classifiers representing the ground in fictive motion constructions may over time develop into factive techniques for representing the speed and/or distance covered by an entity's motion. In support of this hypothesis, we offer two examples from the established lexicon that seem comparable to the DGS phenomenon. TRAIN in the sign language of Sweden (Figure 9) has the dominant hand move forward and backward in what looks like it might be a classifier for a vehicle, while the non-dominant hand runs along the bottom of the dominant hand, moving forward and backward in opposition to the nondominant hand, likely representing the tracks that seem to pass by (that is, fictive motion).

<FIGURE 9 GOES AROUND HERE>

Adjustments to dynamic properties

Many have noted that dynamic factors of the movement component of signs can be exploited to indicate information about the (geo)physical properties of an event. For instance, the maximal distance traveled by the hand can indicate the end of an event/action (Malaia and Wilbur 2010), while changes in the rate of movement and movement repetitions can indicate a range of meanings, including aspectual information (such as continuous or habitual aspect). Rapid acceleration can indicate initiation of an event and rapid deceleration to a complete stop can indicate that an event does not, in fact, occur (Wilbur 2008). Such use of dynamic features to indicate temporal information about events may be universal in sign languages and has been captured, among others, in the Event Visibility Theory (Ferrara and Hodge 2018; Krebs et al. 2021; Malaia and Wilbur 2012; Malaia, Wilbur, and Milković 2013; Wilbur 2003, 2005, 2008; and many more; and for relevant remarks on co-speech gesture, see Kendon 2004, especially p. 169).

In this paper we are concerned with two further geo-physical properties of events that can be depicted via adjustments to movement dynamics: distance and speed. Our examples in this subsection concern the size of the sign (that is, the amount of signing space a sign's movement takes up – what some have called volume), the rate of movement, trilled and repeated movements, and zig-zag shaped motion. At the end of this subsection we try to disentangle co-occurring functions of modulations to movement.

Size of the articulation/ signing space

One can adjust the size of the sign(ing space) in a narrative in at least two ways to indicate that a distance covered is large or small. First, one can enlarge the signing space through larger articulation of the manuals. Our example in Figure 10 is from DGS: Dawei Ni (see 3:04-3:06) signs WORLD-SPIN-ON-ITS-AXIS going from in front of his body to forward and off to the right to show that time is flying by. The passage of time is conveyed metonymically through one of its corollaries, namely the spinning of the world on its axis and around the sun. Both the distance covered by the hands and the speed of the movement indicate that a great spatial distance has been covered and our world knowledge then kicks in to tell us, therefore, a great amount of time has passed by.

<FIGURE 10 GOES AROUND HERE>

Regarding the established lexicon, adjusting the size of the signing space to augment or diminish the size of a sign's sense is commonplace (Cuxac 2000; Nyst 2018; among many). The entries for BIG and SMALL in the sign languages of Germany, Slovakia, and Pakistan/Urdu (as shown on spreadthesign.com), for example, contrast only by the distance between the hands. The same contrast in distance between the hands occurs for BIG and SMALL in the sign languages of 19 other countries (out of 35 that have entries for BIG and SMALL on spreadthesign.com), where there is also a compatible difference in handshapes – such as spreading fingers for BIG or curling fingers for SMALL, or a 5-handshape for BIG versus a 1-handshape for SMALL. In these languages, then, we see examples of moving the hands apart in a gradient way to create signs that show degrees of bigness or smallness. Most pertinent to us, we see distance via signing space built into the entries for FAR in 32 of the 36 sign languages that have an entry for this sign on spreadthesign.com, in that one hand moves (nearly) the full arm span, drawing a line that covers more signing space as it goes.[5] This line can be enlarged even further by using an arc-shaped instead of a straight movement path, as found in the signs for DISTANCE in the sign languages of Brazil, Australia, Italy, Latvia, Iceland, and the US, as well as in signs for FAR in the UK, Germany Poland, New Zealand, and Belarus.

A second way to enlarge the signing space articulates the torso as well as the manuals. This involves leaning away, creating more distance between the torso and the hands, which can "give a sense of distance between the sign and the signer" (Wilbur and Patschke 1998, 279). The example in Figure 11 is from LIS: Rosaria Giuranna in *Sogno* shows how high a building (the metaphorical instantiation of her ambitions) has grown by stretching her right arm as high as possible – increased by the extension of her pinky finger – and making the tip of that hand ever more distant from her trunk by leaning to her left and lowering her left shoulder (0:33).

<FIGURE 11 GOES AROUND HERE>

A further example of this technique in SLL is illustrated in Figure 3, where Vienna Procopio leans away from her hands and thereby creates the impression of a greater distance covered by the character she represents on her dominant hand.

This technique occurs in the established lexicon, as well: among the 33 entries for DISTANCE in on spreadthesign.com, ten involve moving the head further from the moving hand (by tilting it upward or displacing it backward or rotating it to the side so that the nose is farther from the moving hand).

Modulation of movement rate

Increasing the speed with which the hands articulate a movement can show either increased speed of the depicted movement or that the distance an entity covers during such a translocation event increases. Depicting speedy movement via a fast articulation is commonplace and illustrated, for example, in Vienna Procopio's depiction of a little pig running fast from the big bad wolf (see

[5] The four remaining entries exhibit repetition (Bulgaria and Romania), articulating the radioulnar in a trill (Sweden), or rapid deceleration (Estonia) to express great distance. We further observed for several entries for FAR that (full) arm extensions were accompanied by various other articulations to enhance the distance of the movement path: Articulating the radioulnar in a trill (as in China, Czech Republic, Denmark, Finland, and Slovakia) or spiraling the path (as in Croatia) or zig-zagging the path (as in Portugal). See the subsections below on repetition, trilling, and zig-zagging.

Figure 3). Established lexicons of many sign languages also contain instances of fast signing for signs concepts that involve rapid movement – 23 entries for FAST on spreadthesign.com (out of 33) feature a speedy articulation, as do 12 (out of 31) entries for RACE. Perhaps more surprisingly, speedy or accelerated articulations can also represent covering a large distance (at varying speeds). movement. In a re-telling of the Canary Row cartoons from the DGS Corpus, the signer from Hamburg narrates how the cat Sylvester climbs up the outside of a very tall drain pipe to reach the apartment where the bird Tweety lives (Figure 12a, 1.29 in the original cartoon). The signer accelerates the climbing movement of his hands over a span of four seconds, while Sylvester's actual climbing motion in the video remains relatively slow and deliberate. The signer's movement acceleration then seems to indicate that the distance covered is great (Figure 12b, 8:39 in the video).

<FIGURE 12 GOES AROUND HERE>

This technique is also attested in the established lexicons of several sign languages, for instance in the signs for FAR in the sign languages of Iceland, Belarus, Japan, and the US (spreadthesign.com).

Trilled motion to show speed or distance

Repeated small, quick, tense movements are called trilled or oscillated (Brentari, 1998; Liddell, 1990; Padden & Perlmutter, 1987). They are differentiated from other types of movement repetition by their speed and the fact that they are uncountable. Some trilled movement is taken to be a meaningless phonological characteristic of a sign, and is always secondary (that is, it does not have a path), involving rapid repetition of handshape change, orientation change (via radioulnar movement), or finger wiggling (Corina & Sandler, 1993). This type of trilled movement has been called trilled internal movement (TIM) by some (e.g., Brentari 1990; Sandler 1989), but simply trilled movement by others (e.g., Brentari 1996; Sandler 1993) and is studied in relationship to sonority and syllable structure (in varying ways, see discussion in Corina and Sandler 1993, 199 ff). In contrast, here we look both at trilled internal movement and trilled movement overlayed on a movement path. We argue that it is added to the articulation of a sign to indicate speed or distance.[6] Interestingly, this trill can be added to either the manual parameter of the sign (either or both hands) or to non-manuals that accompany the sign.[7]

In the LSF version of *The Gingerbread Man*, Edwige Ratagne represents a cow chasing the gingerbread man by using two 1-handshape classifiers (Figure 13). She trills the forward 1-classifier via slight adduction-abduction movements of the shoulder joint, which, since it is overlayed with a forward path movement, results in the forearm moving forward in a rapid and extremely narrow zig-zag. The trill tells us that the gingerbread man is running as fast as he can (2:22-2:23 – see also 3:04 and several other times).[8] In Figure 13, the classifier on the front manual articulator is trilling so fast, it appears blurred.

<FIGURE 13 GOES AROUND HERE>

In Joshua Beckman's ASL rendition of *Three Kittens* we find a trilled left-to-right rotation of the head while the 3-handshape and the 1-handshape classifiers move forward, the rear one chasing the other (1:10-1:11), shown in Figure 14, again indicating that the referent's movement is particularly fast.

<FIGURE 14 GOES AROUND HERE>

Regarding the established lexicon, a non-manual trill is attested in the ASL sign WAY-OVER-THERE, which, according to Liddell (2003), is produced with a repeated lateral tongue flap. Further, we find trills of a variety of manual articulators in the spreadthesign.com entries for FAST in the sign languages of Spain (fingers flutter), Lithuania (wrist), Bulgaria (elbow), Slovakia (wrist), and China (wrist).

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[6] Trilled movement as studied here is also to be distinguished from trills inherent to a lexical item or trills added to a lexical item to draw the interlocutor's attentional focus to it (as happens in Ethiopian Sign Language; see French, 2018).
[7] Trills of non-manual articulators are common, especially bilabial trills (for Danish Sign Language, see McGregor et al., 2015; for Adamarobe Sign Language, see Nyst, 2008; for Ethiopian Sign Language, see French, 2018; for the variety of sign used in Kakuyl Kulup in the Western Highlands of Papua New Guinea, see Reed, 2019).
[8] The trill here is accompanied by the tight-closed-lips mouth morpheme that means 'fast' (similar to the clench mouth morpheme in ASL that, when accompanying trilled manual movement, also means 'fast'; Bickford & Fraychineaud, 2008, pp. 39-41).

In the above examples, the trill indicates speed, and it has been claimed that this trill "only has a temporal interpretation, never a spatial interpretation" (Wilbur 2008, 235). Of course, speedy movement may imply the coverage of a great amount of distance, but the claim is that displacement across large distances is not entailed. Instead, the claim seems to be that the quick movement of the fingers in a trill are iconic of quick movement of the entity. However, the established lexicon suggests that this is not so. Liddell (2003, 177–178) finds a radioulnar trill accompanying the long path movement of ASL WAY-OVER-THERE, which denotes a location at great distance from a reference point such as the signer – but it does not entail that this distance is covered at great speed. Likewise, we find this radioulnar trill in the spreadthesign.com entries for FAR in the sign languages of China, Czech Republic, Denmark, Finland, Slovakia, and Sweden, and in the entries for TRAVEL (the verb) in Cyprus and Sweden. Trilled movement appears to have evolved from marking only temporal dynamics to also indicating movement over long distances. Importantly, we have not found claims that trills are general intensifiers, excluding the possibility that they mark intensification rather than speedy movement or long distance.

Repetition

One can also show the covering of distance through repetition. In ASL, Clayton Valli in *Dandelions* has a man mow down a field of dandelions. He signs MOW five times: once the movement path is aimed to his left; once, to a little off-center; once, to his right; then again to the left; and again to off-center. He then explicitly signs that the entire field was mowed down, telling us that (the person pushing) the lawn mower covered an extensive distance. In Figure 15, we see the first three instances of MOW (0:12-0:13).

<FIGURE 15 GOES AROUND HERE>

In the established lexicon, regarding repetition, we might look for signs whose sense involves covering distance, such as DRIVE. Of the 32 entries for DRIVE on spreadthesign.com, nearly all show the hands gripping a steering wheel and making various movements. In some countries' sign languages, these movements start at one point and end at another (as in Germany, Latvia, Poland, and Sweden), where the path between the starting and ending points straightforwardly represents distance covered. But in most others, these movements are typical of hands on a steering wheel and involve a repeated alternating up and down (often with a forward or lateral direction added, resulting in a diagonal path) movement, similar to what hands do when driving (as in Brazil, Denmark, France). However, in the sign language of Portugal the hands repeat forward movement (that is, forward, then backward and forward again), which is not typical of hands on a steering wheel, and this repetition, like the repetition in Figure 15, may well serve as an indicator of distance covered. Another example is the entry for FLY (as in an airplane) in Ukrainian. It has a forward path movement, part of which is repeated such that it looks as if the plane moved backward for a bit in midair and then forward again if it were to be taken literally. Importantly, the path movements are longer and less tense than movement repetitions that have been described as deriving nouns from related activities (see, e.g., Abner 2021).

Since repetition is used in many sign languages to show that a (series of) actions extends over time (e.g. in continuous or iterative aspect marking as first described for ASL in Klima & Bellugi, 1979) the question arises whether repetition of a translocation verb primarily marks extension of the movement over time or coverage of a great distance. Distance may simply be inferred from the fact that a translocatory action has continued over an extended period of time. One way to tease the two notions apart would be to check whether repetition can also be used to show covering a great distance in a very short time, for instance to describe the movement of a rocket or a cannonball. On spreadthesign.com, only one entry for CANNON shows the movement trajectory of a cannon that has been fired, and it is done via a single movement. For ROCKET RIDE, all 18 entries that depict the movement trajectory of the rocket do so with a single movement without repetition. A native DGS signer we consulted comments that repeating the path movement of the DGS sign ROCKET-TAKE-OFF (either in its entirety or only during the latter part) quantifies over rocket flying events, hence it does not indicate coverage of great distance here. These findings suggest that repetition does not primarily mark covering distance; when it is added to a depiction of translocation, it indicates that movement extended over time and we infer that a large distance was covered.

Swaying or zig-zagging the primary movement

One can modify factive motion predicates by having the path movement of classifier constructions sway, wiggle, or zig-zag. In this way, the movement path is lengthened, and greater distance covered by the factive movement can be indicated without extending the signing space. In Lisanna Grosso's LIS story *Una giornata con Anna*, two classifiers representing mother and daughter taking a walk move along a zig-zag path (Figure 16, 1:33-1:34).

<FIGURE 16 GOES AROUND HERE>

While it is likely that this zig-zagging indicates manner of motion – that is, the mother and daughter are essentially wandering – we contend that it also indicates that the walking covers quite a distance (which would be compatible with the story). In this regard we point out that Vienna Procopio zig-zags the path of a classifier that represents the wolf in the ASL rendition of *The Three Little Pigs* (see 2:48). In this scene, the wolf is still hungry and in a hurry to find the home of the second little pig. While the wolf is surely looking in many places, he is not swaying as he runs from place to place, so the zig-zag path almost assuredly indicates distance and probably speed. Likewise, the unidentified ASL signer in *Halloween Mice* repeatedly has two hands, both classifiers, move in a zig-zag or swaying path, while translating a portion of the story rendered in English as the mice "hurrying" (see 1:12, 1:26, 1:57). She also makes a zig-zag path with the 4-hand as a classifier representing four mice at 1:39, where again speed is to be conveyed.

In the established lexicon, zig-zag path movements occur in TRAVEL in the sign languages of Russia, the Czech Republic, and Belarus. Travelers typically cover large distances, which we argue is conveyed by the zig zag. This movement modulation also occurs in the movement path of FLY (airplane) in the sign language of the Czech Republic, where it certainly does not indicate a wobbly take-off, but perhaps great acceleration. We see it in CHASE, where both hands zig zag in ten languages and only the rear hand zig zags in four more.[9]

Disentangling great distance and/or speed from general intensification

Some of the dynamic characteristics we listed as indicating great distance or speed of motion might be open to interpretation as general intensification of the depicted activity. Modulating dynamic factors of a sign's movement is said to be a common indication of intensification in sign languages

[9] We note that a spiral path occurs in TRAVEL in the sign languages of America, China, and Portugal, and in CHASE the rear hand travels in spirals in the sign languages of five countries. But we have found no instances in our data set of a spiral hand being a factive motion technique in SLL.

– including the presence of a longer initial hold (Klima and Bellugi 1979) or final hold (Sandler and Lillo-Martin 2006), as well as an increased signing rate, size, tenseness, and certain nonmanual components of a sign (Brentari 1998; Klima and Bellugi 1979; Loos, Cramer, and Napoli 2020; Padden 1988; Wilbur, Malaia, and Shay 2012; Xavier 2013). Many of these claims in the literature about intensification are in passing, however, rather than being the conclusions of pointed studies. In an experiment designed specifically to discover the dynamic factors involved in intensification of adjectives in ASL, Aonuki (2019) finds no increase in speed, nor loss of reduplication (claimed to be deleted under intensification by Klima and Bellugi 1979; Padden 1988). Modulation of the path movement may function to mark both great spatial displacement and intensification (great distance/time). We have already shown examples of zig zag movements that were compatible with covering a large distance, an impression generated by the longer movement path that a zig zagging motion has to cross (more signing space is moved through, hence a greater distance is covered). We also found two examples in which the zig-zagging movement modulation does not correspond to a larger spatial distance and which thus marks general intensification. In *Bear & Turtle and the Great Lake Race*, Peter Cook (ASL) modulates the path movement of the lexical signs SLOW (1:20-1:22) and OLD (1:26-1:27) by zig-zagging it (as in Figure 16). We find similar movement modulations for intensification of lexical signs in DGS, where adjectives such as DUMM 'stupid' can be modified to mean 'extremely stupid' by adding a zig-zag motion to the movement component of the signs (as in Figure 17, from Loos, Cramer, and Napoli 2020).

<FIGURE 17 GOES AROUND HERE>

Conclusion

At the outset of this study, we observed two major obstacles for depicting translocation of an entity in visual-gestural languages: phonological restrictions on the signer's lower-limb movements and the physical limitations of the signing space as imposed by the signer's arm length (plus torso movements). Our examination of the data shows that many of the strategies attested in SLL are conventionalized to such an extent that they can also be found in the established lexicons of these languages.

To circumvent having to use their lower limbs, signers may use metonymic strategies, i.e. representing running or swimming through the arm movements associated with these actions rather than all bodily movements necessary to run or swim. Alternatively, they can represent factive motion through whole entity classifiers or use tracing/extension classifiers to show the change in size of an entity that approaches or moves away from a reference point.

When examining how signers circumvent the physical limitations of the signing space in showing translocatory movement, we focused on two aspects that are especially difficult to depict with limited space available: moving across a great distance and moving at great speed. We looked at two manual signs in DGS that seem to have conventionalized to encode these two dimensions of movement and for which we observed no counterparts in other sign languages in our data set: B-flap marks speedy movement covering a great distance, and xxx seems specialized as a modifier that indicates great distance. At least B-flap likely has its origin in fictive motion, as do some depictions of the movement of trains and elevators in the established lexicons of Swedish Sign Language and ASL, respectively. These examples suggest that when conveying the movement of an entity, sign languages might make use of techniques indicating fictive motion. Thus, an analysis of fictive motion techniques is next on our agenda. We further showed that modulations of the movement path of a sign may be employed to depict both rapid movements and those covering large distances: trilled movements, zig zag paths, and movement acceleration can take on both functions. With our limited data set, we could not discern differences in the use of each movement modulation between a speed and a distance meaning and leave this topic for future research with a larger data base. Strategies that primarily enlarge the signing space, on the other hand, are used only to show great distance. Among those we found enlarging articulations that involve elbow and shoulder joints (e.g. fully extending the forearm), moving the torso in the opposite direction from the hand/arm, and using arc-shaped instead of straight movements as those draw a longer line in the signing space.

While these findings are pertinent to linguists and scholars of sign language literature, we have shown that over and over they have counterparts in the established lexicon. In fact, ordinary conversation displays many of the characteristics discussed here. Therefore, our findings may also have important applications for everyday life. In particular, these findings can be of use in improving assistive devices to allow automatic translation of sign languages into the text and/or speech of the ambient spoken languages. While machine translation of spoken languages operates from text to text (both discrete tokens), machine translation of sign languages operates from video to text (from a continuous to a discrete stream). The video information must be converted into representations rich enough to capture/convey the necessary range of semantic information in a sign. Early attempts revealed that glosses are too limited to do the job (Dreuw, Stein, and Ney 2007; Schmidt et al, 2013), so additional visual information is included in recent models, where it is important to be able to extract spatio-temporal features of signing (Hamidullah, van Genabith, and España-Bonet 2022; Rodríguez and Martínez 2021). De Coster and colleagues (2023) give an overview of attempts at machine translation from sign languages to spoken languages and discuss the current state of the art, where they emphasize the importance and challenge of extracting semantic information from the movement parameter. As Rodríguez and colleagues (2020, 2) say, the movement component of sign languages may "be the key to deal with variance in gestures, reducing complexity in representation models." We offer our study as a contribution toward this effort.

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TABLE 1

Artist	Title	Source
ASL (American Sign Language)		
Joshua Beckman	*Three Kittens*	https://www.youtube.com/watch?v=lapGHX_APuU
Ella Mae Lentz	*Roadrunner Wins Again*	https://www.youtube.com/watch?v=82KcldIwJx8
Vienna Procopio	*Three Kittens*	https://www.youtube.com/watch?v=2UQP39PpVgM
Vienna Procopio	*Three Little Pigs*	https://www.youtube.com/watch?v=H0FTpFWwSYU
Debbie Rennie	*Black Hole: Colors ASL*	https://www.youtube.com/watch?v=rbxPKUOvKYg
Debbie Rennie (author & performer); Peter Cook (performer)	*Psychotic Memory*	https://www.youtube.com/watch?v=RWBrpu4Amuk (26:00 to 29:30)
Peter Cook	*Bear & Turtle and the Great Lake Race*	https://www.youtube.com/watch?v=YIHHvMLkFcA
Peter Cook and Kenny Lerner (poetry duo "The Flying Words")	*Charlie*	https://www.youtube.com/watch?v=rm0WOZqItHg (9:25 to 14:08)
	Baseball	https://www.youtube.com/watch?v=rm0WOZqItHg (16:10 to 19:30)
Clayton Valli	*Dandelions*	https://www.youtube.com/watch?v=hZ1LTInEQbk
Unidentified signer	*Halloween Mice*	https://www.youtube.com/watch?v=v5TL9FgcG64
BSL (British Sign Language)		
Richard Carter	*Owl*	https://www.youtube.com/watch?v=aDFTIRSKXRg
Paul Scott	*Tree*	https://www.youtube.com/watch?v=Lf92PlzMAXo
DGS (German Sign Language/ Deutsche Gebärdensprache)		
Dawei Ni[10]	*Zeitenwandel/ Changing Times*	https://www.youtube.com/watch?v=dE55EKgQPnc
Signers from Berlin, Cologne, and Stuttgart	*Katze und Vogel* (parts 3 & 7) / *Tweety and Sylvester*	https://ling.meine-dgs.de/ Teil 3: Berlin: https://www.sign-lang.uni-hamburg.de/meinedgs/html/1419122_de.html Cologne: https://www.sign-lang.uni-hamburg.de/meinedgs/html/1984202_de.html Stuttgart: https://www.sign-lang.uni-hamburg.de/meinedgs/html/1413234_de.html Teil 7: Berlin: https://www.sign-lang.uni-hamburg.de/meinedgs/html/1419130_de.html

[10] Please note that while Dawei Ni is Austrian, he studied in Hamburg and this performance is at a festival in Germany. So far as we know, there is nothing in this video that marks the signing as Austrian (ÖGS). Rather, in this video he seems to be producing DGS-oriented poetry.

		Cologne: https://www.sign-lang.uni-hamburg.de/meinedgs/html/1431490_de.html Stuttgart: https://www.sign-lang.uni-hamburg.de/meinedgs/html/1413242_de.html original "Canary Row" animated film about Tweety and Sylvester: https://vimeo.com/317665278.
ISL (Irish Sign Language)		
David Eccles	*Frog Where are you?,*	*Signs of Ireland* (SOI) digital corpus (Leeson & Saeed, 2012)
LIS (Italian Sign Language/ lingua dei segni italiana)		
Lucia Daniele	*Tempo / Time*	https://www.youtube.com/watch?v=rohNzdku5Fw
Rosaria Giuranna	*Sogno / Dream*	https://www.youtube.com/watch?v=IcBFpg4yX8g&t=6s
Lisanna Grosso	*Una giornata con Anna*	https://www.youtube.com/watch?v=vE4GpIiiwcA
LSF (French Sign Language/ langue des signes française)		
Edwige Ratagne	*Bonhomme de pain d'épice / Gingerbread Man*	https://www.youtube.com/watch?v=ZNqJzPvDZMY
NGT (Sign Language of the Netherlands/ nederlandse gebarentaal)[11]		
Tony Bloem	*Slow Motion Portrait*	

[11] Tony Bloem's *Slow Motion Portrait* has been removed due to a copyright claim from https://www.youtube.com/watch?v=rWowtWJSd4E.

0:24 0:26 0:26+ 0:27

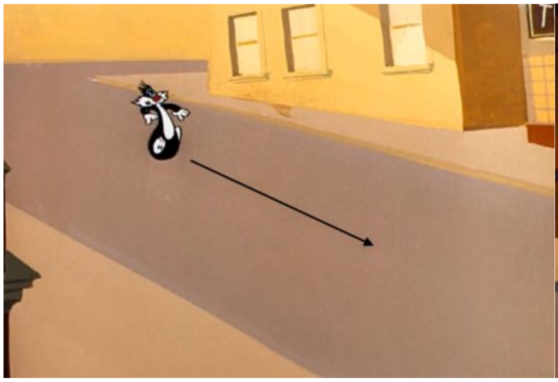
Figure 1: ASL: climbing a ladder, going up on the balls of the feet in embodiment

Figure 2: LFS: running, articulating elbows in embodiment

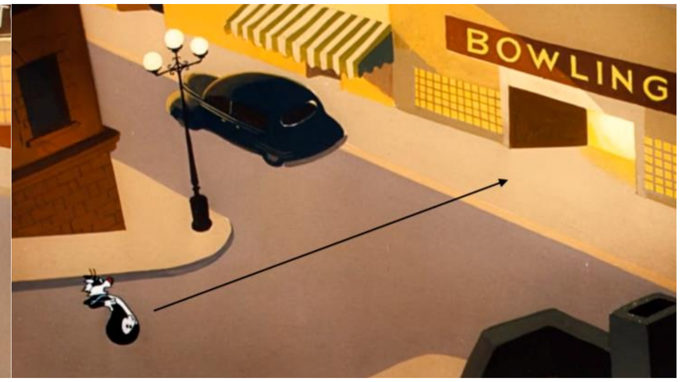
Figure 3: ASL: One of the three little pigs running away, tracing/extension classifier

Figure 4: ASL: Road Runner coming closer, tracing/extension classifier

Figure 5: BSL: boy racing away, whole entity classifier



(a)



(b)

(c)

Figure 6: DGS: cat with bowling ball in tummy rolling along the road. (a) and (b) are stills from the Looney Toons cartoon “Canary Row”, copyright Warner Bros. Home Entertainment.

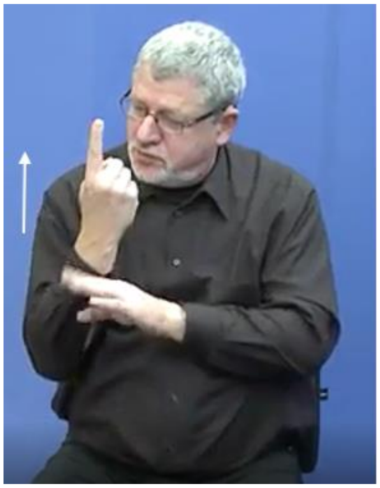


Figure 7: DGS: cat catapulted up into the air, with finger flutter showing distance

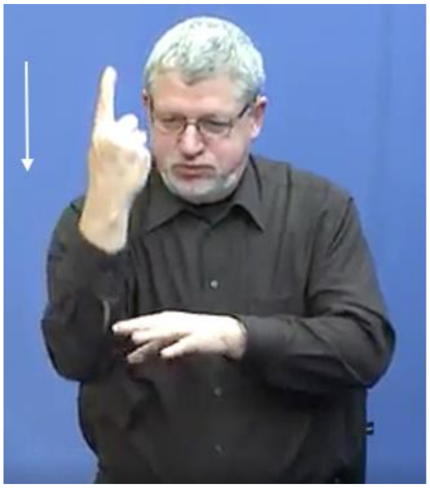


Figure 8: DGS: cat falling down through the air, with finger flutter showing distance and speed

Figure 9: STS: TÅG 'train' reprinted with permission from teckenspraakslexikon.su.se/[12]

[12] Note that there is some variation in the production of this sign: The signer from teckenspraakslexikon.su.se does not move the hand representing the tracks, while the signer on spreadthesign.com does.

Figure 10: DGS: world spinning, size of articulation shows size and speed of entity’s movement

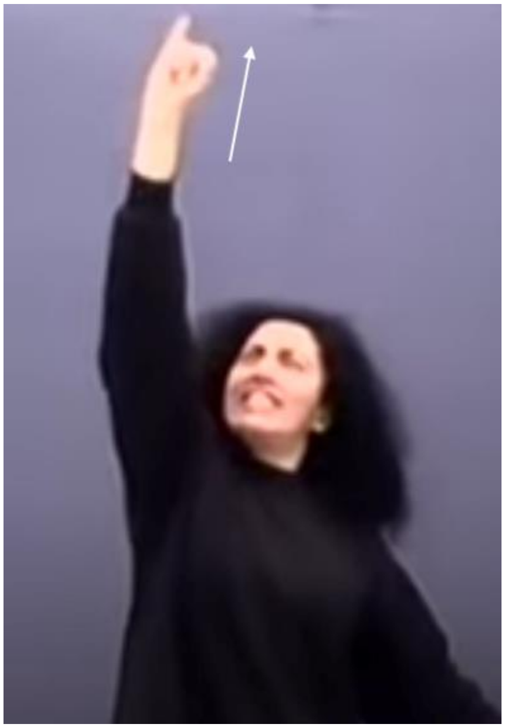


Figure 11: LIS: height of building, making distance between trunk and hand

(a) (b)

Figure 12: DGS: cat climbing slowly up drain pipe, accelerating hand articulation for distance

Figure 13: LSF: cow chasing gingerbread man, trilled classifier

Figure 14: ASL: three kittens chasing a frog, trilled head

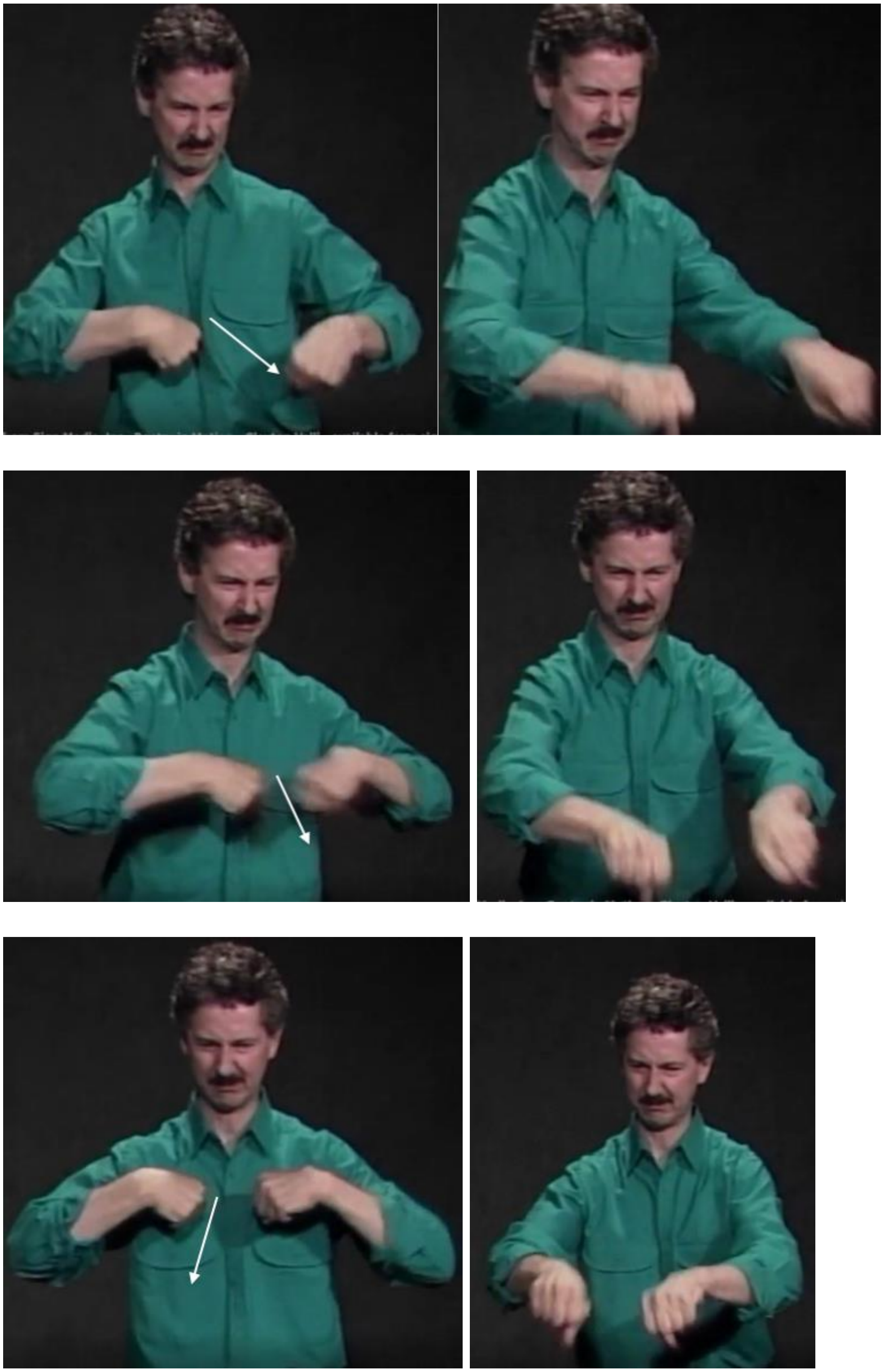


Figure 15: ASL: mowing grass, direction change, where repetition shows space covered

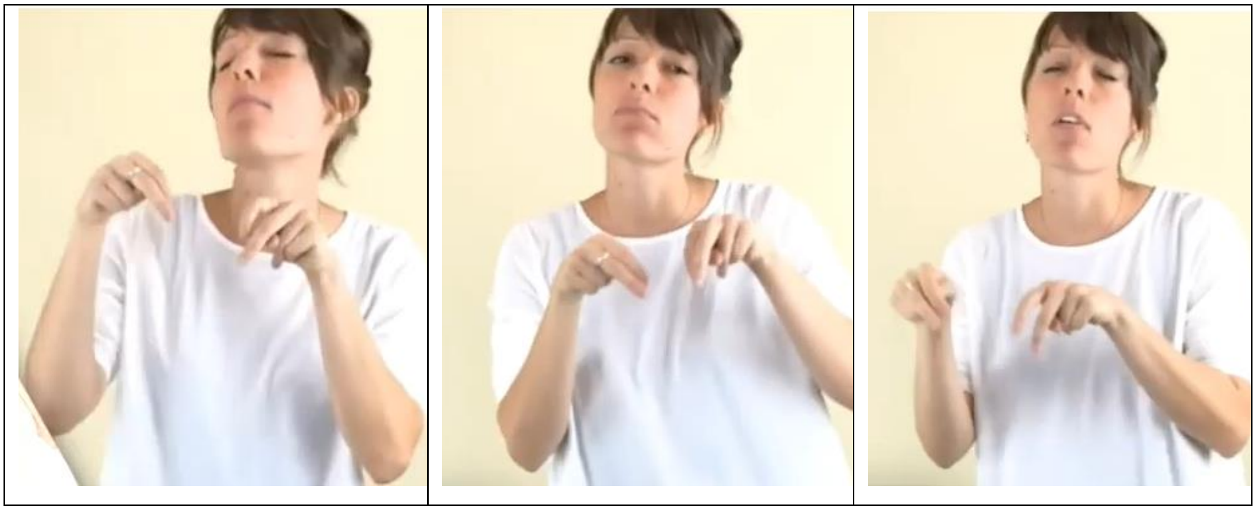


Figure 16: LIS: two characters taking a walk

Figure 17: DGS DUMM 'stupid'