University of Groningen

Linguistic, gestural, and cinematographic viewpoint

Parrill, Fey; Stec, Kashmiri; Quinto-Pozos, David; Rimehaug, Sebastian

Published in:
Cognitive linguistics

DOI:
[10.1515/cog-2015-0081](https://doi.org/10.1515/cog-2015-0081)

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version
Publisher's PDF, also known as Version of record

Publication date:
2016

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

Parrill, F., Stec, K., Quinto-Pozos, D., & Rimehaug, S. (2016). Linguistic, gestural, and cinematographic viewpoint: An analysis of ASL and English narrative. *Cognitive linguistics*, 27(3), 345-369.
<https://doi.org/10.1515/cog-2015-0081>

Copyright

Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

The publication may also be distributed here under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license. More information can be found on the University of Groningen website: <https://www.rug.nl/library/open-access/self-archiving-pure/taverne-amendment>.

Take-down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from the University of Groningen/UMCG research database (Pure): <http://www.rug.nl/research/portal>. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.

Fey Parrill*, Kashmiri Stec, David Quinto-Pozos
and Sebastian Rimehaug

Linguistic, gestural, and cinematographic viewpoint: An analysis of ASL and English narrative

DOI 10.1515/cog-2015-0081

Received August 14, 2015; revised February 5, 2016; accepted March 7, 2016

Abstract: Multimodal narrative can help us understand how conceptualizers schematize information when they create mental representations of films and may shed light on why some cinematic conventions are easier or harder for viewers to integrate. This study compares descriptions of a shot/reverse shot sequence (a sequence of camera shots from the viewpoints of different characters) across users of English and American Sign Language (ASL). We ask which gestural and linguistic resources participants use to narrate this event. Speakers and signers tended to represent the same characters via the same point of view and to show a single perspective rather than combining multiple perspectives simultaneously. Neither group explicitly mentioned the shift in cinematographic perspective. We argue that encoding multiple points of view might be a more accurate visual description, but is avoided because it does not create a better narrative.

Keywords: Gesture, sign language, ASL, viewpoint, film

1 Introduction

The relationship between cognition and film is a growing area of research. Cognitive scientists are particularly interested in how viewers schematize information when they create mental representations of films. Narratives of films – and particularly multimodal narratives – may shed light on these processes, and may help us understand how cinematographic techniques exploit perceptual processes. To

***Corresponding author: Fey Parrill**, Department of Cognitive Science, Case Western Reserve University, Cleveland, OH, USA, E-mail: fey.parrill@case.edu

Kashmiri Stec, Center for Language & Cognition, University of Groningen, Groningen, Netherlands, E-mail: k.k.m.stec@rug.nl

David Quinto-Pozos, Department of Linguistics, University of Texas, Austin, TX, USA, E-mail: davidqp@austin.utexas.edu

Sebastian Rimehaug, Department of Cognitive Science, Case Western Reserve University, Cleveland, OH, USA, E-mail: sxr453@case.edu

Figure 1: Viewer sees man being tossed up and down outside a building.

make this suggestion more concrete, consider the following example. Below we show three sequential camera shots from the 1927 film *College* (Schenck et al. 1927). In Figure 1, the cinematographic perspective (that is, the physical angle of the camera) shows the main character being tossed up and down in a blanket in front of a building. In Figure 2, the cinematographic perspective shifts to inside the same building. The viewer sees a woman getting dressed with a window behind her. As the man is being tossed, his head pops up so that he can see into her room through the window. The camera angle then shifts back to the outside view, shown in Figure 3. During this shot, we see the woman through the window. She notices the man's head popping up and she becomes angry.

To understand the scene, viewers have to know that the man is being tossed against his will. They must infer that the woman *thinks* he is deliberately trying to spy on her. Because she is depicted as middle-aged and not stereotypically attractive (something narrators usually comment on), it is improbable that the man would go to such lengths to spy on her. This series of inferences leads to a humorous interpretation of the scene.

The inferential work is aided by two cinematographic techniques. The first is a shift from a *wide shot* (we see the figures and their surroundings) in Figure 1

Figure 2: Perspective shifts: Viewer sees from inside the building.

to a *medium shot* (we see mostly the characters and some scenery) in Figures 2 and 3. The narrowing of the shot mimics the way that our attention focuses more narrowly on stimuli that are more important to us (Bordwell and Thompson 2006), and has an experiential analogue. We can attend to a larger or smaller region of physical space, and indeed one model of visual attention uses the metaphor of a zoom lens (Barriopedro and Botella 1998). The second film technique seen in Figures 1–3 is the *shot/reverse shot*. This technique, part of the tradition of continuity editing, portrays the interaction between two characters by cutting between them individually, rather than showing both in the same frame (Corrigan 2007: 66). Unlike the wide to medium shot, the shot/reverse shot depicts a shift in visual perspective that is physically impossible. In the physical world we are not able to view a scene from outside a building and then instantly from inside it; rather, we have to move inside the building to new physical location. However, because this technique is a convention in film, viewers are able to integrate such shots as components of a single event. This is an impressive cognitive feat that is often taken for granted. Research in film theory has explained it in several ways, which are summarized in Section 2, “Continuity editing and cognition”. The present study uses a different approach to explore how viewers conceptualize such scenes.

Figure 3: Perspective shifts again: Viewer sees from outside the building.

Specifically, we ask how the shift of perspective shown in a shot/reverse shot is represented in multimodal communication. We know very little about the ways that these sequences are represented in gesture, or about the ways that users of signed languages describe them. Speech-accompanying gesture is spatial, and it often represents perspective more explicitly than speech does (Sweetser 2012). Signed languages encode grammatical and gestural information in a single spatial channel, and often explicitly reference different perspectives (e. g., Emmorey and Riley 1995 for ASL and Özyürek and Perniss 2011 for German and Turkish Sign Languages). For these reasons, co-speech gesture, and also sign and co-sign gesture, provide a window onto the mental representations that viewers form when watching film segments. Studying these data, which combine symbolic (linguistic) and iconic (gestural) semantic information, can shed new light on the conceptualizations we form of such physically impossible sequences – as well as on the “possible” sequences underlying them. A second reason for focusing on a signed language is that signers may be more likely to explicitly encode a shot/reverse shot sequence. Signed languages can represent multiple points of view simultaneously (Aarons and Morgan 2003), and thus may have additional resources for showing such a visually complex scene. Indeed, an analysis of a

single Brazilian Sign Language (LIBRAS) narrative by a single user of LIBRAS (McLeary and Viotti 2010) notes that the signer uses linguistic and gestural resources to faithfully code a shot/reverse shot sequence in his signing. McCleary and Viotti (2010) suggest that various communicative techniques from cinema and LIBRAS appear structurally analogous (see the more detailed discussion of this study in Section 4, “How does cinematography affect behavior in co-speech gesture and sign?”).

In this paper, we compare narrations of the shots described above across two groups of language users: English speakers and signers of American Sign Language (ASL). For the sake of simplicity, we will refer to our English speaker-gesturers as *speakers*, and our ASL signer-gesturers as *signers*. We focus on viewpoint in these multimodal systems because the shot/reverse shot involves a shift in visual point of view. We are interested generally in the gestural and linguistic resources participants use to narrate this event, and we also explore the following specific research questions:

- 1) Because ASL lends itself to the simultaneous representation of multiple spatial perspectives, are signers more likely than speakers to simultaneously show events from the point of view of multiple characters?
- 2) Are signers more likely than speakers to explicitly reference the shift in perspective in the shot/reverse shot, as suggested by the example in McCleary and Viotti 2010?

As noted above, exploring these questions requires us to systematically examine both linguistic representations and gestural representations, given that both language systems combine the two types of information, whether in a single manual channel or across vocal and manual channels. Before describing how we carried out this investigation, we will present a brief overview of continuity editing and the cognitive capacities supporting the film technique of shot/reverse shot. We will then provide some background about the representation of viewpoint in language, co-speech gesture, and ASL before reviewing what is known about how cinematography affects behavior in these two language systems.

2 Continuity editing and cognition

The shot/reverse shot is a kind of continuity edit. Continuity edits link segments of film in ways that preserve coherence and also often edit out time or space (Bordwell and Thompson 2006). *Temporal* continuity edits mean the viewer doesn't have to watch a character walk the entire length of a street but can

just see a few slices, for example, while *spatial* continuity edits allow viewers to see the same scene from multiple angles, as in the case of Figures 1–3 above. They are natural to viewers, despite the fact that they involve abruptly cutting the action in ways counter to our experience. As Zacks and Magliano (2011) put it, “At a cut, every point in the image changes discontinuously. How do human perceptual systems cope with such a jarring transition?” (p.438). Zacks and Magliano review the neurobiological properties of perception that may explain why we don’t find cuts jarring. They suggest that having an event segmented for us by a cut is not strange because we already segment events on an ongoing basis. That is, we don’t perceive events as totally continuous, we automatically segment them. The argument is that cuts in film tend to go unnoticed so long as they correspond to places where a viewer might naturally segment action anyway. In an fMRI study, Zacks and colleagues (Zacks et al. 2010) first had participants passively view a film without having their attention drawn to event boundaries in any way, then asked the same participants to segment the film in a second task. The researchers compared neural responses from the passive viewing task to the manual segmentation, and found a strong relationship between the two. The brain responded strongly (large numbers of activated voxels) to the moments in time participants later identified as event boundaries. Magliano and Zacks (2011) looked specifically at neural response to continuity edits in a film, and found strong neural responses (which could be transient increases or decreases in activation) to temporal and spatial continuity edits, indicating that visual processing and attention regulation increased during these edits. In summary, while we tend not to be consciously aware of continuity edits, perhaps because they take advantage of our own natural event segmentation, we do perceive them.

The shot/reverse shot technique does more than cut the action, however: it also asks viewers to imagine shifting their physical perspective. Very little has been written about the shot/reverse shot from a cognitive point of view. One account argues that it is a natural extension of the human attention system, in that it mimics the way we shift our gaze back and forth between, e. g., two people having a conversation (Pudovkin 1926). However, Bordwell (2010) points out that the technique does not mimic a real perceptual experience. We can’t actually see two people in full view without moving back and forth to multiple locations. Why do we find it natural, then? Bordwell suggests that it is a convention, but one that we can learn easily because it takes advantage of universal experiences such as turn-taking and face-to-face encounters. Grodal and Kramer (2014) further argue that shot/reverse shots of faces mimic the way that we naturally look at each other, and help to create empathy in the viewer.

3 Representation of viewpoint in language, gesture, and ASL

Viewpoint typically indicates a perceiving entity's perspective on an event or scene, i. e., the locus of consciousness in a model of the world (Parrill 2012). Viewpoint can be expressed linguistically and gesturally. In spoken languages, there are many indicators of perspective (see, e. g., Sweetser 2012). Some are explicit, such as when we use direct quotations (e. g., *He said, I'm so hungry!*), which produce speech for another person, or indirect quotations, where third person pronouns and a shift in tense is used to report another's speech (e. g., *He said that he was hungry*). Others are more subtle. For example, Chafe (1976, 1994) and MacWhinney (1977, 2005) have suggested that the syntactic subject is an important indicator of point of view. A referent that appears as the syntactic subject of utterances is likely to be the locus of viewpoint. Syntactic subject will be of primary interest for this study.

The gestures that accompany speech frequently indicate a point of view as well (Parrill 2012; Stec 2012). Many gestures indicate viewpoint, such as when a gesture traces the path a character took. The character's starting point is implicit in the gesture. Gestures can also show events from either within or outside of a scene. Gestures in which the speaker uses her hands or body as though she is a character in the narrative (e. g., pumping the arms as though running while talking about someone running) have been called *character viewpoint* gestures (McNeill 1992). Gestures in which the speaker traces a character's path or indicates a location as though observing from a distance have been called *observer viewpoint* gestures (McNeill 1992). In other words, observer viewpoint gestures schematically condense information into one or two dimensions, e. g., trajectory and /or manner. Character viewpoint gestures, on the other hand, are enactive in the sense that they map the character's body onto the gesturer's body so that the gesturer's body parts *are* the character's body parts, however schematically.

In sign languages, there are important parallels and differences in the ways viewpoint is depicted (e. g., see Aarons and Morgan 2003; Janzen 2012; Perniss 2012). Comparable narrative strategies across sign languages include the use of the signer's body to portray the viewpoint of a character and the use of the signing space topographically to portray map-like information. The use of the signer's body to show the character's actions has been referred to as *constructed action* (Metzger 1995) – this strategy is comparable to character viewpoint in co-speech gesture. A strategy comparable to observer viewpoint is the use of *classifiers* for describing location, orientation, and manner of

movement of a character within topographic space (Zwitserlood 2012; Schembri 2003; Supalla 1982). Classifiers are used to portray various properties of objects and how they interact, including location/orientation, (manner of) motion, and visual-geometric features. Various types of classifiers have been proposed (e. g., see Schembri 2003), although we focus on *entity classifiers* because they portray aspects of entire objects (e. g., as opposed to a classifier that might describe only the shape of a geometric object). For example, in ASL a 1-hand-shape (index finger facing upward) is used as a person classifier, and the handshape can be articulated and moved in space to portray a person's movement in the real world, e. g., walking forward, backward, or down a hill. Classifiers may be more likely to encode information about entity shape and size (and can be argued to possess linguistic qualities such as lexical hand-shape), making them rather different from observer viewpoint gestures. Yet, both show the event from an observer's point of view.

In addition to the 'unified' viewpoint strategies described above, both language systems can also simultaneously represent multiple points of view. These multiplicities of viewpoint typically involve a partitioning of the body (Dudis 2004), such that multiple entities are simultaneously depicted on different parts of the body. In co-speech gesture, *dual viewpoint* gestures (originally described in McNeill 1992, see Parrill 2009 for a detailed description) allow a narrator to encode one entity from the point of view of a character and another entity or the same entity from point of view of an observer, as when a narrator moves her legs to show a character running (character viewpoint) and also traces the path a character took with her hand(s) (observer viewpoint). Although relatively infrequent in co-speech gesture, this partitioning of the body is quite frequent in the signed modality, where non-manual signals may combine with manuals to present multiple perspectives of an entity or event (Dudis 2004; Perniss 2012; Quinto-Pozos 2007). For example, a narrator may use a classifier (observer viewpoint) with one hand and constructed action (character viewpoint) with the other. Distributing viewpoint across the body in this way reinforces perspective, and thus is a creative and efficient meaning-making strategy which maximizes information content (Aarons and Morgan 2003). The greater frequency of body partitioning by signers, compared to dual viewpoint gesture use by speakers, is one reason why signers might be more likely than speakers to simultaneously show events in the shot/reverse shot from the point of view of multiple characters.

Speakers and signers appear to use similar strategies for communicating information about characters within narrated events (Cormier et al. 2012; Quinto-Pozos and Parrill 2015). That is, speakers tend to use character

viewpoint for descriptions of events where signers use constructed action (Quinto-Pozos and Parrill 2015), and the same pattern is observed for observer viewpoint and the use of classifiers. This suggests that properties of the events may evoke the same perspectival choice from both groups of language users. The distinction between character and observer point of view will be the primary focus on this study. While the two sets of behaviors (character viewpoint and constructed action, observer viewpoint and classifiers) are not perfectly analogous, we will collapse over the sets of terms and use character viewpoint and observer viewpoint going forward. This is not to privilege terms from the gesture literature, but simply because character and observer viewpoint are more transparent to readers not familiar with sign language research. Thus, readers should bear in mind that when we are talking about both language systems together, character viewpoint will mean character viewpoint gesture and constructed action in ASL, while observer viewpoint will mean observer viewpoint gesture and entity classifiers in ASL.

4 How does cinematography affect behavior in co-speech gesture and sign?

To our knowledge, only four studies have considered how the representation of information in video stimuli affects gesture, and none of them focused on cinematography. McCullough (1993) asked whether people describing left/right motion in a cartoon stimulus used the words left and left and right in speech, and whether their gestures accurately depicted direction of motion from the stimulus. He found that while left and right never appeared in speech, gestures were accurate for left-right motion. In other words, no one ever said *the cat comes from the left and runs right to go after the bird*, but participants showed the cat's path from an observer's point of view moving left to right. Özyürek (2002) explored whether addressee location shaped gesture. She showed participants a cartoon video in which there were left-right (lateral) and front-back (sagittal) trajectories, and asked how these trajectories were represented in gesture. She found that the location of an addressee exerted an influence. For example, participants were more likely to produce sagittal gestures when seated face to face with an addressee, as compared to side by side. This finding suggests that participants don't *always* accurately represent information from a video stimulus. Kita and Özyürek (2003) focused on how the grammatical and lexical properties of Turkish, Japanese, and English influenced the encoding of information in narrations of cartoon clips. Their study was not about

cinematography, but they did observe that left-right/front-back trajectories from the stimulus tended to be faithfully reproduced in gesture (Kita and Özyürek 2003). Finally, Parrill et al. (2010) compared narrations based on cartoon clips to narrations based on text versions of those clips, and found no differences in gesture rate, gesture type, motion event feature encoding (path, manner), or the viewpoint represented in gesture. However, it should be noted that this study did not examine *direction* of trajectory. To summarize, what literature there is suggests that cinematography serves as one input to the representations that give rise to gesture, and properties of the original stimulus (such as direction of trajectory) are sometimes faithfully depicted, but that narrators also create representations that are independent of the original input.

5 What do we know about the effects of cinematography on signed language?

Again, there is little research on the subject. There is some indication that the depiction of an event in a cartoon may influence the way it is later represented: Özyürek and Perniss (2011) and Perniss and Özyürek (2008) describe several instances of *observer perspective fused with character perspective* in Turkish Sign Language (TID). In these examples, TID signers use constructed action to enact a character's movements, but with the direction of character movement made in observer space. For example, their stimuli included a movie of a mouse flipping a pancake from a frying pan onto the floor. In *fused* re-tellings, TID signers used constructed action to show the frying pan in the hand of the mouse, but rather than flip the pancake forward along the sagittal axis – which would be consistent with the constructed action enactment – the pancake is flipped on the lateral axis, which is consistent with the way viewers saw the motion in the cartoon.

One analysis of a single Brazilian Sign Language (LIBRAS) narrative told by a single user of LIBRAS (McLeary and Viotti 2010) notes that the signer uses linguistic and gestural resources to replicate a cinematographic shift of perspective. Specifically, McCleary and Viotti note that various communicative techniques from cinema and LIBRAS appear structurally analogous. In their data, a LIBRAS user faithfully coded a shot/reverse shot sequence in his signing. Using constructed action on the same half of his body, he represented the two interacting characters in succession, simulating the cut between them with what they describe as a reset gesture (closing his eyes).

To recapitulate: the shot/reverse shot is a cinematic convention that is not faithful to perception or experience, but seems easy for viewers to integrate. We investigate how users of two languages, ASL and English, represent a shot/reverse shot sequence. Because the sequence involves a shift in point of view, we have discussed the fact that both languages are able to depict events in a character way or an observer way. Because ASL more frequently represents multiple perspectives via body partitioning, we ask whether signers are more likely than speakers to simultaneously show events from the point of view of multiple characters. We also ask whether signers will be more likely than speakers to explicitly reference the shift in perspective in the shot/reverse shot. Thus, we may see language-specific patterns in the descriptions of these scenes. However, there are also good reasons to expect speakers and signers to behave in similar ways. As summarized above, both language systems use similar strategies for portraying certain kinds of events – there are many known parallels. This pattern of results would reflect underlying cognitive principles of iconic representation.

6 Method

6.1 Materials and participants

Eighteen native English speakers (11 women) and ten ASL signers (4 women) were shown a 1 minute, thirty second video clip from the film *College* that contained the shot/reverse shot sequence in Figures 1 through 3. The film is silent (no dialogue, though typically accompanied by a musical score), so both groups watched the clip without audio. No captions were added for the ASL participants. After watching the clip, participants were instructed to “describe the clip to your partner in as much detail as possible”. For speakers, the partner was a friend who came to the study with the participant. For signers the listener was either a friend or family member. Six of the signers were native ASL signers, three were exposed to ASL between ages 6 and 12, and age of exposure is unknown for one participant.

6.2 Stimulus coding

We first created a list of camera shots for the entire clip. The first two authors watched the clip and listed camera shots: agreement was 100 %. Our focus is on

how participants describe the series of camera shots shown in Figures 1–3. We will attempt to name these shots in a way that will help readers track what we are talking about as we present our findings. The first shot will be referred to as *Man-tossed-outside*, the second as *Woman-dresses-inside*, and the third as *Woman-sees-man-outside*, where *inside/outside* refer to the cinematographic perspective (where the camera is placed). The shots are repeated here for reference as Figures 4–6.

Figure 4: Man-tossed-outside.

Figure 5: Woman-dresses-inside.

Figure 6: Woman-sees-man-outside.

6.3 English speech

All coding was carried out in ELAN.¹ Speech was transcribed and divided into clauses. We defined a clause as a complete proposition, consisting of a subject (expressed or implied) and a predicate. We then matched each clause to a camera shot as a way of organizing our analysis. Because syntactic subject of a clause will be relevant for one of our analyses, we coded the syntactic subject of each clause.

6.4 Co-speech gesture

All gestures produced by participants were transcribed and sorted into the following categories (following McNeill 1992): *concrete iconic* (gestures in which the path or shape of the hand resembles the referent), *metaphoric iconic* (the referent of the gesture is an abstract concept, such as time, or ideas), *deictic* (pointing or locating gestures), *beat* (purely rhythmic gestures). Concrete iconic gestures were also coded for viewpoint. Gestures in which participants took on the role of the character and used their hands as the character's hands were identified as

¹ Annotation software created by the Max Planck Institute for Psycholinguistics, The Language Archive, Nijmegen, The Netherlands. See Crasborn and Sloetjes 2008 and <http://tla.mpi.nl/tools/tla-tools/elan/>

character viewpoint gestures. Gestures in which the participant took on the role of an observer, using hand movements in the space in front of the body to reflect the character as a whole, were identified as observer viewpoint gestures. Very rarely, participants produced gestures that simultaneously reflected both viewpoints, classified as dual viewpoint (only two instances in this dataset). A second coder coded 20 % of the dataset to establish reliability of coding for gesture type. The two coders agreed on 86 % of coded gestures (Cohen's kappa = 0.77, indicating substantial agreement). Disagreements were resolved via discussion to create the final coded dataset. We also coded *role* for each concrete iconic gesture. Role refers to which of the characters were mapped onto the hand: the man (main character), the group of men who toss the man in the blanket, or the woman. If the gesture represented an inanimate entity (e. g., the shape of the window), we coded this as other. Because of our research questions, we will be restricting our analysis to iconic gestures (70 % of the dataset), and to gestures that had the role of men, man, or woman (93 % of the iconic gesture dataset).

6.5 ASL coding

The ASL narratives were coded for manual and non-manual depictions of meaning, which included both linguistic and gestural features of communication. ELAN tiers were used to capture lexical signs of ASL (glossed with English words), meaningful articulations occurring on each of a signer's hands (e. g., classifiers, portrayals of handling which were coded as constructed action, or deictic pointing), and uses of other body parts for representation of a character's actions (i. e., gaze, head movement, facial expression, and hand/arm movements). Each hand was represented on a separate tier to capture either the simultaneous representation of two different entities or the same entity by both hands. Entity classifiers (e. g., to represent the man, men, or woman in the narrative) were coded as classifiers. We also coded the role each hand represented (man, men, or woman). A second coder (a Deaf user of ASL) coded 30 % of the dataset to establish reliability of coding for English gloss, lexical signs, and constructed action/classifiers. The two coders agreed on 79 % of coded gestures (Cohen's kappa = 0.72, indicating substantial agreement). The third author decided on the status of the items for the final coded dataset. Because of our research questions the analyses we present will include only representations coded as manual constructed action or classifier (94 % of the total ASL dataset – this excludes only lexical signs/fingerspelling and points) and only those that had the role of men, man, or woman (96 % of the constructed action/classifier dataset). This means that non-manual actions (gaze, facial expression) are not included in the analysis.

7 Analysis

For the purposes of quantitative analysis, we noted the gender (M or F) and native language (English or ASL) for each participant. We also noted the age of acquisition (native or late), as some signers were only exposed to sign language in late childhood. For speakers of English, age of acquisition defaulted to ‘native’. For signers, age of acquisition was coded as ‘native’ if they were exposed between ages 0 and 5, and as ‘late’ if they were exposed after age 6. One participant had an unknown age of acquisition; we made the decision to code his age of acquisition as ‘late’. In order to match the co-English coding, we also recoded manual signs so that they could be reduced to character or observer viewpoint: see the appendix for details. Role was coded as man (1 if representing the man, 0 otherwise), men (1 if representing the men, 0 otherwise) and woman (1 if representing the woman, 0 otherwise). Inanimate entities were coded as 0 for role and were not included in frequency analyses. We first present an overview of the linguistic and gestural resources participants used to narrate this event, then return to our specific research questions.

How did our language users represent the three individual shots? Table 1 shows the frequencies with which the two language groups represented each role for each camera shot. We show mean proportions rather than raw frequencies because different participants produced different numbers of descriptions of each camera shot and proportions give equal weight to each participant. To clarify: if a participant showed the man once, the men twice, and the woman once in describing the Woman-dresses-inside scene, that would be a total of 4

Table 1: Mean proportions of each role by camera shot, Standard deviations in parentheses.

		Man	Men	Woman
Speakers	Man-tossed-outside	0.32 (0.27)	0.67 (0.26)	0
	Woman-dresses-inside	0.23 (0.37)	0.20 (0.37)	0.57 (0.42)
	Woman-sees-man-outside	0.12 (0.19)	0.04 (0.13)	0.84 (0.23)
Signers	Man-tossed-outside	0.58 (0.37)	0.42 (0.37)	0
	Woman-dresses-inside	0.20 (0.17)	0.03 (0.10)	0.76 (0.23)
	Woman-sees-man-outside	0.26 (0.17)	0	0.74 (0.17)

representations for that scene. The number for each character would be divided by the total, so .25 for man, .5 for men, .25 for woman. (Representations are sorted by character in this way because of our interest in the depiction of different characters.) The proportions shown in Table 1 are then the averages across all speakers and across all signers.

For each camera shot, both language groups tended to represent the same character (man, men, woman), although with some differences in relative proportion. In Man-tossed-outside, both groups represented the action of the men holding the blanket. Some participants also represented the man’s path up in the air – this was more common for signers than speakers. When describing Woman-dresses-inside, participants tended to represent the woman’s actions. For Woman-sees-man-outside, participants again primarily represented the woman’s actions, but signers were more likely than speakers to show the man’s path as well.

What viewpoint did narrators use to represent these different roles? Table 2 shows the frequencies of character and observer viewpoint for each role by language group (shown as mean proportions for the same reason as above). When representing the action of the men holding the blanket, both groups used character viewpoint. When representing the man’s path up in the air, both groups tended to use observer viewpoint. When representing the woman’s actions, both groups tended to use character viewpoint.

Table 2: Mean proportions of each viewpoint by role, Standard deviations in parentheses.

		Man	Men	Woman
Speakers	CVPT	0.20	1	0.95
		(0.31)	(0)	(0.11)
	OVPT	0.80	0	0.05
		(0.32)	(0)	(0.11)
Signers	CVPT	0.08	1	0.90
		(0.11)	(0)	(0.09)
	OVPT	0.91	0	0.10
		(0.11)	(0)	(0.09)

Note. CVPT = character viewpoint, OVPT = observer viewpoint

Rather than comparing these frequencies, we chose to use logistic regression to more thoroughly explore the relationships among our different variables. We did this so that we could determine whether viewpoint in gesture or sign was best predicted not just by language, camera shot, and the role being represented, but

also by individual characteristics, such as the gender of our participants and age of acquisition for signers. It is possible, for example, that men are more likely to represent the role of the man while women are more likely to represent the role of the woman. It is also possible that native signers will include different amounts of information than late learners do. While we do not predict that these variables will impact our results, logistic regression allows us to explore many possible relationships. Note that the regression results are based on frequency data, not the proportions shown in Tables 1 and 2.

As logistic regression is not very common in gesture or sign language studies, we provide a brief overview of the technique. By using logistic regression, we model the probability of observing a certain outcome (e. g., viewpoint) based on features entered into the model. These features are eliminated in a stepwise fashion in order to reach a final, best-fit model. In the final model, these features are called predictors, as their presence (or absence) has a statistically significant probability of predicting the desired outcome. This probability is given in terms of logits, the logarithm of the odds, i. e., an estimate of 0 indicates that there is a 50 % chance of observing a given outcome, an estimate > 0 indicates higher than 50 %, and < 0 less than 50 % chance.

To fit each model, we used a stepwise exploratory procedure whereby the features that accounted for the least variance were eliminated one at a time. Akaike's information criterion (AIC) was used to compare models as a lower AIC indicates a better fit of the model (Akaike 1974). In general, an AIC difference of two is used as the minimum criterion for model selection, and indicates that the model with the lower AIC is 2.7 times more likely to provide a precise model of the data. When comparing models, the winning model should therefore have an AIC which is at least two points lower than any competing model. Finally, we measured the robustness of final models with C, the index of concordance. C indicates the amount of variance in the data that the model accounts for, and ranges from 0 to 1. Higher values indicate better performance of the model (see Baayen 2008: 205, 281).

We implemented generalized linear mixed regression in R 3.2.0 (R Core Team 2014) via the `glmer` function in the `lme4` package (Bates et al. 2014). We tested the fit of our final model using the `somers2` function in the `Hmisc` package (Harrell 2014), which returns the index of concordance C. We describe the winning model for manual character viewpoint below. This model started with the following independent variables: language, age of acquisition, participant gender, and role (man, men and woman). These variables were eliminated in a stepwise fashion, resulting in the final best-fit model which is presented below. We also included random intercepts for participant and camera shot, which allowed us to model individual differences due to these factors. Including

random intercepts and slopes is important for preventing Type-II errors when assessing the significance of the predictors (see Barr et al. 2013 and Baayen et al. et al. 2008 for a thorough discussion on the merits of this approach). However, the data must be able to accommodate the random structure introduced by these terms. Therefore, we included the maximum random effect structure supported by the data, and assessed the fit of final models using AIC and C. Table 3 presents the summary of the best-fit model for manual character viewpoint. This model has a fit of $C = 0.93$, which is indicative of a well-performing model.

Table 3: Best generalized mixed-effects regression model for character viewpoint.

Predictor					
Random Effect	Variance	Std. Dev.			
Participant (Intercept)	0	0			
Camera Shot (Intercept)	0	0			
Fixed Effects	Estimate	Standard Error	z-value	p-value	Signif.
(Intercept)	-1.6005	0.3505	-4.567	4.95e-06	***
Language: ASL (1) vs. English (0)	-1.0906	0.4997	-2.182	0.0291	*
Role: Men (1) vs. Other (0)	5.8178	1.0694	5.440	5.32e-08	***
Role: Woman (1) vs. Other (0)	4.5232	0.5121	8.832	<2e-16	***

Notes: Only predictors for the best-fit model are shown. Negative estimates indicate lower probability. Significance is indicated as follows: *** $p < 0.001$, ** $p < 0.01$ and * $p < 0.05$.

The regression shows a main effect of language: ASL signers in this study were less likely to express character viewpoint ($\beta = -1.09$, $z = -2.18$, $p < 0.05$). There are two main effects for role: The role of men is more likely to be represented with character viewpoint ($\beta = 5.82$, $z = 5.44$, $p < 0.001$), and so is the role of woman ($\beta = 4.52$, $z = 8.83$, $p < 0.001$). There is also a main effect of the intercept, indicating that, in general, a manual action in our dataset (whether a gesture for speakers, or manual signing for signers) is less likely to express character viewpoint than observer viewpoint ($\beta = -1.60$, $z = -4.57$, $p < 0.001$). Individual characteristics, such as gender or age of acquisition, were not predictive. To summarize: our model indicated that when describing these scenes, speakers used character viewpoint more than signers, both groups used character viewpoint more when showing the men and the woman (compared to the man), and observer viewpoint was more common than character viewpoint.

In addition to being interested in overall patterns, we also asked whether signers would be more likely to simultaneously show both characters in the

shot/reverse shot because they use a visuospatial language which might facilitate this more complex representation. To count as a depiction of multiple simultaneous perspectives, a speaker had to either produce a dual viewpoint gesture (only two were produced), or represent different perspectives in speech and in gesture. We chose to use syntactic subject as our measure of perspective in speech. If gesture role was not the same entity as the syntactic subject of the clause, we marked this as a case of multiple perspectives (with the exception of presentational/existential constructions, as in *there was a woman in the window* –although a deictic pronoun is the subject of the clause, this construction is used to introduce a new entity [Lambrecht 1994] and is not truly a case of simultaneous perspectives). There were seventeen instances of this phenomenon. In 40 % of these cases, speakers showed the men holding the blanket via character viewpoint gesture while the subject of the utterance was the man. Interestingly, speakers used the passive voice in 86 % of these cases (e.g., *he's being thrown up* accompanied by a character viewpoint gesture showing the men's hands on the blanket). Tomlin (1995) has suggested that the passive is used when focal attention is allocated to the patient rather than the agent of an action. These cases might point to a split in focus: while the patient (*he*) is the subject of the sentence, rather than gesture showing the man's experience of being tossed, it shows the action of the agents (the men tossing). In the remaining cases, participants did one of two things. They either produced an observer viewpoint gesture showing the man's trajectory and produced utterances with men as syntactic subject, or they produced a character viewpoint gesture for the woman with an utterance having the man as the syntactic subject. To sum up: for speakers, multiple perspectives were infrequent. When they occurred, narrators tended to use speech to keep one character focused, while using gesture to show what was being done to or by another character.

For ASL, there are several possibilities for the representation of multiple perspectives using the mechanism of body partitioning. We simply looked for cases where different roles were assigned to different articulators (e.g., the left hand represented the man, while the right hand showed the woman's actions). Only four instances occurred, all for descriptions of Woman-dresses-inside. Signers tended to use a classifier to show the man's path in space while showing the woman's actions (dressing) through constructed action. These patterns reflect the tendency of signers to represent the event in similar ways to the speakers, but to occasionally add more information via body partitioning. In sum, signers were not more likely than gesturers to show multiple points of view when describing the shot/reverse shot (17 cases for speakers versus four for signers).

Our second research question was whether signers would be more likely to explicitly reference the shot/reverse shot. To count as a reference, the narrator had to mention that the view was now from inside the room in *Woman-dresses-inside*. Only two English speakers and only one signer did this. Thus, it appears that narrators very rarely comment on this cinematic technique, which is compatible with the view that the convention is easily integrated into a coherent event, perhaps because it mimics the experience of turn-taking (as Grodal and Kramer 2014 suggest).

While participants did not explicitly note the shot/reverse shot (e. g., by saying *now the view is from inside the building*), it is possible that they implicitly showed the shot/reverse shot by using space in ways isomorphic with the shift in perspective. Addressing this research question therefore also requires us to examine use of space. We considered where in space various actions were produced and asked whether this use of space was consistent or inconsistent with the layout of the camera shots. There is some evidence that speakers can be consistent in their use of referential space: that is, a space is assigned to a referent, and this is used with some measure of consistency (Permiss and Özyürek 2015; So et al. 2009). For signers, the use of space for reference is much more obligatory (Permiss 2012; Lillo-Martin 1995). To be consistent with the use of space in the camera shots, narrators would have to be *inconsistent* in the assignment of space to referents: they would have to reassign spaces to particular referents because the camera's point of view reverses, thereby introducing a kind of spatial unnaturalness. For speakers, we coded the spatial location of gestures for the three shots: speaker's left, speaker's right, or center. Location coding was already part of the ASL coding. We looked for cases where the location of a character (based on our role coding) changed across shots. We found no cases for speakers that indicated the locations of the characters in the stimulus were being duplicated in gesture. For signers, we found only one case where space was used in a way that duplicated the stimulus. In this instance, the signer depicted the man on his right – but his viewer's left side of space, consistent with a viewer's perspective of the stimulus. Thus, we found that both groups of narrators used space in a referentially consistent fashion, as has been observed in previous work on space and reference, rather than showing it in a way that was consistent with the stimulus, and neither group explicitly referenced the shift in camera angle.

8 Discussion and conclusions

We compared descriptions of a shot/reverse shot sequence across users of English and ASL. We asked whether we would observe language-specific patterns in the descriptions of these scenes due to the visuospatial nature of signed

languages, or whether both groups of narrators would use similar representations, given known commonalities in the representation of certain kinds of events within the manual modality. Our analysis focused on the occurrence and relative frequency of character and observer viewpoint, thus interesting avenues remain for investigating the quality (e.g., how minimal or elaborate each occurrence might be) across the two language systems. We found both similarities and differences. When representing a particular character, speakers and signers typically used the same viewpoint to represent the character. This consistency in viewpoint is likely due to the nature of the events in these shots. Parrill (2010) has suggested that events involving handling (e.g., the men holding the blanket in *Man-tossed-outside*) or reference to the torso (the woman dressing in *Woman-dresses-inside*) are likely to evoke character viewpoint. Quinto-Pozos and Parrill (2015) have suggested that events that evoke character viewpoint gesture are likely to evoke constructed action from signers. For two of the shots we examined, speakers and signers tended to represent the same character, while for *Man-tossed-outside*, signers were more likely to use observer viewpoint to show the man being tossed while speakers tended to focus on the tossing action of the men. The overall patterns in our data were thus best predicted by role, and language (because signers were more likely than speakers to show the role of the man), and not by speaker characteristics like the narrator's gender or age of acquisition.

Both groups tended to show a single perspective rather than combining multiple perspectives simultaneously. Neither group explicitly mentioned the shift in cinematographic perspective (with the exception of one use of space in a way consistent with the stimulus). Why did narrators not simultaneously represent multiple viewpoints? We suggest that while encoding multiple points of view might provide a more accurate visual description, it may not create a better narrative. Describing the shot/reverse shot may not do anything to clarify the concept of two people seeing each other, and may in fact be confusing to a listener. After all, film theorists argue that the shot/reverse shot technique is integrated seamlessly by viewers not because it naturally mimics visual perception, but because it mimics universal aspects of human interaction (turn-taking, face-to-face conversation). Explicitly representing the shot/reverse shot might impose a heavy cognitive load on the speaker, and might also be less comprehensible to a listener. This suggestion could be empirically tested to help us understand whether drawing conscious attention to this cinematic technique destroys its effectiveness. Examining the decisions that language users make may therefore help us understand how conceptualizers schematize information when they create mental representations of films, and these processes may shed light on why some cinematic conventions are easier or harder for viewers to integrate.

References

- Aarons, Debra & Ruth Zilla Morgan. 2003. Classifier predicates and the creation of multiple perspectives in South African Sign Language. *Sign Language Studies* 3(2). 125–156.
- Akaike, Hirotugu. 1974. A new look at the statistical model identification. *IEEE Transactions on Automatic Control* 19. 716–723.
- Baayen, R. Harald. 2008. *Analyzing linguistic data: A practical introduction to statistics using R*. Cambridge, UK: Cambridge University Press.
- Baayen, R. Harald, Doug J. Davidson & Douglas M. Bates. 2008. Mixed-effects modeling with crossed random effects for subjects and items. *Journal of Memory and Language* 59(4). 390–412.
- Barr, Dale J., Roger Levy, Christoph Scheepers & Harry J. Tily. 2013. Random effects structure for confirmatory hypothesis testing: Keep it maximal. *Journal of Memory and Language* 68(3). 255–278.
- Barriopedro, Maria I. & Juan Botella. 1998. New evidence for the zoom lens model using the RSVP technique. *Perception & Psychophysics* 60(8). 1406–1414.
DOI 10.3758/BF03208001
- Bates, Douglas, Martin Maechler, Ben Bolker & Steve Walker. 2014. lme4: Linear mixed-effects models using Eigen and S4. *R package version 1.1–7*. Retrieved from: <http://CRAN.R-project.org/package=lme4>.
- Bordwell, David. 2010. Convention, construction, and cinematic vision. In Brian Boyd, Joseph Carroll & Jonathan Gottschall (eds.), *Evolution, literature, and film*, 416–432. New York: Columbia University Press.
- Bordwell, David & Kristin Thompson. 2006. *Film art: An introduction*. New York: McGraw-Hill.
- Chafe, Wallace. 1976. Givenness, contrastiveness, definiteness, subjects, topics, and point of view. In Charles N. Li & Sandra A. Thompson (eds.), *Subject and topic*, 27–55. New York: Academic Press.
- Chafe, Wallace. 1994. *Discourse, consciousness, and time: The flow and displacement of conscious experience in speaking and writing*. Chicago: University of Chicago Press.
- Cormier, Kearsy, David Quinto-Pozos, Zed Sevcikova & Adam Schembri. 2012. Lexicalisation and de-lexicalisation processes in sign languages: Comparing depicting constructions and viewpoint gestures. *Language and Communication* 32. 329–348.
- Corrigan, Timothy. 2007. *A short guide to writing about film* (6th edn.). London: Pearson Longman.
- Crasborn, Onno & Han Sloetjes. 2008. Enhanced ELAN functionality for sign language corpora. In *Proceedings of LREC 2008, Sixth International Conference on Language Resources and Evaluation*, 39–43.
- Dudis, Paul. 2004. Body partitioning and real-space blends. *Cognitive Linguistics* 15(2). 223–238.
- Emmorey, Karen & Judy S. Riley (eds.). 1995. *Language, gesture and space*. Hillsdale: Lawrence Erlbaum Publishers.
- Grodal, Torben K. & Mette Kramer. 2014. Film, neuroaesthetics, and empathy. In Jon O. Lauring (ed.), *An introduction to neuroaesthetics: The neuroscientific approach to aesthetic Experience, artistic creativity, and arts appreciation*, 271–291. Copenhagen: Museum Tusculanum.
- Harrell, Frank E., 2014. *Hmisc package version 3.14-6*. Retrieved from: <http://cran.r-project.org/web/packages/Hmisc/index.html>

- Janzen, Terry. 2012. Two ways of conceptualizing space. In Barbara Dancygier & Eve Sweetser (eds.), *Viewpoint in language: A multimodal perspective*, 156–174. Cambridge, UK: Cambridge University Press.
- Kita, Sotaro & Asli Özyürek. 2003. What does cross-linguistic variation in semantic coordination of speech and gesture reveal? Evidence for an interface representation of spatial thinking and speaking. *Journal of Memory & Language* 48(1). 16–32.
- Lambrecht, Knud. 1994. *Information structure and sentence form: Topic, focus, and the mental representations of discourse referents*. Cambridge, UK: Cambridge University Press.
- Lillo-Martin, Diane G. 1995. The point of view predicate in American Sign Language. In Karen Emmorey & Judy S. Reilly (eds.), *Language, gesture and space*, 155–170. Hillsdale, NJ: Lawrence Erlbaum Publishers.
- MacWhinney, Brian. 1977. Starting points. *Language* 53. 152–187.
- MacWhinney, Brian. 2005. The emergence of grammar from perspective taking. In Diana Pecher & Rolf Zwaan (eds.), *Grounding cognition: The role of perception and action in memory, language, and thinking*, 198–223. Cambridge, UK: Cambridge University Press.
- Magliano, Joseph P. & Jeffrey M. Zacks. 2011. The impact of continuity editing in narrative film on event segmentation. *Cognitive Science* 35. 1489–1517. DOI 10.1111/j.1551-6709.2011.01202.x
- McCleary, Leland & Evani Viotti. 2010. Sign-gesture symbiosis in Brazilian Sign Language narrative. In Fey Parrill, Vera Tobin & Mark Turner (eds.), *Meaning, form, and body*, 181–201. Palo Alto, CA: CSLI Publications.
- McCullough, Karl Erik. 1993. Spatial information and cohesion in the gesticulation of English and Chinese speakers. Paper presented at the 5th Annual Meeting of the American Psychological Society, Chicago, June 25–28.
- McNeill, David. 1992. *Hand and mind: What gestures reveal about thought*. Chicago: University of Chicago Press.
- Metzger, Melanie. 1995. Constructed dialogue and constructed action in American Sign Language. In Ceil Lucas (ed.), *Sociolinguistics in deaf communities*, 255–271. Washington, DC: Gallaudet University Press.
- Özyürek, Asli. 2002. Do speakers design their co-speech gestures for their addressees? The effects of addressee location on representational gestures. *Journal of Memory & Language* 46, 688–704.
- Özyürek, Asli & Pamela Perniss. 2011. Event representation in sign language: A crosslinguistic perspective. In Jürgen Bohnemeyer & Eric Pederson (eds.), *Event representation in language: Encoding events at the language-cognition interface*, 84–107. Cambridge, UK: Cambridge University Press.
- Parrill, Fey. 2009. Dual viewpoint gestures. *Gesture* 9(3). 271–289.
- Parrill, Fey. 2012. Interactions between discourse status and viewpoint in co-speech gesture. In Barbara Dancygier & Eve Sweetser (eds.), *Viewpoint in language: A multimodal perspective*, 97–112. Cambridge, UK: Cambridge University Press.
- Parrill, Fey. 2010. Viewpoint in speech-gesture integration: Linguistic structure, discourse structure, and event structure. *Language and Cognitive Processes* 25(5). 650–668.
- Parrill, Fey, Jennifer Bullen & Huston Hoburg. 2010. Effects of input modality on speech-gesture integration. *Journal of Pragmatics* 42(11). 3130–3137.
- Perniss, Pamela M. 2012. Use of sign space. In Roland Pfau, Markus Steinbach & Bencie Woll (eds.), *Sign language: An international handbook*, 412–431. Berlin: Mouton de Gruyter.
- Perniss, Pamela & Asli Özyürek. 2008. Representations of action, motion and location in sign space: A comparison of German (DGS) and Turkish (TİD) Sign Language narratives. In Josep

- Quer (ed.), *Signs of the time: Selected papers from TISLR 8*, 353–378. Hamburg: Signum Press.
- Perniss, Pamela & Asli Özyürek. 2015. Visible cohesion: A comparison of reference tracking in sign, speech, and co-speech gesture. *Topics in Cognitive Science* 7. 36–60. DOI 10.1111/tops.12122
- Pudovkin, Vsevolod I. 1926. *Film technique* (Reprint, 1970). New York: Evergreen.
- Quinto-Pozos, David. 2007. Can constructed action be considered obligatory? *Lingua*, 117, 1285–1314.
- Quinto-Pozos, David & Fey Parrill. 2015. Signers and co-speech gesturers adopt similar strategies for portraying viewpoint in narratives. *Topics in Cognitive Science* 7(1). 12–35. DOI 10.1111/tops.12120.
- R Core Team. 2014. R: A language and environment for statistical computing. *R Foundation for Statistical Computing*, Vienna, Austria. URL <http://www.R-project.org/>.
- Schembri, Adam. 2003. Rethinking ‘Classifiers’ in signed languages. In Karen Emmorey (ed.), *Perspectives on classifier constructions in sign languages*, 3–34. Mahwah, NJ: Lawrence Erlbaum Associates.
- Schenck, Joseph M. (producer), James W. Horne & Buster Keaton (directors). 1927. *College* [Motion picture]. USA: United Artists.
- So, Wing Chee, Sotaro Kita & Susan Goldin-Meadow. 2009. Using the hands to identify who does what to whom: Gesture and speech go hand-in-hand. *Cognitive Science* 33. 115–125.
- Stec, Kashmiri. 2012. Meaningful shifts: A review of viewpoint markers in co-speech gesture and sign language. *Gesture* 12(3). 327–360.
- Supalla, Ted. 1982. *Structure and acquisition of verbs of motion and location in American Sign Language*. San Diego, CA: University of California unpublished doctoral dissertation.
- Sweetser, Eve. 2012. Introduction: Viewpoint and perspective in language and gesture, from the ground down. In Barbara Dancygier & Eve Sweetser (eds.), *Viewpoint in language: A multimodal perspective*, 1–22. Cambridge, UK: Cambridge University Press.
- Tomlin, Russell S. 1995. Focal attention, voice and word order. In Pamela Downing & Michael Noonan (eds.), *Word order in discourse*, 517–552. Amsterdam: John Benjamins.
- Zacks, Jeffrey M. & Joseph P. Magliano. 2011. Film, narrative, and cognitive neuroscience. In Francesca Bacci & David P. Melcher (eds.), *Art and the senses*, 435–454. New York: Oxford University Press.
- Zacks, Jeffrey M., Nicole K. Speer, Khen M. Swallow & Corey J. Maley. 2010. The brain’s cutting-room floor: Segmentation of narrative cinema. *Frontiers in Human Neuroscience* 4(168). 1–15. DOI 10.3389/fnhum.2010.00168
- Zwitserslood, Inge. 2012. Classifiers. In Roland Pfau, Markus Steinbach & Bencie Woll (eds.), *Sign language: An international handbook*, 158–186. Berlin: Mouton de Gruyter.

Appendix

While gestures were coded as either character viewpoint or observer viewpoint, manual signing was slightly more complex. Because the left and right hands may act independently of each other (e. g., one hand may produce a CL sign while the other produces CA signing), we re-coded the data as shown in Table 4, and used

Table 4: Recoding of ASL data for regression.

Left hand	Right hand	Manual Iconic-1	Manual Iconic-2
CA	CA	CA	CA
CL	CL	CL	CL
CA	CL	Mixed	- CA
			- CL
CA	Other	Other_CA	CA
CL	Other	Other_CL	CL
other	Other	Other	(delete)

the codes in the Manual Iconic-2 column for all quantitative analyses. There are 112 ASL items. Six of these items were coded as Mixed (Manual Iconic-1), as the signer had produced CA signing with one hand and a CL sign with the other. Rather than delete these items, we counted them twice.