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Long Absent, NOT Soon Forgotten: Prosodic Marking of Information Status in Chinese Sign Language

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Abstract

In spoken languages, new information is often expressed with a longer duration than given information. We investigated whether signers use duration to mark information status. Fifty deaf Chinese Sign Language (CSL) signers retold a cartoon clip, and we examined how they tracked references. The results showed that CSL signers mostly used nominals, classifiers and constructed actions, but rarely used any pointing or zero anaphora. When focusing on nominals, newly introduced references had a longer duration than the maintained and re-introduced ones, while the durations of maintained and re-introduced nominals did not differ. Additionally, there was a gradient decrease in sign duration over the first three mentions followed by an increase for the fourth and fifth mentions. Furthermore, between two nominal mentions, the more non-nominal referring there were, the shorter the duration of the current nominal mention. Thus, CSL signers vary the duration of nominals to indicate the degree of accessibility.

Keywords: information status; CSL; prosody; duration; referring expressions, accessibility, givenness

Introduction

When talking about objects, events and people, we exchange information about these entities (or referents). If a referent is mentioned for the first time, it is usually new information; if the referent is referred to again after its first mention, it becomes given information in the context. Such a change from new information to given reflects information status, and the varying degree of activation of the referent.

Chafe identified a three-way distinction in information status: active (given), semi-active and inactive (new) (Chafe, 1987), depending on their accessibility (Lambrecht, 1994). Specifically, new information has not been mentioned yet previously and remains outside the addressee's awareness, or is currently inactive in any way, whereas given information is already present in the addressee's consciousness. Semi-active information is in the addressee's peripheral consciousness and is not directly focused on (e.g., a referent becomes deactivated from an earlier active state after being long out of the focus of attention, and is re-introduced into the discourse following a topic shift).

Similarly, Gundel *et al.* also believe that speakers adjust their speech according to an addressee's knowledge and attention state within the specific context (Gundel et al., 1993). When introducing new information, speakers often expend more effort on information encoding to help the receiver decode it. However, to maintain given information, which is usually easier and more accessible for the receiver, speakers tend to use less effort. This may involve using less complicated forms, or conveying information in a more cost-effective way, such as using pronouns, zero anaphora, or reducing the duration of repeated words). For example, in a retelling of a story about an unlucky bear in English:

    a. [A bear1] was walking on [a slope2].
    b. [He1 kicked at [a rock3].
    c. [The rock3] is hard.
    d. [The bear1] got hurt and [Ø1] fell down.

When the bear is introduced for the first time, a noun phrase ('A bear1' in sentence a) is used. Then in sentence b, a pronoun is employed to maintain the referent, as it is already active and easily accessible and retrieved from sentence a. In sentence d, the noun phrase (or nominal) 'the bear' is re-introduced, albeit slightly removed from its first mention, with the word duration of 'bear' likely having a shorter duration than its first mention. Additionally, in the same sentence, the referent is maintained by a zero anaphora.

The tracking of information is not only restricted in the morphosyntactic strategies, but also evident in the visual modality in gestures (Gullberg, 2006). For example, new information is typically accompanied by gestures, while old information is often conveyed solely through speech (Azar et al., 2019; Debreslioska & Gullberg, 2019, 2022).

Another visual mode of language is sign language, which has rich means of marking information status (Ferrara et al., 2023; Frederiksen & Kroll, 2022; Perniss & Özyürek, 2015). Apart from the common strategies like nominals, pronouns, and zero anaphora, classifiers also play a role (Ferrara et al., 2023; Perniss & Özyürek, 2015). Frederiksen and Mayberry even further identified three subcategories of classifies and looked at how they interact with information status (Frederiksen & Mayberry, 2019).

Sign languages share some common features in reference tracking. American Sign Language (ASL) signers use bare nouns for both introduced and re-introduced discourse contexts and zero anaphora is used for reference maintenance (Swabey, 2011). By contrast, Turkish signers also use

nominals and extension classifiers for the first introduction (Keleş et al., 2023). However, unlike spoken languages, pronouns are much less often used in sign languages (Ferrara et al., 2023; Perniss & Özyürek, 2015; Slonimska et al., 2020, 2021; Swabey, 2011).

Furthermore, both spoken and signed language can use prosody to indicate information status. In speech, the degree of givenness can be reflected in the level of prosodic prominence (Baumann & Grice, 2006). For instance, the first mention of a referent is generally spoken with a wider pitch range and longer duration than the second mention of the same referent (Chen, 2009; Gu & Chen, 2014; Swerts et al., 2002). However, reintroducing a referent which has been absent from the center of focus for a while will often result in an increase in pitch range and duration (Arnold, 2008).

As for sign language, articulators comprise the arms, hands, upper body, head, and face, which can be further subdivided into smaller units. Manual means such as tension and large articulation and the lengthening of signs are relevant along with nonmanual features to form articulatory arrays of the visual language system in the signing stream. Visual intonation is argued to be part of prosody that also functions as linguistic device for grammatical marking or pragmatic usage (Brentari, 2019; Dachkovsky & Sandler, 2009). Prosody is key to marking information status (Herrmann, 2021; Kimmelman, 2015; Kimmelman & Pfau, 2021; Van der Kooij et al., 2006). For example, squints in German sign language (DGS) are found to be used to mark given information (Herrmann, 2015). Additionally, Van der Kooij et al. discussed focus marking from a prosodic perspective in Netherland Sign Language (NGT). They found that NGT focus is marked by modification of manual means such as varying the size of articulation, raising the sign in space, and using repetitions (Van der Kooij et al., 2006). Herrmann also shows that nonmanual co-occur with zero marking, which added complexity to the situation (Herrmann, Pfau, & Annika, 2021).

Despite various means of prosodic marking of information status in sign language, no research has investigated how signers vary their sign duration in different mentions of the same references (but see two very recent studies on prosodic marking of focus in Turkish Sign Language (Karabüklü & Gürer, 2024) and phonetic reduction in a new young sign language (Stamp et al., 2024). According to Chafe's degree of activation/ givenness, if the distinction between new and given can be reflected in word duration in spoken language, and if referents with the highest cognitive accessibility are usually produced with minimal phonetic form (Ariel, 1991; Gundel et al., 1993), we should also expect some duration adjustment in signs. Based on the literature above, this paper aimed to fill in the literature gap by investigating two aspects of information status in Chinese Sign Language: (1) We described the distribution of major means in reference tracking: nominals, pronouns, classifiers and zero marking. (2) Prosodically, we studied how Chinese deaf signers used duration cue to mark the different degrees of accessibility of nominal expressions in a discourse.

Method

Participants

Fifty deaf signers of CSL (27 females and 23 males) participated in the study. The mean age was 28.95 years old (SD = 6.76). Their education level ranged from primary school (n = 3), senior high school (n = 3), vocational college (n = 13) to university (n = 32). Eighteen participants were born deaf, and the rest had a mean age of becoming deaf at 3.03 years (SD = 1.97). Their severity of hearing loss was mostly profound (n = 40), with six participants having severe hearing loss, three having moderate and one unknown. All but three attended deaf primary school. The mean age of acquisition of CSL was 6.77 years (SD = 4.65). According to a 7-point-scale self-assessment, both their average CSL proficiency (M = 5.56), and written Mandarin proficiency levels (M = 5.41) were quite high.

Materials

A short cartoon clip called 'I love picnic' was used as elicitation material. The clip depicted a polar bear embarking on a three-day holiday, each with a different theme. In the present study, we focused on the episode of the 1st day, which lasted about 1.5 minutes. In the clip, a polar bear walked up a hillside, unaware of a small stone on the road, and accidentally stumbled over it. The bear stared at the stone with great anger and purposefully hit it again. In a few seconds, a big rock rolled down from the hill prompting the bear to run downhill. When the bear came back by the small stone on the road again, this time he maneuvered around it carefully to avoid another collision. In a few seconds, the bear ran back and hid behind the small stone as more big rocks tumbled down from the hill. While the bear managed to dodge most of the rocks, he ultimately was hit by some rocks and rolled down from the hill. The content of the clip leads itself well to studying information status as it features several repeated mentions of different referents such as the 'bear', 'small stone', and 'rocks', etc. The link to the video is https://www.youtube.com/watch?v=tvtPalE-E6M&ab_channel=JUSTCruz.

Procedure

Participants were informed by an experimenter to carefully watch the cartoon clip and subsequently retell its content to another signer who had not viewed it. Participants recorded their sign narration with their mobile phones. They were especially told to check the distance to the phone and ensure that all signs were clearly visible within the recording frame. After the task, demographic information such as age, sex, education was collected. All participants gave their consent to use their recordings for research purposes. As a token of appreciation for their help they received a small monetary reward. The study received ethical approval from Shanghai International Studies University.

Transcription and coding

Ex1. BEAR TRAVEL HILL CL:WALK^HILL

Translation: A bear travelled around on a hill, and walked on the slope along the hill.

Ex2. ONE STONE CL:FALL^STONE FINISH IX-3 ANGRY

Translation: There was a stone (on the road), (the bear) stumbled over the stone. He was very angry.

The sign narration of each participant was first glossed by one native deaf CSL signer in ELAN (Wittenburg et al., 2006). Two bimodal bilingual researchers double checked the annotation and identified the nouns that could potentially be studied for information status. These usually included full form signs such as 'bear', 'stone', 'rock', 'hill', 'slope', etc. (see BEAR, HILL in Ex1, STONE in Ex2). Apart from nominals, signers also used pointing as a pronoun, which was typically signed with an extension of the index finger. In addition, signers frequently used classifiers to track the references. A classifier was signed with either one hand or two hands. Take the classifier construction 'CL:WALK^HILL' (Ex1) as an example, the signers' left forearm is placed to refer to 'hill' while his index and middle fingers move along his forearm to refer to the whole event 'the bear is walking along the hill'. Thus, classifier handshapes are used for reference.

When the signer uses the entire body to mimic the action of the subject, or referred to as 'the bear', this is called Constructed Action (CA), which is considered as one type of classifiers, specifically the whole-body classifier (Jantunen, 2017; Supalla, 1982). Additionally, when no visible cues are used to mark reference, it is considered as zero anaphora (zero marking). This is comparable to 'pro-drop' in spoken languages, where the subjects or objects are simply dropped without any other visible cues.

Each reference was initially coded in three aspects: the referent, the form (nominals, pointing, classifier, CA, zero anaphora) and the number of mentions (1st mention, 2nd...). For example, bear_ff_1^{st} indicated that the nominal form of bear was signed for the first time.

Furthermore, we selected the nominals for further annotation to compare the duration of each occurrence of the noun phrases. To gloss their duration, we adopted Kendon's coding principle (Kendon, 2004): segmentation begins from the first movement of the dominant hand of the sign, and ends at the final movement before the hand moves to another sign.

We also coded the information status of these nominals: new (first time), maintained (mentioned again without

changing a topic), and reintroduced (reintroduced after mentioning another topic). In addition, for each noun phrase, we calculated (1) the number of times a referent was mentioned between the target nominal and the nearest last mention of the nominal (NonNominal_Mention), as this can be an indicator of degree of accessibility. For example, to obtain data of NonNominal_Mention for a 3rd mentioning of the nominal 'BEAR', we counted the number of non-nominal references (classifier, zero anaphora, CA, pointing) after the 2nd mention of the same nominal 'BEAR'.

Data processing and analysis

The annotations of referents, including the durations of signs were extracted from ELAN eaf files. First, we described the distributional differences in the use of nominals, pointing, classifiers, CA and zero anaphora in marking information status by comparing their respective proportions.

Second, focusing on the nominals, we studied how signers varied the duration of a nominal sign (dependent variable) across different mentions of the same referents. We excluded target referents with only a first mention, as no other nominal mentions could be compared. We limited our analysis to up to five mentions of the nominals due to an insufficient number of observations beyond that.

As the change of the duration may not follow a linear pattern over different mentions, we used a linear mixed-effects model with polynomial terms for the number of mentions (linear and quadratic terms of Num.Mentions) in R. We included the NonNominal_Mention (NNM) as a predictor, gave a random intercept for each participant and added different nominal items as control variables. We did not add a random intercept for the nominals because we only had 8 target referents in the end and adding them as control variables had better model fitness according to a comparison of their AIC values. The main effects remained the same significance in both models.

Furthermore, as a sensitivity analysis, we replaced the number of mentions with three information status according to our coding of the different mentions (new, maintained and reintroduced), and examined the effect of information status on nominal durations. We could not have three information status and Num.Mentions include in the same model as the references coded as 'new' would almost always be the first mentions, thus resulting in a multicollinearity problem.

Results

First, overall, there were 2363 data points of references, consisting of 451 nominals, 1220 classifiers, 489 CAs, 84 pronouns (pointing), 119 zero anaphora. The distribution of five types of marking information structure was significantly different than the chance level, $\chi^2 (4) = 1767.64$, $p < .001$. As shown in Figure 1, classifiers accounted for the largest proportion, which was more frequent than the other four types of references (all p's $< .001$). The frequency of nominals was significantly higher than that of pointing, $\chi^2 (1) = 251.76$, $p < .001$, and zero anaphora, $\chi^2 (1) = 193.38$, $p < .001$, but it did not differ from CA, $\chi^2 (1) = 1.54$, $p = .22$.
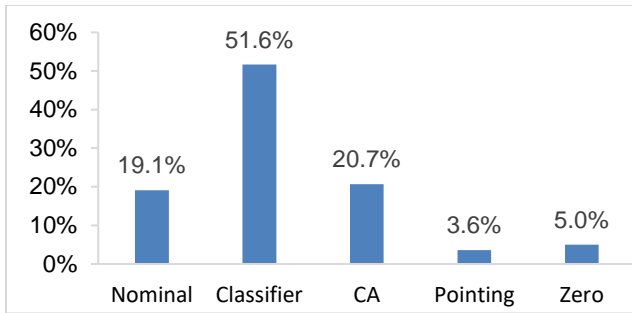
Figure 1: The proportion of nominal, classifier, CA, pointing and zero anaphora as references used by CSL deaf signers.

As for the durations of different mentions of nominals, Table 1 shows their descriptive statistics up to five mentions. They displayed a gradual decrease in duration from the first to the third mentions, while there was an increase for the fourth and fifth mentions of the same nominals.

Table 1: Mean durations and SD of nominals over five mentions.

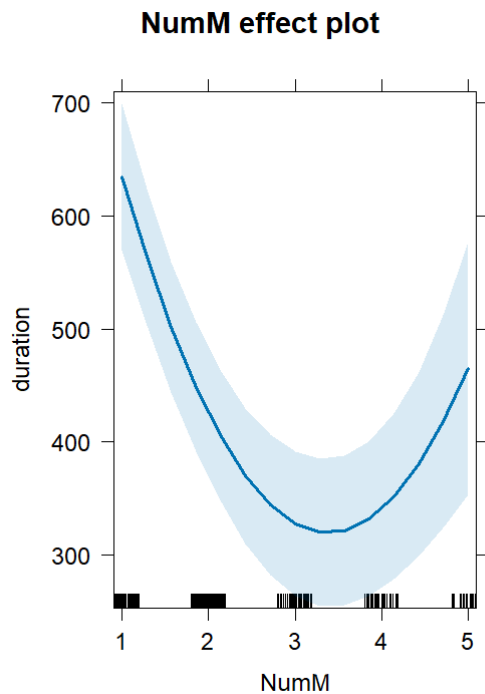| Mentions	Duration	SD
First	664.18 ms	398.32 ms
Second	405.17 ms	227.06 ms
Third	380.39 ms	229.62 ms
Fourth	441.13 ms	283.64 ms
Fifth	485.13 ms	270.95 ms

Figure 2: Predicted effect of number of mentions of nominals over five mentions, with 95% CI (shaded bands). The rugs indicate the distribution of the data.
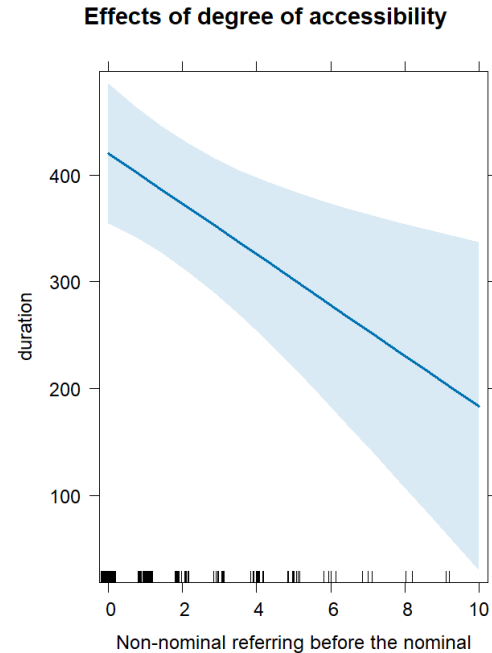

Figure 3: Predicted effects of number of mentions of non-nominal referring, between the nearest last same nominal and the target nominal, with 95% CI (shaded bands). The rugs indicate the distribution of the data.

Regression analysis showed that first the linear term of Num.Mentions (poly(Num.Mentions, 2)1) was significantly negative (β = -1327.4, t = -4.60, $p < 0.001$), suggesting a decreasing trend. By contrast, the quadratic term of Num.Mentions (poly(Num.Mentions, 2)2) was significantly positive (β = 1425.3, t = 5.34, $p < 0.001$), indicating a subsequent increase in duration after the initial decrease (Figure 2). These results suggest that the number of mentions has a significant impact on the duration of full-formed signs, exhibiting a nonlinear relationship with an initial decrease followed by an increase.

In addition, the NonNominal_Mention (mean = 1.22 mentions, SD = 2.32) was also significant (β = -23, p = .006), showing that the larger the number of non-nominal mentioning (classifier, CA, zero anaphora, pointing) of the target reference between the two mentions of the same nominal, the shorter the duration of the target full form nominal (Figure 3). This indicates that having other forms of referring in between increases the accessibility of the nominal and thus reducing its duration. Therefore, the results show that the degree of accessibility of a reference indeed predicts the duration of a nominal sign.

Furthermore, as a sensitivity analysis, we replaced the number of mentions with three information status according to our coding of the different mentions (new, maintained and reintroduced). The results showed that new nominals had a significantly longer duration than that of the maintained (β = 225.6, p < .001) and of reintroduced (β = 262.6, p < .001). This suggests that new information indeed had a longer duration than the given information (Figure 4). Although

there was no significant difference between the maintained and reintroduced information ($p > 0.05$), the variable NonNominal_Mention (number of non-nominal referring between two mentions of the same nominal) was again significant ($\beta = -15.5$, $p = .036$), showing that a more degree of givenness predicted a shorter duration of a nominal sign. Additionally, when collapsing 2nd-5th mentions into one group and comparing them as a group to 1st mentions, the differences were highly significant ($p < .001$).
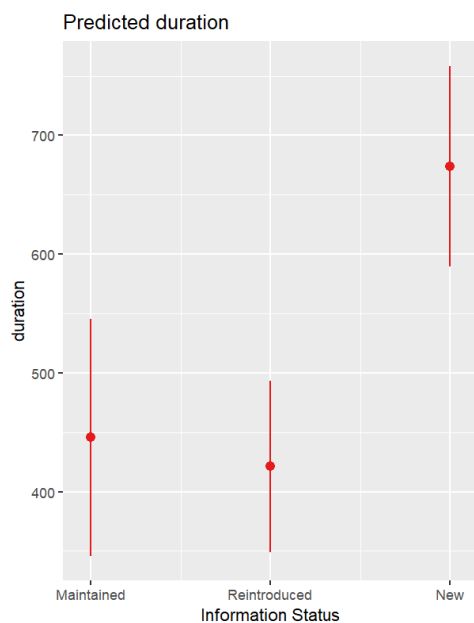

Figure 4: Predicted effects of information status on the duration of full nominal signs, with 95% confidence intervals (shaded bands).

Discussion

The reference tracking in sign languages is well-studied, see e.g., American Sign Language (Lucas et al., 2001; Wulf et al., 2002), New Zealand Sign Language and Australian Sign Language (McKee et al., 2011), and German Sign Language (Perniss & Özyürek, 2015). Two latest studies looked at the interaction between duration of sign form and information status (Karabüklü & Gürer, 2024, Stamp et al., 2024). In this study we described for the first time how deaf CSL signers employed different strategies, such as nominals, classifier, CA, pointing and zero anaphora to track references in a discourse. Focusing on the full-formed signs, we further investigated the prosodic marking of these references across different mentions. We found that the sign duration was reduced in the first three mentions but increased in the fourth and fifth mentions.

First, CSL deaf signers mostly used nominals, classifiers and CA to mark information status whereas zero anaphora and pointing were only sparsely used. Apart from nominals, all other means were predominantly used in the non-first mentions of a referent. There were several exceptions for a classifier to be used as a first mention. For the only case in the constructed action, the signer 'forgot' to use a full nominal to name the referent BEAR but used a constructed action to refer to it. This also occurred once in the use of a classifier for the first mention. Neither is common in reference tracking as it is not an optimal way of communication. A further examination of other cases of first-mentioning classifiers showed that they were mainly of two types. First, it was obvious in the context what the classifier referred to. For example, referring to a stone on a hillside could be easily activated according to the environment. This is in line with so-called situational accessibility (Lambrecht, 1994) (e.g., the concept of a waitress is activated in a restaurant). Second, the referent was inferable from an already active or accessible referent. For example, after mentioning a small stone on the hillside, the concept of a stone became accessible and therefore the use of a classifier to refer to a big rolling rock became *inferentially accessible*.

Second, focusing on the full nominals, we showed for the first time how deaf signers use the durational cue to mark the different mentions. Past research on repeated references in Dutch Sign Language has shown that when signers described figures to an addressee repeatedly, the repeated references were shorter, and contained fewer and shorter signs than initial references (Hoetjes et al., 2014). Consistent with this finding, our study showed that the first mention of a nominal was longer than the subsequent mentions in a spontaneous sign narration. We observed a gradient decrease in duration over the three mentions of nominals (Table 1). This is in line with the cognitive activation of a reference that different degrees of givenness can be marked by prosodic prominence. The first mention is new information, which is produced with the longest duration, whereas the second mention is given which leads to a reduction in sign duration. As the reference becomes even more accessible in the third nominal mention, the duration of the sign is further attenuated.

Interestingly, in a perception experiment Hoetjes et al. (2014) showed that signs produced in repeated references were not considered to be less precise than signs produced in initial references as judged by native signers (unlike spoken languages). As that perception study was on the repeated whole reference rather than the repeated nominals, it remains to be seen whether signing addressees are sensitive to such reductions. For example, future research can compare signers' reaction time and accuracy in judging the meaning of different mentions of the same nominals.

Furthermore, we also showed that there was a significant trend of increase in duration for the fourth and fifth mentions. This could be due to two reasons. First, the reduction in duration has reached its floor level. Like word duration in spoken language, the duration of sign will not reduce further after reaching its minimal requirement for communicative intelligibility (e.g., fewer movements, smaller size, one hand, phonetic reduction in hand shapes, orientation and trajectory).

If this is the sole reason, we would expect that the duration of nominal sign should level or slightly fluctuate around a

duration after the third or fourth mentions. Nevertheless, the fourth and fifth mentions had significantly increased duration. Particularly, the fifth mention (485.13 ms) seemed to be even longer than the second mention (405.17 ms). This indicated that there may be a re-introduction of the reference. It could be the case that the reference has been out of the centre of focus for a while, thus becoming accessible information (half new). Thus using a nominal to re-introduce the reference could result in high prosodic prominence.

However, the analysis using the three distinctions of new, maintained and reintroduced only showed significance between new vs. maintained and new vs. reintroduced, but not between the maintained and reintroduced references. This could be due to the coding of reintroduced references were not ideally perfect as there could be different changes of topics and various times of non-nominal referring, which made the category not sensitive to the duration.

In addition, it could simply be due to the fact that there was a long interval between the two mentions of nominals, even though the reference was maintained with other non-nominal means. Further analysis of temporal distances, the number of other referents introduced, as well as number of non-nominals used between the nominal mentions showed that only the number of non-nominal mentions between the two mentions of the same nominal was highly significant. It means that if there has been a long interval between the two mentions of nominals without having many non-nominal referring in between, the target nominal reference becomes less accessible. This implies that the degree of accessibility is indeed a useful predictor for nominal sign duration.

Due to limited data, we did not examine the effect of CSL signers' proficiency on their distribution of reference tracking or their durational marking of nominals. Past research on spoken language showed that second language learners with intermediate proficiency level tend to be overspecified in reference tracking by over-using full nouns and accentuating given information (Chen, 2009; Gullberg, 2006). Some studies in sign languages have explored the different categorical distribution among the native vs non-native signers (Keleş et al., 2023), as well as among early learners (Frederiksen & Mayberry, 2019). It would be intriguing to investigate whether CSL signers of varying proficiency levels use full nominals differently (Williams, 1988) and whether there are any differences in prosodic marking of the information status. Additionally, other aspects of prosodic marking of the nominals such as the size of sign (intensity/saliency) can also be investigated.

Conclusion

We show that CSL signers use nominals, classifier, CA, pointing and zero anaphora to track references in a discourse. The first mentions are predominately nominals and signers used sign duration to mark the distinction between new and given information, while a re-introduction of references results in a climb in duration. In conclusion, the degree of accessibility of a nominal is marked by the duration of a sign in CSL, which is for the first time quantitatively documented in sign language research.

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