Sign Language Prosodic Cues in First and Second Language Acquisition*

Diane Brentari

Purdue University

brentari@purdue.edu

Abstract

In this paper the prosodic structure of American Sign Language (ASL) narratives will be analyzed in three groups: two groups of native (L1) signers and one group of highly proficient, second language (L2) signers. The results of this study show that the performance in the native hearing, bilingual group is due to both to their ASL language experience, and, under certain conditions, to their experience as hearing gesturers using co-speech gesture. The goals of the present study are: (1) to better understand the prosodic cues used by L1 and L2 users of ASL, (2) to contextualize these findings with respect to cross-linguistic tendencies, register, and task, and (3) to begin to understand the role that gestural experience has on L2 prosody of ASL. The results suggest that a lifetime of experience gesturing while speaking may have some effect on the prosodic cues used by hearing signers, similar to the effects of an L1 on an L2.

Index terms: ASL, signed language, gesture, second-language acquisition, prosody

1. Introduction

The understanding of sign language prosody has made great strides in the last decade [1]-[4], [15]-[16], [21]-[24]. Almost all of this work has used Deaf native (or near native) signers to establish a foundation of the prosodic cues used in sign languages and their distribution. Only a few studies have explored the prosody of other signing groups, such as hearing native signers, second language users of a sign language, deaf individuals acquiring a sign language later in life [1] or in non-signers [3], [7].

The focus of the current project will be on the I(ntonational)-Phrase and the Utterance (U). Previous studies have shown that there are influences of English on ASL in 'contact' varieties of signing [13] and ASL on English [5]-[6], [18], but not specifically in prosody. One hypothesis concerning prosodic differences between L1 and L2 users of ASL might be that there is no influence on ASL from English in the prosodic domain. Since the two languages are in different communication modalities it could be that the prosodic structures of the two systems are simply too different for such effects to be possible. If this is the case, the overall distribution should be the same, but some groups might be less accurate or more imprecise in their use of them in L2 signers. Alternatively, one might hypothesize that gesture (as a part of English) has an effect on L2 performance in ASL prosody, since some of the same cue are used in both gesture and sign. If there is an influence from English, the L2 signers might show evidence of a different distribution of their prosodic cues.

2. Methods and Procedures

2.1. Participants

The study was originally designed to analyze narrative structure in ASL [14]. All of the participants were highly competent signers so that, to the greatest extent possible, differences would not be due to general proficiency in the language. Nine adults in 3 subject groups participated in this study: 3 Deaf native ASL signers (henceforth the L1-D group) whose mean age was 31 yrs. and who attended residential schools for the Deaf; 3 native hearing signers who learned ASL from their Deaf parents (henceforth the L1-H group), whose mean age 51 yrs.; and 3 highly proficient second-language learners of ASL (henceforth referred to as the L2-H group) whose mean age 34 years. The L1-H and the L2-H signers were employed as full-time ASL-English interpreters and were certified either by the state of Indiana or by the national Registry of Interpreters for the Deaf, and were considered to be among the best in the area.

2.2. Stimulus

The target stimulus was a video clip selected from the fourth season of the cartoon television series "The Simpsons" from the episode "Homer the Heretic". The stimulus lasted 31 seconds and contained no audio. This clip focused on two cars involved a chase.

2.3.Procedure

Signer and researcher sat across from each other, with a laptop computer on a table or chair off to the side facing the signer. One camera filmed the signer and a second camera filmed the researcher, a proficient hearing L2 ASL signer who began learning ASL at age 8 and taught ASL at Purdue University. Each session began with a short ASL conversation to ease the signer into being filmed. The signer was able to view the clip as many times as s/he wanted, and then retold the story. The researcher limited her responses to the signer's narration to nodding in comprehension, copying emotive facial expressions of the signer (e.g., smile or surprise), and infrequently signing OH-I-SEE.

I-Phrases and Us were determined on the basis of three independent transcriptions by 3 highly proficient L2 signers who were not participants in the study (two learned ASL at 7 and 8 years of age, respectively, and one was a full time certified interpreter). Judges were instructed to break the

narratives into the largest prosodic units first, which were labeled Us, and the second largest units, which were labeled I-Phrases, without attending to specific prosodic cues or semantic content. Only those units on which there was agreement for two out of three judges on constituent type (I-Phrase or U) and placement of the boundary were analyzed further.

All of the prosodic cues transcribed for this study have been discussed in the literature as robust cues of I-Phrases, although it is important to note that none of the cues is obligatory (Table 1). The transcriptions were done in ELAN, a tool that allows the location and duration of each annotation to be indicated using time-aligned tier structures. The first three—Length, Pause, Hold— can be considered durational in nature, conceptually similar to their spoken language counterparts. Blink and Drop Hands appear at boundaries, conceptually similar to boundary tones in spoken languages. Brow Change, Head Position Change, and Torso Change are domain cues, conceptually similar to nasal harmony or vowel harmony in spoken languages, in that these cues extend over the entire domain.

Cue	Definition
Length/ Sign Duration	Duration of the sign's articulation measured from the complete formation of the initial handshape of the sign to the time when the final handshape begins to deteriorate [3], [4], [22]. Measured in U-final and in I-Phrase -initial, -internal, & -final positions.
Pauses	The hold at the end of the sign plus the transition movement between one sign and the next [9], [11]. Measured in I-Phrase final and U-final positions.
Hold	The period of time when the hand is kept in its particular shape and position at the end of a sign [12], [17]. Measured in I-Phrase final and U-final positions.
Blinks	Inhibited, voluntary eye blinks [23].
Drop Hands	Deviation from the direct trajectory between the end of the preceding sign and the beginning of the next sign during the transitional movement: hands drop to the lap or to neutral position, or the wrists become lax [16].
Brow Change	A change in the position of the eyebrows – up, down, or back to neutral position [11].
Head Position Change	A change in head position independent from changes in the torso – forward, back, sideways, or back to neutral position [15].
Torso change	A change in position of the torso – forward, back, sideways, or back to neutral position [1], [24].

Table 1. Cues transcribed in the ASL narratives and their definitions.

3. Results

Each cue was measured and averaged by participant, and then compared within and across groups. In groups such as these with only three participants, a difference was significant only if there was no overlap among measurements for the signers of two comparison groups ($p < .05$, Mann-Whitney). This criterion is used throughout the following sections.

3.1 Cues prevalent in all groups

Two cues were observed to have a consistently high rate for all participants as I-Phrase cues. Signs in pre-boundary position length have been shown to be 1.5 times that of the phrase-internal mean [3], and all nine signers displayed this lengthening at I-Phrase boundaries. An average I-Phrase final pause has been shown to be at least 165 ms. [8], and eight of the nine signers also had an average Pause duration of >165 ms. at I-Phrase boundaries. The proportion of I-Phrases marked by a Blink was high (number of I-Phrase final blinks/number of I-Phrases = 77) but also varied considerably among signers within each group (SD = .31).

3.2 Cues that differed across groups

The distribution of four cues differed across groups: Brow Change, Torso Change, Initial Length, and Pauses used to distinguish an I-Phrase from an Utterance.

On measurements of Brow Changes and Utterance Pauses, the L1-D and the L2-H groups showed significant differences, and the L1-H group patterned with the L1-D group. Brow Changes were more consistently present at I-Phrase boundaries for the two L1 groups in comparison with the L2 group (Figure 1). Longer Utterance Pauses were consistently absent for the two L1 signing groups in comparison with the L2 group (Figure 2).

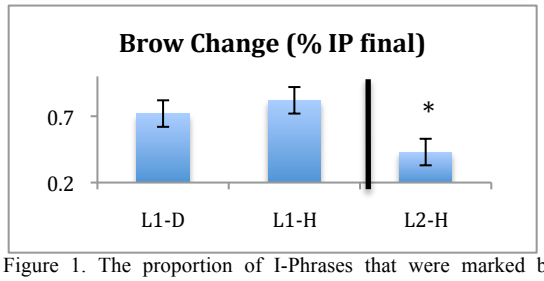

Figure 1. The proportion of I-Phrases that were marked by a change in the position of the eyebrows in the L1-D, L1-H, L2-H groups: 72%, 82% and 43%, respectively.

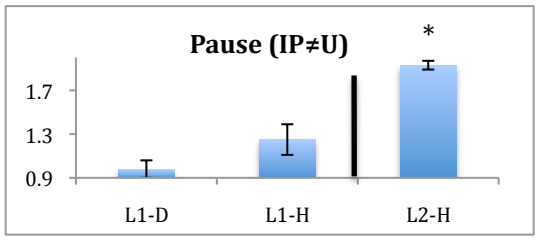

Figure 2. The multiple by which pauses were lengthened in Utterance-final position compared with I-Phrase-final position in the L1-D, L1-H, and L2-H groups: x.98, x1.25, and x1.93, respectively.

Measurements on the cues of Torso Changes and Initial Length also showed significant differences between the L1-D and L2-H groups, but unlike the two cases just described above, the L1-H group showed the same pattern as the L2-H group. Torso Changes were more consistently present at I-Phrase boundaries for the two hearing groups in comparison with the L1-D group (Figure 3). Initial Lengthening was more consistently absent for the two hearing signing groups in comparison with the L1-D group (Figure 4). This is a prosodic cue that has not previously been reported in the literature.

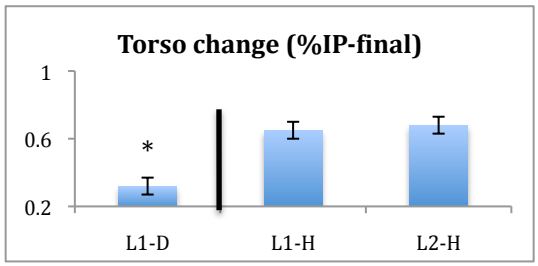

Figure 3. The proportion of I-Phrases that were marked by a change in the position of the torso in L1-D, L1-H, and L2-H groups: .32%, .65%, and 68%, respectively.

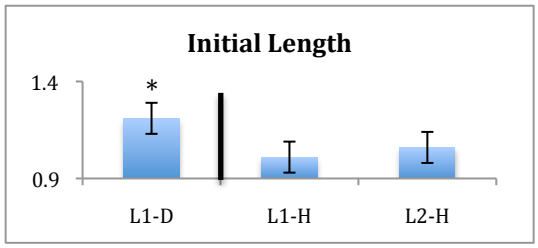

Figure 4. The multiple by which I-Phrase-initial signs were lengthened compared with their phrase-internal counterparts in L1-D, L1-H, and L2-H groups: x1.21. x1.01, and x1.06, respectively.

3.3 Cues not used by any group

Some cues were not used or not used consistently as an I-Phrase cues across signers or groups. The proportion of Holds, Head Position Changes, and Dropping the Hands was low for all signers in all groups (average < 20%) and was also highly variable (SD >.15).

The results are summarized in Table 2.

Cue	L1-D	L1-H	L2-H
Length /_]$_{IP}$	yes	yes	yes
Blinks	yes	yes	yes
Pause/ _]$_{IP}$	yes	yes	yes
Brow	yes	yes	no
Pause—IP≠U	no	no	yes
Length / $_{IP}$[_	yes	no	no
Torso	no	yes	yes
Hold	no	no	no
Head position	no	no	no
Drop Hands	no	no	no

Table 2. Summary of results showing prosodic cues divided into three groups: those that were present in all groups (top), those that differed across groups (middle), and those that were absent and/or inconsistently used in all groups (bottom).

4. Discussion

The results just described cannot be captured by a single explanation, so I will address them in the same three groups that were used in the Results section: cues that were present in all groups; cues that differed across groups; and cues that were absent in all groups.

4.1 Cues prevalent in all groups

In these highly proficient signers there is no difference in the number of articulatory structures used for prosody, and I would argue that all groups are using a basic prosodic pattern in the same way. The most prevalent cues in our data—Pre-boundary lengthening, Blinks, and I-Phrase Pauses—have also been observed cross-linguistically in Israeli, Hong Kong, and Swiss German Sign Language as well [1], [21]-[22]. These cues might therefore be considered to be among the most robust across sign languages, even if Blinks were somewhat variable in the present study. In particular, Pause as an I-Phrase cue has been shown to be the most salient prosodic cue in a perception experiment requiring subjects to make judgments about the presence of I-Phrase boundaries in ASL [3]. The fact that it is the most salient cue for both signers and non-signers suggests that, despite their language-specific variability and variability in L1 and L2 language users [9], [20], the presence of a pause at I-Phrase boundaries is a possible language universal across both spoken and signed modalities.

4.2 Cues that differed across groups

Four cues that differed significantly across groups were discussed: Brow Changes, U-level Pauses, Torso Changes, and Phrase-Initial Lengthening. I would argue that the L2 pattern in these cases demonstrates a case of *language fusion* [19]; the resulting pattern is present neither in the L1 (in this case, English) nor in the L2 (ASL). The L2 pattern is grounded in the gestural experience of hearing people, not spoken English. It is modified to fit into ASL grammar, but the exact pattern is found in neither English nor ASL.

The cues in question have different functions in gesture and sign that motivate different prosodic domains. For example, the use of eyebrows in gesture is affective [10], and the fusion appears in the L2 signers' prevalent use of the eyebrows in adverbial expressions (avg. 77% vs. 66% in the two L1 groups). Adverbial expressions are certainly grammatical in ASL, but they often resemble the affective use of eyebrows in gesture. They also have a more variable prosodic domain; therefore this cue is used less consistently by the L2 group overall as an I-Phrase marker. In contrast, the high prevalence of Brow Changes as an I-Phrase marker in the L1 groups is motivated by ASL syntax. Eyebrows are raised in topic structures in ASL, and these structures constitute independent I-Phrases that occur sentence initially [23]. I-Phrases generated by the topic structure begin with the brows moving up and end with a brow change to another posture or to neutral position. This structure is used more frequently in the two L1 groups than in the L2 group (34% the two L1 groups vs. 23% in the L2 group). The L2 prosodic pattern is therefore neither a purely gestural pattern nor a purely ASL pattern, but rather a blending of the two. The uses of this cue in gesture and sign are very different; i.e., there is no overlap in the two uses (affect/ adverbial vs. syntactic). I would argue that it is the lack of overlap between the uses of this cue in ASL and gesture that accounts for the L1-H group patterning with the L1-D group.

The pattern of the Torso Change cue is also a case of language fusion in the L2-H group, but it produces a different effect on the L1-H group. The use of Torso leans in gesture in order to show a speaker's disposition towards a speech act or event is well-known, and their domain is suggested to be the proposition [10]; however, in ASL this cue is used for specific verbal or pragmatic uses [24]. The ASL/pragmatic and gestural/dispositional uses overlap

since the notion of inclusion/exclusion is implicated in both uses. I would argue that it is the overlap between the uses of this cue in sign and gesture that accounts for the fact that in this case the L1-H group patterns similarly to the L2-H group.

4.3 Cues not used by any group

Some cues do not appear prevalently in these data—Drop Hands, Head Position, and Holds. Dropping the hands has been observed in Infant Directed Signing [3] and in the signing of interpreters while working [16]. Both of the hearing groups were full time interpreters; however, they did not use this cue in this task, which would indicate that it is a strategy for making a boundary more noticeable when such strategies are called for, but it is not a cue used in longer adult-directed narratives. Head Position—another cue that did not occur in our data as an I-Phrase marker—has been observed in Japanese Sign Language [22] and Israeli Sign Language [15], but its presence appears to show more language-specific variation than cues such as I-Phrase Pause, Blink, and pre-boundary Lengthening. Finally, Holds did not appear prevalently in these data. This conflicts with predictions based on the early literature on sign languages [12], [17]; however, more recent work has expressed doubts about Holds as a reliable cue, and the present results contribute to growing evidence that Lengthening is a much more reliable I-Phrase cue than Holds [3], [22].

5. Conclusion

The results of this study have several implications. First, we see that cues fall into three categories of robustness: high, low, and systematically varying. These categories can be investigated in more cross-linguistic studies and in more register contexts to determine their language-particular or universal nature in sign languages. Second, for the cues that systematically vary, we see some sources of what might be seen a contributing factor to "accent" based on prosodic structure in L2 users of ASL. If these factors can be more carefully isolated, as I have begun to do here, curricula can be developed that begin to address these issues. Third, I have argued that overlap (or lack of overlap) in the uses of these cues in sign and gesture motivates the patterns seen in the L1-H group; namely the more overlap there is between the ASL and gestural use, the more likely the gestural use is to appear in L1-H (bilingual) signers. This suggests that the use of gesture in English can have an effect on the ASL prosodic structure in L2 and bilingual users despite the fact that these two languages are in different modalities. These influences can be further explored in future work to understand the role of general language processing and visual salience in the use and distribution of these cues in production as well as in perception.

6. References

* Special thanks to Marie Nadolske for work on the design of the study and data collection, and to George Wolford for help with the transcription and for feedback on this manuscript.

[1] Boyes Braem, B. "Rhythmic temporal patterns in the signing of early and late learners of German Swiss Sign Language", Language and Speech, 42, 177–208, 1999.

[2] Brentari, D. A Prosodic Model of Sign Language Phonology. MIT Press, 1998.

[3] Brentari, D., González, C., Seidl, A. & Wilbur, R. "Sensitivity to visual prosodic cues in signers and nonsigners", Language and Speech.

[4] Brentari, D. & Crossley, L. "Prosody on the hands and face: Evidence from American Sign Language", Sign Language and Linguistics, 5, 105–130, 2002.

[5] Casey, S. & Emmorey, K. "Co-speech gesture in bimodal bilinguals, Language and Cognitive Process, 24, 290–312, 2008.

[6] Emmorey, K. & McCullough, S. "The bimodal bilingual brain: Effects of sign language experience", Brain and Language, 109, 124-132, 2008.

[7] Fenlon, J., Denmark, T., Campbell, R. & Woll, B. "Seeing sentence boundaries", Sign Language & Linguistics*, 10,* 177-200. 2007.

[8] Grosjean, F., & Lane, H. "Pauses and syntax in American Sign Language", Cognition, 5, 101-117, 1977.

[9] Grosjean, F., & Dechamps, A. "Analyse constrastive des variables temporelles de l'anglais et du français: Vitesse de parole et variables composantes, phénomènes, Phonetica, 31, 144–184, 1975.

[10] Kendon, A. Gesture: visible Action as Utterance. Cambridge University Press, 2004.

[11] Liddell, S. "Non-manual signals and relative clauses in American Sign language", in P. Siple, [ed.], Understanding Sign Language Through Sign Language Research. Academic Press, 1978.

[12] Liddell, S. & Johnson. R. "American Sign Language: The phonological base", Sign Language Studies, 64, 197–277, 1989.

[13] Lucas, C. & Valli, C. Language Contact in the American Deaf Community. Academic Press, 1992.

[14] Nadolske, Marie. Mastering the pressures of variation: A cognitive linguistic examination of advanced hearing ASL L2 signers. Doctoral dissertation, Purdue University, West Lafayette, IN, 2009.

[15] Nespor, M. & Sandler, W. "Prosody in Israeli Sign Language", Language and Speech, 42, 143–176, 1999.

[16] Nicodemus, B., & Smith, C. "Prosody and utterance boundaries in ASL interpretation" 32nd Annual Meeting of the Berkeley Linguistics Society, 2005.

[17] Perlmutter, D. "Sonority and syllable structure in American Sign Language", Linguistic Inquiry, 23, 407-442, 1992.

[18] Pyers, J. & Emmorey, K. "The Face of Bimodal Bilingualism: Grammatical Markers in American Sign Language Are Produced When Bilinguals Speak to English Monolinguals", Psychological Science, 19, 531-536, 2008.

[19] Queen, R. "Bilingual intonation patterns: Evidence of language change in Turkish-German bilingual children", Language in Society 30, 55-80, 2001.

[20] Riazantseva, A. "Second language proficiency and pausing: A study of Russian speakers", Studies in Second Language Acquisition, 23, 487-526, 2002.

[21] Sandler, W. & Lillo-Martin, D. Sign Language and Linguistic Universals, Cambridge University Press, 2006.

[22] Tang, G., Brentari, D., González, C. & Sze, F. "Crosslinguistic variation in the use of prosodic cues: the case of blinks", in D. Brentari [ed.] Sign Languages: A Cambridge language survey, 519-541. Cambridge University Press, to appear.

[23] Wilbur, R. B. "Eyeblinks & ASL phrase structure", Sign Language Studies, 84, 221–240, 1994.

[24] Wilbur, R. B., & Patschke, C. G. "Body leans and the marking of contrast in American Sign Language", Journal of Pragmatics, 30, 275–303, 1998.