University of Pennsylvania Working Papers in Linguistics

Volume 25
Issue 2 *Selected Papers from NWAV47*

Article 15

1-15-2020

Weak Hand Variation in Philadelphia ASL: A Pilot Study

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Abstract

In this pilot study of variation in Philadelphia ASL, we connect two forms of weak hand variability to the diachronic location asymmetries that Frishberg 1975 observed for changes between one- and two-handed sign realizations. We hypothesize that 1) variable weak hand involvement is a pathway for change from one- to two-handed and thus should be more frequent for body signs than head signs, and 2) variable weak hand lowering is a pathway for change from two- to one-handed and thus should be more frequent for head signs than body signs. Conversational data from four signers provides quantitative support for hypothesis (1) but not (2). We additionally observe differences in weak hand height based on sign location and one/two-handedness. The results motivate further work to investigate the possibility that weak hand involvement is a mechanism for diachronic change in sign languages.

Weak Hand Variation in Philadelphia ASL: A Pilot Study

Meredith Tamminga, Jami Fisher and Julie Hochgesang*

1 Introduction

One of the central goals of quantitative sociolinguistics is to connect the variability observed in everyday language use (synchronic variation) with the outcomes of language change over long periods of time (diachronic change; Weinreich et al. 1968). Since any language change requires a transition period in which old and new forms coexist, at least some of the variation that can be found in a community of language users at a single point in time may be a reflection of ongoing language changes. As a result, the study of synchronic variation provides an opportunity to investigate the mechanisms by which language change take place while change is ongoing. We can look at fine-grained quantitative patterns of variability, even within the language of individuals, to better understand the broad constraints on processes of linguistic change.

Sign language linguistics has, over the past several decades, witnessed a proliferation of research on both the sociolinguistics (e.g. Schembri and Johnston 2012, Lucas and Bayley 2014) and historical linguistics (e.g. Shaw and Delaporte 2011, Supalla and Clark 2014, Wilcox and Occhino 2016) of signed languages. A touchstone for the study of diachronic change in American Sign Language (ASL) is Frishberg 1975. Frishberg observes and classifies a number of types of changes that have taken place in the forms of ASL signs, such as changes toward increased symmetry. While Lucas et al. point out that "the processes resulting in the historical change that Frishberg described are still operative in the language today" (2001:14), there has been less sign language research seeking evidence from conversational signing to explicitly link quantitative patterns of synchronic variation to historical changes. In this paper we take a preliminary step in this research direction through the analysis of conversational ASL data from four participants in the Philadelphia Signs Project.

The particular variable synchronic processes that we investigate here are those having to do with the presence or absence of the weak hand (WH) in certain ASL signs. Two-handed signs may exhibit lowering of the WH to a variable degree relative to the dominant hand (DH), up to and including omission of the WH. These processes may sometimes be called weak hand lowering (Paligot and Meurant 2016) or weak hand drop (Brentari 1998).[1] At the same time, some degree of WH involvement is sometimes observed for one-handed signs, sometimes called weak hand sympathy (Meier 2006, Chen Pichler 2012) and weak hand copy or addition (Lucas et al. 2001). We refer to the first set of phenomena as WH lowering (an umbrella term that includes the possibility of both lowering and drop) and the second as WH involvement (an umbrella term that includes the possibility of sympathy, copy, and/or addition). The proposal we consider is that processes involving WH variation might be mechanisms by which signs can change from being one-handed to two-handed (1H→2H) or from two-handed to one-handed (2H→1H).

Handedness changes are well attested and can go in both directions, but such changes are not equally likely in either direction at every sign location. Frishberg observes that "for signs made in contact with the face, two-handed signs become one-handed" while "for signs made below the neck, one-handed signs become two-handed" (1975:3). She calls the former process "head displacement" and the latter "body displacement." In this paper, we ask whether there is evidence for a parallel asymmetry in the WH variable processes just discussed. If WH lowering is part of the process by which two-handed signs become one-handed, we might expect to see it more frequently in con-

*Thanks to interviewers Randy Fisher, Janessa Carter, and Domonic Gordine, to our participants from the Philadelphia Deaf community, to the Pennsylvania School for the Deaf, to the Deaf-Hearing Communication Centre, and to our RAs/annotators at both Penn and Gallaudet: Kaylee Bodtke, Nicole Carlo, Elana Chapman, Heather Hamilton, Jamila Hubbard, Franklin Jones, Jr., August Klett, Carmen Lugo, Ginette Redmond, and Robin Spigner. This research was funded by a Research Opportunity Grant from the University of Pennsylvania School of Arts and Sciences.

[1]We do not make a systematic attempt to distinguish between phonetic and phonological conversational signing processes in this paper.

texts where Frishberg observes 2H→1H changes: that is, more WH lowering for signs produced around the face. And if WH involvement is part of the pathway by which one-handed signs become two-handed, we might expect to see it more frequently in the signs produced around the body where Frishberg observes 2H→1H changes. If we are able to observe quantitative patterns in the synchronic WH variation that parallel the diachronic patterns, it would be one line of evidence that the handedness changes may be the outcome of such variability accumulating gradually over time and/or being reanalyzed in acquisition.

This paper reports on a pilot study investigating these hypotheses in a small set of data from four Philadelphia signers. We undertook the pilot study to motivate and guide our next steps in the analysis of conversational ASL variation, which are proceeding in tandem with a set of broader goals around the documentation of Philadelphia ASL and Deaf community experiences.

2 Background

2.1 The Philadelphia Signs Project

The data for this paper come from the Philadelphia Signs Project. The Philadelphia Signs Project is a corpus containing conversational ASL interviews between Deaf Philadelphians who are daily users of ASL. The project is rooted in the Philadelphia Deaf community's desire to document their local variety of ASL. These signers are motivated to record and preserve the dialect of older community members because they have observed that former signing styles are disappearing and being replaced by a pan-regional version of ASL. Since 90-95% of deaf children are born to hearing parents (Mitchell et al. 2006), sign languages, deaf community values, and the histories of deaf people are typically passed between peers and generations in deaf schools. As a result, social changes that play out in deaf education are likely to have effects on sociolinguistic variation in conversational signing as well as long-term patterns of language change. The main locus of sign language transmission in the Philadelphia area is Pennsylvania School for the Deaf (PSD). PSD was originally a residential school, but eliminated its residential component in the 1980s. The day-school model meant that there was no longer a need for residential staff, many of whom were deaf themselves; this shift reduced PSD students' exposure to native sign language models, including models of Philadelphian signs. In part because PSD had no high school from 1984-2000, many deaf children from the area opted to attend high school outside of the city in a federally sponsored program in Washington D.C. on Gallaudet University's campus, where they were exposed to the signing of deaf children and adults from around the country. Meanwhile, employment opportunities for deaf people expanded and deaf people became more mobile and interconnected (Padden and Humphries 2009). These combined shifts have led to greater adoption of a pan-regional variety of ASL by younger signers while older Philadelphian signers are aging and dying. For a more detailed history of the social and educational factors impacting the Philadelphia Deaf community and Philadelphia ASL, see Fisher et al. 2018.

Though language change occurs regularly and often uneventfully in all languages, deaf communities are particularly sensitive to and aware of the social forces that impact their language use and transmission. ASL has survived serious threats in the United States, including the ascendance of oralist pedagogies[2] and an outright call for the banishment of sign language in the education and everyday lives of deaf people (see Baynton 1996 and Lane 1989 for historical accounts). Documentation of ASL has long been motivated by deaf resistance to these threats. For example, as oralist philosophies took hold in deaf education from 1913-1920, the National Association of the Deaf (NAD) raised funds to document the sign language of deaf people in the United States in the newly created film medium, with the dual aim of uniting deaf communities around the country in their fight against oralist methods and preserving their language for posterity. Throughout these

[2]Oralism is the educational philosophy of using only speech and lipreading in educating deaf children. The social aim behind the oralist philosophy, which was imposed by hearing educators in defiance of deaf people themselves, was to integrate deaf people into mainstream society by making them appear to be as hearing as possible.

challenges, Philadelphia ASL has persisted thanks to the steadfast resistance of deaf Philadelphians. Signers who attended PSD and lived in the residential setting continued to use sign amongst their peers, even under threat of punishment—sometimes physical—by school administrators. Others who did not attend PSD regularly sought out social opportunities with other signing deaf people in church and other community settings, spreading Philadelphia ASL to populations that might have otherwise been excluded from sign language access.[3]

Over the years, however, lamentation of the changes to the educational and linguistic landscape of the Philadelphia deaf community has grown, leading to increasing desire to document their 'old' signs before they disappear. In response to the community's desire to document and preserve their signs, as observed by one of the authors (JF, who is a native signer from a Philadelphia deaf family), we began the Philadelphia Signs Project. While we, as researchers, provide guidelines and documentation protocols, the project has always been driven by deaf community motivations and co-led by community members themselves. We aim for reciprocity and transparency in our work; our collected data will be made public and we aim to create community-friendly research output for their use and benefit.

At the same time, the data collected from the Philadelphia Signs Project offers scientific promise; the field of sign language linguistics stands to benefit from the creation of annotated corpora on conversational ASL. There have been two groundbreaking, large-scale sociolinguistic studies of ASL, one on ASL variation across seven US locations (Lucas et al. 2001) and one on Black ASL (McCaskill et al. 2011). However, ASL still lacks a searchable, publicly available corpus comparable to those of other sign languages around the world, such as the Auslan Corpus (Johnston 2001) or the British Sign Language (BSL) Corpus (Fenlon et al. 2014). While the Philadelphia Signs Project will not itself become such a "main" corpus (Fisher et al. 2016), by collaborating with other regional projects and adopting emerging standards for annotation and corpus organization (Hochgesang 2015, Hochgesang et al. 2019), we hope to help increase the amount of usable ASL linguistic data that is available to researchers and the public alike.

2.2 Weak Hand Variation and Change

From a theoretical linguistic perspective, we are interested in how sign languages change over time. The study of language change, both completed changes in historical linguistics and ongoing changes in sociolinguistics, has established many general principles based primarily or entirely on research on spoken languages. Research on the social and linguistic conditioning of variation in ASL has suggested that the principles governing synchronic variation are very similar to those in spoken languages (Lucas et al. 2001), making it reasonable to hypothesize that the mechanisms common in spoken language change should be operative in sign languages as well. However, there are both social and linguistic reasons that such a hypothesis may not be borne out. Section 2.1 identified properties of the social and developmental contexts of sign language use that might influence language change: questions of *when* and *from whom* deaf children learn to sign are very likely to be relevant to the processes and trajectories of language change. Differences between the oral-aural modality and the visual-manual modality should also be taken into consideration; for example, pathways of phonetic change motivated by specific properties of the vocal tract (such as asymmetries between front and back vowels) will not be applicable to changes in manual articulation.

There are a number of variable processes and possible changes at play when we consider the linguistic relationship between sign handedness and weak hand variation. Variation between one-handed and two-handed versions of signs has been observed in ASL for decades (Battison 1974, Frishberg 1975, Woodward and DeSantis 1977, Brentari 1998, Crasborn 2011), and also occurs in BSL (Deuchar 1981) and Sign Language of the Netherlands (NGT) (van der Kooij 2001). Woodward and DeSantis (1977) find that race, region, and age play a role in determining signers' handedness preferences; Deuchar (1981) finds markedness and stylistic considerations play a role. Siedlecki and Bonvillian (1993) show that contact features and informativity influence young childrens' weak drop production. When Frishberg notes that historical handedness changes may be connected to synchronic variation existing in the community (1975:704), she is referring to this variation between

[3] This was particularly common in Black Deaf Philadelphians' experiences.

one-handed and two-handed signs. Indeed, this kind of 1H∼2H variation offers a possible mechanism for change, with 1H→2H change involving increasing probability of 2H variants over time and 2H→1H change involving increasing probability of 1H variants over time. Such phonetically abrupt changes (that is, ones not involving intermediate forms) are often associated with lexically-specific change in the sound change literature (Labov 1981), which fits well with apparent lexical differences in handedness change outcomes.

As we proposed in Section 1, another possible change mechanism is that of gradient variation in the height of the weak hand. In Labov's (1981) terms, this would be phonetically gradual change: the WH presence is eroded over time until it is lost completely, or partial WH involvement increases over time until it becomes part of the sign. Phonetically gradual change is sometimes associated with regular Neogrammarian change,[4] but it is nonetheless possible for phonetically gradual change to be lexically specific or have an otherwise non-regular outcome. Location variation is a frequently-studied variable process that occurs cross-linguistically, but the focus has been primarily on two-handed signs, particularly between higher and lower locations on the face (Lucas et al. 2002, Schembri et al. 2009). Location variation in the WH has received somewhat less attention. Gradient WH variation, where the WH is in some intermediate position between absent and fully symmetrical, comprises at least two processes that we distinguish here. WH sympathy is when the WH shows some articulatory activity mirroring the DH in a one-handed sign; such activity may be whispery or may be more fully realized. WH lowering is when the WH in a symmetrical two-handed sign does not reach the same height as the DH, and might be thought of as a form of target undershoot. Paligot and Meurant (2016) and Paligot (2017) find that WH lowering in Belgian Sign Language (LSFB) is conditioned by stylistic context: more formal settings disfavor WH lowering while less formal settings increase the likelihood of WH lowering. They also find that WH lowering is more likely when the preceding or following sign is one-handed rather than two-handed. Both of these results are consistent with a view of WH lowering as a form of phonetic or phonological reduction.

The possible relationship between 1H∼2H variation and 1H↔2H change seems straightforward and easy to understand, but that does not mean it is the true or the only mechanism by which such changes take place, especially since stable variation (that is, alternations not leading to any long-term change) is well attested in sociolinguistics. It is worthwhile to consider whether gradient processes such as WH lowering and WH sympathy may also play a role in handedness changes. Understanding the pathways of language change requires careful attention to multiple sources of evidence at different levels of generality. In this study, we make no attempt to determine whether any signs in our data are in fact in the process of changing from 2H→1H or 1H→2H. What we are looking for is parallels between quantitative synchronic patterns and attested diachronic outcomes that may point us toward areas for closer inspection in future work.

Accordingly, the hypotheses we test here both combine two ingredients: a variable synchronic phonetic or phonological process that could serve as a mechanism for diachronic change, and an observation of asymmetries in the location distribution of diachronic outcomes. When we combine these two ingredients, the active phonetic/phonological process and the diachronic asymmetry, we derive the prediction that we might see more of the process that, by hypothesis, gives rise to a change in the locations where we see more of that type of change historically. For canonically two-handed signs, we consider the proposal that WH lowering might be a process by which two-handed signs gradually become one-handed signs. Since Frishberg observes more 2H→1H changes in head signs (Head Displacement), we predict that WH lowering will occur at a higher rate in head signs than body signs. This is Hypothesis 1. For canonically one-handed signs, we consider the proposal that WH involvement might be a process (or set of processes) by which one-handed signs gradually become two-handed signs. Since Frishberg observes more 1H→2H changes in body signs (Body Displacement), we predict that WH involvement will occur at a higher rate in body signs than head signs. We discuss these hypotheses in Section 4.1. We discuss an additional set of post-hoc analyses of the distance between the WH and DH in Section 4.2.

[4]That is, change that affects a phoneme uniformly throughout the lexicon.

3 Data and Methods

3.1 Interview Recording and Annotation

All of the interviews in the Philadelphia Signs Project were conducted by Deaf signers who are native users of ASL and members of the Philadelphia Deaf community. The structure of the interviews was loosely based on the sociolinguistic interviewing methods described in Labov 1984 and is similar to sign language corpus studies starting with Lucas et al. 2001. These interviews contain free conversation followed by more focused elicitation techniques such as picture identification. The data for the current study was drawn from the free conversation portions of the interviews. Interviews were video recorded with two video cameras, one capturing a frontal view of the signer and one capturing both interlocutors from the side. The height classifications made in Section 3.2 were made using the frontal view videos. Annotation of the video recordings is being done in ELAN (Wittenburg et al. 2006) following the conventions of the SLAAASh Project (Hochgesang 2015) and using the integrated ASL Signbank (Hochgesang et al. 2019). Currently, most interviews have had an approximately 15-minute section annotated, with tiers representing the ASL Signbank ID gloss for each hand for individual signs and an utterance-level free translation into English.

We selected portions of four interviews for this pilot study. The interviews were conducted between 2015 and 2017. The signers in these interviews are Sherry (a white woman in her mid 70s), Domonic (an African American man in his late 20s), Jenny (a white woman in her early 50s), and Harrison (a white man in his early 90s). We chose these interviews based primarily on the clarity and angle of the frontal recordings, as well as the availability of annotations during portions of the interview where the participant produced dense stretches of conversational signing. All four signers attended the Pennsylvania School for the Deaf for at least one year during their education, and all report that ASL is their primary language.

3.2 Data Coding

From each interview, we selected a starting point and then coded the first 100 one-handed and symmetrical two-handed signs occurring after that point that met our inclusion criteria (detailed below). Two of the authors, one a native signer of ASL (JF) and the other a sociophonetician (MT), worked together to form a consensus on each sign's inclusion and coding. We take as our reference point for each sign the citation form of the sign in the ASL Signbank (Hochgesang et al. 2019). ASL Signbank forms are based in observed contemporary conversational usage, but should not be assumed to represent an "underlying form" nor to represent a prescriptive standard. Coding of the signs in the conversational data was done prior to extraction of the citation form information from the ASL Signbank.

The broad sign categories of interest were one-handed and symmetrical two-handed signs. Fingerspellings, classifier constructions, and pronominal indices were excluded. Use of the weak hand as a buoy, such as for pragmatic or narrative structure or list formation, was excluded. All asymmetrical two-handed signs were excluded, as were symmetrical two-handed signs involving sustained contact between the hands (such as MACHINE). We excluded two-handed signs with alternating bilateral symmetrical movement, such as SIGN. Most spatial agreement verbs were excluded, except SAME-AS. These exclusions were established primarily following (Battison 1974) and (Brentari 1998) on the environments that license WH drop, as well as based on standard sociophonetic practices of excluding contexts where the relevant phonetic information is unavailable.

For each sign, we coded the height of both the DH and WH on the six-level scale shown in Figure 1. We developed this coding scheme to be atheoretical and easy to use across different participants filmed under different conditions. When the WH is not active during the sign production, it is given an N/A value. For signs involving a path, we made an arbitrary decision to code the height of the signs at the starting point of the path. If the DH and WH start out at the same height but diverge during the path movement, it will not be captured in our coding scheme. For signs not involving a path, we coded the hand heights at the fullest realization of what we took to be the sign's articulatory target. We used the center of the palm as the point in the hand that we classified on the height scale,

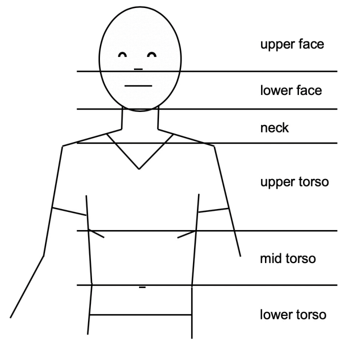

Figure 1: Six-level coding scheme for hand height.

except in cases where there is contact with the body, where we then used the point of contact as the articulatory target. We excluded instances of signs where there was obvious perseveration of the preceding sign or anticipation of the next sign.

Signs were included if their ASL Signbank citation forms are one-handed, two-handed symmetrical, or two-handed symmetrical or alternating. We recorded the ASL Signbank handedness information and coded the WH and DH heights according to our six-level height scheme from the ASL Signbank videos, using the same criteria as for the interview data. In a small number of cases, two-handed signs that we coded in the conversational data had citation forms that were asymmetrical; these were excluded from our analysis.

After coding the hand heights for each sign, we classified the levels "upper face," "lower face," and "neck" under the broader label "head" and the levels "upper torso," "mid torso," and "lower torso" under the heading "body." Like the more fine-grained classification, the head/body distinction is not intended as a claim about linguistically meaningful location values, but rather as a simplified phonetic classification scheme allowing us to operationalize Frishberg's concepts of head displacement and body displacement.

The analysis in Section 4 will report rates of WH lowering and involvement across this two-way head/body distinction. Signs are classified as head signs or body signs based on their ASL Signbank height, not their observed height. WH lowering is identified when the observed WH height is one or more levels lower than the observed DH height, or when the WH is absent entirely. In some cases, this may undercount subtle instances of WH lowering where both hands are still classified at the same level despite some vertical offset. WH involvement is identified when the WH has any height classification in a sign that is one-handed in its ASL Signbank citation form.

4 Results

As a reminder, the hypotheses we test here are as follows:

- Hypothesis 1: WH lowering will occur at a higher rate in head signs than body signs
- Hypothesis 2: WH involvement will occur at a higher rate in body signs than head signs

4.1 Rates of WH Processes

We begin by focusing only on the two-handed subset of our data to test Hypothesis 1. The left facet of Figure 2 shows the rates at which we observe WH lowering in signs whose ASL Signbank form is two-handed, broken down by head locations and body locations also based on the height of the citation form from ASL Signbank. The graph shows that the rate of WH lowering in head signs, shown in blue on the left, is almost identical to the rate of WH lowering in body signs, shown in orange on the right (Chi-squared test: $\chi^2 = 0.03, p = 0.87$). In other words, we do not find any

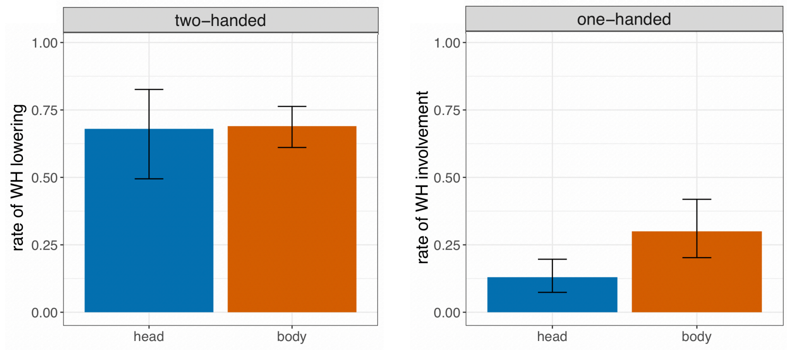

Figure 2: Left facet: Rate of WH lowering in two-handed signs, across head and body locations. Right facet: Rate of WH involvement in one-handed signs, across head and body locations.

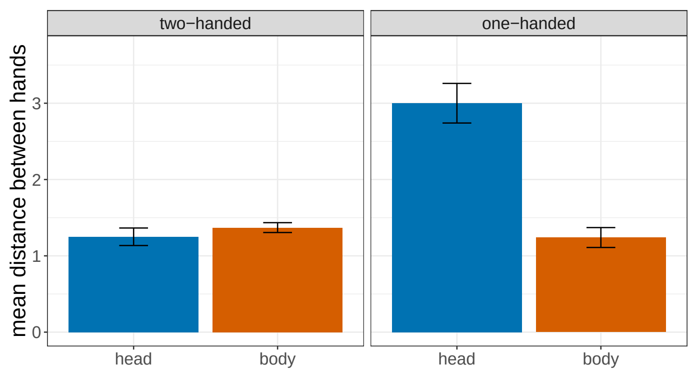

Figure 3: Distance between WH and DH in two-handed signs with WH lowering and one-handed signs with WH involvement, across head and body locations.

evidence to support Hypothesis 1 and cannot conclude that WH lowering is conditioned by whether a sign is a head sign or a body sign.

Next, we examine only the one-handed subset of our data to test Hypothesis 2. The right facet of Figure 2 shows the rates at which we observe WH involvement in signs that are one-handed in their ASL Signbank form, again broken down by head locations and body locations based on the Signbank citation form height. The graph shows that there is very little WH involvement for head signs, as shown in blue on the left, but significantly more WH involvement for body signs, shown in orange on the right. The significant difference between these involvement rates (Chi-squared test: $\chi^2 = 9.56, p = 0.002$) is in the direction predicted by Hypothesis 2: a higher rate of WH involvement in the same area of the body where we see a higher incidence of diachronic 1H→2H change.

4.2 Distance Between Hands

The above analyses address our specific hypotheses, but they also abstract away from other information available in the coded data. An additional aspect of the data that is directly relevant to the questions we are interested in here is the distance between the DH and the WH in cases of lowering or involvement. So far we have reported only how often these processes happen, not how extreme their magnitude is when they do happen. Here we calculate the distance between WH and DH on our 6-point height scale, only for the cases that were classified as having WH lowering (for two-handed signs) or WH involvement (for one-handed signs). We do so for the same data subsets as discussed in Section 4.1. Figure 3 shows these distances in terms of number of steps on the scale, with "upper face" given a value of 6, "lower torso" given a value of 1, and N/A values treated as 0.

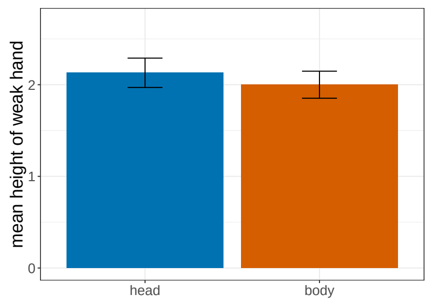

Figure 4: WH height in one-handed signs with WH involvement, across head and body locations.

In Figure 3 we see that for two-handed signs, the distance between the hands when the WH is lowered is about the same across head and body signs (Welch's two-sample t-test: $t = -0.4, p = 0.69$). For one-handed signs, the distance between the hands when the WH is involved is much larger for head signs than for body signs (Welch's two-sample t-test: $t = 5.7, p < 0.001$). This suggests the possibility that the head versus body difference in the WH–DH distance for one-handed signs is driven entirely by the height of the dominant hand, rather than reflecting the height of the weak hand. To check this, we ask whether the height of the weak hand when it is involved in one-handed signs affected by whether it is a face or body sign. Figure 4 suggests that the head/body differences in one-handed signs seen in Figure 3 indeed arise from DH height differences: there is no evidence for a WH height difference across head and body signs (Welch's two-sample t-test: $t = 0.6, p = 0.56$).

5 Discussion

We began this pilot study with the intention of testing two hypotheses, inspired by the diachronic findings of Frishberg (1975): that there would be more WH lowering in head signs than body signs, and that there would be more WH involvement in body signs than in head signs. Of these two hypotheses, we found evidence only for the second: WH involvement is significantly more likely for signs produced at a body height level than at a face height level. We additionally found that WH lowering led to the same amount of distance between the DH and WH in head signs and body signs, while head signs with WH involvement had a greater distance between DH and WH than did body signs with WH involvement. We further argued that the greater WH–DH distance in WH-involved head signs is attributable to the higher position of the DH, not any raw difference in WH height.

These pilot data do not give us a strong reason to pursue the idea that WH lowering may produce or reflect 2H→1H change. We did not find evidence that this process applies either more often or more strongly in the contexts where Frishberg (1975) documented 2H→1H changes, namely the area around the face. In fact, having observed that the average distance between hands is constant across head and body signs exhibiting lowering, we might expect a diachronic asymmetry that is the opposite of Frishberg's head displacement, for the following reason: When both hands in a symmetrical two-handed sign start out at the face, there is a large distance through which the WH could lower before it hits the bottom of the signing space. When both hands start out lower down, the lowering WH would reach the bottom of the signing space much sooner. It thus might be easier for the WH to gradually drop out of a two-handed sign more quickly if that sign started out lower down — but that is the opposite of the attested historical outcomes.

We believe that these results do motivate further inquiry into the phenomenon of WH involvement and its possible role in 1H→2H change. First, WH involvement is more frequent with body signs, although overall much rarer than WH lowering. This is the kind of quantitative synchronic/diachronic parallel we were looking for: a greater occurrence of WH involvement in the same locations where Frishberg (1975) observes 1H→2H change, namely signs that are around the body instead of the face. The distance differences offer another reason for additional exploration. Figure 3 makes it look like WH involvement is sensitive to location, but actually WH involvement leads to a constant average WH height relative to the signing space, instead of a constant average distance from the DH. This opens up the possibility that WH involvement could be perceived and learned differently across head and body signs because of the distance differences it creates. WH involvement for a one-handed body sign may produce a surface form that is ambiguous with a two-handed sign plus WH lowering. WH involvement for a one-handed face sign, however, is unlikely to be confused for a two-handed face sign with a lowered WH, because the expected WH–DH distance for the 1H+involvement form will be much greater than the expected WH–DH distance for the 2H+lowering form. This ambiguity in body signs may create an opportunity for change via reanalysis in acquisition.

There are, of course, many directions for improving and continuing this work. The obvious one is to collect more data, but before we move forward on additional data collection we plan to implement a number of changes to the process. There are many properties of each token's environment that should be coded and controlled for: phonological context (such as height of the preceding and following signs) is chief among these, but also factors like part of speech, handshape, sign frequency, iconicity, signing rate, and stylistic context. Adopting a more phonologically sophisticated scheme for coding the dependent variable is likely to pay off in terms of achieving a clearer description of the linguistic processes at play. And our work connecting variation to change will be strengthened greatly as we incorporate a larger number of signers into our dataset so we can look at whether individual signs seem to be changing in apparent time.

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