**Processing weak drop by signers and non-signers of Shanghai Sign Language**

**Shengyun Gu**

Two-handed signs are divisible into balanced and unbalanced signs (van der Hulst 1996), the former having the non-dominant hand copying the dominant hand and the latter involving the non-dominant hand as location for the execution of the dominant hand. This study investigates one-handed realization of a two-handed sign, also called weak drop (WD) in Shanghai Sign Language (SHSL). Previous studies (Battison 1974; Brentari 1998; van der Kooij 2001; Nishio 2009; a.o) found that WD is phonologically constrained. Some scholars stress the role of iconicity on WD: Iconicity may facilitate WD in unbalanced signs (Becker 2022); Iconicity impedes WD (van der Kooij 2002; Vennes 2018) except for signs with a figure-ground relation on the two hands (Paligot et al. 2016). To better understand how iconicity impacts WD, I investigate deaf signers' judgment and production of WD in SHSL. Going beyond this, in determining the relevance of iconicity in/outside the grammar, I ask whether and how signers and non-signers differ in their processing. I argue that WD impedes iconicity, but the patterns vary by the subcategories of iconicity. Further, nuances in judgment and production were found between signers and non-signers, informing areas where mediation of a language grammar matters. Finally, similarity in judgment of balanced signs' WD was found across signers and non-signers, which implies that experience of another language or potentially general cognitive mechanism might help achieve partially deaf-like performance.

**Participants**. 15 deaf native SHSL signers and 30 hearing college ASL students have at least taken two semesters of ASL classes. None of these students were exposed to SHSL and were regarded as non-signers of SHSL. Half of these participants (N=15) were told the sign meanings, making the meaning-given group. The other half (N=15) were not told the sign meanings, making the meaning-ungiven group. **Stimuli**. Video clips of 50 SHSL monomorphemic two-handed signs (half/half balanced/unbalanced signs). To minimize the interference of ASL signs on the WD judgment by the ASL students, all the SHSL signs tested in this study are different from ASL signs in at least one aspect in their phonological form (i.e., differ in movement, handshape, or location). **Tasks**. Each participant watched stimuli in pseudorandomized order and were asked to intuitively tell whether they accepted a one-handed realization. If the sign was judged to be WD-amenable, they were instructed to naturally produce the one-handed form with the non-dominant hand down. If the sign was judged to be WD-resisting, they were asked to do forced production, imagining the non-dominant hand was holding an object and not available for full participation. All studies were conducted and recorded on Zoom. **Iconicity**. Applying the notion of two-handed iconicity categories (Lepic et al. 2016), which were proposed based on a typological study of four historically unrelated sign languages, I divided the tested SHSL signs into 5 categories: (a) Interaction: paired, interacting entities mapped onto each of the two hands (N=6); (b) Dimension: boundaries of an entity's shape/volume mapped onto the two hands (N=8); (c) Location: paired entities and their locations mapped onto each of the two hands (N=17); (d) Composition: component parts of an entity mapped onto the two hands (N=5); (e) Non-iconic (N=14).

**Results & Discussion**. To jointly analyze the association between WD acceptance, WD production, group (deaf, hearing meaning-given, hearing meaning-ungiven), sign form, and iconicity, I performed a logistic regression model with participant and item level random effects. All the analyses were conducted using R and package lme4. **(1) For deaf signers, iconicity impedes WD, but the impact varies by subcategories of iconicity**. When lumping the four iconic categories, namely composition, dimension, interaction, and location, into one iconic category, we found that in comparison to the non-iconic signs, WD judgments of the iconic signs by the deaf group were associated with less WD acceptance (**Table 1**). Regarding each iconic subcategory, in comparison

to non-iconic signs, signs with composition, interaction, dimension, or location were all negatively associated with less WD acceptance, although only composition and interaction categories reached a level of significance (**Table 2**). **(2) Iconic effects differ between deaf signers and hearing non-signers**. Even though the iconic signs were associated with less WD acceptance in all the three groups, the strongest negative association was seen in the deaf group (**Figure 1**, **Table 1**). Further, within the iconic categories, in addition to composition and interaction, the negative association between location and WD acceptance reached a significant level for the hearing meaning-given group (**Table 2**). This indicates location iconicity has a differing impact on WD acceptance between deaf signers and hearing non-signers. **(3) Group differences in WD acceptance are seen in unbalanced signs, but not in balanced signs**. Group differences in WD acceptance were also found in sign form type. We did not find evidence for a significant difference between the deaf group and each of the hearing groups in WD judgment for balanced signs. However, significant differences in WD judgment on unbalanced signs occurred between the deaf and each hearing group, with significant differences among the two hearing groups too **(Figure 2)**. This indicates that non-signers differ from signers in WD judgment on unbalanced signs only. Access to meaning helps performance in unbalanced signs, but it is not sufficient to parallel the deaf signers. In contrast, deaf-like performance in WD acceptance of balanced signs may not require knowledge of SHSL. **(4) Deaf signers make more modulations than the non-signers in producing one-handed forms of WD-amenable signs**. We found that in producing one-handed realizations of WD-amenable signs, the corresponding one-handed WD forms are not always identical to the two-handed counterpart without the non-dominant hand. This means in the implementation of WD, phonetic adjustments occur. We also found that the deaf group made more phonetic adjustments than the two hearing groups, who seldom implemented any adjustments (**Figure 3**). And this pattern was separately identified in balanced signs and unbalanced signs as well. This suggests that although phonetic implementation is mostly subject to language-external factors, it is nonetheless mediated by knowledge of the language. **(5) Deaf signers are more reluctant than the non-signers to modulate the one-handed forms of WD-resisting signs**. An opposite pattern was seen in producing one-handed form of WD-resisting signs. The hearing groups frequently adjusted the production of signs that they judged to resist WD. In contrast, the deaf group was less willing to employ compensatory strategies to produce the ungrammatical one-handed form (**Figure 3**). This pattern was found in balanced and unbalanced signs. This suggests that while non-signers actively turn to broader semiotic systems to depict meaning, a tighter mapping from meaning to form may impede signers from repairing the already ungrammatical forms. For them, modulating the form of individual words cannot save ill-formed production.

**Conclusion**. I show that WD in SHSL is constrained by iconicity. Overall iconicity impedes WD, although the degree of impact varies by subcategories of iconicity. These online processing tasks of WD inform the ways deaf signers leverage grammar-external resources like iconicity in phonological processes. Moreover, by comparing deaf signers and hearing non-signers, I propose that knowledge of the sign language grammar mediates the WD judgment of a subset of signs (unbalanced signs and signs with location iconicity) and the WD production of all signs. This fine-grained analysis of nuances and parallels between signers and non-signers of SHSL helps shed light on areas where a linguistic system in the visual-manual modality comes into play.

**Selected references**. [1] Battison (1974). Phonological Deletion in American Sign Language. [2] Perlmutter & Padden (1987). American Sign Language and the architecture of phonological theory. [3] van der Kooij (2001). Weak Drop in Sign Language. [4] Paligot et al. 2016. Weak drop in context. [5] Lepic et al. 2016. Taking meaning in hand: iconic motivations in two-handed signs. [6] Becker (2022). The effect of iconicity on weak hand drop in American Sign Language.

**Table 1** Multifactor logistic regression of WD acceptance on iconicity and sign type in each group (MG: meaning-given, MU: meaning-ungiven; *p<0.05, ***p<0.001)

| Factor | Reference | Deaf OR | Hearing (MG) OR | Hearing (MU) OR |
|---|---|---|---|---|
| Iconic (two-handed) | Non-iconic | 0.106* | 0.357*** | 0.236* |
| Unbalanced | Balanced | 1.559 | 0.338*** | 0.069*** |

**Table 2** Multifactor logistic regression of WD acceptance on each iconic category in deaf and hearing meaning-given groups (MG: meaning-given; **p<0.01, ***p<0.001)

| Factor | Reference | Deaf OR | Hearing (MG) OR |
|---|---|---|---|
| Iconic (composition) | Non-iconic | 0.004*** | 0.077*** |
| Iconic (dimension) | Non-iconic | 0.843 | 1.302 |
| Iconic (interaction) | Non-iconic | 0.039** | 0.314*** |
| Iconic (location) | Non-iconic | 0.121 | 0.413** |

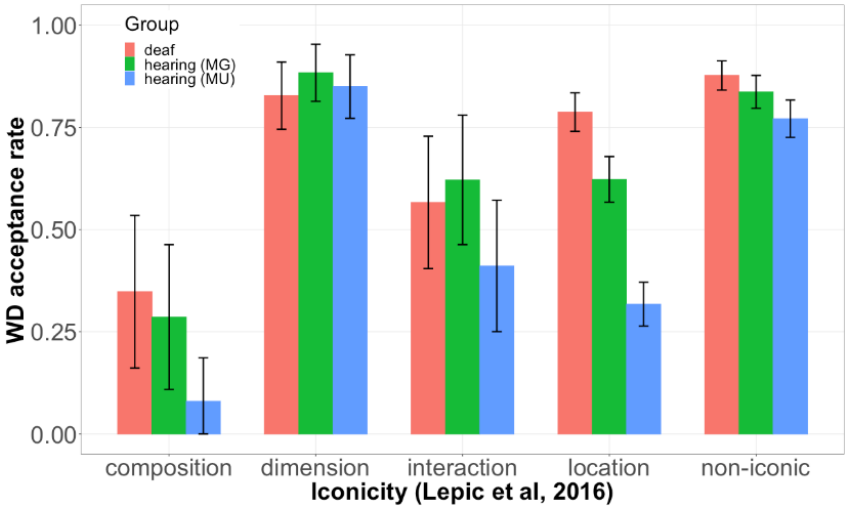


**Figure 1** WD acceptance by iconicity

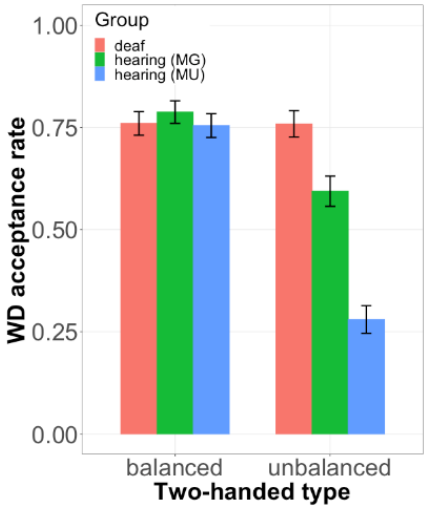


**Figure 2** WD acceptance by sign form

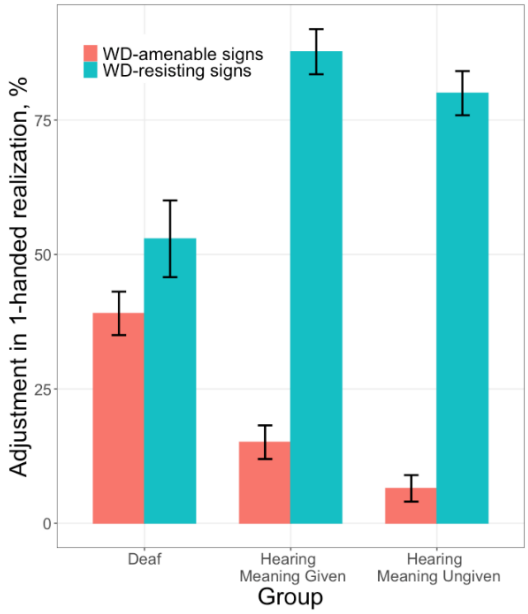


**Figure 3** Adjustments in one-handed production of WD-amenable and WD-resisting signs