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Linguistic and Motor Influences in Second Sign Language Production

Second language (L2) signers exhibit ‘accents’ influenced by prior linguistic and motor experience. These accents vary based on whether learners have a signed first language (L1) or a spoken L1. This study examines novel Hong Kong Sign Language (HKSL) production to explore the roles of linguistic and motor skills in L2 learning.

Background: Spoken L2 production reflects phonological transfer and L1-specific speech motor patterns (Gass et al., 2020; Chakraborty & Shanmugam, 2011). These patterns cannot directly transfer to a signed L2, which relies on manual modalities with unique demands. Hearing L2 signers show greater kinematic variability (Hilger et al., 2015) and less precise motor control (Mirus et al., 2001) compared to fluent Deaf signers, likely due to limited experience coordinating fine motor movements in 3D space.

This study integrates linguistic (phonological features) and motor (movement kinematics) analyses to explore whether motor skills alone facilitate L2 sign production or if sign-specific knowledge is essential. Groups: (1) native/early BSL learners with sign-specific motor patterns, (2) skilled-motor group (musicians with fine-tuned bimanual control; Sobierajewicz et al., 2018), and (3) non-signer/musician group with no prior sign language or musical experience.

Methodology: Participants viewed 96 HKSL signs and reproduced them, including facial expressions. Signs varied in six phonological complexity levels (Ortega & Morgan, 2015). Responses were analyzed for phonological accuracy (Stokoe, 1960) and movement kinematics (OpenMMLab).

Results:

Linguistic analyses (N=35/group) revealed a significant Group × Complexity interaction ($\chi^2(2) = 10.17$, $p = .006$). Skilled-motor group outperformed the non-signer/musician group on complex signs, but L1 signers were most accurate overall.

Dynamic Time Warping (DTW) assessed motion similarity between participants and model signers (Mueen & Keogh, 2016), further exploring motor contributions to L2 sign production. Preliminary results from 10 participants per group suggested that motion similarity differed significantly across groups (Kruskal–Wallis, $\chi^2(2) = 139.53$, $p < 0.001$, $\eta^2 = 0.050$). Pairwise Wilcoxon tests with Bonferroni correction revealed that both novice learners and motor-trained participants showed lower similarity to the model than signers ($Z = 11.555$, $p < 0.001$; $Z = 7.918$, $p < 0.001$, respectively). Importantly, motor-trained participants outperformed novices ($Z = –3.669$, $p < 0.001$), indicating that targeted motor experience facilitated closer alignment with model signing, though not to the level of experienced signers.

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