On categoriality and tolerance in sign comprehension: Evidence from ERPs

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Linguistic processing of lexemes involves prediction and updating of the representational model. In this study, we explore these processes on the level of the sublexical elements of signs (i.e. the parameters of handshape, location, and movement). Previous research has found that the individual parameters are processed in distinct ways, e.g. in recognition and access. Parameters are recognized at different times in the unfolding sign, most notably handshape and location being accessed in the pre-stroke transitional movement.[1][2] Furthermore, formational parameters differ in the degree to which they are clearly phonologically specified (i.e. handshape but not location exhibits categorical perception effects[3]), which may affect their online processing further. The different parameters also play differential roles in learning, with evidence that location is easiest and handshape is hardest to learn (i.e. most susceptible to errors) in both L1 and L2 learning.[4][5] While electrophysiological data point to a processing advantage for overlapping parameters,[6] a systematic assessment of the processing of different parameters is still missing.

In the present study, we use EEG to explore the time course of processes involved in sign comprehension. Our paradigm manipulates the correct execution of a sign, deviating in one parameter, as a window into differential effects of formational parameters. The errors we introduce are of the most naturalistic type, taken from a corpus of learner error data.[7] We predict formational errors to affect predictive processing (N400) and model updating (P3/P600). The use of error processing allows us to additionally investigate another factor that may affect sign comprehension: the role of (perceived) proficiency of the signer. Previous research found that native speakers were more tolerant of morphosyntactic errors produced by learners than native speakers.[8] We explore whether signers exhibit a similar 'foreign accent effect' in comprehension, and whether this differs by parameter.

Our design involved 42 adult, deaf, native DGS (German Sign Language) signers, who were shown videos of individual DGS signs. Half of the participants (N = 22) were told that the person producing the signs was a native signer; the other half (N = 20) were told that the person was currently learning DGS in order to become an interpreter. Participants saw each sign (N = 90) twice, once executed in its phonologically correct form, and once with an error in one of the three parameters (handshape, location, movement), whereby each parameter contained an error in an equal number of signs (N = 30). In addition, the task included 90 fillers that did not contain errors. To maintain attention, participants were tasked with judging if a German word, presented after the sign, semantically matched the sign. All critical items were a match in both conditions, while the fillers were mismatches.

Event-related potentials (ERPs) were time-locked to the individual parameter identification points[1] for parameter-specific and parameter-general analyses. Analyses across parameters (Fig. 1) registered a more pronounced negativity for errors (200-300ms) followed by a positivity that had an earlier onset latency for native input (350-550ms) than for learner input (450-600ms). An additional positivity was observed between 700-900ms for native input. The data further point to differential processing of parameters: The negativity and the late positivity were most pronounced for handshape (and for the native signer). Overall, these data suggest that formational mismatches result in prediction errors and that comprehenders update their model later for learners, pointing to a higher tolerance with respect to learner input, and especially for the more categorical parameter, where there is less flexibility in comprehension compared to the other parameters. Signers seem to intuit that while handshape articulation is inherently less flexible, they need to allow for more variation when it comes to those still trying to master the exact categories in this parameter.

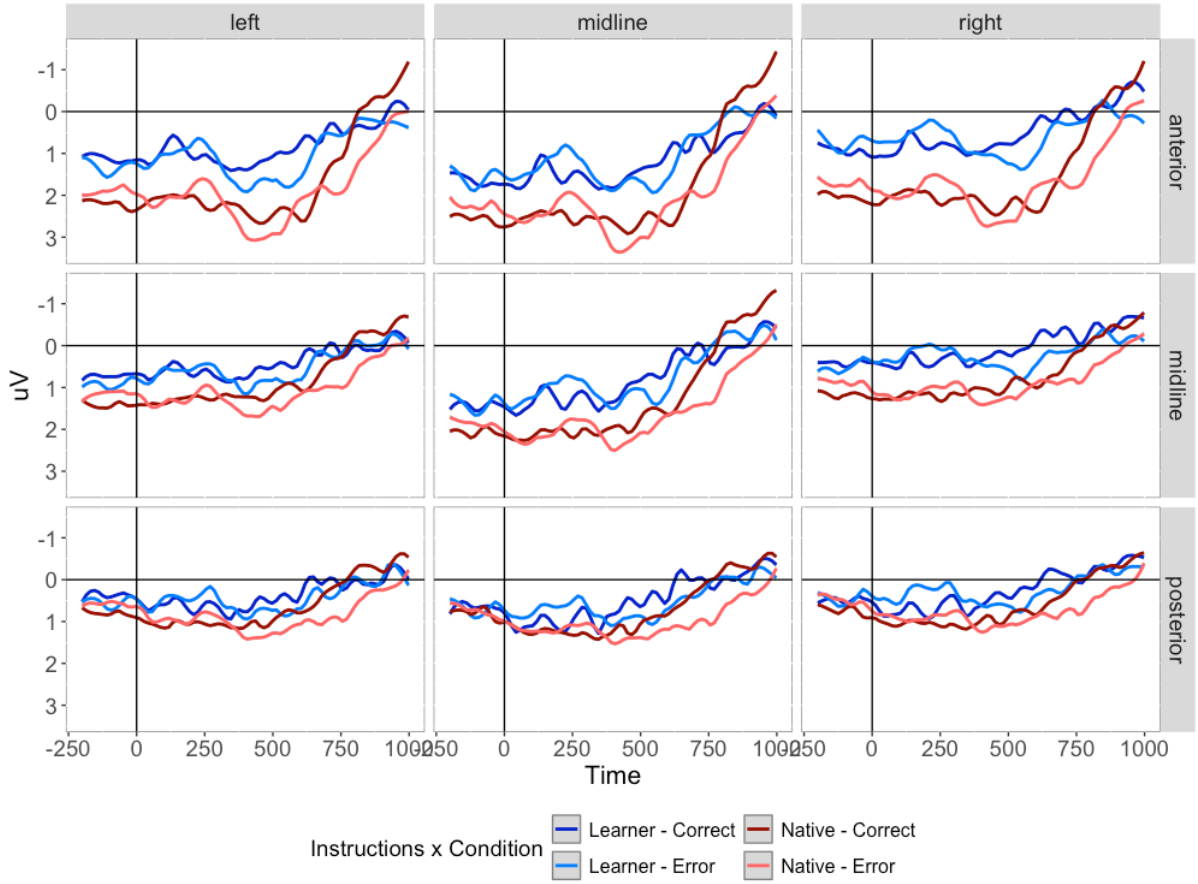

Figure 1 Grand average ERP waveforms elicited by signs that are phonologically correct or contain an error, for both the groups receiving learner and native instructions

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