Gesturing influenced by cognitive and linguistic factors

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Gestures are all around us, and they help us communicate. We instinctively point to select a pastry or happily wave to get a friend's attention. Nonetheless, a lack of gesture use can be observed in environments that could facilitate successful communication across cultural contexts (airports, hospitals, refugees), as well as in spaces that predominantly use sign languages. Using gestures is vital in areas where people, who do not share a language, come together. We investigated cognitive factors hypothesized to contribute to successful gesture use: visual language experience, working memory, and attention. We analyzed data from 26 hearing adults, 12 monolingual non-signers (English only), and 14 bimodal-bilingual signers (English and American Sign Language, ASL). In a 2 x 3 block design, receptive and expressive performance was measured for three gesture types: high semantic content ("eating food", "taking a picture"), some semantic content ("surprise", "thumbs up"), and low semantic content ("triangle outline", "circle outline"). Behavioral responses to gesture stimuli were time-locked with online webcam eye tracking. Behavior and eye gaze area (visual attention area, pixels x pixels) were analyzed with linear mixed-effects statistical modeling in R. Eye gaze density was further analyzed in MATLAB. There were significant main and interaction effects. Both groups were most accurate when perceiving gestures with high semantic content ("eat food") and when producing gestures with low semantic content ("triangle outline"). Signers were less accurate than non-signers when producing gestures with some semantic context ("surprise"). For this condition, signers more often produced sign language instead of gestures. Signers were faster to produce responses than non-signers. Signers also used larger, denser visual attention areas than non-signers, except when perceiving gestures with some semantic context ("surprise," no difference). These findings suggest that successful gesture use relies on cognitive and linguistic factors. More semantic content may aid in mapping top-down concept knowledge when perceiving gestures, but it may be more difficult to express these gestures than those with less semantic content. Visual language experience yielded faster responses and larger, more dense visual attention areas. However, we observed significant interference of sign language semantics for gestures with only some semantic content. All participants were naïve gesturers, and perhaps these outcomes could change with gesture training. These findings provide new insight into the human capacity to communicate with gestures. Successful gesture use relies on semantic content (verbal working memory), experience with visual sign language, and visual and executive attention. This work identifies factors that may increase a person's willingness to use gestures. Ultimately, this knowledge will lead to the creation of optimal gesture learning contexts to best facilitate communication across languages and cultures. (430/500)