Why are some individuals better gesturers? Multiple cognitive factors influence performance

Bradley E. White, Cryss Padilla, G. Gallagher, J. Palagano, C. Harris, and Laura-Ann Petitto

Petitto Brain and Language Center for Neuroimaging (BL2)
Gallaudet University, Washington, DC USA

INTRODUCTION

Gestures are all around us, and they help us communicate.[1–2] We instinctively point to select a pastry or happily wave to get a friend's attention. Simultaneously, we can witness a paucity of gesture use in contexts that could facilitate communication (e.g., airports and hospitals), where their use could aid in successful communication ***across cultural contexts***, and in retail spaces that predominately use sign languages. **Why are some individuals better gesturers?**

METHODS

We investigated key cognitive factors hypothesized to contribute to a person's willingness or resistance to gesturing, specifically language experience, attention, and working memory. We performed preliminary analysis of time-locked data from 15 hearing subjects (see Demographics), 5 monolingual (H1, English only) and 10 bimodal-bilingual (H2, English and American Sign Language, ASL).

RESULTS

Preliminary results revealed striking group differences. H2 was more accurate when perceiving gestures (receptive), and H1 was more accurate, but slower, when producing gestures (expressive). H2 was more accurate when perceiving and producing neutral gestures (no semantic context, "triangle outline"), but H1 was more accurate when producing intangible gestures (low semantic context, "surprised"). ***Both groups were comparable and most accurate when perceiving and producing tangible gestures (high semantic context, "drinking").*** H2 used a wider visual attention area (VAA) than H1 overall. Higher accuracy related to larger VAAs, and lower accuracy related to smaller VAAs.

DISCUSSION

Group differences in expressive, especially intangible, gesturing are hypothesized to be due to ASL semantic interference in H2. And, group differences in receptive, especially neutral, gesturing are hypothesized to be due to lack of visual linguistic experience in H1. Additionally, gesturing appears to rely on our visual attention systems to support successful performance. Through combined online webcam eye tracking and behavioral analyses, new insight is revealed about the complex cognitive factors that impact gesture use, such as language experience, attention, and working memory. This work has broad scientific and translational impact by elucidating factors that might drive a person's proclivity to gesturing, and ultimately support successful and comprehensive multi-modal (gesture+language) use ***across cultural contexts***.

Gesturing influenced by linguistic and attention factors

Scan with camera to access **all materials**!

GALLAUDET UNIVERSITY

BL2

International Mind, Brain and Education Society, April 21–23, 2022, Montréal, QC, Canada

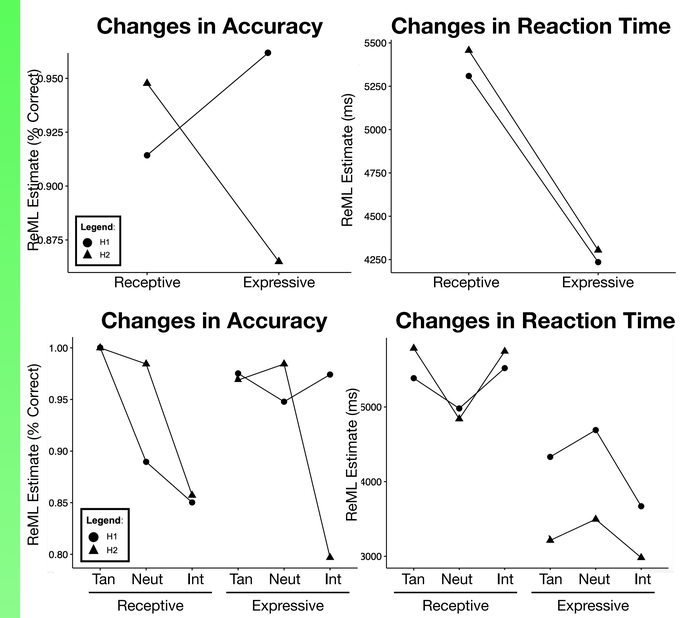
1. **Petitto** (1987). On the autonomy of language and gesture… *Cog.* 2. Kang & Tversky (2016). From hands to minds: Gestures promote understanding. *Cog. Research*. 3. Finger et al., (2017). *LabVanced*. Intl. Conf. on Comp. Social Sci. See www.petitto.net/published for full list of **Petitto** publications.

ADULT DEMOGRAPHICS

M (SD)	**H1 Monolingual (ENG)**	**H2 Bilingual (ENG+ASL)**
***N* = 15 (Sex)**	5 (5F, 0M)	10 (9F, 1M)
Age at Session	5.01 (0.91)	4.93 (0.56)
English Understanding	0.99 (0.04)	0.96 (0.06)
Sign Lang. Understanding	49851 (10654)	3600 (12996)

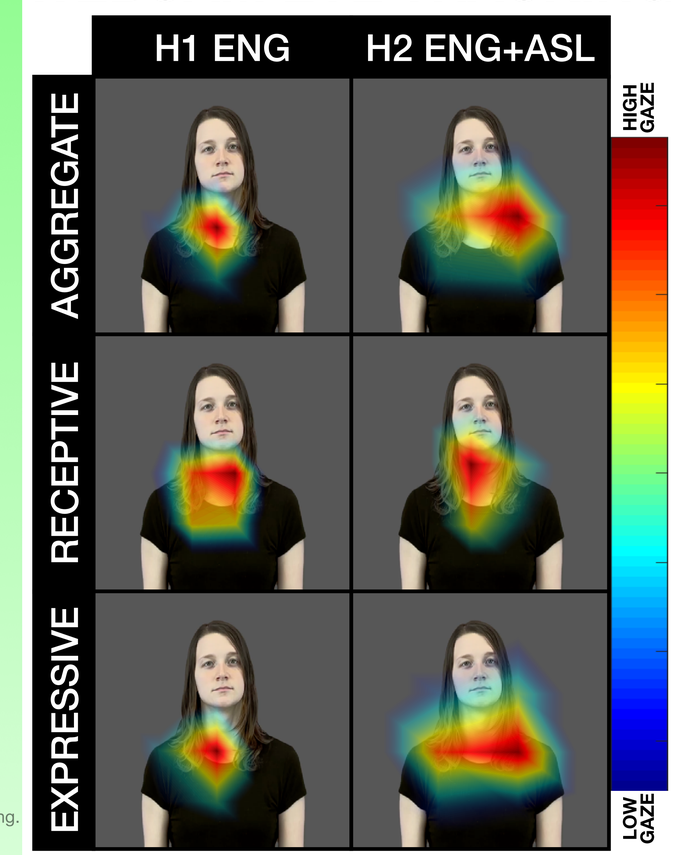
Language understanding was self-rated on a 7-point Likert scale.

BEHAVIORAL RESPONSE



Index: Tan, Tangible; Neut, Neutral; Int, Intangible; ReML, Reduced Maximum Likelihood

WEBCAM EYE TRACKING



INTRODUCTION

Gestures are all around us and help us communicate.[1–2] We instinctively point to select a pastry we want or happily wave to get a friend's attention. Simultaneously, a resistance to gesturing is widely observed, such as in airports and hospitals, where gestures could aid in successful communication across cultural contexts, and in retail spaces that predominately use sign languages. **Why are some individuals better gesturers?**

METHODS

Using novel online webcam eye tracking[3] during a behavioral task, we investigated key cognitive factors hypothesized to contribute to a person's willingness or resistance to gesturing, specifically language experience, attention, and working memory. The experiment was a 2x3 block design that measured performance for *expressive* and *receptive* gesturing of *tangible* ("drinking"), *intangible* ("surprised"), and *neutral* ("triangle outline") targets. We performed preliminary analysis of time-locked data from 15 hearing subjects (see Demographics), 5 monolingual (H1, English only) and 10 bimodal-bilingual (H2, English and American Sign Language, ASL). Behavioral data were analyzed with linear mixed-effects statistical models in R. Eye tracking data were analyzed with interpolated gaze density mapping in MATLAB.

RESULTS

Preliminary results revealed striking group differences. H2 is more accurate when perceiving gestures (receptive), whereas H1 is more accurate, but slower, when producing gestures (expressive). H2 was more accurate when perceiving and producing neutral gestures (no semantic context, "triangle outline"), but H1 was more accurate when producing intangible gestures (low semantic context, "surprised"). ***Both groups performed comparably and most accurately when perceiving and producing tangible gestures (high semantic context, "drinking").*** H2 used a wider visual attention area (VAA) than H1 overall. Higher accuracy related to larger VAAs, and lower accuracy related to smaller VAAs.

DISCUSSION

The fascinating group differences in expressive, and especially intangible, gesturing are hypothesized to be due to ASL semantic interference in H2. And, the differences in receptive, and especially neutral, gesturing are hypothesized to be due to lack of visual linguistic experience in H1. Additionally, gesturing appears to rely on our visual attention systems to support successful performance. Through combined online webcam eye tracking and behavioral analyses, new insight is revealed about the complex cognitive factors that impact gesture use, such as language experience, attention, and working memory. This work has broad scientific and translational impact by elucidating factors that might drive a person's proclivity to gesturing, and ultimately support successful and robust multi-context gesture use.