English speakers and American Sign Language (ASL) signers extend the metaphor MORE IS UP to subset/superset relationships for quantification

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Introduction

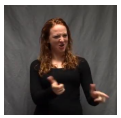
- English speakers demonstrate a **MORE IS UP** metaphor in speech and gesture production, e.g. *stock prices are rising, a lower number* (Lakoff & Johnson, 1980)
- MORE IS UP has been further confirmed in reading and processing studies (Langston, 2002; Sell & Kaschak, 2012; Winter, Perlman & Matlock, 2013)

MORE IS UP in ASL

- ASL shares the MORE IS UP metaphor for cardinalities (e.g. sign for INCREASE)
- ASL also extends the metaphor to **subset/superset relationships** (Davidson & Gagne, 2014)

Akin to this "vortex," signs produced **higher** on the vertical axis refer to **larger** domains

- Different set sizes signed at different heights



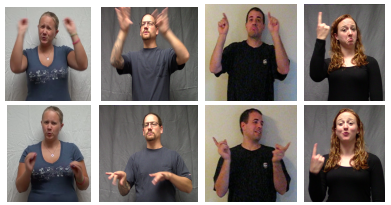
"All of [my friends]"

"All of [the people in the world]"

- Occurs with quantifiers, verbs, and pronominal IX-arcs

HIGH

LOW



"No-one" "Pick-from" "They" IX-arc "Someone"

Research questions

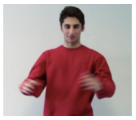
- Is vertical height also used by non-signers in their gesture to carry information about subset/superset relationships?
- If vertical height is used by non-signers, is it used in the same linguistic contexts?

Method

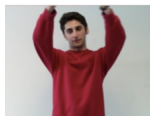
- English non-signers (N=4) were presented with 13 prompts, which included quantifiers
- Pantomime and co-speech gesture were elicited
- Each gesture referring to quantification was coded for change in height and/or width relative to the participant's most recent quantificational gesture.

Results

1. Set increase with corresponding increase in height



"Everyone in my suite"



"Everyone in the world"

PROMPT: There's a zombie attack at Yale. First **everyone in my suite** became a zombie. Then everyone in my college becomes a zombie. Then I heard that everyone at Yale has became a zombie. Then everyone in New Haven became zombie. Then everyone in the US became a zombie. Suddenly, **everyone in the world** had become a zombie. Except for me.

2. Set increase with corresponding increase in width and height

"Someone in my suite"

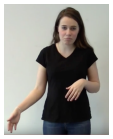
"Someone in my college"

"Someone at Yale"

PROMPT: There's a lottery at school. **Someone in my suite** is going to win a shirt. **Someone in my college** is going to win a bag. **Someone at Yale** is going to win a lot of money.

3. Set decrease with corresponding decrease in height

"Everyone"

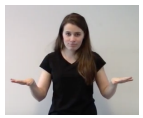


"my family"

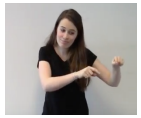
PROMPT: The flu is bad this year. **Everyone** got sick–including **my family**."

OBSERVATION: Uses of height for set sizes occurred here with noun phrases or referential contexts in gesture, while they are more flexible in ASL (e.g., occurring with verbs)

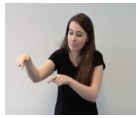
4. No overall set increase results in no increase in height



"two twin brothers"



"my one twin brother and his friends"



"my other twin brother and his friends"

"everyone" [not including the speaker]

PROMPT: I have **two twin brothers**. Everyday this week, **my one twin brother and his friends** played soccer against **my other twin brother and his friends**. Some days, my one brother's team did better. Some days, my other brother's did better. Everyday, no matter who did better, afterward **everyone** would go out for a drink.

Cross-cultural research

- **Sign language**: In both Nicaraguan and Japanese Sign Languages, the vertical axis is used to convey subset/superset relationships, as in ASL

"All of us [here]"

"All of us [here in Nicaragua]"

- **Gesture**: Research is currently being conducted on the extension of the metaphor in co-speech gestures and pantomimes of Nicaraguan and Japanese speakers

Conclusions

- English speaking non-signers extend the metaphor of MORE IS UP to abstract subset/superset relationships in gesture (see ex. 1-3), but, unlike signers, gesturers use the horizontal and vertical axes together to express set increases with superset relationships (see ex. 4)
- Gesture and sign research in the USA, and preliminarily cross-culturally, support the existence of a general cognitive bias consistent with the metaphor MORE IS UP extended to set/superset relationships

References

Davidson, K. and Gagne, D. (2014). Vertical representation of quantifier domains. In *Proceedings of Sinn und Bedeutung 18*, 110127

Lakoff, G., & Johnson, M. (1980). "Metaphors we live by." Chicago: University of Chicago Press

Langston, W. (2002). Violating orientational metaphors slows reading. *Discourse Processes*, 34, 281–310

Sell, A.J. & Kaschak, M.P. (2012) "The comprehension of sentences involving quantity information affect responses on the up–down axis." *Psychon Bull Rev*, 19, 708–714

Winter, B., Perlman, M. & Matlock, T. (2013) "Using space to talk and gesture about numbers: Evidence from the TV news archive." *Gesture*, 13, 377-408

Acknowledgments

We thank the Hearing and Deaf participants, members of the Coppola Lab, and the members of the Sign Language Reading and Discussion Group at UConn.. This research was supported in part by NSF IGERT Grant 1144399 to the University of Connecticut and by the Yale University Cognitive Science Department. This material is also based upon work supported by the National Science Foundation Graduate Research Fellowship under Grant No. DGE-1247393.

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