Do animated cues elicit similar patterns of pronoun comprehension as live cues?

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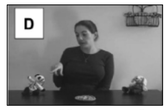
Background

- Pronoun comprehension is influenced by:
  1) Subjecthood: In *Ana is cleaning up with Liz. She needs the broom,* people tend to assume Ana needs the broom (Arnold et al., 2018).
  2) Gaze/Point cues: The subject bias is modulated by social cues (Nappa & Arnold, 2014).
  3) Print Exposure: The subject bias is stronger for people with higher print exposure (Arnold et al., 2018).



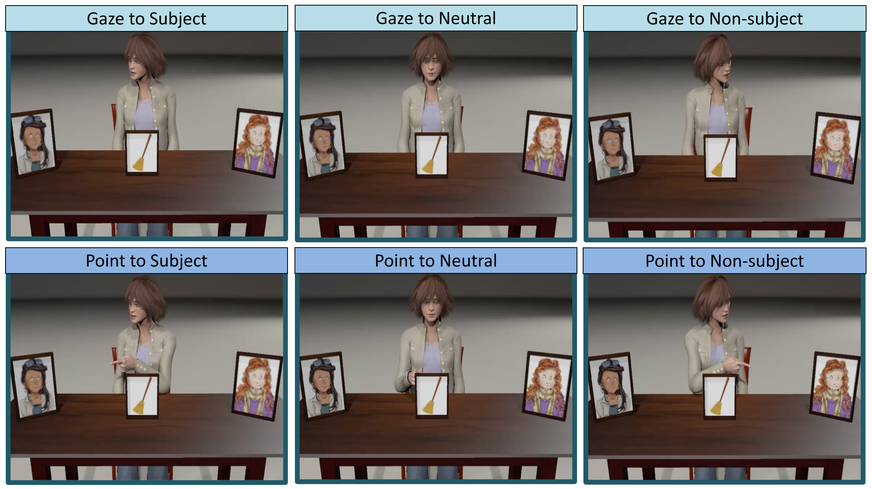
- This establishes the importance of gesture with a live human actor:
- Animated speaker stimuli would allow for greater control for testing the effects of **social cues** on pronoun comprehension, in addition to **individual differences**.

Key Questions

- Can we replicate the effect of social cues using an animated speaker?
- Do other individual difference measures correlate with pronoun comprehension?

Methods

Speaker gazes or points to the subject, non-subject, or the neutral middle picture, which occurs at the onset of the ambiguous pronoun.



"Ana is cleaning up with Liz. She needs the broom."

- Second sentence always plausible for both characters
- Participants given a question that measures pronoun comprehension (e.g. "Who needs the broom?" 2AFC: Ana/Liz)
- **Three experiments**: Ex.1a & b were gaze, Ex.2 were points. All fillers pointing.

Individual Difference Measures

Print Exposure: Author Recognition Task (ART; Stanovich & West, 1989; Moore & Gordon, 2015)

Working Memory: One block operation span, rotation span, and symmetry span, which all load onto working memory capacity (Foster et al., 2015)

SES: Parental education, family income, & subjective income → composite score

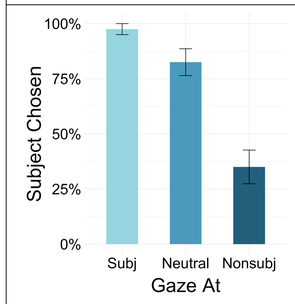
SAT: Reported scores from reading & writing section

Arnold, J. E. (2001). The effect of thematic roles on pronoun use and frequency of reference continuation. Discourse processes, 31(2), 137-162. • Arnold, J. E., Strangmann, I. M., Hwang, H., Zerkle, S., & Nappa, R. (2018). Linguistic experience affects pronoun interpretation. Journal of Memory and Language, 102, 41-54. • Foster, J. L., Shipstead, Z., Harrison, T. L., Hicks, K. L., Redick, T. S., & Engle, R. W. (2015). Shortened complex span tasks can reliably measure working memory capacity. Memory & cognition, 43(2), 226-236. • Moore, M., & Gordon, P. C. (2015). Reading ability and print exposure: Item response theory analysis of the author recognition test. Behavior research methods, 47(4), 1095-1109. • Nappa, R., & Arnold, J. E. (2014). The road to understanding is paved with the speaker's intentions: Cues to the speaker's attention and intentions affect pronoun comprehension. Cognitive Psychology, 70, 58-81. • Goodrich Smith & Hudson (2012). Knowing 'who she is' based on 'where she is': The effect of co-speech gesture on pronoun comprehension. Language and Cognition, 4(2), 75-98. • Stanovich, K. E., & West, R. F. (1989). Exposure to print and orthographic processing. Reading Res. Quarterly, 402-433.

Results

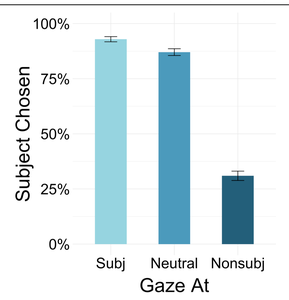
Exp. 1A

6 critical and 5 fillers (N = 24)



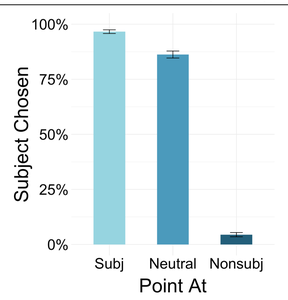
Exp. 1B

24 critical and 24 fillers (N = 60)



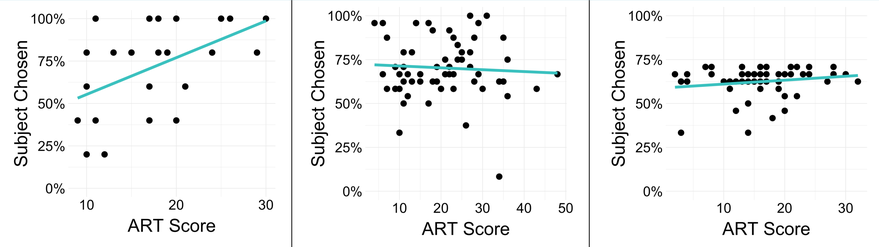
Exp. 2

24 critical and 24 fillers (N = 60)



In all three experiments: overall subject bias, overall gaze/point bias

ART Results

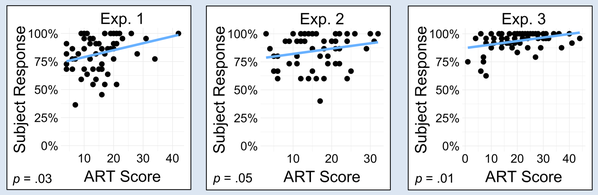


ART effect only in Ex. 1a (p = .03), but not in Exp. 1b or 2

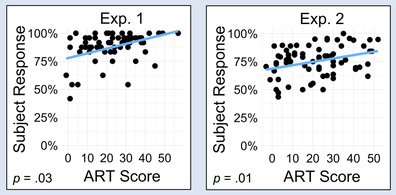
Why didn't we get an ART effect?

The ART effect is robust in other studies

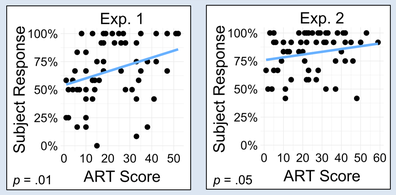
Arnold et al. (2018):



Langlois & Arnold (CUNY 2019):



Williams & Arnold (CUNY 2019):



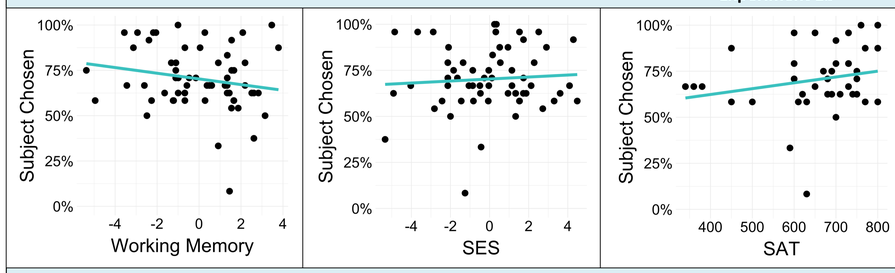
Possible Reason:

Variation in ART scores may also modulate sensitivity to animated gaze and pointing cues.

(see Zerkle & Arnold, CUNY poster in same session)

Other Individual Differences

Experiment 1b



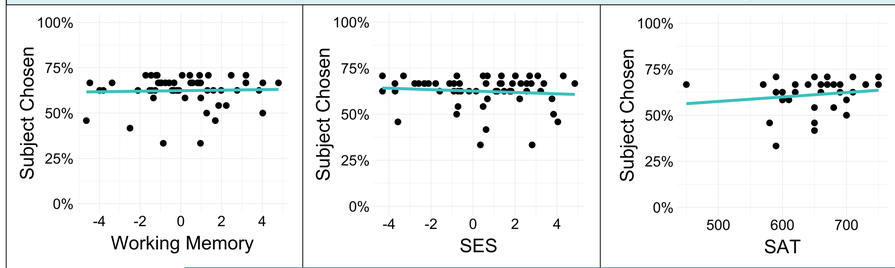
Pearson correlation coefficients; * p < .05

Measure	1	2	3	4
1. ART	-			
2. Working Memory	-.23	-		
3. SES	.14	-.11	-	
4. SAT	.31	-.16	.50*	-

Working Memory	1	2	3
1. OSPAN	-		
2. RSPAN	.26*	-	
3. SSPAN	.18	.25	-

SES	1	2	3
1. Income	-		
2. Subjective Inc.	.54*	-	
3. Parental Educ.	.26*	.31*	-

Experiment 2



Measure	1	2	3	4
1. ART	-			
2. Working Memory	-.14	-		
3. SES	.23	-.13	-	
4. SAT	.56*	-.38*	.09*	-

Working Memory	1	2	3
1. OSPAN	-		
2. RSPAN	.19	-	
3. SSPAN	.37*	.20	-

SES	1	2	3
1. Income	-		
2. Subjective Inc.	.43*	-	
3. Parental Educ.	.39*	.40*	-

No other individual differences significantly predict pronoun interpretation

Discussion

- We replicated both subject effect and gaze/point effect using stimuli from an animated speaker, but this did not extend to print exposure, in contrast to Arnold et al. (2018).
  - Other studies have found effect of print exposure on subject bias, which raises questions about the current study.
- Other individual difference measures did not correlate with pronoun comprehension.