REAL-TIME JOINT ATTENTION WITH ROBOTS

C. Yu, M. Scheutz, and P. Schermerhorn. (2010). Investigating multimodal real-time patterns of joint attention in an HRI word learning task. *HRI 2010*.

TRISTAN MC LEAY

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QUESTION

Q: HOW DO PEOPLE REACT TO ROBOT GAZE IN REAL TIME?

SUBQUESTION:

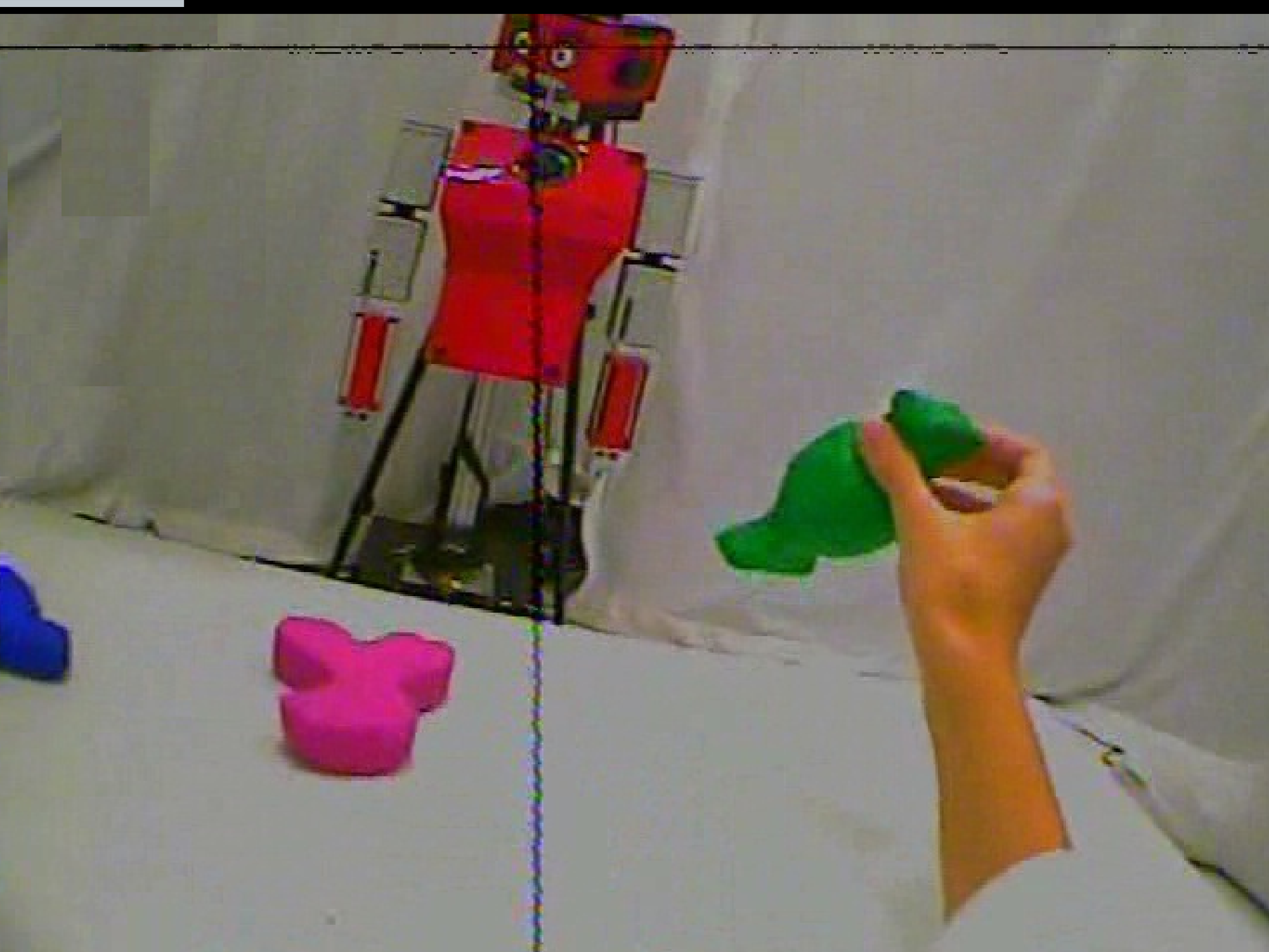
1. if the gaze is odd (random), do people pay more attention to the robot, or behave differently vs normal gaze or people?

METHOD

- word learning task:
  - p's "teach" the robot the names of colored objects
  - no restriction on approach and no instruction given
- p's eye tracked with a head-mounted eye tracker
- robot head can move and either:

  following looks at whatever the p is looking at

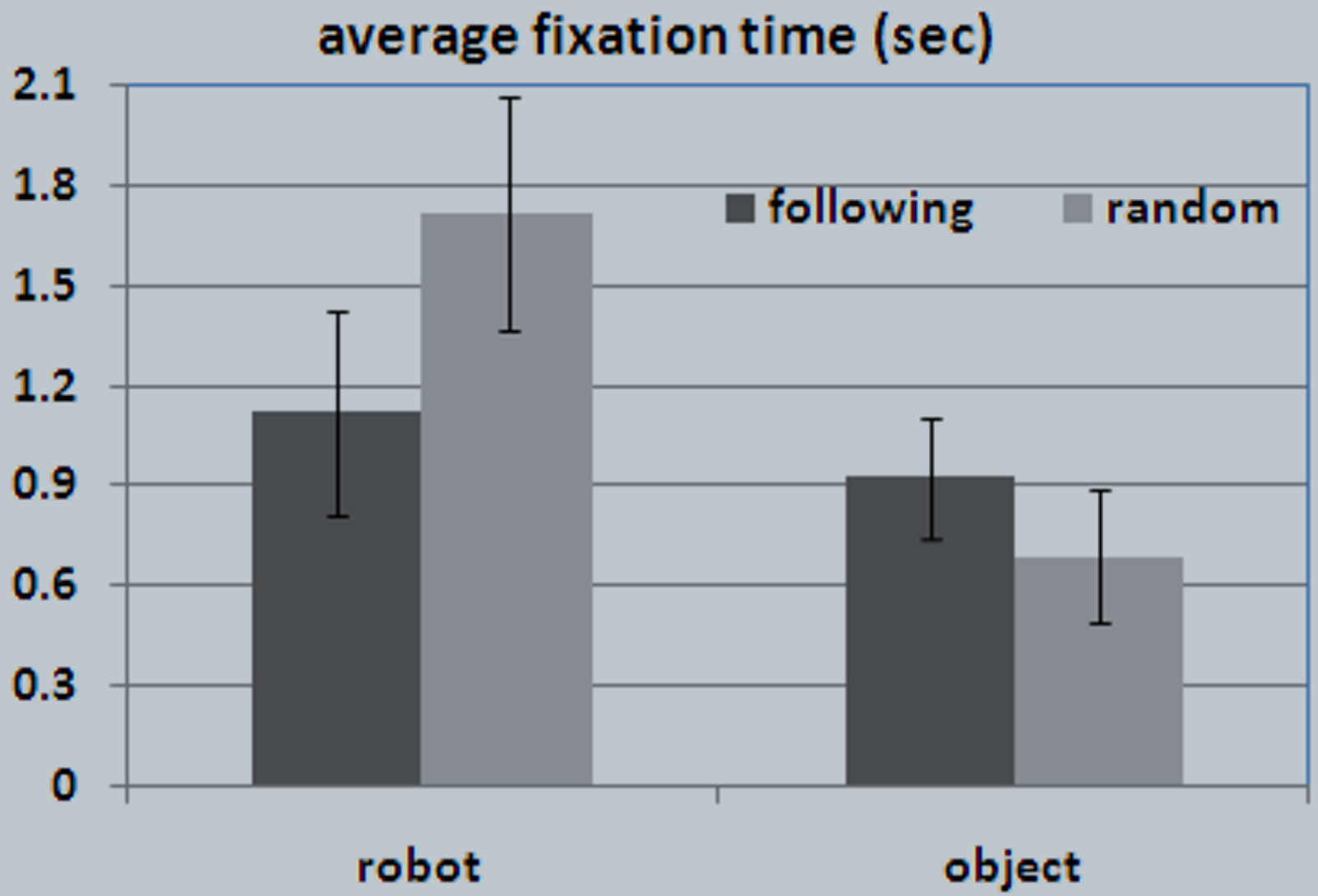
  random looks around randomly without regard for the p
- robot never moves arms or eyes nor does it ever speak



RESULTS

EYE-MOVEMENT DATA

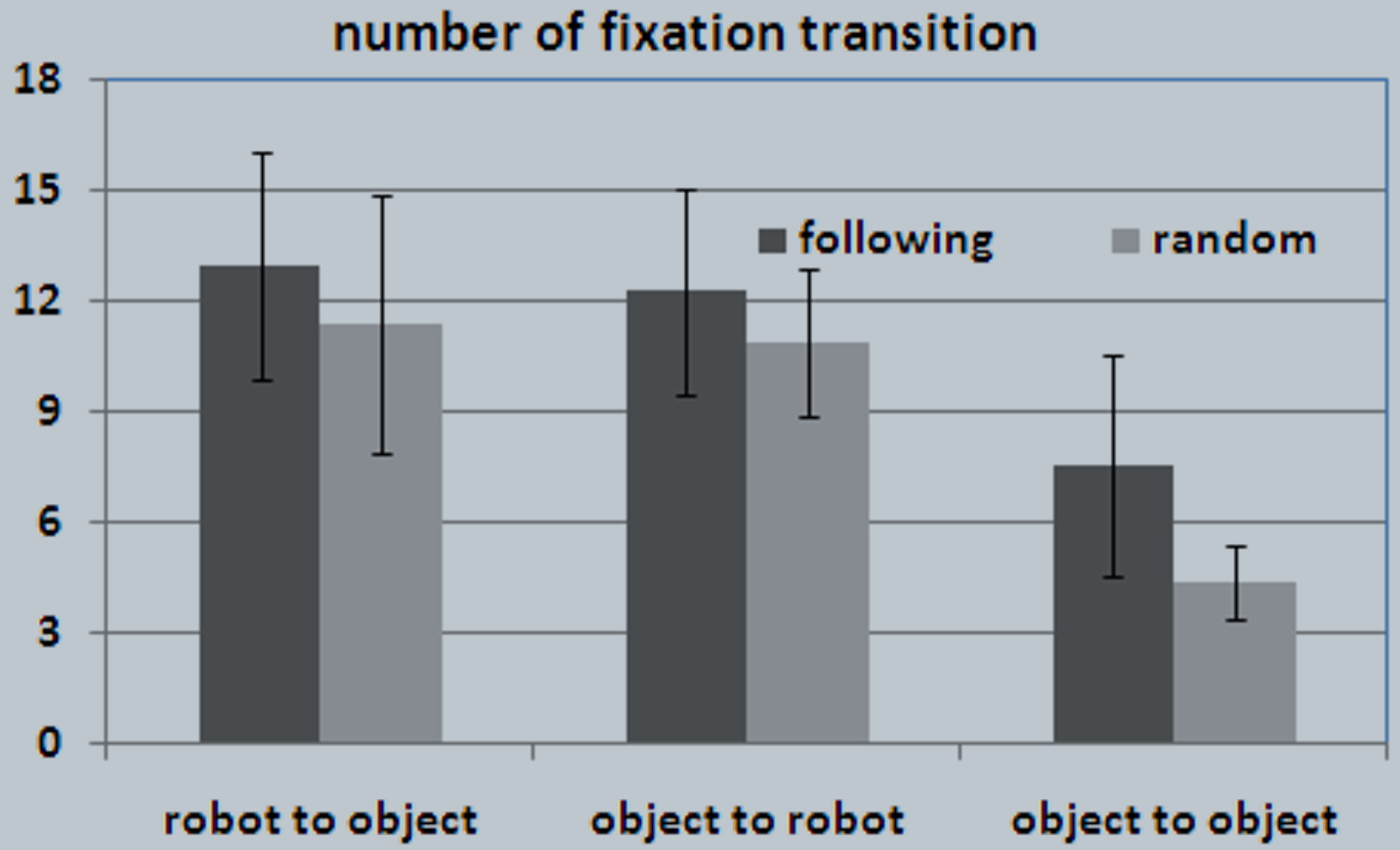
- longer fixations to the robot



RESULTS

EYE-MOVEMENT DATA

- fewer object-to-object transitions



RESULTS

SPEECH ACTS

- same number of different words (types)
- but more words spoken (tokens)**
- mostly more attention-attracting words (“look”, “see”, “hey!”, “here”) as well as object-naming words

* $p < 0{\cdot}01$; ** $p < 0{\cdot}001$

RESULTS

SPEECH ACTS

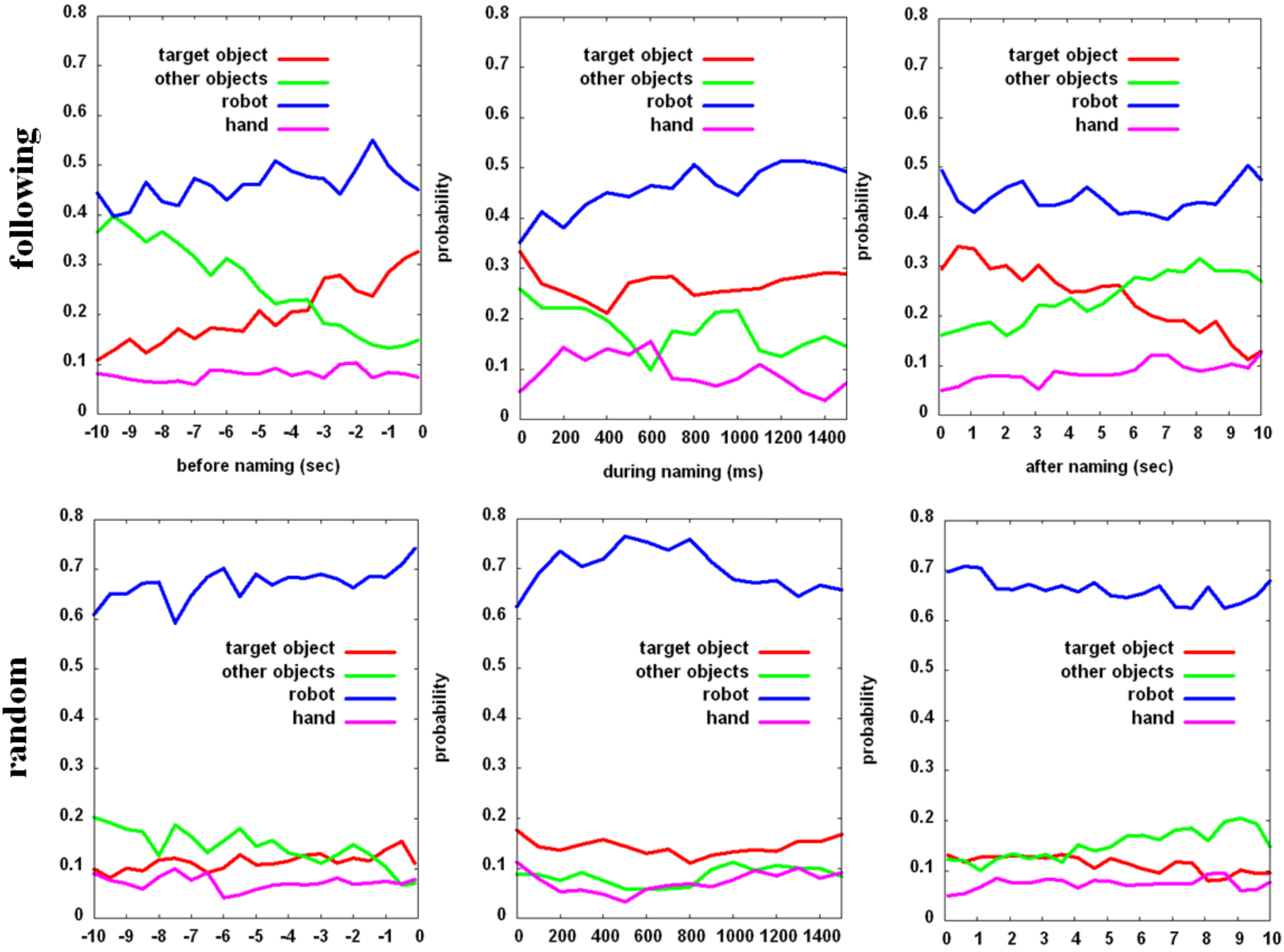
- same number of different words (types)
- but more words spoken (tokens)**
- mostly more attention-attracting words (“look”, “see”, “hey!”, “here”) as well as object-naming words
- same number of utterances
- but longer utterances*, more** and longer naming utterances

* $p < 0{\cdot}01$; ** $p < 0{\cdot}001$

RESULTS

TEMPORAL DYNAMICS: LOOKS DURING NAMING EVENTS

- in "random" condition, looks to robot dominate at all times during naming
- in human-human naming, looks to target object increase early
  - this happens in "following" condition
  - but not during "random" condition


following
random
target object
other objects
robot
hand
probability
before naming (sec)
during naming (ms)
after naming (sec)

(THEIR) CONCLUSION

1. people pay more attention to robots (and therefore less attention to the task) if the robot behaves abnormally
2. people exhibit normal j.a. behavior if robots follow gaze, but "unnatural" behavior if they don't

(OUR) DISCUSSION

- based on (?appearance/?task) the p's attempted to establish j.a. *even when the robot showed absolutely no indication of having attention/understanding*
- p's were frustrated ("hey!", "look") when the robot betrayed normal gaze conventions

(OUR) DISCUSSION

"CAN PHENOMENA LIKE JOINT ATTENTION APPEAR IN HRI?"

- j.a.b. are communication
- but they're artifacts of being human
  - e.g. gaze works because of how our eyes work; we don't have real nose-gaze or ear-gaze

(OUR) DISCUSSION

"CAN PHENOMENA LIKE JOINT ATTENTION APPEAR IN HRI?"

- j.a.b. are communication
- but they're artifacts of being human
  - e.g. gaze works because of how our eyes work; we don't have real nose-gaze or ear-gaze
- robots don't have attention?
- should robots behave like they have attention?
  - are j.a. functions helpful in h.r.i?
  - is it helpful for a robot to speak English in h.r.i?

THANKS!

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2 JULY 2010