



Ostensive communication modulates action interpretation at 9 months

Christian Kliesch¹ Vincent Reid¹, Anna Theakston², Eugenio Parise¹

¹ Lancaster University, ² Manchester University

INTRODUCTION

Infants interpret actions as goal directed (Hunnus & Bekkering, 2010) and are also sensitive to ostensive communication (Csibra, 2010). When ostensively addressed, infants perceive the informative content of the communication as relevant, meaningful and generalisable (Csibra & Gergely, 2009). In the following experiments we ask whether ostensive communication on its own can change the interpretation of an arbitrary action outcome in 9m-old infants, or whether referential signals are also required (c.f. Hoicka, 2015).

METHODOLOGY

Based on Reid et al. (2009), we measured the N400 ERP component in an expectancy violation paradigm using a HGCS 124 channel EEG system. Infants saw videos of actors addressing them either ostensively (Infant-Directed Speech, direct gaze) or in a control condition (Adult-Directed Speech, no direct gaze, c.f. Yoon et al., 2008). This was followed by 6 instances of the actor engaging in everyday actions: Eating with a spoon, drinking from a cup, eating an apple. Each action consisted of a prime and an outcome picture.

ERP COMPONENTS

- The N400, a marker of semantic expectancy violation (Reid et al., 2009)
- The Pb, which has been reported in similar research on infants' integration of multimodal ostensive signals (Parise & Csibra, 2013)
- The Nc, an infant-specific marker of attention (Reynolds & Richards, 2017)

References

Csibra & Gergely (2009). Natural pedagogy. *Trends in Cognitive Sciences*
Csibra (2010). Recognizing communicative intentions in infancy. *Mind & Brain*
Hoicka (2016). Parents and Toddlers Distinguish Joke, Pretend and Literal Intentional Contexts through Communicative and Referential Cues, *Journal of Pragmatics*

GREETING

Ostensive
[Infant-Directed Speech]

Exp. 1



Exp. 2



Control
[Adult speech]



PRIME



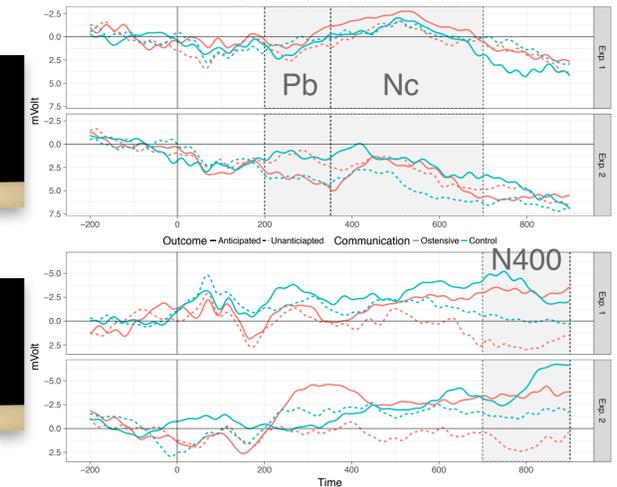
OUTCOME



Anticipated



Unanticipated



EXPERIMENT 1

During greeting, object was absent, actor did not look at object location.

Sixteen 9m-old infants (average age = 278 days, range = 265–296 days, 9 female, 35 tested).

- **N400** effect for Outcome between 700-900ms ($F(1, 15) = 10.03, p = .006, \eta^2G = 0.20$), no Outcome x Communication interaction, or main effect of Communication (all $ps > .25$)
- **Pb**: No effects 200-350ms ($ps > .26$)
- **Nc**: No effects 350-700ms ($ps > .49$).

EXPERIMENT 2

During greeting, object was present, actor looked at object (referential cue).

Sixteen 9m-old infants (average age = 270 days, range = 254–282 days, 7 female, 34 tested)

- **N400** effect for Outcome ($F(1, 15) = 7.09, p = .02, \eta^2G = 0.15$).
- **Pb**: Communication x Outcome interaction ($F(1, 15) = 10.24, p = .006, \eta^2G = 0.14$), increased positive peaks for communicative-expected ($t(28.83) = 1.80, p = 0.08$) and non-communicative unexpected outcomes ($t(28.83) = -2.25, p = 0.03$).
- **Nc**: marginally significant result for the Outcome x Communication interaction on the Nc ($F(1, 15) = 4.14, p = .06, \eta^2G = 0.06$), no significant main effects (all $ps > .20$).

DISCUSSION

These results indicate that infants assess actions differently in the presence of communication, but only if the agent makes clear she is referring to a particular object. Furthermore, already by 9months, infants take into account the reliability of the actor as expressed by the enhanced Pb for the expected actions (cf. older children: Poulin-Dubois et al, 2011; Zmyj et al., 2010), but not for the unexpected actions. In the absence of communication, the reversed Pb-response possibly reflects an attempt to maximise learning by seeking novel information (Twomey & Westermann, 2017).

Hunnus & Bekkering (2010). The early development of object knowledge: A study of infants' visual anticipations during action observation. *Developmental Psychology*
Poulin-Dubois, Brooker & Alexandra Polonia (2011). Infants prefer to imitate a reliable person. *Infant Behavior and Development*

Reid, Hoehl, Grigutsch, Groendahl, Parise & Striano (2009). The neural correlates of infant and adult goal prediction: evidence for semantic processing systems. *Developmental Psychology*
Twomey, & Westermann, (2017). Curiosity-based learning in infants: a neurocomputational approach. *Developmental Science*

Yoon, Johnson, & Csibra, (2008). Communication-induced memory biases in preverbal infants. *Proceedings of the National Academy of Sciences*
Zmyj, Buttelmann, Carpenter & Daum (2010) The reliability of a model influences 14-month-olds' imitation. *Journal of Experimental Child Psychology*