



# Ostensive communication modulates action interpretation at 9 months

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## INTRODUCTION

Infants interpret actions as goal directed (Hunnius & 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)

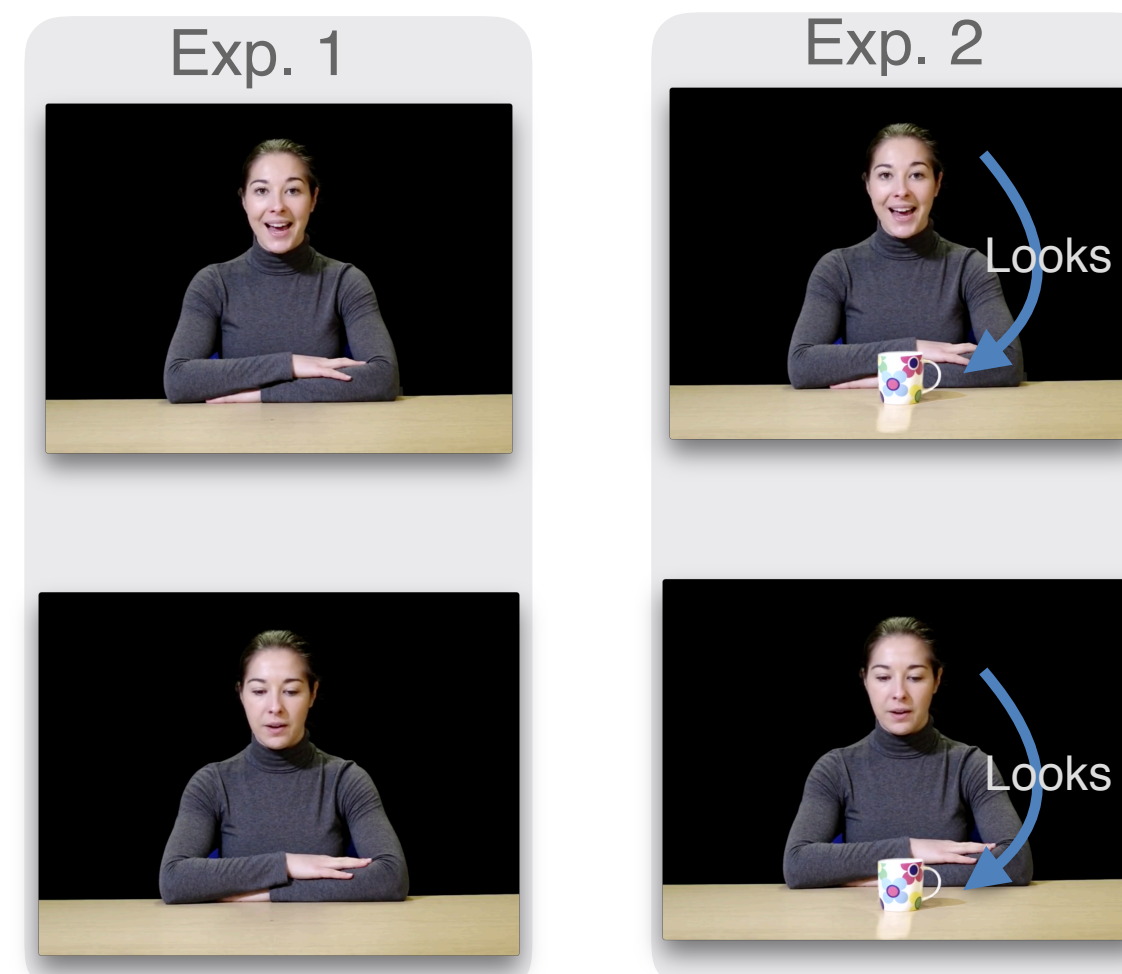
### References

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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*

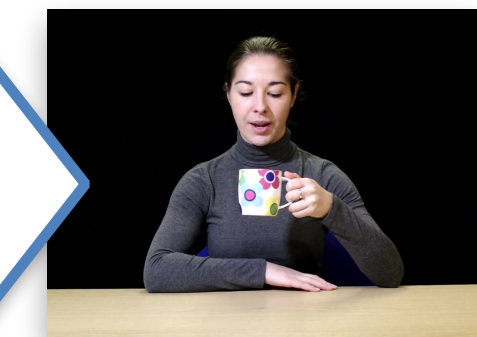
## GREETING

Ostensive  
[Infant-Directed Speech]

Control  
[Adult speech]



## PRIME



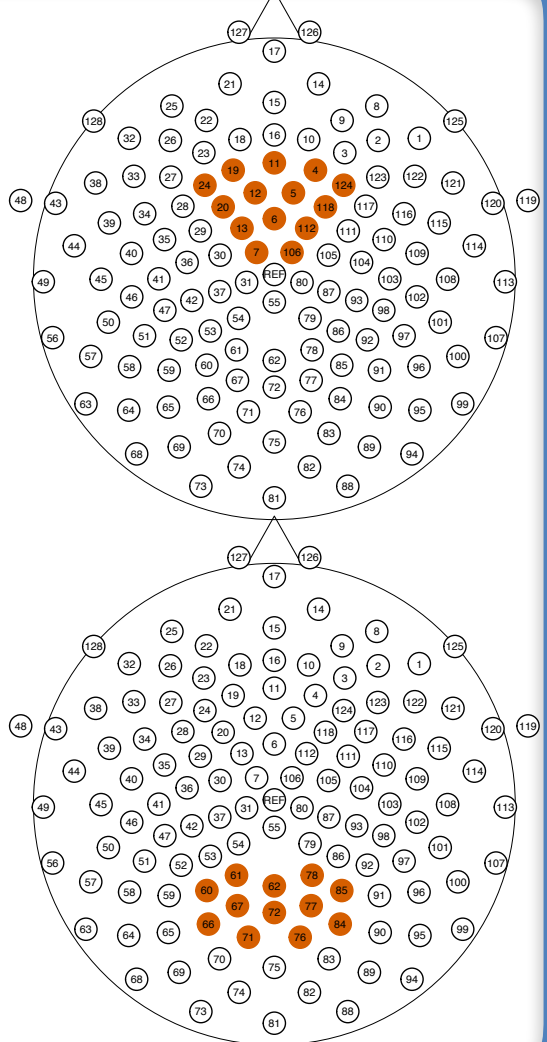
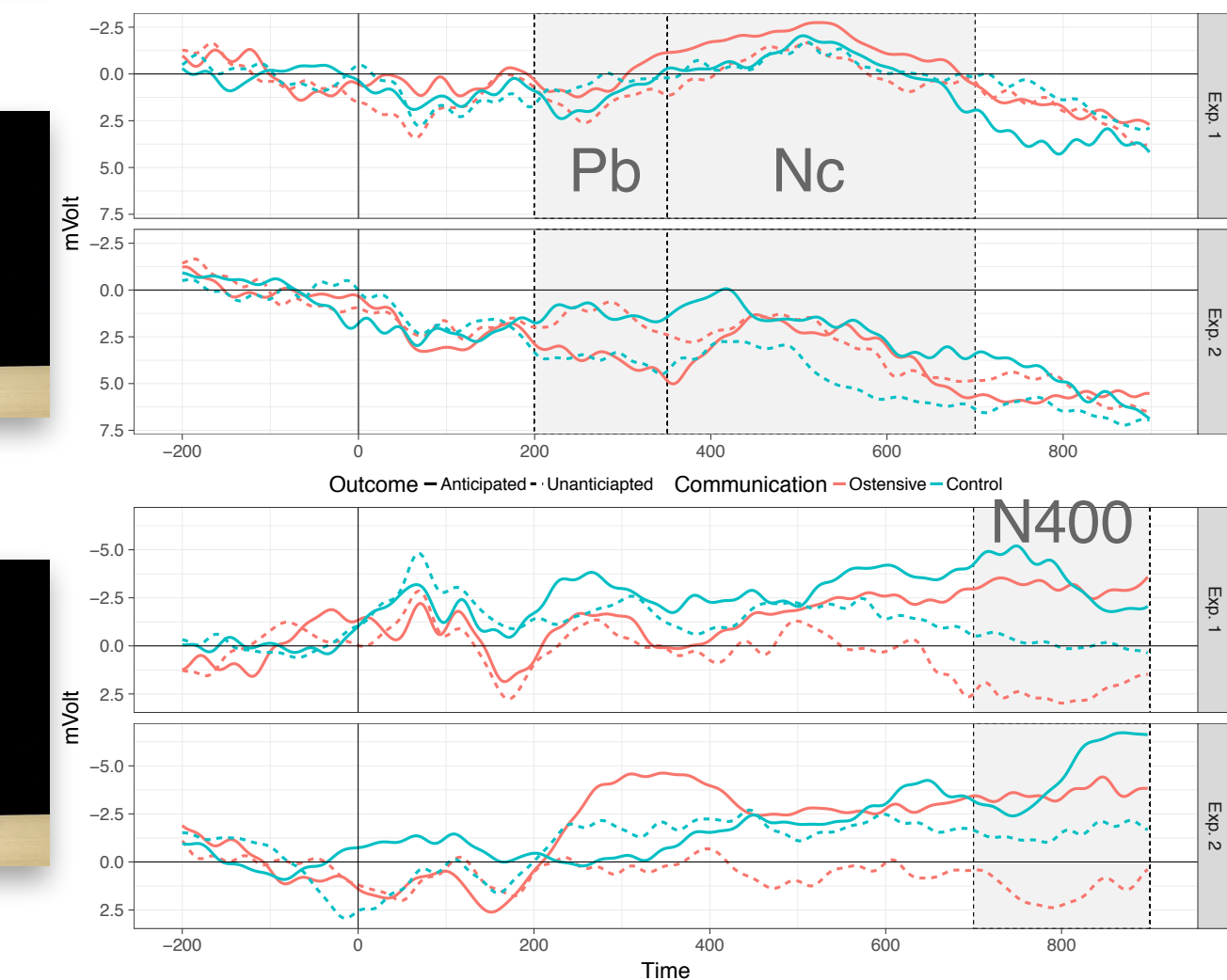
## OUTCOME



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  $p > .20$ ).

## 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).

Reid, Hoehl, Grigutsch, Groendahl, Parise & Striano (2009). The neural correlates of infant and adult goal prediction: evidence for semantic processing systems. *Developmental Psychology*  
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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*