

Prosody and gesture as scaffolding mechanisms in language development

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Joint work with...



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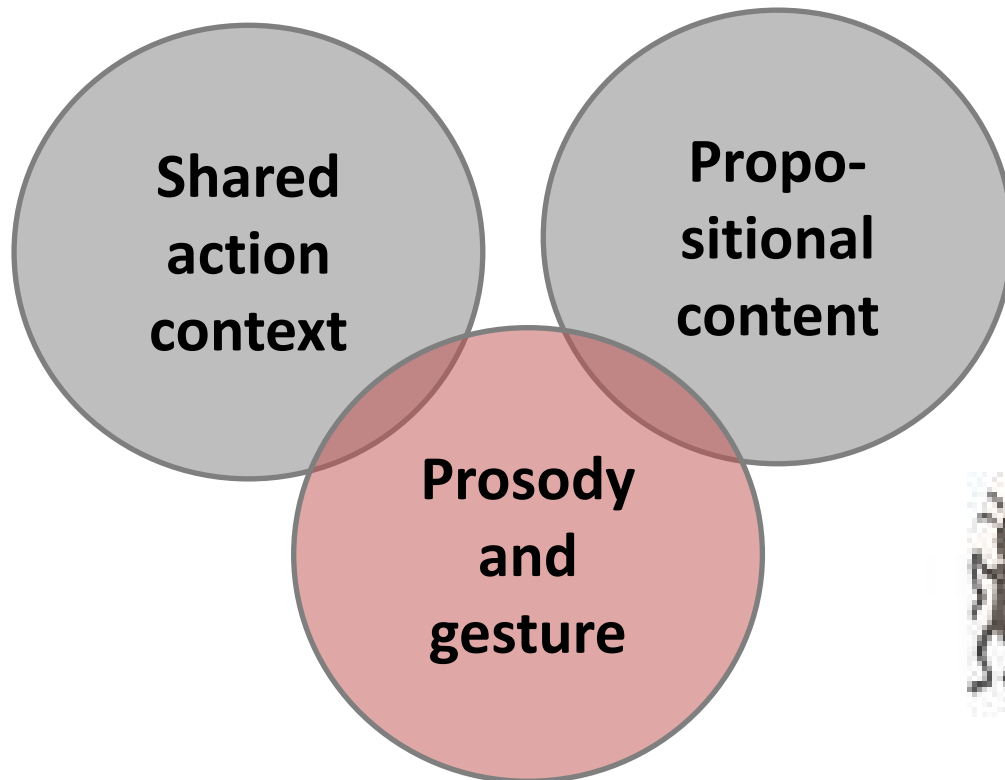
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In normal conversation, speakers are able to rapidly combine different types of information during utterance comprehension, including action/discourse context, propositional content, and visual and prosodic cues.

Online communication



Prosody and gesture

In adult communication, listeners draw conversational inferences which lie beyond the propositional content of the utterance.

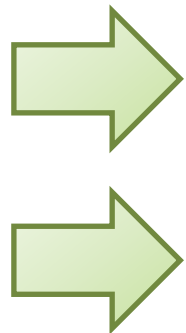
Prosodic and gestural features are **key to pragmatic interpretation.**



Mehrabian & Ferris' research results of communication during a presentation.
"Inference of Attitude from Nonverbal Communication in Two Channels"
The Journal of Counselling Psychology 31,
S. 248-252, 1967

Pragmatic meanings in prosody and gesture

- Intonational and gestural meanings are **closely related** and share a joint management of a set of pragmatic meanings:



In conjunction with lexical and morphosyntactic marking.

Gesture in development



Early sensitivity
to gesture

Beneficial effects of parental IDS with exaggerated prosodic and gestural features (e.g., Özçalışkan & Dimitrova 2013)

Gestural features act as scaffolding mechanisms in adult language processing (Viglioco 2013 for iconic gestures)

Pointing gestures with verbs are a precursor of V+NP constructions (e.g., Goldin-Meadow & Butcher 2003)

Early use of gestures to express specific pragmatic meanings (pointing, agreement, refusal, expressions of time, negation; Guidetti 2005, Stitesab, & Ozcaliskan 2015, a.o.).

Gesture as an early predictor of development

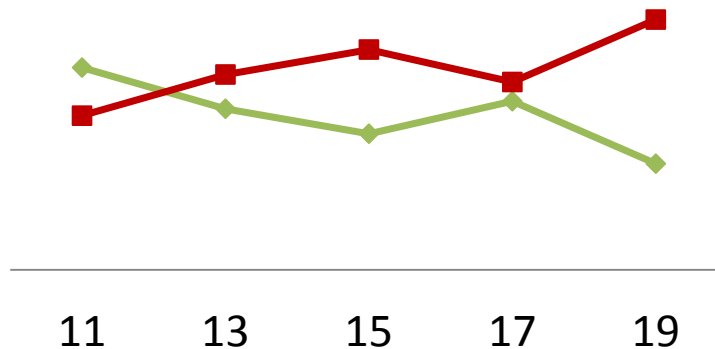
Early gesture production

Pointing: early production of pointing gestures before speech → predictor of word development (e.g., Behne et al., 2012; Camaioni et al., 2004; Liszkowski et al., 2004, 2006).

Pointing-only productions are a majority before 11 months of age

Esteve-Gibert & Prieto (2012), *Sp. Comm.*

—◆— gesture only —■— gesture + speech



Children achieve increasingly complex language milestones initially in gesture before they do so in speech (Goldin-Meadow, 2007).

In sum, gesture seems to **predict** language attainments in typically developing (TD) children (Rowe & Goldin-Meadow, 2009).

The use of gestures constitutes a **predictor of language development** in several areas, namely in vocabulary and semantic acquisition (Goldin-Meadow, 2009; Ozcaliskan & Goldin-Meadow, 2005), and syntactic skills (Goldin-Meadow, Goodrich, Sauer, & Iverson, 2007).

What about prosody?

Prosody in development

- Before children become proficient verbal communicators, they recognize and use prosodic cues.

Sensitivity to prosody

Early preference for IDS (e.g., Fernald, 1985)

Early ability to distinguish languages that belong to distinct rhythmic categories (e.g., Nazzi et al., 1998; Höhle et al., 2009; Bosch & Sebastián-Gallés, 2001)

Early detection of phrasing and stress..

Yet, little is known about whether an early understanding and use of prosody can constitute an early predictor of later language development.



RESEARCH QUESTION:

Do children understand **speech act** and **epistemic information** before through gesture and prosody than from **lexical marking**?

We expect developmental changes in gesture and prosody understanding to pave the way for later lexical development.

If so, prosody and gesture would constitute a window to early pragmatics and act as scaffolding mechanisms for later grammatical development.

Study 1

Do twelve-month old infants use prosodic and gesture cues to infer **speech act information**?

Esteve-Gibert, N. – Prieto, P. – Lizskowski, U. (submitted). “Twelve-month-olds infer social-pragmatic intentions based on prosody and gesture shape”

Study 2

Do three-year old infants use prosodic and gesture cues to infer **epistemic information**? Do they use these cues before lexical cues?

Hübscher, I.; Esteve-Gibert, N., Igalada, A. Prieto, P. (to be submitted). Young children's sensitivity to intonation and gesture in the detection of speaker uncertainty

Study 1: Early detection of speech act information



The pointing gesture

- **Pointing** is the first evidence of the infant becoming an intentional agent (Bates et al., 1975; Kita 2003; McNeill, 1992).
- **Pragmatic intentions** behind a point (Bates et al, 1975; Tomasello et al., 2007):
 - **Imperative**: ask for referent
 - **Declarative informative**: inform about something
 - **Declarative expressive**: express an interest

Twelve-month-old infants **understand** and **produce** pointing gestures with distinct social intentions, **given the appropriate shared action context** (Aureli et al., 2009; Behne et al., 2012; Camaioni et al., 2004; Liszkowski et al., 2004, 2006).



When do children understand speech act information through prosodic and gestural cues?

The acquisition of lexicosyntactic cues to speech act distinctions appear between 3 and 4 years (e.g., Reeder & Wakefield 2008)

Experiment 2

– Do 12-month-old infants rely on prosody and gesture to **infer speech act information** if the **preceding shared action context** and **the lexical information** is the **same across intentions**?



Esteve-Gibert, N. – Prieto, P. – Lizskowski, U. (submitted). “Twelve-month-olds infer social-pragmatic intentions based on prosody and gesture shape”

Methods

- Thirty Dutch caregiver-infant dyads - mean infants' age = 12;12.
 - Participated in a **pointing comprehension task** involving a cup
 - 3 between-subject conditions (**imperative**, **expressive**, **informative**); 8 trials per condition
 - Exp 1: same setting & different lexical information
- ➔ **Exp 2: same setting & same lexical information (“Hey! Die! Die!” ‘Hey! This one! This one!’).**



Stimuli and expected child's behavior



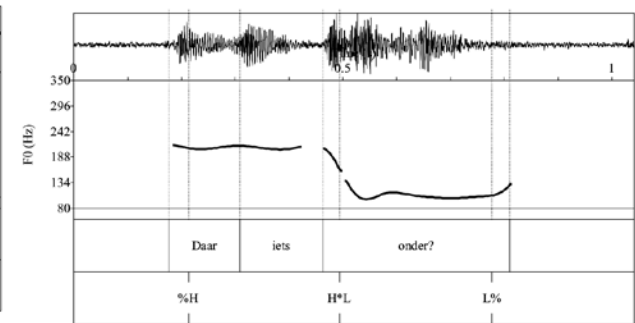
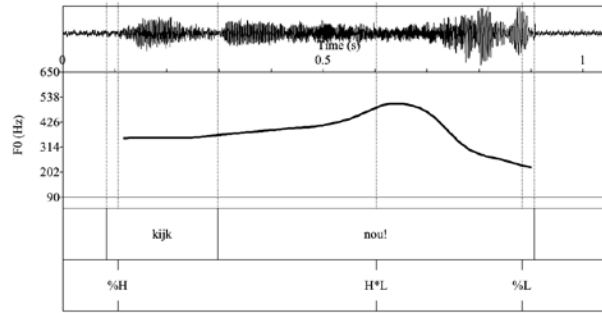
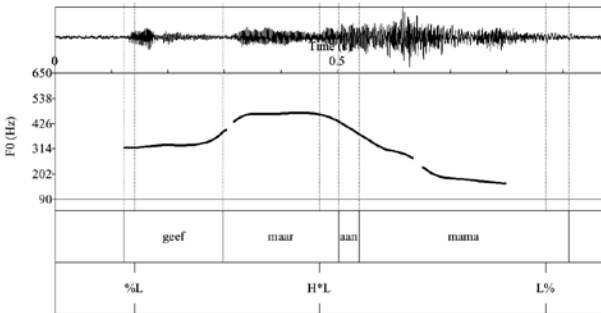
imperative



expressive



informative



Short syllables
Wide pitch range

Long syllables
Very wide pitch range

Short syllables
Narrow pitch range



offering cup

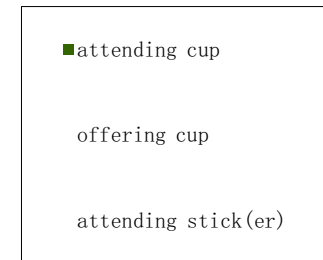
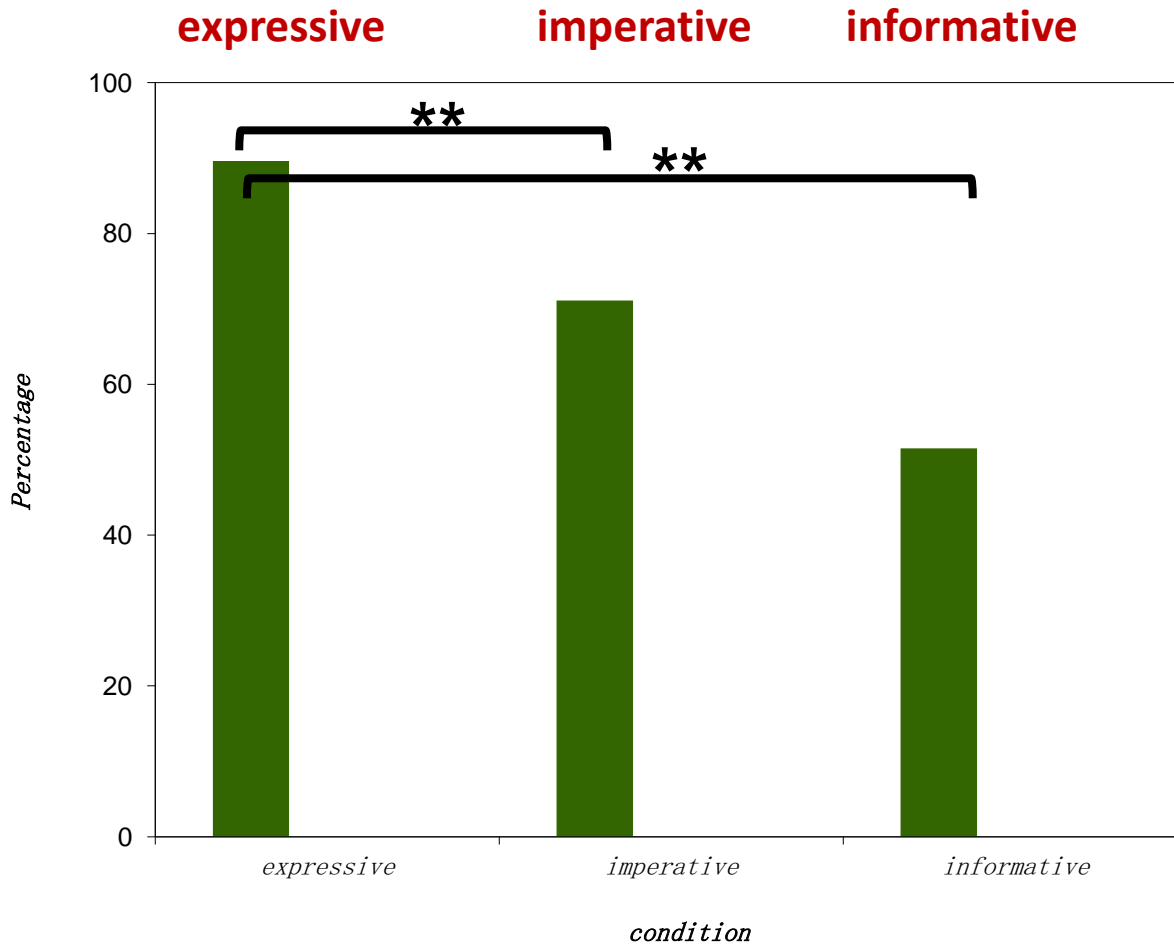


attending cup



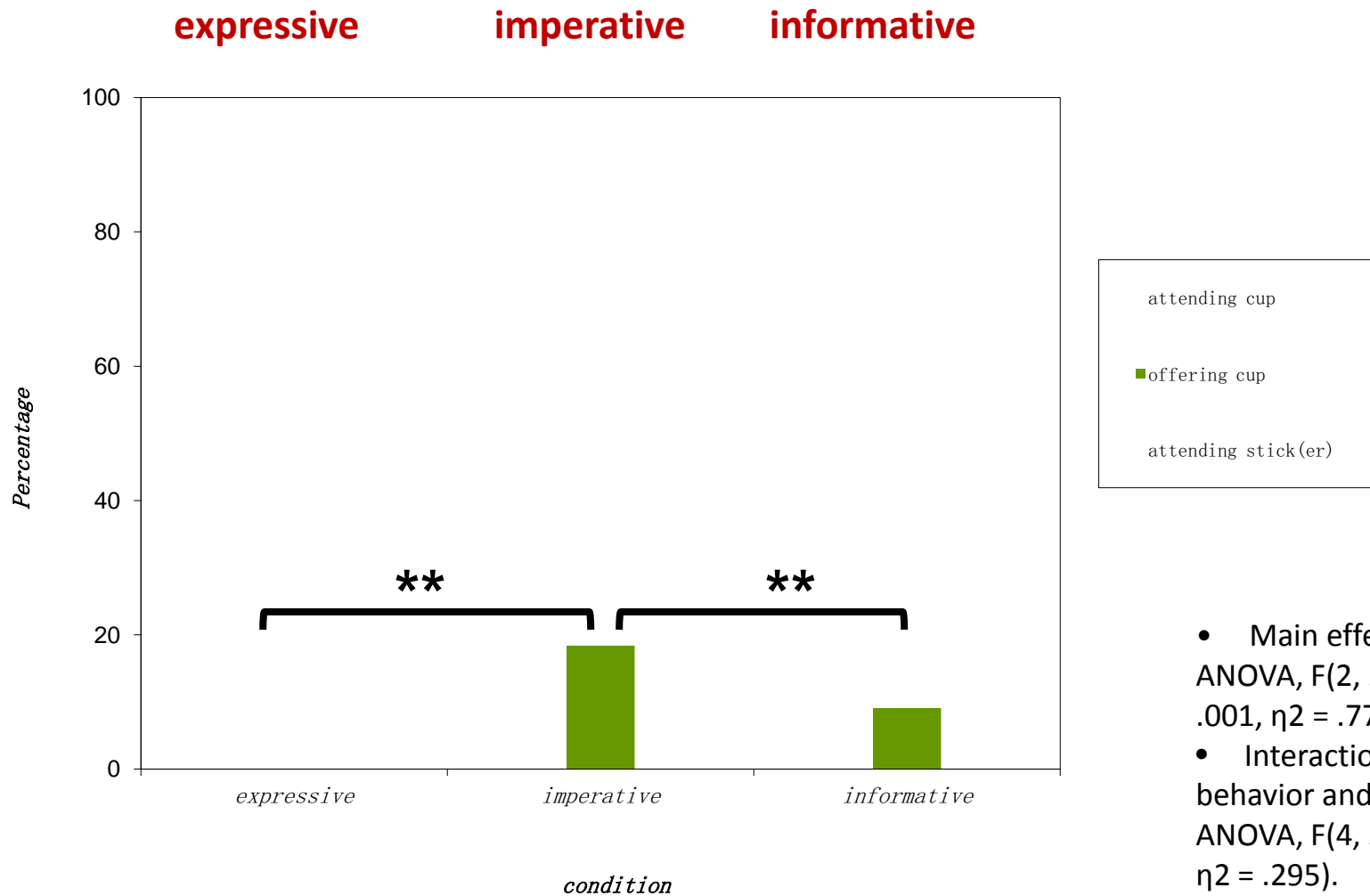
attending sticker

Results



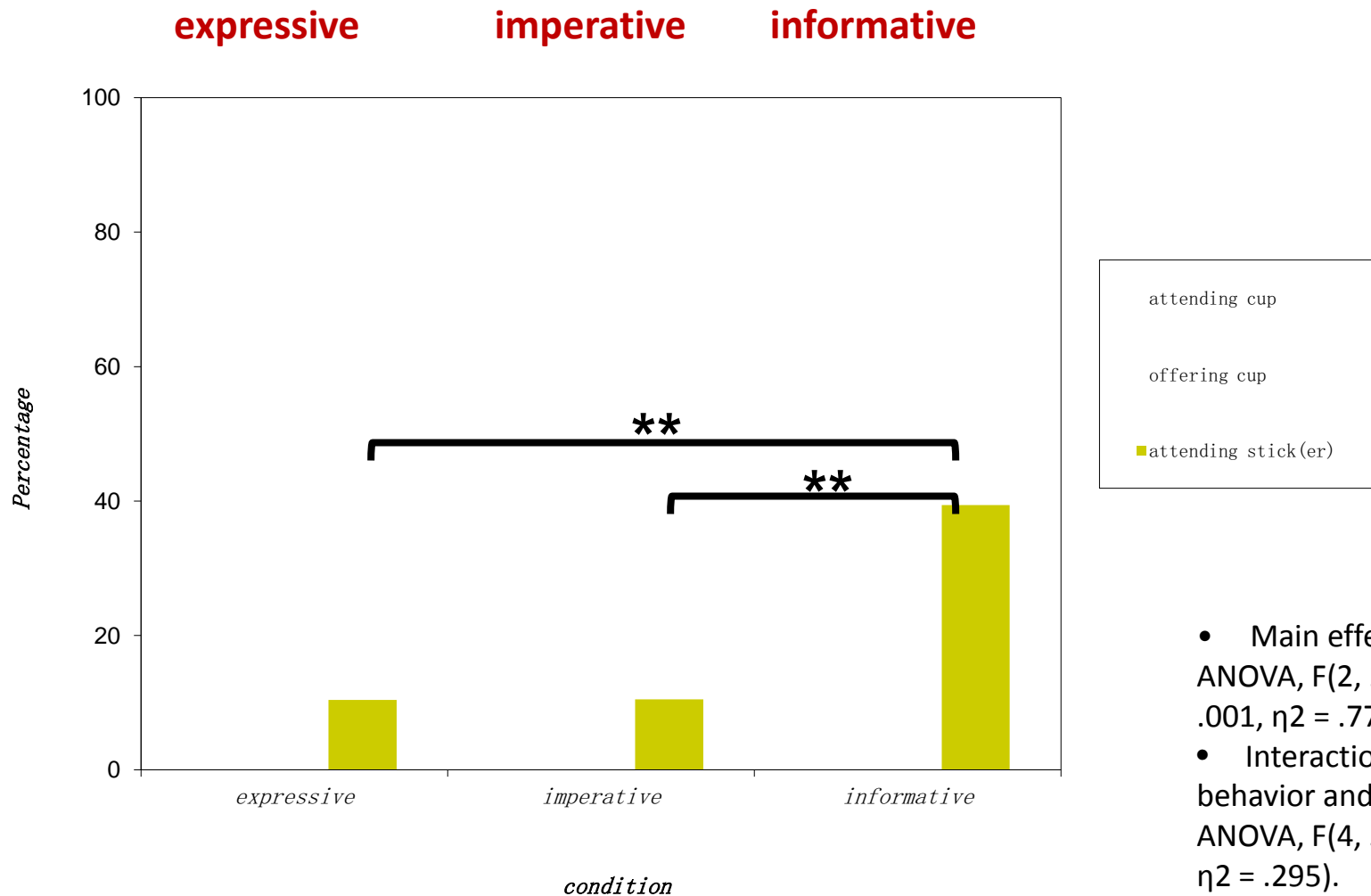
- Main effect of behavior (RM ANOVA, $F(2, 26) = 45.666$, $p < .001$, $\eta^2 = .778$)
- Interaction between behavior and condition (RM ANOVA, $F(4, 52) = 5.444$, $p < .01$, $\eta^2 = .295$).

Results



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Results



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Conclusion

- Pre-lexical infants are able to use prosody and gesture shape in an integrated way to understand the meaning of the other's speech acts
- Infants understand the others' intentions not only through the interpretation of the action-preceding context but also through the **prosodic and gesture** cues.
- **Pragmatic uses of prosody** (in this case, **speech act comprehension**) develop **before** infants master the use of lexical cues.

Study 2:

Early comprehension of epistemicity



HÜBSCHER, I. - ESTEVE-GIBERT, N. - IGUALADA, A. - PRIETO, P. (to be submitted), “Young children's sensitivity to intonation and gesture in the detection of speaker uncertainty”

Speaker knowledge

- The production of **uncertainty** in language can be encoded in various ways:

- **Lexical cues:** epistemic adverbs *maybe*, grammatical particles / mental state verbs *think* (e.g. Smith & Clark, 1993)



- **Prosodic cues:** fillers, delays, linguistic hedges & intonation H% (e.g. Corley & Stewart, 2008, Swerts & Krahmer, 2005)

- **Gestural cues:** eyebrow-movements, funny faces, delays (e.g. Swerts & Krahmer, 2005; Borràs-Comes et al., 2011;)



Children's acquisition of uncertainty

- Children's acquisition of uncertainty has focused on the acquisition of **lexical cues**
- Children acquire the difference between certainty and uncertainty **lexical expressions** by four years (e.g., Matsui et al. 2009; Moore et al., 1990)
- **Except:** earlier detection through grammaticalized particles in Japanese (Matsui et al. 2009)



Yet, little is known about the children's comprehension of uncertainty through prosody and gesture.

Social cognitive development



Studies on uncertainty comprehension so far have correlated children's performance with their ToM development.



What about emotion understanding?

Theory of Mind (ToM)

The ability to attribute mental states (desires, intentions, beliefs) and to understand that others have mental states that are different from one's own

Emotion understanding:

The ability to identify overt emotional reactions and to predict others' emotional reactions

Research questions

- Are 3-year old children better at detecting uncertainty through intonation and facial gestures than with lexical marking (e.g. *perhaps*)?
- Do children with better belief reasoning and emotion detection abilities perform better in the comprehension of uncertainty?



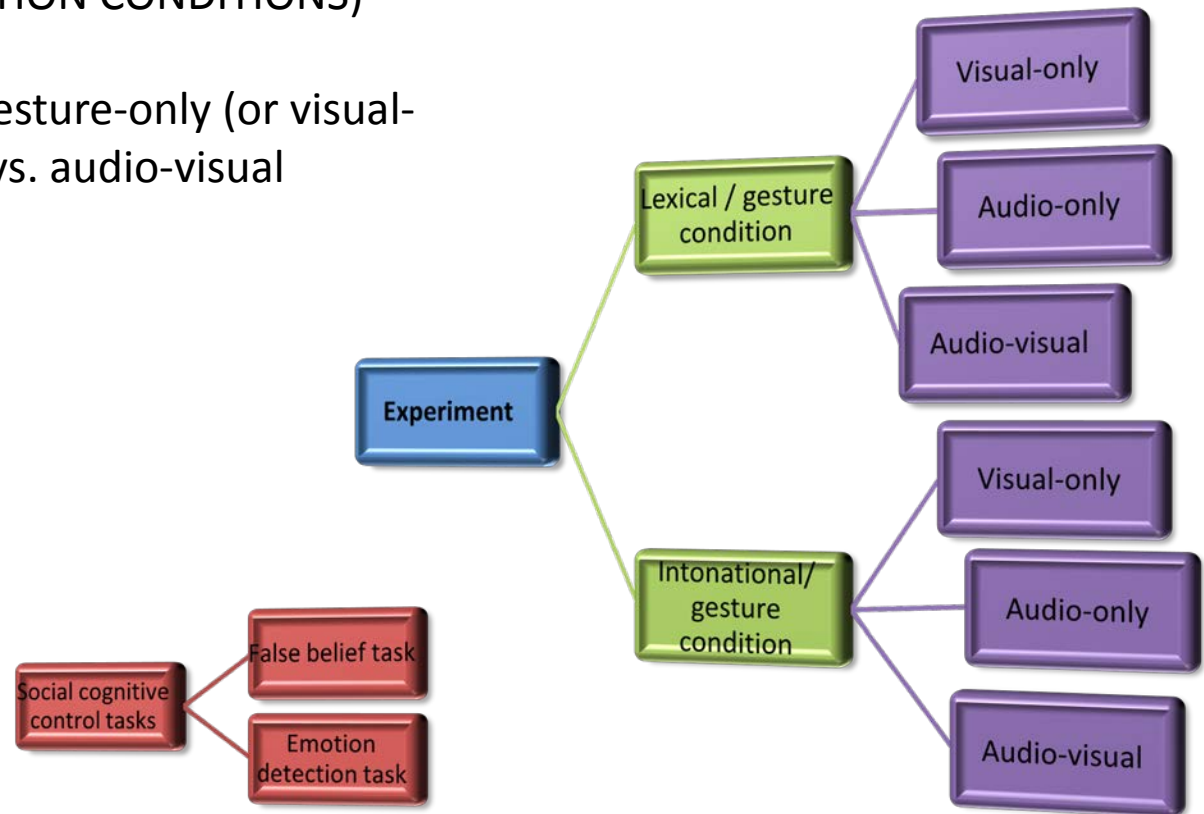
Participants

- One hundred and two Catalan-dominant 3- to 5-year-olds of public schools in the surroundings of Barcelona (central variety)
- Comprehension task



Structure of the experiment

- Effects of epistemic adverbs vs intonation (LEXICAL vs INTONATION CONDITIONS)
- Effects of gesture: gesture-only (or visual-only) vs audio-only vs. audio-visual conditions.



Procedure



'Which twin is not sure, this one or that one? (while pointing to the twin on the left and on the right).

Procedure



'Which twin is not sure, this one or that one? (while pointing to the twin on the left and on the right).

Nine trials per child, counterbalanced per presentation modality (visual-only, audio-only, audio-visual)

Audiovisual recordings: Quiz show

- 15 Catalan-dominant speaking adults (20-30 years old)
- Answered 12 general knowledge questions
- e.g. *What is the capital of Uruguay?* (Quina és la capital d'Uruguai?)
- Indicated degree of (un)certainty (0-7) → Feeling of Knowing (FOK)
→ 146 target sentences (degree of uncertainty 1-7)

Based on: Swerts and Krahmer (2005)



Audiovisual recordings: Quiz show



- **Nuclear Intonation Patterns**

- Dominant pattern: L* H%
- Dominant pattern when lexical cues appear: L* L%

- **Lexical cues**

potser 'maybe', *em sembla que* 'it seems to me', *crec que* 'I think'

- **Facial Gestures**

Head nod gestures in answers with high degree of certainty

Diverted gaze, low/ high gaze, eyebrows raising and

furrowing, funny face, squinted eyes as gestures in uncertain answers.

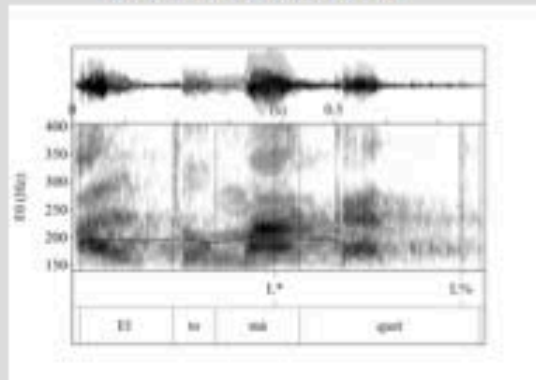
Stimuli – Intonation Condition – AudioVisual

The same
lexicon

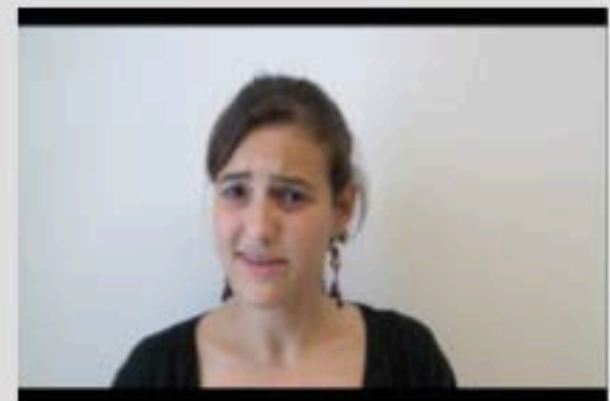
Certainty
El tomàquet 'tomato'



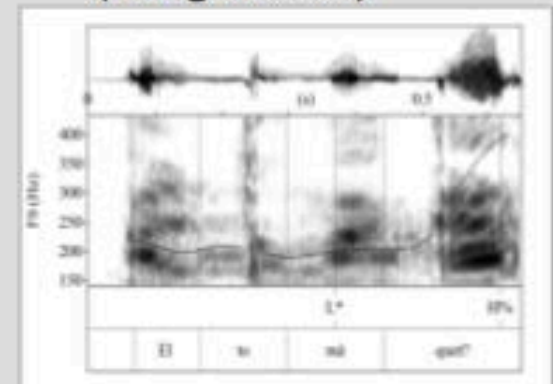
with **L*L%**
(falling contour)



Uncertainty
El tomàquet 'el tomato'



with **L*H% / L+H* H%**
(rising contour)

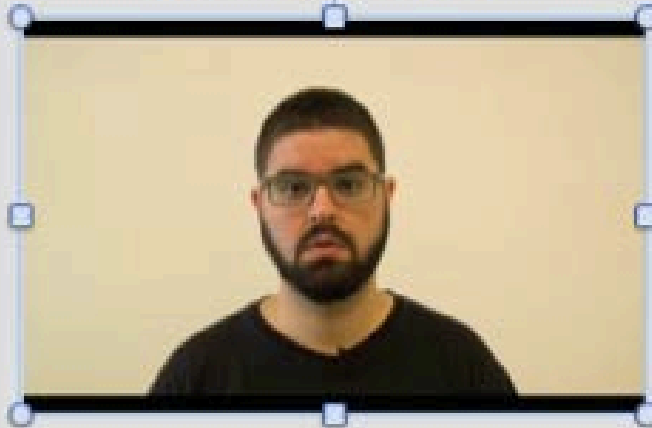


Target
intonational
differences

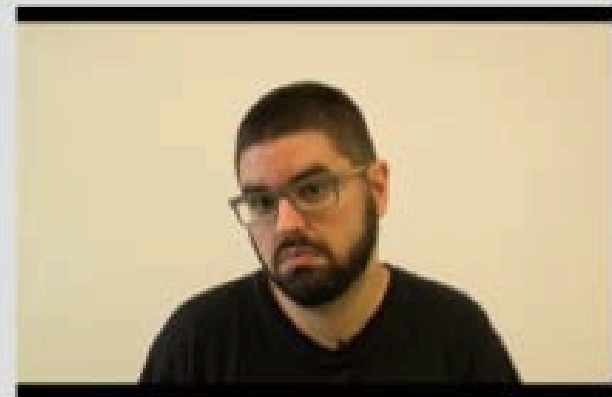
Stimuli – Lexical condition - Audiovisual

Target
lexical
differences

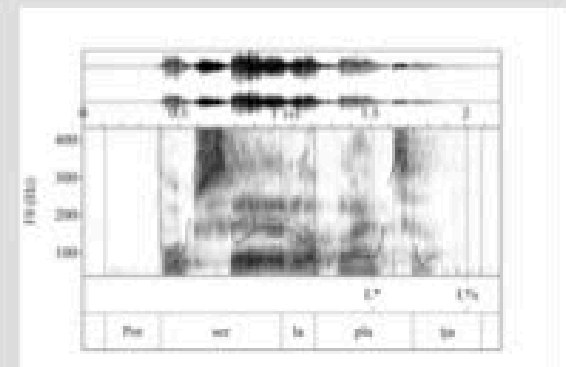
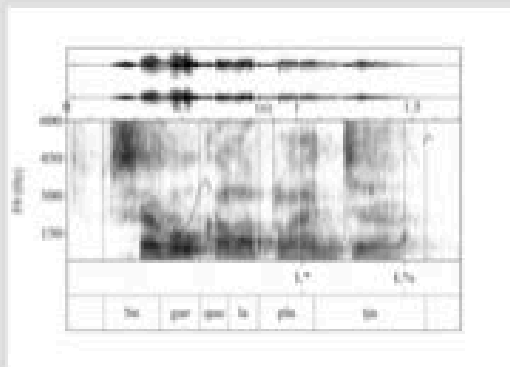
Certainty
Segur que la platja
'Certainly the beach'



Uncertainty
Potser la platja
'Maybe the beach'



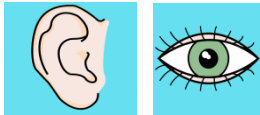
The same
intonation
pattern



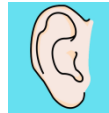
Procedure

Each child (between subjects) was exposed to 9 trials in total (plus one familiarisation trial)

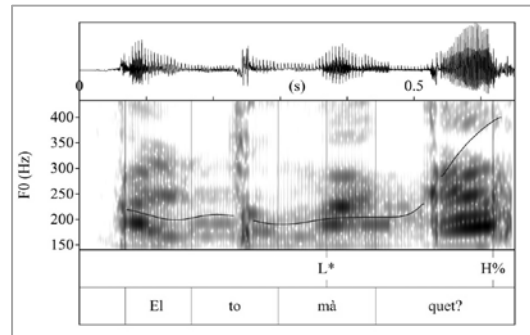
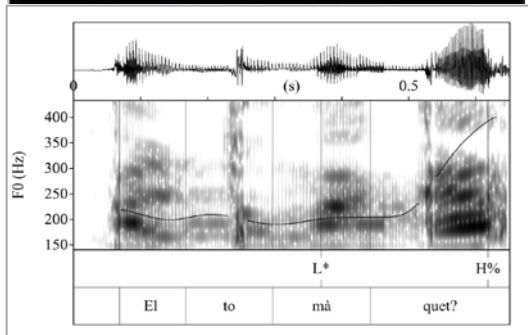
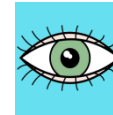
3 audiovisual (AV)



3 audio (AO)



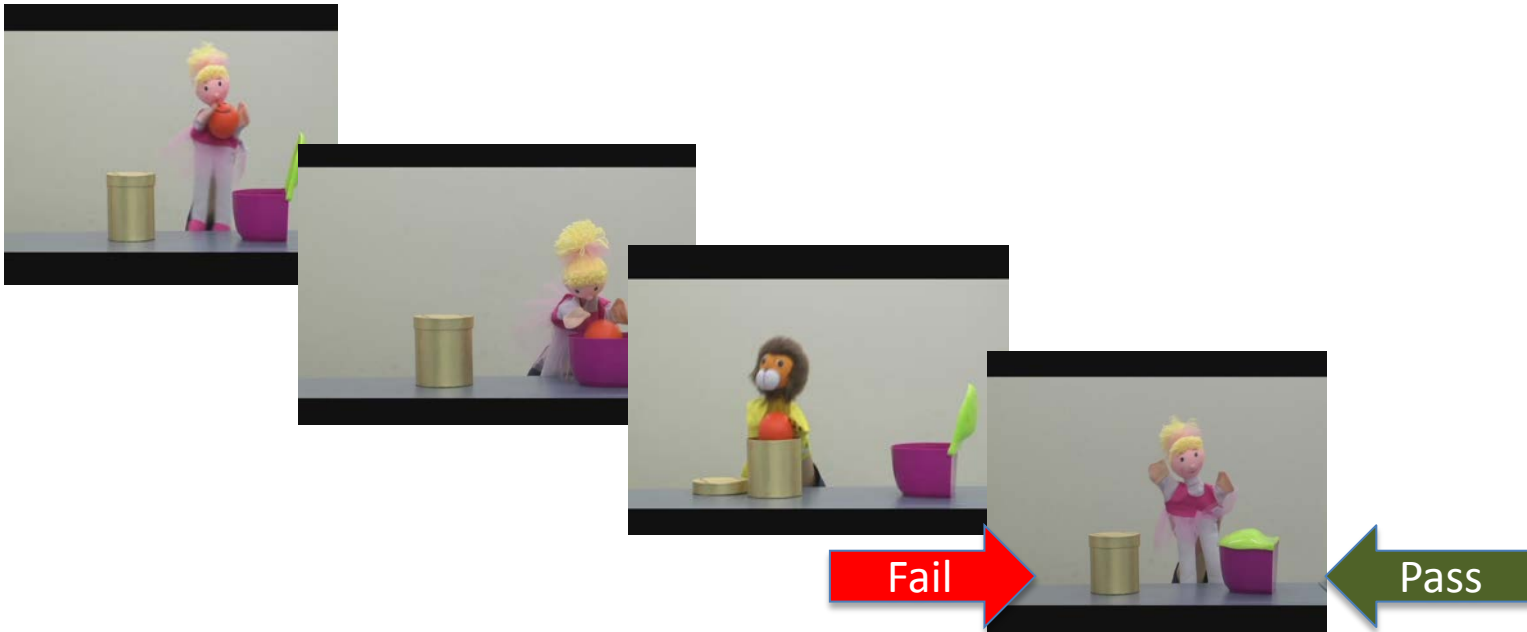
3 visual (VO)



Social Cognitive Control Tasks

False-belief task

Adaptation of Sally Ann task (Wimmer & Perner, 1983) by Armstrong et al. (2014)

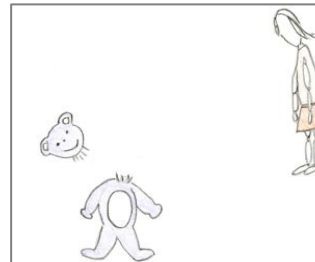
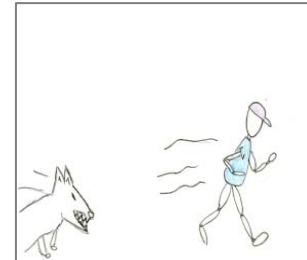


On buscarà la pilota, la nena?
Where will the girl look for the ball?

Social Cognitive Control Tasks

Emotion detection task

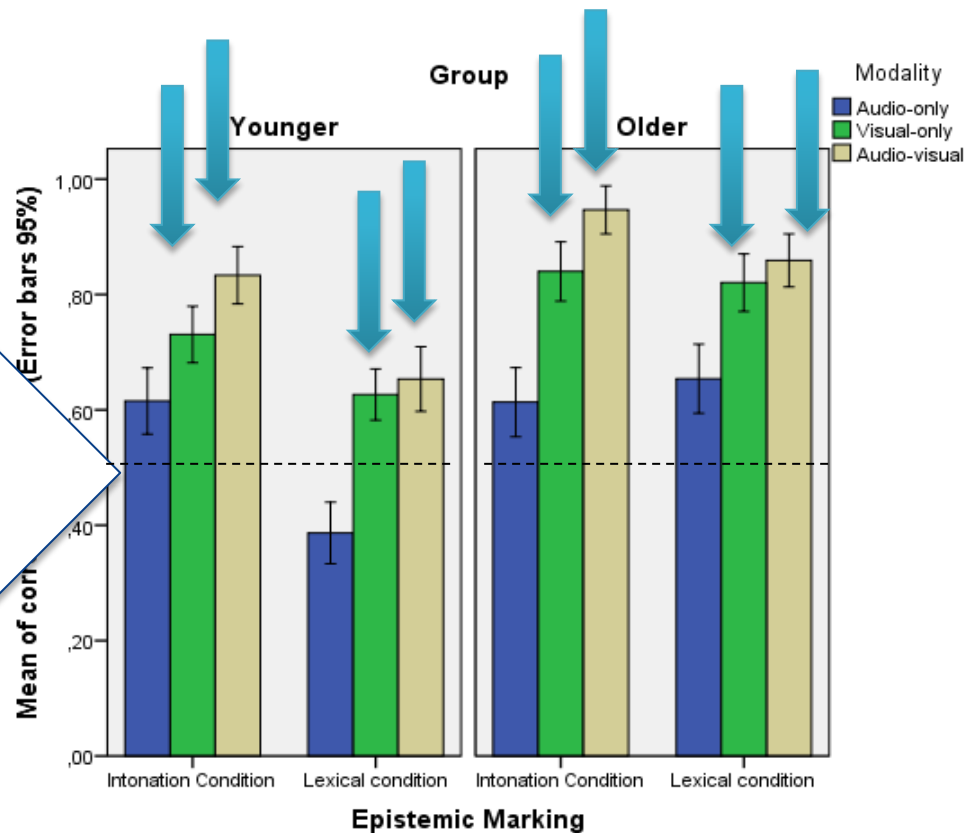
Adaptation of Ruffman et al. (2002)



Com se sent, la Sarah?
How does Sarah feel?

Results

In all conditions, children performed significantly better when presented with visual modalities (VO and AV), they when presented with the AO modality ($p < .001$).



Error bars: +/- 1 SE

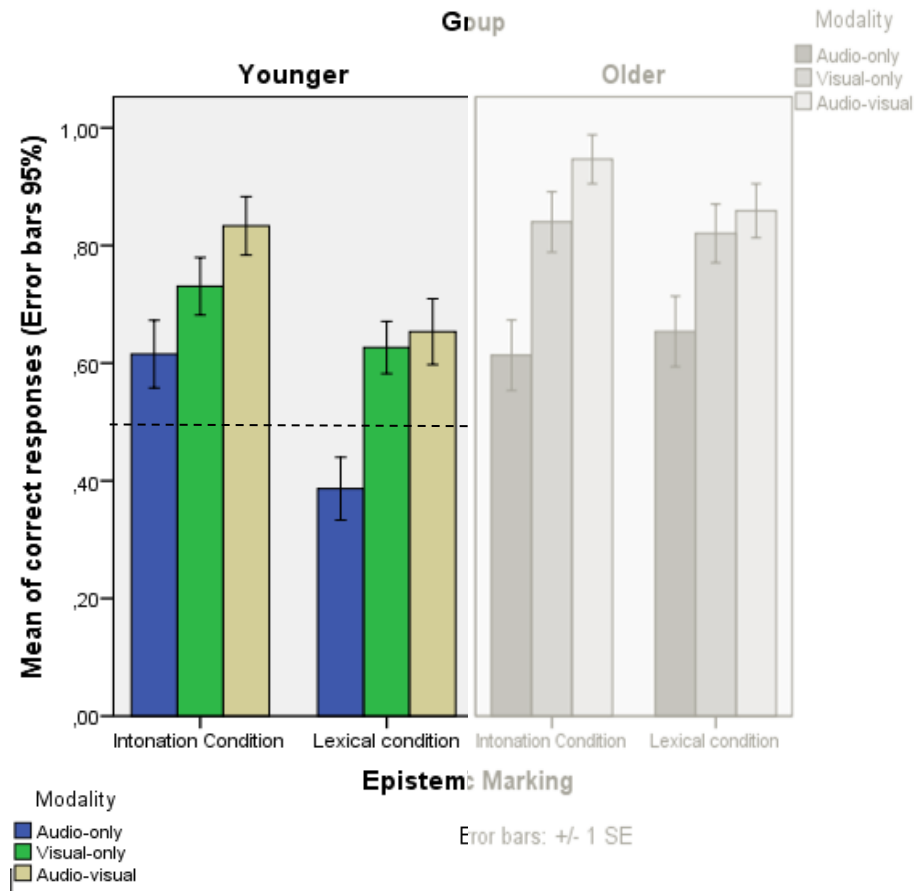
Results

- Interaction of **epistemic marking condition * age** ($p < .05$)

Interaction with age:

In the **younger age group**, children performed significantly better in the Intonation Condition than in the Lexical Condition

- Emotion detection task (and not false belief task) correlates with children's performance



Conclusion

Significant contribution of intonation

- Intonational cues provide scaffolding to access the meaning of uncertainty when they have not yet acquired the lexical cues

Significant contribution of gesture

- Gesture is instrumental for decoding uncertainty where lexical cues have not been acquired yet.

Relationship: cognitive control tasks and comprehension task

- Emotion detection performance correlates with children's results in the comprehension task

General Conclusion

These two studies have shown that:



Study 1. Twelve-month olds are able to detect **speech act information** through prosody and gesture



Study 2. Three-year olds are able to detect **epistemic information** through prosody and gesture

Pragmatic information conveyed in prosody and gesture is recognized earlier than pragmatic information conveyed by propositional content.

That is, these non-propositional cues act as scaffolding mechanisms for later grammatical development

General Conclusion

Can prosodic and gestural developments be considered reliable predictors of pragmatic development?

Speech act management

Epistemic management

Information status management

Politeness management

Affective/emotional management

THANK YOU!!

OBRIGADA!!

MOLTES GRÀCIES!!



Núria Esteve-Gibert, Aix-Marseille Université, LPL



Ulf Lizskowski, Hamburg University



Iris Hübscher, Universitat Pompeu Fabra, GrEP



Alfonso Igualada, Universitat Pompeu Fabra, GrEP

- All responses obtained (918 trials in total) in the comprehension task were analysed through a Generalised Linear Model (GLM)
- Dependent variable: child's performance
- fixed factors:
 - Epistemic marking (two levels: intonation condition, lexical condition)
 - Modality (three levels: audio-only, visual-only, audio-visual)
 - Age (two levels: younger group, older group)
 - Performance on the false-belief task (two levels: pass vs. fail),
 - Performance on the emotion-situation task (two levels: pass vs. fail)

