

Top-down learning in the acquisition of pronouns

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Intro & Research Questions:

Pronoun interpretation depends on both internal grammatical information and external **discourse** information.

- (1) María greeted Ana and Juan, and now she (3SgFem) is leaving.



Grammatical cues indicate pronominal person, number, and gender. Statistically reliable.

Discourse-level cues are probabilistic:

- Antecedents are more "salient" when: mentioned first (Arnold et al. 2007, a.o.), agentive (Pyykkonen & Jarviki 2010, a.o.), introduced in subject position (Grosz & Sidner 1986, a.o.), structurally parallel (Chambers & Smyth 1998).
- More reduced forms favor relatively more salient antecedents: ex. null subjects favor preceding subject (Ariel 1990, Carminati 2002, Alonso-Ovalle et al. 2010).

Research Question: *How do children learn to integrate these two sources of information?*

Linguistic Background:

Linguistic framework for discourse cues: semantic relations between propositions, called DISCOURSE RELATIONS, regulate which factors in (A) are relevant for antecedent salience (Kehler et al. 2008, Asher & Lascarides 2003).

- OCCASION (narrative sequence) → topic bias
Juan, hit Pedro and then he, left.
- RESULT (cause-effect sequence) → plausibility bias
Juan, hit Pedro, and so {he, cried/he, apologized}.
- PARALLEL (parallel events & actors) → parallel bias
Juan, hit Pedro, and he, hit Diego, too.
Juan hit Pedro, and Diego hit him, too.

Acquisition Background:

- Grammatical cues: Children sometimes fail to use number agreement in picture selection (Johnson et al. 2005, Pérez-Leroux 2005) or fail to link 3rd person pronouns to a non-speaker, non-addressee referent (Charney 1980, a.o.), despite accurate production of these features (Legendre & Smolensky 2012)
- Discourse cues:** sensitivity to first-mention (Song & Fisher 2005, Hartshorne et al. 2015), parallelism (Maratsos 1974), null subjects (Shin & Cairns 2012) found in eye-tracking, act-out & metalinguistic tasks. Errors with 3rd person pronouns are discourse driven (Forsythe 2015). No studies explicitly address discourse relations.

Hypotheses: Top-down learning

- H1:** Children use higher-level discourse cues to facilitate processing of low-level grammatical cues.
H2: Sensitivity to discourse cues leads to better overall deployment of grammatical cue knowledge.

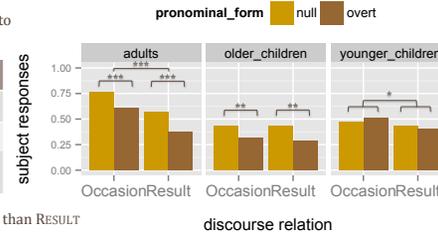
Study 1: two discourse cues

Q1: Can children use DISCOURSE RELATIONS and the **null/overt** contrast to interpret 3rd person singular pronouns in a picture selection task?

Study 1	2 (OCCASION /RESULT) x 2 (null/overt subj.)
OCCASION	(1) <i>Juan_i le pega a Pedro_p y después {ø_i/él_i} se va.</i>
RESULT	(2) <i>Juan_i le pega a Pedro_p y por eso {ø_i/él_i} se va.</i>
	Joe _y hits Peter _p and { then / so } {pro _i /he _i } leaves

Target: null elicits more subject responses than overt; OCCASION more than RESULT

Fig. 1: Interpretation of grammatically ambiguous pronouns



Analysis: one logistic regression model per age group:
subject.response ~ relation + nullover + (1|item) + (1|subject)

- Younger children** (N = 40, 2;11-4;5, M=3;9): distinguish OCCASION vs. RESULT ($\beta = -0.36, p = 0.03$)
- Older children** (N = 33, 4;6-6;4, M=5;5): distinguish **null/overt** ($\beta = -0.58, p < 0.01$)
- Adults** (N = 40): distinguish OCCASION vs. RESULT ($\beta = -1.1, p < 0.0001$) and **null/overt** ($\beta = 0.88, p = 0.001$)

Discussion: Children appear sensitive to both cues but may weight them differently at different ages.

Study 2: discourse cue OCCASION vs. grammatical cue 1st/3rd PERSON

Q2: Does discourse facilitate the processing of grammatical cues on agreement and object clitics?

Study 2	2 (in/congruent) x 2 (1 st /3 rd) x 2 (subject/object)
subject	(3) <i>Ana bailó una cumbia conmigo y ahora canta/o.</i>
	Ana danced a cumbia with me and now pro sing -3S congruent w/ topic bias -1S incongruent
object	(4) <i>Ana llegó a la casa conmigo y ahora Chicho está saludándola/me.</i>
	Ana arrived home with me and now Chicho is greeting CL.3S congruent CL.1S incongruent

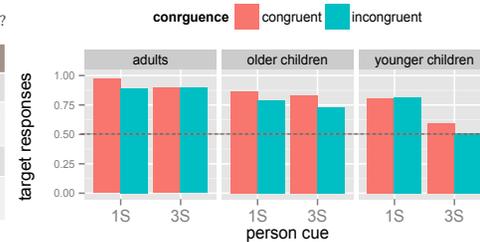
Prediction 1: Better performance in congruent relative to incongruent conditions.

Prediction 2: Sensitivity to discourse (congruence effect) triggers above-chance use of person/number cues.

Analyses: (i) Logistic regression: correct ~ congruent + subjob + person + (1|subject/item), (ii) accuracy vs. chance (2-tailed t-test)

- Younger children** (N = 37, 2;11-4;5, M=3;9): person ($\beta = 0.7, p = 0.01$), subjob ($\beta = 1.7, p < 0.0001$) 3rd person not above chance
- Older children** (N = 36, 4;6-6;5, M=5;6): congruence ($\beta = 2.4, p < 0.0001$) all conditions above chance (all $p < 0.004$)
- Adults** (N = 36): congruence ($\beta = 2.1, p < 0.004$) all conditions above chance (all $p < 0.001$)

Fig. 2: Interpretation of person-disambiguated pronouns



Discussion: After age 4 ½ children use OCCASION to help process person cues. This coincides with better accuracy in 3rd person.

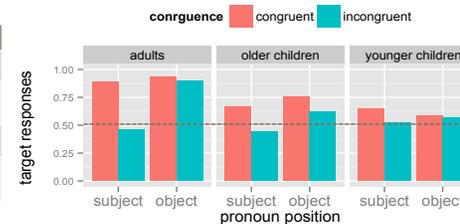
Study 3: discourse cue PARALLEL vs. grammatical cue NUMBER

Study 3	2 (in/congruent) x 2 (Sg/Pl) x 2 (subject/object)
subject	(5) <i>La maestra abraza a las niñas y abraza/n a los niños también.</i>
	The teacher hugs the girls and pro hug-Sg the boys too. congruent w/ parallelism -Pl incongruent
object	(6) <i>La maestra abraza a las niñas y María la/las abraza también.</i>
	The teacher hugs the girls and Maria CL.Sg hugs too. congruent CL.Pl incongruent

Analyses: (i) Logistic regression: correct ~ congruent + subjob + number + (1|item) + (1|subject), (ii) accuracy vs. chance (2-tailed t-test)

- Younger children** (N = 23, 2;11-4;5, M=3;9): no significant effects only congruent subject above chance ($t(21) = 2.47, p = 0.022$)
- Older children** (N = 17; 4;6-5;10, M=5;3): congruence ($\beta = 0.8, p = 0.003$), subj/obj ($\beta = 0.6, p = 0.02$) all $p \leq 0.05$ except incongruent subject
- Adults** (N = 23): congruence ($\beta = 2.0, p < 0.001$), subj/obj ($\beta = 2.8, p < 0.001$) all $p < 0.001$ except incongruent subject

Fig. 3: Interpretation of number-disambiguated pronouns



Discussion: After age 4 ½ children use PARALLEL to help process subject & object number. This coincides with better overall number accuracy.

Adults appear to ignore incongruent subject agreement, similar to cases of agreement attraction (Wagers et al. 2009), possibly related to syntactic priming.

General discussion:

- Children use discourse cues in picture selection at least as early as has been shown for person/number cues (Study 1).
- After 4 ½, children use discourse relations to facilitate processing of person and number cues (Studies 2&3).
- This coincides with better overall deployment of grammatical cues, consistent with the top-down hypothesis.

Acknowledgements: Many thanks to the MSU Language Acquisition Lab, especially Cristina Schmitt, Alan Munn, Ni La Le. Thanks to parents and children at SEDI, Mexico City, and to Patricia de la Fuente and Bety López Juárez for recruitment and testing. Partial funding provided by MSU College of Arts & Letters and MSU Dissertation Completion Award.