BUCLD 44 Proceedings
To be published in 2020 by Cascadilla Press
Rights forms signed by all authors

Resolving pronouns with multiple cues: Children use pragmatics before morphology

Hannah Forsythe

1. Intro and research question

From the perspective of the language learner, pronouns present a special challenge: their defining characteristic is the fact that they lack a fixed meaning. This means that children must learn to recruit additional information to interpret pronouns in each new context. To further complicate matters, some kinds of information may be more reliable than others, and different kinds may conflict.

This paper focuses on Spanish-acquiring children's ability to use three different kinds of information relevant to pronoun interpretation: (1) the alternation between strong and weak forms of the pronoun (null vs. overt), (2) the Coherence Relation between clauses, explicitly realized as a discourse connective (temporal vs. causal), and (3) the pronoun's number features, as indicated by morphological marking on the agreeing verb.

(1) *Juan llamó a Pedro cuando* {***Ø***/***él***} *estaba en casa.*
Juan called A Pedro when *pro*/he was at home.
"Juan called Pedro when (he) was at home."

(2) *Juan le dice adiós a Pedro* {***y después***/***porque***} *Ø se va a la casa.*
Juan LE says bye A Pedro and then/because *pro* leaves for home.
"Juan says goodbye to Pedro and then/because (he) is going home."

(3) *Las niñas*$_i$ *le dicen adiós a la maestra*$_k$ *y después Ø se* {*v****an***$_i$/*v****a***$_k$} *a la casa.*
The girls LE say bye A the teacher and then *pro* leave-3P/3S for home.
"The girls say goodbye to the teacher and then PRONOUN go(es) home."

The first two pieces of information are probabilistic, while the third is categorical. In (1), both forms of the pronoun can refer to either antecedent, *Juan* or *Pedro*, but the null form is biased in favor of the preceding subject

*University of California, Irvine, hforsyth@uci.edu. This research was supported by NSF Grant #SPRF-1810159 to Hannah Forsythe. Many thanks to the teachers, parents, and children at Servicios Educativos para el Desarrollo Infantil, Mexico City, MX, as well as Beatriz López Juárez and Patricia de la Fuente Zuno for administrative help. Thanks to Lisa Pearl, Greg Scontras, Richard Futrell and the other members of the Computation of Language Lab and the Language Science Community at UC Irvine for their feedback and mentorship.

antecedent *Juan*, while the overt form *él* is not. This is part of a broader, cross-linguistic tendency for more reduced referring expressions, such as null or unstressed pronouns, to pick out highly salient antecedents, such as subjects. Subject antecedents can be considered salient because they are more syntactically prominent than non-subjects (Carminati 2002), they are typically mentioned first (Arnold et al. 2000, a.o.), and they are more likely to be agents than non-subjects are (Pyykkönen et al. 2010, a.o.).

Second, pronoun reference is probabilistically influenced by the semantic relationships, or Coherence Relations (Kehler 2002, Kehler et al. 2008) between the clause containing the pronoun and the clause containing its potential antecedents. In (2), these relations are made explicit with the discourse connectives *después* ('and then') and *porque* ('because'), which establish temporal and causal relations, respectively, between the events of saying goodbye and leaving. According to one proposal (Asher & Lascarides 2003), temporal sequences tend to preserve the same participants in the same grammatical roles; thus, using *después* biases the subject pronoun toward the subject antecedent, favoring the interpretation that *Juan* is the one leaving. Causal relations, on the other hand, prime the listener to use real-world knowledge to infer which participants fill each role (Hobbs 1979); thus, using *porque* primes the listener to use their knowledge of events like saying goodbye and leaving, favoring the interpretation that *Pedro* is the one leaving. Depending on the predicates, this bias can change directions and be weak or strong, but both readings should still be grammatical.

In contrast to these probabilistic factors, subject-verb agreement places a hard constraint on pronoun reference. In (3), using plural agreement means that the pronoun must refer to the subject antecedent *las niñas* ('the girls'), congruent with the bias of the lexical connective *después* and the null pronoun. However, using singular agreement categorically overrides both of these biases and disambiguates towards the object *la maestra* ('the teacher').

This illustrates the special challenge that pronouns present to the learner: while there are many sources of information available to help guide pronoun interpretation, this information may conflict. This means that learners must not only *extract* individual pronominal cues from the input but also learn to *integrate* them together, deciding how to prioritize each cue in relation to the others. This paper looks at both of these steps on the learning path:

I. *When do children learn to use pronominal form, discourse connectives, and number agreement to help identify pronoun antecedents?*
II. *How do children integrate these cues together?*

2. Background

Each of these cues has been fairly well studied on its own. Here, I briefly summarize the literature on how adults and children use pronominal form, Coherence Relations, and verbal agreement to guide pronoun resolution.

The alternation between null and overt subjects is probably one of the most well studied phenomena in Spanish linguistics. Work in formal syntax, psycholinguistics, and sociolinguistics reveals that, to different degrees, all varieties of Spanish favor the null pronoun when referring to the immediately preceding subject antecedent and an overt pronoun otherwise (Carvalho et al. 2015, Gelormini-Lezama & Almor 2011, Keating et al. 2016, a.o.). Adult learners of Spanish are generally slow to acquire this contrast (Jegerski et al. 2011, Pérez-Leroux and Glass 1999, a.o.), but child behavior varies by task. Spontaneous production by monolingual children shows acquisition by age 6-7 (Shin 2016), or even earlier in more constrained environments (4 ½; Forsythe et al., to appear). As for comprehension, pronoun resolution tasks (4) find that chidlren associate the null pronoun to the preceding subject antecedent more strongly relative to the overt pronoun (Spanish: 4 ½-6, Forsythe et al. 2019; Greek: 6-7, Papadopoulou *et al*. 2015). However, felicity judgment tasks (5) reveal slower development, with children taking until adolescence in some cases to develop a preference for canonical over non-canonical pronoun choices (Spanish, Shin & Cairns 2012), and bilingual children trailing their monolingual peers (Italian, Sorace et al. 2009).

(4) *Juan le pega a Pedro y después* {*ø/él*} *se va.*
"Juan hits Pedro and then PRONOUN leaves."
Context: Child chooses one picture: (i) Juan leaving; or (ii) Pedro leaving.

(5) *María y José cantan canciones. María canta una ranchera*. [Canonical] *Luego él canta la de Pimpón, ó* [Non-canonical] *Luego ø canta la de Pimpón?*
Maria and José sing songs. Maria sings a ranchera. [Canonical] 'Then he sings the one about Pimpón,' or [Non-canonical] 'Then *pro* sings the one about Pimpón'?
Context: Maria sings; then José sings. Child chooses the better description.

The discrepancy in comprehension results may be partly explained by the greater demands of felicity judgment tasks, which require the child to simultaneously hold two grammatical structures in working memory and judge their appropriateness for a given event, rather than simply interpreting a single structure. This study will therefore use a pronoun resolution task like (4).

In addition to pronominal form, Coherence Relations also shape pronoun resolution. In many contexts, listeners display a "first mention bias," favoring the antecedent that is mentioned first and/or in subject position (Arnold et al. 2000, Crawley et al. 1990, Järvikivi et al. 2005, a.o.). Certain contexts, however, trigger a "parallel" bias, with subject pronouns preferring subject antecedents and object pronouns preferring object antecedents (Chambers & Smyth 1998), and other contexts trigger a "pragmatic" bais, with listeners relying on real-world knowledge to pick the most situationally plausible antecedent (Hobbs 1979). Kehler et al. (2008) show that what triggers these biases are Coherence

Relations. In one experiment (6)-(7), they showed that changing the Coherence Relation between a clause containing a pronoun and a clause containing two potential antecedents systematically changes listeners' biases. Parallel coherence contexts, which juxtapose semantically similar, parallel events (6), triggered a parallel bias. Result coherence contexts, in which one event results from another (7), triggered a pragmatic resolution bias.

(6) *Parallel* coherence relation (Kehler et al. 2008, Expt.1)
   a. Samuel threatened Justin with a knife, and Erin blindfolded him.
   b. Samuel threatened Justin with a knife, and he blindfolded Erin.
(7) *Result* coherence relation
   a. Samuel threatened Justin with a knife, and Erin stopped him.
   b. Samuel threatened Justin with a knife, and he alerted security.

There is a growing body of evidence that children access the same pronoun resolution strategies as adults. 3-year-olds apply a parallel resolution strategy to pronouns in parallel contexts (ex. *Susie jumped over the old woman, and then Harry jumped over her*, Maratsos 1974). 5-year-olds accurately act out sentences requiring a pragmatic resolution strategy (ex. *Jane needed Susan's pencil. She gave it to her*, Wykes 1981)—although accuracy is better for gender-disambiguated sentences (ex. *John needed Susan's pencil. She gave it to him*). And preschoolers use the first-mention strategy in a variety of contexts (Song & Fisher 2005, 2007, Pyykkönen et al., 2010)—although gender information is processed more quickly (Hartshorne et al. 2015). These results show that children can interpret not only pronoun-internal gender semantics but also the semantics of the wider discourse. It is less clear whether children use Coherence Relations *per se*, but there is suggestive evidence in that direction. In their pronoun resolution task (see 4 above), Forsythe et al. (2019) manipulated not only pronominal form but also Coherence Relations, by alternating between temporal connective *y después* ('and then') and the result connective *y por eso* ('and for that'). Children over 4 ½ ignored this difference, paying attention only to the contrast between null and overt pronouns. However, younger children did treat the two discourse connectives differently, displaying an increased first-mention bias in the temporal condition, relative to the result condition.

Of the three cues examined here, subject-verb agreement is probably the most well studied. L1 studies reveal a surprising asymmetry between children's early perception and production of agreement and their apparent inability to use it in comprehension tasks. English-acquiring infants under 2 readily perceive a range of agreement violations, such as **A boy does bakes bread*, (Soderstrom et al. 2007), yet even 5-year-olds fail to use agreement to select a target picture (ex. *The duck swims* vs. *The ducks swim*, Johnson et al. 2005). In Spanish, toddlers correctly produce agreement by age 2 (Clahsen et al. 2002), but in picture-selection tasks, preschoolers are unable to use 3rd plural agreement (ex. *nad**an*** '(they) swim') until after 3 ½ and 3rd singular agreement (ex. *nad**a*** '(it) swims') until even later (Legendre et al. 2014, Pérez-Leroux 2005). Similar

production-comprehension asymmetries are found in Xhosa (Gxilishe et al. 2009) and Arabic (Rastegar et al., 2010).

The reason for this developmental asymmetry is still unclear, but recent work has found that it varies in strength by language (Legendre et al. 2014) and by task (Brandt-Kobele & Höhle 2010, González-Gómez et al. 2017, Verhagen & Blom 2014). Forsythe (2015) reports that children acquiring Spanish do not have nearly the same trouble using 1st and 2nd person agreement morphology in picture selection tasks that they do with 3rd person agreement and 3rd person object clitics. They also report that in 3rd person conditions both children and adults produced non-target answers because they were selecting the most recently mentioned antecedent from the preceding filler item. This suggests that children are aware that 3rd person pronouns prefer antecedents that are salient—not just antecedents with the right number features. If potential antecedents are explicitly mentioned in addition to simply appearing visually, this could raise their salience and improve children's performance. The pronoun resolution task used here will do just that.

2. Hypothesis and predictions

Assuming that learners have some mechanism for tracking prononimnal form, discourse connectives, and agreement in their input, they can learn to use these cues in pronoun resolution by tracking how each cue correlates with different antecedent properties. Thus, children exposed to Spanish should be able to track (i) the (categorical) correlation between the number features of agreement and the number features of subject pronouns' antecedents, as well as the (probabilistic) correlations between (ii) null pronouns and subject antecedents, and (iii) temporal discourse connectives and first-mentioned antecedents.

A natural hypothesis is that correlation (i) will be learned first. That is, children will be in a better position to detect how a given cue correlates with a given pronoun interpretation when that cue is abundant in the input and the correlation is strong. A second hypothesis is that children will *integrate* these cues by prioritizing correlation (i) over the other two. That is, when multiple cues are available, learners will rely most heavily on the most reliable predictors of pronoun meaning in their input. These hypotheses lead to two predictions for how children will behave in a pronoun resolution task where all three cue types are available, simultaneously.

(8) *Prediction 1.* Children will use agreement morphology to interpret subject pronouns **earlier** in development than the cues of pronominal form and discourse connective.

(9) *Prediction II.* Children's pronoun interpretations will be **more strongly** influenced by agreement morphology than the other two cues.

3. Methods

To test these predictions, we use a forced-choice picture-selection paradigm to elicit children and adults' interpretations of subject pronouns, systematcally aligning cues (10a) or pitting them against one another (10b-d).

(10) a. *La maestra saluda a las niñas y después ø sale.*
The teacher waves at the girls and then *pro* leaves-3S.
b. *La maestra saluda a las niñas y después ø sale**n**.*
The teacher waves at the girls and then *pro* leave-3P.
c. *La maestra saluda a las niñas **porque** ø sale*.
The teacher waves at the girls because *pro* leaves-3S.
d. *La maestra saluda a las niñas y después **ella** sale.*
The teacher waves at the girls and then she leaves-3S.

3.1. Subjects

Participants were recruited from a daycare in Mexico City, Mexico. Adult participants were all native speakers of Spanish working at the school. Children were learning Spanish as their first language and reported no atypical cognitive development. A total of 47 adults (43 women) and 97 children (57 girls) ages 1;11 to 6;9 completed the task. Children were divided into three age groups for analysis: 33 children under age 4 (R = 1;11-3;10; M = 3;3), 35 children age 4 to 5 (R = 4;0-4;11; M = 4;5), and 29 children age 5 and up (R = 5;0-6;9; M = 5;8).

3.2. Stimuli and experimental design

Experimental stimuli were created by fully crossing the three cues of pronominal form (null, overt), connective (temporal, causal), and agreement morphology (subject- disambiguated, object-disambiguated) with number (singular, plural) across 8 items, for a total of 128 distinct experimental prompts.

Participants were randomly assigned to one of three experiment types with 16 experimental trials and 16 filler trials, each of which tested a different cue type (morphology, connective, pronominal form) by systematically aligning and pitting that cue against the other two. Thus, participants assigned to the *morphology* experiment were exposed to 8 congruent trials in which all cues favored the same antecedent and 8 incongruent trials in which agreement morphology favored the opposite antecedent as the antecedent favored by pronominal form and connective. Likewise for participants assigned to the *connective* and *pronominal form* experiment types.

Within each experiment type, fillers and experimental items were presented in a fixed order that formed a coherent narrative arc about two consecutive days at a school with a teacher, a group of girls, and a group of boys. Each item was randomly assigned to appear in its congruent form on either "day 1" or "day 2,"

and its incongruent form on the other day. Each pair of congruent/incongruent items was randomly assigned to appear in the plural or the singular.

Experimental items were created by choosing 8 pairs of verbs that were easily depicted and likely to be known by children under 3. Following Johnson et al. (2005), we chose /s/-initial verbs for the second clause in order to mask plural /s/ marking on the subject in overt subject conditions (*sigue–sube*: 'follow–get up,' *busca–se esconde*: 'seek–hide,' *sigue a X–sigue a Y*: 'follow X–follow Y,' *sigue–sale* 'follow–go out,' *echa porra–salta la cuerda*: 'cheer on–jump rope,' *tapa–se acuesta*: 'cover–sleep,' *canta–saca pastel*: 'sing–take out a cake,' *dice adiós–se va*: 'say bye–leave'). Fillers were created by choosing an additional 16 verb pairs, replacing the pronoun with the definite DP *los niños* ('the boys'), and using either the girls or the teacher as a competing antecedent.

3.3. Procedure

The experiment began with an introductory screen introducing the characters (a teacher, 3 identically dressed girls, 3 identically dressed boys). Next, participants were given an explanation of the task and 3 practice trials. During each trial, participants saw an illustration of the first clause as it was read out loud by the experimenter (children) or a recording of her voice was played over headphones (adults). Next, participants saw a blank screen and heard the second clause. Next, two illustrations appeared, one corresponding to the subject interpretation and one to the non-subject interpretation, and participants chose the one that matched their own interpretation. Pictures were presented on a 13" MacBook Air using Psychopy version 3.0.0b11 (Peirce et al. 2019). Pictures were randomly placed on the left or right side of the screen. Upon completion, children received a piece of candy and adults received the equivalent of US$10.

4. Results

Figure 1 shows the rate of subject antecedent responses that participants produced in response to each combination of pronominal form, discourse connective, and subject- or object-disambiguating agreement. Figure 2 shows the magnitue of each cue's effect on pronoun interpretation, within the experiment type in which it was tested. To evaluate prediction I, we test which of these three cues had a significant effect on children's responses at each age. To evaluate prediction II, we compare the magnitude of these effects within and across ages.

4.1 Significant effects across ages 3-5

The first statistical analysis consisted of a logistic regression with one main effect each for pronominal form (null=1, overt =0), connective (*después*=1, *porque*=0), and agreement morphology (subject-disambiguated=1, object-disambiguated=0).

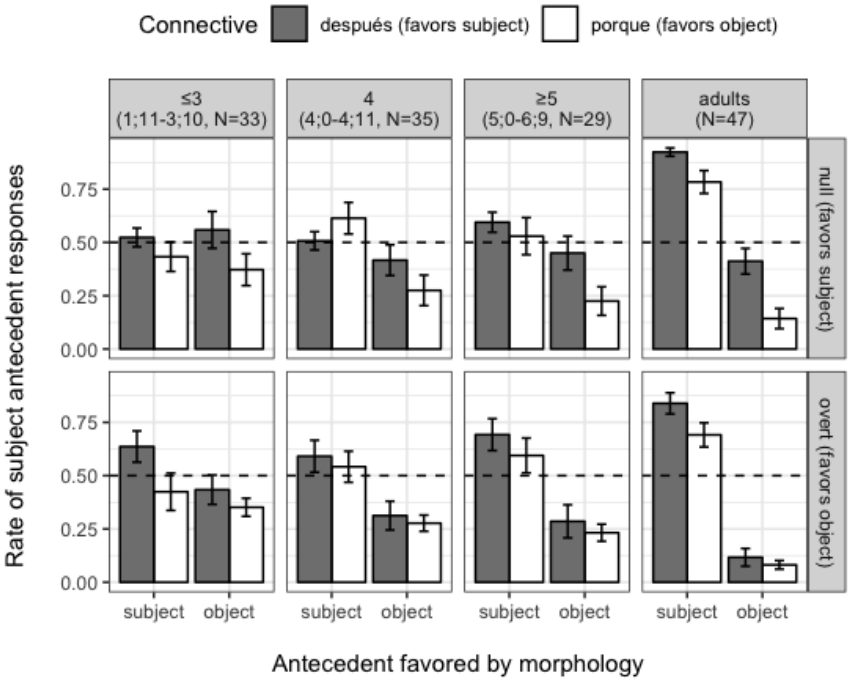

Figure 1: Rate of subject antecedent responses selected by children and adults interpreting Spanish null and overt subject pronouns accompanied by temporal (*después*) and causal (*porque*) connectives and disambiguating agreement morphology. (Error bars represent +/-1SE).

Table 1: β coefficients (SE) and maximal converging random effects structure estimated for each age group using R's *glmer()* function for logistic regression: subj.antecedent ~ form + connective + agreement. Significant effects in bold; marginal effects in italics.

	form	connective	morphology	random effects
≤3	-0.01 (0.21)	**0.52 (0.22)***	*0.41(0.22)(0.06)*	(1|item) + (1+agr+conn|ptcpt)
4	0.03 (0.20)	0.08 (0.20)	**1.00 (0.20)*****	(1|item) + (1|ptcpt)
≥5	-0.18 (0.28)	**0.63 (0.28)***	**1.52 (0.43)*****	(1|item) + (1+ agr|ptcpt)
adults	**0.93 (0.27)*****	**1.81 (0.43)*****	**4.05 (0.48)*****	(1|item) + (1+agr+conn|ptcpt)

Results for each age group appear in Table 1, along with the largest random effects structure that produced a converging, non-singular fit. Interactions were excluded from this analysis for two reasons: first, (i) because interactions increase the complexity of the model, requiring higher power than is available within each age group, and second (ii) because interactions are not part of the research question, that is, we are only concerned with whether or not each cue has any effect at all on children's responses, regardless of whether that effect is modulated by an interaction.

The first analysis provides evidence that children age 3 and under were influenced by discourse connectives, but not necessarily by agreement morphology or pronominal form. They produced significantly more subject responses in the presence of the subject-favoring connective *después* relative to the object-favoring connective *porque* ($\beta = 0.52 > 0$), but they produced only marginally more subject responses for subject-disambiguating agreement relative to object-disambiguating agreement, and they failed to produce significantly more subject responses for subject-favoring null pronoun relative to object-favoring overt pronouns. In contrast, 4-year-olds were reliably influenced by agreement morphology ($\beta = 1.00$, $p < 0.001$) but not by discourse connectives or pronominal form, while 5-year-olds were reliably influenced by both agreement morphology ($\beta = 1.52$ $p < 0.001$) and the connective ($\beta = 0.63$, $p < 0.05$), but not by pronominal form. Adults were reliably influenced by all three cues.

To confirm whether children's ability to use agreement morphology changes with age, a second analysis used a build-up procedure to determine the best-fitting model for children as a group. Models with each age-by-cue interaction were compared against a baseline model with a main effect of age only, using the *anova()* function to evaluate whether or not including the interactions improved model fit. Next, models with two age-by-cue interactions were compared to the single-interaction models. Finally, the models with all three interactions failed to converge, even when random effects were removed, and it was therefore not considered. The best-fitting model, as determined by this procedure, included an interaction between age and agreement morphology ($\beta = 0.48$, SE = 0.14, $p < 0.001$) and between age and connective ($\beta = 0.01$, SE = 0.13, $p = 0.95$). This confirms that morphology does interact with age.

In sum, we have reliable evidence that children begin using discourse connectives before age 4, but no such evidence for agreement morphology. Rather, children's use of agreement morphology grows with age. This finding contradicts prediction I that children should begin using agreement morphology earlier than other cues.

4.2 Effect sizes

To evaluate prediction II, we must compare the size of each significant effect (see Figure 2). That is, once children begin using agreement morphology to interpret pronouns, *how strong* is that influence, compared to other cues?

Effect sizes for each cue (see Figure 2) were calculated by taking the average difference in proportion of subject responses between congruent and incongruent conditions of each experiment type. Recall that the only difference between congruent and incongruent conditions of a given experiment type was whether or not the critical cue (pronominal form, discourse connective, agreement morphology) aligned with or conflicted with the other two cues; thus, the greater the difference in responses between these two conditions, the stronger the effect of the critical cue on pronoun interpretation. For each participant, separate difference scores were calculated for each of the 8 congruent/incongruent item pairs, replacing any missing responses with that participant's overall rate of subject responses across the whole experiment. These 8 scores, ranging between 1 (shift from object antecedent towards subject antecedent) and -1 (shift from subject to object), were then averaged to produce a single difference score per participant.

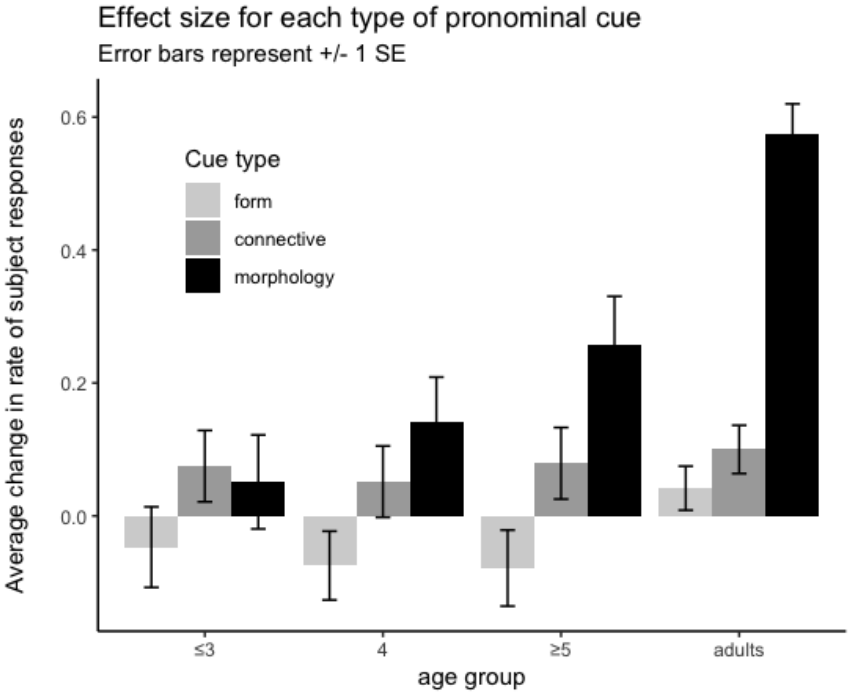

Figure 2: Effect sizes for each cue type (Error bars represent +/-1SE).

Figure 2 seems to indicate that starting at age 4, children were more strongly influenced by agreement morphology than by discourse connectives, and that they were not influenced in the expected direction by pronominal form. To test this, I used a linear mixed-effects model within each age group to test for

a positive correlation between effect size and experiment type (coded numerically: morpho = 2, connective = 1, and form = 0). Random intercepts and slopes for item and participant were dropped only if the model failed to converge, and *p*-values were generated using the *lmerTest()* library. For adults, there was a significant, positive effect of experiment type (β = 0.27, SE = 0.04, $p < 0.001$). For children 3 and under, there was no effect (β = 0.05, SE = 0.05, $p = 0.29$); for 4-year-olds there was a trend towards significance (β = 0.11, SE = 0.05, $p = 0.052$); for 5-year-olds there was a significant positive effect (β = 0.17, SE = 0.05, $p < 0.01$). One-sided t-tests comparing effect sizes within each age group showed that adults were more strongly influenced by agreement morphology relative to connectives ($t(20) = 6.94$, $p<0.001$) but not more strongly influenced by connectives relative to pronominal form ($t(25) = 1.39$, $p = 0.09$). 5-year-olds, were more strongly influenced by agreement morphology relative to connectives ($t(14) = 1.91$, $p < 0.05$), but there was no such difference for 4-year-olds ($t(15) = 0.85$, $p = 0.20$) or 3-year-olds ($t(16) = -0.23$, $p = 0.59$). In other words, it seems to take until age 5 for children to put significantly more faith in agreement morphology than they do in discourse connectives.

5. Discussion

This study probed the ability of Spanish-acquiring children to resolve subject pronouns, using a combination of three cues: (i) the pronoun's form (null vs. overt), (ii) the discourse connective linking the pronoun's clause to the clause containing its potential antecedents (*después* vs. *porque*), and (iii) the pronoun's number features, as indicated by agreement morphology on the verb. While previous work has examined these cues in isolation, this is the first study to examine how children integrate multiple cues together. It was hypothesized that the abundant, categorical information provided by agreement morphology should be more easily acquired from the input than the probabilistic, pragmatic information provided by pronominal form and discourse connectives. Therefore, when interpreting subject pronouns in the context of all three cues, children should rely on agreement, (i) earlier in development, and (ii) more heavily than they rely on the other two cues.

Contra the first prediction, we find reliable evidence that children under 4 use the lexical-pragmatic cue of discourse connectives and only weak evidence that they use agreement. Between the ages of 4 and 5, we do find that children use agreement; however, contra prediction II, we do not find that they are more strongly influenced by agreement than by connectives. Rather, it is only at age 5-6 that we find children relying on agreement more heavily than on connectives.

These result replicate previous findings that children's perception and production of agreement does not automatically translate into adult-like use of agreement in comprehension tasks (Johnson et al. 2005, Pérez-Leroux 2005, Legendre et al. 2014, Gxilishe et al. 2009, Rastegar et al. 2012). For children to perform like adults in the present task, they must first realize that agreement is

relevant to pronoun resolution and then learn to integrate it with other, weaker cues. This study shows that this process takes some time; however, it is not yet clear which of these steps is to blame. Children under 4 may fail to interpret agreement, as suggested by some (deVilliers & Gxilishe 2009), or they may simply fail to rank it appropriately. The fact that even 5-year-olds who clearly use both agreement and connectives still do not show as strong of an agreement effect as adults, certainly suggests that it takes some time for children to calibrate how much weight to assign each cue. Future work, including techniques like cognitive modeling, may distinguish between these possibilities.

References

Arnold, Jennifer E, Eisenband, Janet G, Brown-Schmidt, Sarah, & Trueswell, John C. (2000). The rapid use of gender information: evidence of the time course of pronoun resolution from eyetracking. *Cognition*. *76*, B13-26

Asher, Nicholas, & Lascarides, Alex. (2003). *Logics of Conversation*. Cambridge: Cambridge University Press.

Brandt-Kobele, Oda-Christina, & Höhle, Barbara. (2010). What asymmetries within comprehension reveal about asymmetries between comprehension and production: The case of verb inflection in language acquisition. *Lingua*, *120*(8), 1910– 1925.

Carminati, Maria Nella. (2002). *The processing of Italian subject pronouns*. Unpublished Doctoral dissertation, University of Massachusetts, Amherst.

Carvalho, Ana M, Orozco, Rafael, & Shin, Naomi Lapidus. (Eds.). (2015). *Subject pronoun expression in Spanish: A cross-dialectal perspective*. Georgetown University Press.

Chambers, Craig, & Smyth, Ron. (1998), 'Structural parallelism and discourse coherence: a test of centering theory'. *Journal of Memory and Language*, *39*, 593–608.

Clahsen, Harald, Aveledo, Friabet, & Roca, Iggy. (2002). The development of regular and irregular verb inflections in Spanish child language. *Journal of Child Language, 29*, 599–622.

Crawley, Rosalind A., Stevenson, Rosemary, & Kleinman, David. (1990), 'The use of heuris- tic strategies in the interpretation of pronouns'. *Journal of Psycholinguistic Research*, *19*, 245–64.

Forsythe, Hannah. (2015) "Person and number asymmetries in child comprehension of Spanish agreement and object clitics." *Supplemental proceedings of the 39th Boston University Conference on Child Language Development* (BUCLD39). Online.

Forsythe, Hannah., Greeson, Daniel. & Schmitt, Cristina. (2019) "Learnability in Romance: How indirect input helps children acquire the contrast between null and overt subjects." in Brown, Megan M. and Bradey Daily (Eds.) *Proceedings of the 43rd Boston University Conference on Child Language Development* (BUCLD43), vol. 1, pages 231-244. Somerville, MA: Cascadilla Press.

Forsythe, Hannah., Greeson, Daniel. & Schmitt, Cristina. (to appear). "How preschoolers acquire the null-overt contrast in Mexican Spanish: Evidence from production," in Colomina-Almiñana, J. & S. Sessarego (eds.), *Patterns in Spanish: Structure, Context and Development*. Amsterdam/Philadelphia: John Benjamins.

Gelormini-Lezama, Carlos. and Almor, Amit. (2011). Repeated names, overt pronouns, and null pronouns in Spanish. *Language and cognitive processes*, *26*(3), 437–454.

González-Gómez, Nayeli, Hsin, Lisa, Barriere, Isabelle, Nazzi, Thierry, & Legendre, Geraldine. (2017). Agarra, agarran: Evidence of early comprehension of subject-verb agreement in Spanish. *Journal of Experimental Child Psychology, 160*, 33–49.

Gxilishe, Sandile, Smouse, Mantoa Rose, Xhalisa, Thabisa, & deVilliers, Jill. (2009). Children's insensitivity to information from the target of agreement: The case of Xhosa. In Crawford, J., Otaki, K., and Takahashi, M (Eds.) *Proceedings of the 3rd Conference on Generative Approaches to Language Acquisition North America*, (pp. 46–53), Cascadilla Proceedings Project.

Hartshorne, Joshua. K., Nappa, Rebecca., & Snedeker, Jesse. (2015). Development of the first-mention bias. *Journal of Child Language, 42*(2), 423–446.

Hobbs, Jerry R. (1979), Coherence and coreference. *Cognitive Science, 3*, 67–90.

Järvikivi, Juhani, van Gompel, Roger, Hyönä, Jukka, & Bertram, Raymond. (2005). Ambiguous pronoun resolution: contrasting the first-mention and subject preference accounts. *Psychological Science, 16*, 260-264.

Jegerski, Jill; VanPatten, Bill, & Keating, G. (2011). Cross-linguistic variation and the acquisition of pronominal reference in L2 Spanish. *Second Language Research, 27*(4), 481–507.

Johnson, Valerie, de Villiers, Jill, & Seymore, Harry. (2005). Agreement without understanding? The case of third person singular /s/. *First Language, 25*(3), 317–330.

Keating, Gregory D., Jegerski, Jill, & VanPatten, Bill. (2016). Online processing of subject pronouns in monolingual and heritage bilingual speakers of Mexican Spanish. *Bilingualism: Language and Cognition, 19*(1), 36–49.

Kehler, Andrew. (2002). *Coherence, Reference, and the Theory of Grammar*. CSLI Publications.

Kehler, Andrew, Kertz, Laura, Rohde, Hannah, & Elman, Jeffrey L. (2008). Coherence and coreference revisited. *Journal of Semantics, 25*, 1-44.

Legendre, Geraldine, Culbertson, Jennifer, Zaroukian, Erin, Hsin, Lisa, Barrière, Isabelle, & Nazzi, Thierry. (2014). Is children's comprehension of subject-verb agreement universally late? Comparative evidence from French, English, and Spanish. *Lingua*. *144*, 21-39

Maratsos, Michael. (1974). Preschool children's use of definite and indefinite articles. *Child Development, 45*(2), 446–455.

Papadopoulou, Despina, Peristeri, Eleni, Plemenou, Evagelia, Marinis, Theodoros, & Tsimpli, Ianthi. (2015). Pronoun ambiguity resolution in Greek: Evidence from monolingual adults and children. *Lingua, 155*, 98–120.

Peirce, Jonathan, Gray, Jeremy R., Simpson, Sol, MacAskill, Michael, Höchenberger, Richard, Sogo, Hiroyuki, Kastman, Erik, & Lindeløv, Jonas Kristoffer. (2019). Psychopy2: Experiments in behavior made easy. *Behavior Research Methods, 51*(1), 195-203.

Pérez-Leroux, Ana T. (2005). Number problems in children. In Gurski, C., editor, *Proceedings of the 2005 Canadian Linguistics Association Annual Conference*, pp. 1–12.

Pérez-Leroux, Ana T., & Glass, William R. (1999). Null anaphora in Spanish second language acquisition: probabilistic versus generative approaches. *Second Language Research*, *15*(2), 220-249.

Pyykkönen, Pirita, Matthews, Danielle, & Järvikivi, Juhani. (2010). Three-year-olds are sensitive to semantic prominence during online language comprehension: A visual world study of pronoun resolution. *Language and Cognitive Processes*, *25*(1), 115–129.

Rastegar, Zahra, Shirazi, Haghighi, & Sadighi, Firooz. (2012). An amazing conundrum in children's comprehension and production of verb inflection. *World Applied Sciences Journal*, *18*(8), 1095–1101.

Shin, Naomi & Cairns, Helen Smith. (2012). The Development of NP Selection in School-Age Children: Reference and Spanish Subject Pronouns. *Language Acquisition*, *19*(1), 3–38.

Shin, Naomi. (2016). Acquiring constraints on morphosyntactic variation: Children's Spanish subject pronoun expression. *Journal of child language*, *43*(4), 914–947.

Soderstrom, Melanie, White, Katherine S., Conwell, Erin, & Morgan, James L. (2007). Receptive grammatical knowledge of familiar content words and inflection in 16-month-olds. Infancy 12, 1–29.

Song, Hyun-Joo, & Fisher, Cynthia. (2005). Who's "she?": Discourse prominence influences preschooler's comprehension of pronouns. *Journal of Memory and Language*, *52*(1), 29–57.

Song, Hyun-Joo, & Fisher, Cynthia. (2007). Discourse prominence effects on 3-year-old children's interpretation of pronouns. *Lingua*, *117*, 1959–87.

Sorace, Antonella, Serratrice, Ludovica, Filiaci, Francesca, & Baldo, Machela. (2009). Discourse conditions on subject pronoun realization: Testing the linguistic intuitions of older bilingual children. *Lingua*, *119*(3), 460–477.

Verhagen, Josje & Blom, Elma. (2014). Asymmetries in the acquisition of subject-verb agreement in Dutch? Evidence from comprehension and production. *First Language*, *34*(4), 315–335.

de Villiers, Jill & Gxilishe, Sandile. (2009) Number agreement in the acquisition of English and Xhosa. In J. M. Brucart, A. Gavarró, and J. Solà (Eds.) *Merging Features: Computation, Interpretation, and Acquisition* (pp. 104–122). Oxford University Press

Wykes, Til. (1981). Inference and children's comprehension of pronouns. *Journal of Experimental and Child Psychology*, *32*, 264–278.