The Acquisition of Adjunct Control and Working Memory

Juliana Gerard and Dana McDaniel

1. Introduction

In sentences with adjunct control, as in (1), the main clause subject c-commands the silent subject of the adjunct clause:

(1) John called Bill after PRO leaving the store.

This configuration results in a subject control interpretation – in (1), that John left the store. For adults, subject control is generally consistent in adjunct control with temporal adjuncts.[1] However, children have allowed a range of non-adult interpretations in previous studies: in addition to the main clause subject, 4-7-year old children have accepted other internal antecedents, as well as external antecedents, resulting in a free reference for adjunct PRO (Goodluck 1981; Hsu et al. 1985; McDaniel et al. 1991; Goodluck & Behne 1992; Cairns et al. 1994; Broihier & Wexler 1995; Adler 2006; Gerard et al. 2017; 2018; Gerard 2022).

Children's non-adultlike behavior may be accounted for by a non-adult grammar, which generates a different set of interpretations from the adult grammar – i.e. a competence account – or by non-adultlike deployment of the adult grammar, such that children's behavior does not accurately reflect their grammatical knowledge – i.e. a performance account. These accounts make different predictions for children's behavior across contexts, and have different implications for acquisition.

In this study, we consider the interaction between language-specific knowledge of adjunct control and domain general cognitive processes. While both types of accounts have been proposed in previous studies on the acquisition of adjunct control, they make different predictions about the role of these general processes in determining children's behavior: as competence accounts explain non-adultlike behavior in term of grammatical knowledge, they do not predict a direct relation between non-adultlike behavior and cognitive processes; in

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[1] Adults allow a non-subject interpretation under certain pragmatic conditions (Williams 1992; Green 2018; Janke 2018), leading Landau (2021) to propose a pragmatically-based acquisition account. We discuss this proposal in section 4.2.

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contrast, performance accounts appeal directly to cognitive processes as the source of non-adult behavior.

Consistent with performance accounts of adjunct control, we find that children's non-adultlike behavior is predicted by working memory. We discuss the implications of this finding for acquisition, and consider alternative analyses of adjunct control in light of this result.

2. Role of cognitive processes

While children's non-adultlike behavior is an observable outcome, the source of this behavior is not directly observable. Competence and performance accounts posit different non-observable sources: under a competence account, children's non-adultlike behavior arises from incomplete linguistic knowledge, independent of the interaction between this knowledge and general cognitive processes; in contrast, performance accounts shift the focus to this interaction with cognitive processes, attributing non-adultlike behavior to the non-adultlike deployment of linguistic knowledge. These accounts therefore make different predictions about the role of general cognitive processes in predicting children's non-adultlike interpretations. To spell out these predictions for adjunct control, we will consider the context of processing the dependency in real time.

2.1. Adjunct control in real time

For a sentence with adjunct control like (1) above, repeated below in (2), the arguments in the main clause, *John* and *Bill,* are first stored in memory.

(2) John called Bill after PRO leaving the store.

Since the adjunct subject is not pronounced, the first cue to the adjunct control dependency is the non-finite verb *leaving.* The verb itself provides the first overt signal that an antecedent must be retrieved for the adjunct subject, while the non-finite form of the verb identifies the adjunct control dependency. With a strict subject control grammar, this form serves as a cue to retrieve the main clause subject.

For adults, this retrieval process is relatively straightforward: the grammar identifies the antecedent as the closest c-commanding DP; this is the main clause subject, which thus becomes the target of retrieval. Resolving the dependency therefore involves retrieving the main clause subject as the antecedent of the adjunct subject, and incorporating this interpretation into the ongoing parse.

2.2. Performance account predictions

For the adult parser, this process of retrieving the antecedent of adjunct PRO is unlikely to result in misretrieval for sentences like (2). However, the immature parser may be more likely to retrieve a non-target antecedent, even when the adult

grammar identifies the main clause subject as the target of retrieval. For performance accounts, this misretrieval by the immature parser is the source of children's non-adultlike behavior.

If this misretrieval is due to immature general cognitive processes, then children's non-adultlike behavior will be predicted by their performance on general cognitive tasks. In particular, children's behavior for other syntactic dependencies (e.g. relative clauses) is predicted by working memory (Arosio et al. 2011; Haendler et al. 2015). However, antecedent retrieval may also interact with other performance factors, e.g. inhibitory control. If misretrieval is related specifically to working memory, then we predict a relation between adjunct control and working memory, but not between adjunct control and inhibitory control. In contrast, if misretrieval is related specifically to inhibitory control, then the reverse pattern is predicted. Finally, if misretrieval is a more general phenomenon which is not specific to working memory or inhibitory control, then a relation is predicted for both working memory and inhibitory control.

2.3. Competence account predictions

The retrieval process is necessarily different with a non-adult grammar, due to the ambiguity of multiple possible antecedents. That is, in addition to the general process of retrieving an antecedent from memory, a procedure is required for identifying which antecedent to retrieve. For example, this procedure may involve the same discourse properties as for ambiguous pronouns, in (3):

(3) John called Bill after he left the store.

The subject pronoun *he* is syntactically ambiguous, but comprehenders prefer to link the subject pronoun to the main clause subject. This preference may be modified by the salience of the antecedents in the discourse and well as the content of the main clause; importantly, the antecedent is determined from the information structure of the discourse rather than the syntax of the adjunct clause (Kehler & Rohde 2013; Ariel 1990; 2014; Arnold et al. 2007; Arnold et al. 2018; 2019).

In contrast with other syntactic dependencies, discourse preferences have not been linked to working memory. Therefore, if children deploy a discourse-based procedure to identify an antecedent, then their interpretations for adjunct control may be similar to an ambiguous pronoun as in (3), but should not be predicted by working memory or inhibitory control.

In this study we test the predictions of performance and competence accounts by comparing children's interpretations of adjunct control and ambiguous pronouns with domain general processes. In the next sections, we describe each respective task and the relations observed between them. Consistent with a performance account, we find that adjunct control is predicted by working memory but not inhibitory control, while no relation is observed for ambiguous pronouns. We consider the implications of this result for the acquisition of adjunct control and working memory.

3. Experiment

To test the above predictions, we compared children's behavior on adjunct control with ambiguous pronouns (between-subjects), and on both sentence types with working memory and inhibitory control (within-subjects). In addition, adjunct control and ambiguous pronouns were also tested with a control group of adults to confirm the expected adultlike behavior for both sentence types. In the next sections, we describe the participants and the task designs; we then present the general results for each task individually, followed by the statistical analysis of the relations between tasks.

3.1. Participants

Eighty-one children ages 4;0-7;10 (M=5;6) participated in the study. They were recruited through Lookit, ChildrenHelpingScience, or scistarter.org (Scott & Schulz 2017; Scott et al. 2017; Sheskin et al. 2020). Seventy-two adults also participated; they were recruited through the online study platform Prolific. Families who completed all components of the study received a $10 gift card, while adults who completed the language component received $4 via Prolific.

3.2. Methods

The study was conducted entirely online, and included (a) a truth value judgment task (TVJT) with sentences containing adjunct control or ambiguous pronouns (synchronous, over Zoom), (b) a working memory task (asynchronous), and (c) an inhibitory control task (asynchronous). Participants completed the TVJT in one session, and the working memory task and the inhibitory control task in another; session order was counterbalanced across participants. Sessions were completed at the children's homes, with a parent present.

3.2.1. Adjunct control and pronouns

The TVJT was adapted from the in-person version used in Gerard (2022), with pre-recorded test sentences to allow for more natural online delivery. Children viewed the context in Figure 1, in which Diego has a blue teddy bear, and Mickey has a red teddy bear.

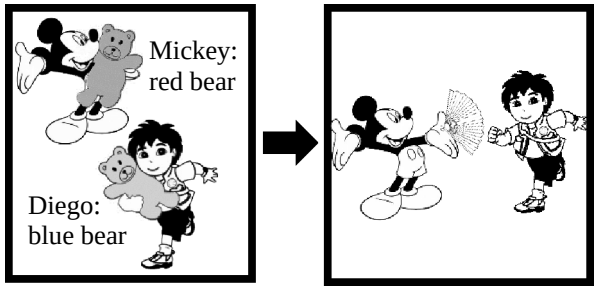

Figure 1: Picture context for adjunct control and ambiguous pronouns

With the context in Figure 1, children heard sentences with adjunct control or an ambiguous pronoun (between-subjects), as in (4):

(4) a. Mickey fanned Diego after hugging the *blue* bear. (adjunct control)
b. Mickey fanned Diego after he hugged the *blue* bear. (pronoun)

For both sentences in (4), the truth value of the sentence depends on the interpretation of the subject of the adjunct clause: if the adjunct subject is interpreted as the main clause subject (Mickey) then the sentence is false, since Mickey's bear is red. However, if the adjunct subject is interpreted as the main clause object (Diego), then the sentence is true, since Diego's bear is indeed blue. With a strict subject control grammar for adjunct control, the sentence with adjunct control should be unambiguously false. However, if children have a grammar which generates both subject control and object control, then both interpretations are available. As discussed above, some selection procedure is therefore required to identify a single antecedent. Notably, the truth value judgment task predicts that children will select the true interpretation when both interpretations are available, i.e. the Principle of Charity (Crain & Thornton 1998). Therefore, children with a non-adult should give a *true* response, in contrast with the adult grammar which requires a *false* response.

Although the Principle of Charity gives a clear prediction for ambiguous contexts, additional discourse factors may also affect children's behavior. This concern is directly addressed with the ambiguous pronoun condition, which provides a baseline for children's responses to syntactic ambiguity.

To directly compare sentences with adjunct control and ambiguous pronouns, all test sentences contained a subject and object with matching genders (Diego and Mickey Mouse). In addition, filler (control) sentences were included with an unambiguous pronoun, to confirm that children's responses were based on their interpretation of the adjunct subject, as in (5):

(5) Dora fanned Diego after {he/she} hugged the blue bear.

Adults and children saw 8 test items and 8 filler items, as well as 4 training items to establish the importance of the color property. Test trials were balanced

for true/false answer and the main clause subject (*Mickey/Diego*) while control trials balanced the combinations of *Dora/Mickey* and *Dora/Diego* and both subject and object pronoun antecedents. The truth value of the filler trials was determined dynamically based on the participant's response to the previous trial to check for response biases. To compare children's interpretations with working memory and inhibitory control, we report the dependent measure as the proportion of interpretations as the main clause subject for each sentence type.

3.2.2. Working memory task

The working memory task was a backwards span task adapted from the Monkey task by Van de Weijer-Bergsma et al (2016). The task started with a three-by-three array of black and white pictures of common items. Children were presented with lists of items to remember and produce in the reverse order; a list of items was presented by turning one picture at a time from black and white to color along with audio which played the name of the item in the picture. Children were then prompted to tap or click the same items which had appeared in the reverse order.

After a practice set with a forward order, children were presented with three levels of backwards lists, starting with two items, and ending with four items. Children had one practice set with feedback before starting the two-item level, and each level consisted of four lists.

To score the working memory task, accuracy was computed for each list, and then averaged across the four lists in a given level. A child's overall score was then computed as the average of the three levels' accuracy scores (Van de Weijer-Bergsma et al. 2016).

3.2.3. Inhibitory control task

The inhibitory control task was adapted from the kid-friendly Stroop task developed by Huang & Hollister (2019), with minor modifications for remote delivery. Children were introduced to six dogs, and prompted to tap a dog's picture upon hearing its name. After two control dogs, children were introduced to a green dog named Green and a brown dog named Brown – the *non-conflict* dogs – followed by a red dog named Blue and a blue dog named Red – the *conflict* dogs. Importantly, a response for the *conflict* dogs is expected to require inhibitory control, in contrast with a *non-conflict* dog response. To measure the effect of conflict for each child, their average accuracy in the *conflict* condition was subtracted from the *non-conflict* condition, resulting in a more negative score for a greater effect of conflict.

3.3. Results

We first present the results of each task individually, followed by the comparison across tasks.

3.3.1. TVJT results

The results of the TVJT for adults and children are presented in Figure 2.

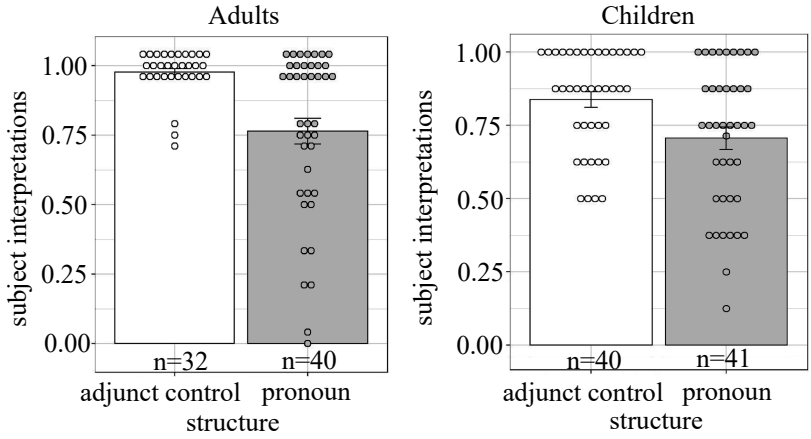

Figure 2: Subject interpretations for adults and children, by sentence type

As expected, adults exhibited strict subject control for sentences with adjunct control. In contrast, interpretations were much more varied for ambiguous pronouns. Contrary to the predictions of the Principle of Charity, adults did not always select the *true* interpretation, and most adults exhibited a subject preference; however, this preference was significantly weaker than the strict subject pattern observed for adjunct control, and 25% of the adults were just as (if not more) likely to accept an object interpretation.

Notably, children exhibited the same pattern of behavior as adults: although many children in the adjunct control condition did accept an object control interpretation on one or more trials, they gave significantly more subject interpretations for adjunct control than for ambiguous pronouns (logistic regression with sentence type as a fixed effect and subject and item as random effects: β = -1.02, SE = 0.33, Z = -3.12, p = 0.002).

In addition, children's subject interpretations were not predicted by age: although a marginal effect of age was observed for pronouns ($F(1,79) = 3.82$, p =.05), there was no effect of age for adjunct control ($F(1,79) = 0.96$, p = 0.33). Instead, the variation in children's responses may be predicted by factors other than age, e.g. the cognitive processes tested in the current study.

3.3.2. Working memory and inhibitory control results

As expected, children's accuracy was highest in the working memory task when the list included just two items (74%), compared to three items (56%) or four items (44%). This decrease was significant for each successive level, as

confirmed by a logistic regression with level as a fixed effect and subject, item, and list as random effects: two items vs three items β = -1.02, SE = 0.11, Z = -9.57, $p < 0.001$; three items vs four items β = -1.61, SE = 0.10, Z = -15.56, $p < 0.001$. Although the overall score was calculated as the average accuracy across the three levels, the decrease in accuracy with each level supports the validity of the task, with an increased memory load imposed by additional items.

In the inhibitory control task, children's accuracy on the inhibitory control task was higher in the non-conflict condition (85%) than in the conflict condition (72%). This result was analyzed with a logistic regression with condition as a fixed effect and subject and item as random effects, which revealed a significant difference between the conflict and non-conflict conditions (β = 0.94, SE = 0.13, Z = 7.02, $p < 0.001$). This contrast confirms that the *conflict* condition with inconsistent colors involved more conflict than the *non-conflict* condition with consistent colors, and required inhibitory control to resolve the inconsistency.

Next, we compare children's behavior across tasks to assess the predictions of competence and performance accounts.

3.3.3. Results across tasks

The relations between children's subject interpretations and the general cognitive tasks are presented in Figures 3 and 4. To analyze the results across tasks, we used a logistic regression model with the fixed effects sentence type (adjunct control/ambiguous pronoun), working memory, and inhibitory control, with sentence type in an interaction with working memory and inhibitory control. Random effects included subjects and items, with random slopes and intercepts. The model summary is presented in Table 1.

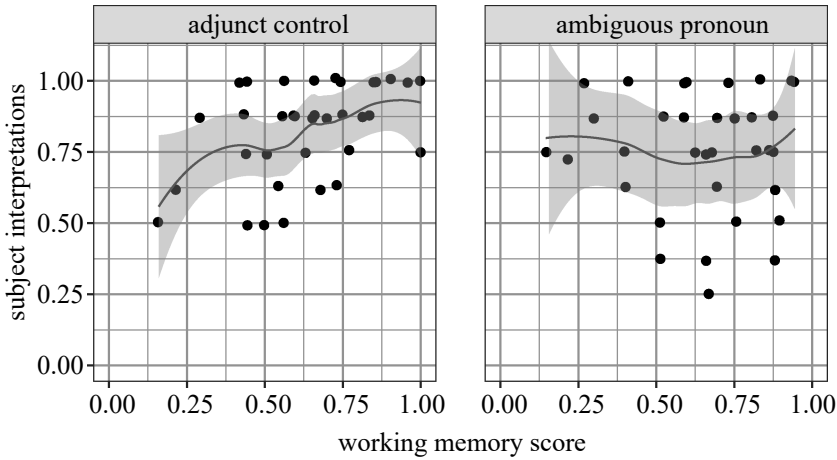

Figure 3: Subject interpretations by working memory score

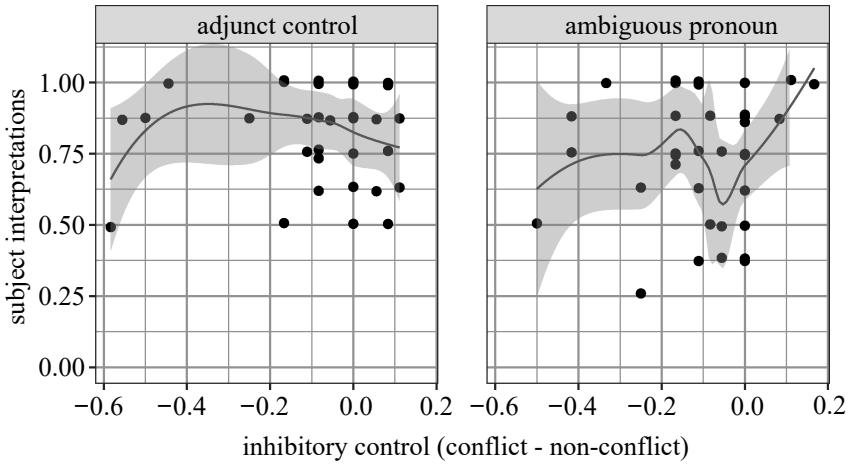

Figure 4: Subject interpretations by inhibitory control

Table 1: Model for sentence type, working memory, and inhibitory control

Fixed effects	β	SE	Z	p
Intercept	1.74	0.31	5.60	<0.001 ***
sentence type	-0.22	0.35	-0.62	0.537
working memory	0.61	0.19	3.23	0.001 **
inhibitory control	-1.67	1.60	-1.04	0.297
sentence type : working memory	-0.68	0.29	-2.35	0.018 *
sentence type : inhibitory control	2.90	1.95	1.49	0.137

In Table 1, the significant effect of working memory reveals that children's responses across structures were predicted by working memory, but not by inhibitory control. There was also a significant interaction between working memory and sentence type, suggesting that working memory did not equally predict responses on both sentence types. This was investigated using posthoc tests from the emmeans package in R (Lenth et al. 2022), which revealed a significant effect of working memory for adjunct control ($F(1,79) = 10.43$, $p = 0.001$), but not for ambiguous pronouns ($F(1,79) = 0.11$, $p = 0.74$).

Importantly, the effect of working memory is consistent with the predictions of performance accounts: as reflected by the trend for adjunct control in Figure 3, higher working memory scores predicted a higher proportion of subject control interpretations. This suggests that working memory is a factor in antecedent retrieval for adjunct control, and that misretrieval occurs as a result of immature working memory. In the final sections, we discuss the implications of this finding for children's acquisition of adjunct control, as well as non-obligatory control.

4. Discussion

In this study, we investigated the relation between adjunct control and general cognitive mechanisms. Children exhibited some non-adultlike interpretations of adjunct control, and in previous studies this behavior has generally been attributed to a non-adult grammar which generates a different set of interpretations from the adult grammar. However, children's adjunct control interpretations in the current study were predicted by their performance on a working memory task, which suggests instead that children's non-adultlike interpretations are due to immature working memory.

4.1. Acquisition: grammar and behavior

When children's behavior is not adultlike, an account which achieves descriptive adequacy can predict the observed pattern of non-adultlike behavior. The results of the current study suggest that children's non-adult behavior is due to immature working memory, which affects the deployment of the adult grammar.

An account with explanatory adequacy must also explain how the adult grammar is acquired, and how children's behavior becomes adultlike. For a competence account, these explanations are one and the same (an explanation is also required of how children acquire a non-adult grammar). They diverge, however, for a performance account.

4.1.1. The adult grammar

For a competence account, the sequence of acquisition involves an account of how children have acquired a non-adult grammar. However, under the performance account supported by the results of the current study, children's grammars are already adultlike. This still requires an explanation of how children's grammars come to be adultlike – via evidence from the input or innate linguistic knowledge, or a combination of the two.

As children accepted non-adult interpretations of adjunct PRO in an experimental context, they are also likely to access these same interpretations for adjunct control in the linguistic input (Gerard 2021). As a result, subject control in the input will not necessarily constitute evidence for the adult grammar, since children are likely to access non-subject control interpretations. That is, evidence for the adult grammar in the input cannot be dependent on children's interpretations of PRO; this suggests that adjunct control itself is not acquired from the input, and instead requires some form of innate linguistic knowledge. Meanwhile, any evidence in the input will involve language-specific features of the dependency, e.g. the form of non-finite morphology (Gerard 2021).

4.1.2. Adultlike behavior

The results of the current study suggest that children's behavior becomes adultlike with the development of working memory. This development may involve domain-general maturation – i.e. pre-programmed processes which cause working memory to develop, independent of the environment (Feigenson 2007; Courage & Cowan 2008) – or greater experience with language input, which may further support working memory in retrieval contexts (Stanford & Durrleman & Delage 2019; Stanford 2020). The relative roles of maturation and experience may be further investigated in intervention studies, along with how immature working memory may influence retrieval processes to result in non-adult interpretations.

4.2. Non-obligatory control

In this section, we consider Landau's (2021) pragmatic account of the acquisition of control, which is based on the observation that adults can allow non-subject interpretations in temporal adjuncts, as illustrated in (6).

(6) a. The security guard stopped the woman$_i$ [before PRO$_i$ boarding the plane]. (Green 2018: 73)
b. Potatoes are tastier after boiling them. (Ackema & Schoorlemmer 1995: 182)

Landau proposes that the adult grammar allows two structural possibilities for non-finite temporal (and other) adjuncts. The preferred one is obligatory control, determined by local c-command. The other one is non-obligatory control, where the controller is determined by the pragmatic notions of topicality and logophoricity. Landau argues that, since non-obligatory control is possible for adults, children's responses never violate the adult grammar; instead, they reflect immature pragmatic knowledge.

Although Landau's proposal is appealing in that it avoids a poverty-of-stimulus problem with respect to grammatical knowledge, it recreates a learning puzzle in the domain of pragmatics. Our findings also raise an empirical problem with the pragmatic account, in that the correlation with working memory is unexpected. In fact, one might predict exactly the reverse; if children allow all interpretations of PRO, high working memory would make those interpretations more accessible, leading to more non-subject responses on a TVJT.

We find it more plausible that children would start out avoiding the non-obligatory control option. This acquisition approach not only avoids a learnability problem in the domain of pragmatics, but also facilitates interpretation, since the obligatory control option deterministically identifies a controller. Furthermore, this account provides an answer to the question raised by Landau of why obligatory control is preferred across languages and speakers: It would be due to the preference in acquisition for interpretation that is determined by the grammar.

4.3. Conclusion

In this study, we tested the predictions of competence and performance accounts for children's interpretations of adjunct control. Under a competence account, children's non-adult behavior is due to a non-adult grammar and therefore will not be predicted by general cognitive processes. In contrast, performance accounts explain non-adultlike behavior as the result of immature parsing mechanisms, and therefore predict a relation between these mechanisms and children's behavior. Consistent with a performance account, we observed that children's non-adultlike interpretations of adjunct control were predicted by working memory. Future research may further investigate a causal link between immature working memory and children's interpretations, and how children acquire the adult grammar despite accessing non-adult interpretations of the linguistic input.

References

Ackema, Peter & Schoorlemmer, Maaike. 1995. Middles and nonmovement. *Linguistic Inquiry* 173–197.

Adler, Allison Nicole. 2006. *Syntax and discourse in the acquisition of adjunct control*. Massachusetts Institute of Technology dissertation.

Ariel, Mira. 1990. Accessing noun-phrase antecedents. *London & New York: Routledge*.

Ariel, Mira. 2014. Accessing noun-phrase antecedents (rle linguistics b: Grammar). Routledge.

Arnold, Jennifer E. & Brown-Schmidt, Sarah & Trueswell, John. 2007. Children's use of gender and order-of-mention during pronoun comprehension. *Language and Cognitive Processes* 22(4). 527–565.

Arnold, Jennifer E. & Castro-Schilo, Laura & Zerkle, Sandra & Rao, Leela. 2019. Print exposure predicts pronoun comprehension strategies in children. *Journal of Child Language* 46(05). 863–893.

Arnold, Jennifer E. & Strangmann, Iris M. & Hwang, Heeju & Zerkle, Sandra & Nappa, Rebecca. 2018. Linguistic experience affects pronoun interpretation. *Journal of Memory and Language* 102. 41–54.

Arosio, Fabrizio & Guasti, Maria Teresa & Stucchi, Natale. 2011. Disambiguating Information and Memory Resources in Children's Processing of Italian Relative Clauses. *Journal of Psycholinguistic Research* 40(2). 137–154.

Broihier, Kevin & Wexler, Kenneth. 1995. Children's acquisition of control in temporal adjuncts. *Papers on Language Processing and Acquisition, MIT Working Papers in Linguistics* 26. 193–220.

Cairns, Helen Smith & McDaniel, Dana & Hsu, Jennifer Ryan & Rapp, Michelle. 1994. A longitudinal study of principles of control and pronominal reference in child English. *Language* 70(2). 260–288.

Courage, Mary & Cowan, Nelson. 2008. *The development of memory in infancy and childhood*. Psychology Press.

Crain, Stephen & Thornton, Rosalind. 1998. Investigations in universal grammar: A guide to experiments on the acquisition of syntax and semantics. MIT Press.

Feigenson, Lisa. 2007. Continuity of format and computation in short-term memory development. *Short-and Long-Term Memory in Infancy: Taking the First Steps towards Memory* 51–74.

Gerard, Juliana. 2022. The extragrammaticality of the acquisition of adjunct control. *Language Acquisition* 29(2). 107–134.

Gerard, Juliana & Lidz, Jeffrey & Zuckerman, Shalom & Pinto, Manuela. 2017. Similarity-Based Interference and the Acquisition of Adjunct Control. *Frontiers in Psychology* 8.

Gerard, Juliana & Lidz, Jeffrey & Zuckerman, Shalom & Pinto, Manuela. 2018. The acquisition of adjunct control is colored by the task. *Glossa: A Journal of General Linguistics* 3(1).

Goodluck, Helen. 1981. Children's grammar of complement-subject interpretation. In Susan Tavakolian (ed.), *Language acquisition and linguistic theory*, 139–166. Cambridge, MA: The MIT Press.

Goodluck, Helen & Behne, Dawn. 1992. Development in control and extraction. In J Weissenborn & Helen Goodluck & Tom Roeper (eds.), *Theoretical issues in language acquisition*, 151–171. Hillsdale, NJ: Lawrense Erlbaum.

Green, Jeffrey. 2018. *Adjunct control: Syntax and processing*. University of Maryland dissertation.

Haendler, Yair & Kliegl, Reinhold & Adani, Flavia. 2015. Discourse accessibility constraints in children's processing of object relative clauses. *Frontiers in Psychology* 6.

Hsu, Jennifer Ryan & Cairns, Helen Smith & Fiengo, Robert W. 1985. The development of grammars underlying children's interpretation of complex sentences. *Cognition* 20(1). 25–48.

Huang, Yi Ting & Hollister, Erin. 2019. Developmental parsing and linguistic knowledge: Reexamining the role of cognitive control in the kindergarten path effect. *Journal of Experimental Child Psychology* 184. 210–219.

Kehler, Andrew & Rohde, Hannah. 2013. A probabilistic reconciliation of coherence-driven and centering-driven theories of pronoun interpretation. *Theoretical Linguistics* 39(1–2). 1–37.

Landau, Idan. 2021. A Selectional Theory of Adjunct Control. MIT Press.

Lenth, Russell V. & Buerkner, Paul & Giné-Vázquez, Iago & Herve, Maxime & Jung, Maarten & Love, Jonathon & … Singmann, Henrik. 2022, October 27. emmeans: Estimated Marginal Means, aka Least-Squares Means (Version 1.8.2).

McDaniel, Dana & Cairns, Helen Smith & Hsu, Jennifer Ryan. 1991. Control principles in the grammars of young children. *Language Acquisition* 1(4). 297–335.

Scott, Kimberly & Chu, Junyi & Schulz, Laura. 2017. Lookit (Part 2): Assessing the Viability of Online Developmental Research, Results From Three Case Studies. *Open Mind* 1(1). 15–29.

Scott, Kimberly & Schulz, Laura. 2017. Lookit (Part 1): A New Online Platform for Developmental Research. *Open Mind* 1(1). 4–14.

Sheskin, Mark & Scott, Kimberly & Mills, Candice M. & Bergelson, Elika & Bonawitz, Elizabeth & Spelke, Elizabeth S. & … Schulz, Laura. 2020. Online Developmental Science to Foster Innovation, Access, and Impact. *Trends in Cognitive Sciences* 24(9). 675–678.

Stanford, Emily. 2020. The language-cognition interface: Executive functions and syntax in atypical development. University of Geneva dissertation.

Stanford, Emily & Durrleman, Stephanie & Delage, Hélène. 2019. The Effect of Working Memory Training on a Clinical Marker of French-Speaking Children With Developmental Language Disorder. *American Journal of Speech-Language Pathology* 28(4). 1388–1410.

Van de Weijer-Bergsma, Eva & Kroesbergen, Evelyn H. & Jolani, Shahab & Van Luit, Johannes E.H. 2016. The Monkey game: A computerized verbal working memory task for self-reliant administration in primary school children. *Behavior Research Methods* 48(2). 756–771.

Williams, Edwin. 1992. Adjunct Control. In Richard K. Larson & Sabine Iatridou & Utpal Lahiri & James Higginbotham (eds.), *Control and Grammar*, 297–322. Springer Netherlands.

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