

## COGNITIVE INHIBITION CONTROL EXPLAINS CHILDREN'S PRODUCTION OF MEDIAL QUESTIONS IN BRAZILIAN PORTUGUESE

[4,5] propose children's non-adult-like medial questions (MQs)—long-distance questions with an extra *wh*-element in intermediate [Spec,CP], (1)—arise as a type of speech error due to the interaction of a target grammar and underdeveloped cognitive inhibition control (IC). We extend their account to Brazilian Portuguese (BrP). We show the cognitive IC of BrP-acquiring children predicts MQ production, corroborating this account with evidence from a distinct linguistic population.

While some propose MQs arise from a (temporary) non-target grammar setting, made available by Universal Grammar [1–3], others propose MQs arise from the interaction of a target grammar and immature performance systems [4–6]. [4,5] propose MQs are effectively speech errors (e.g., *blue blug* for *blue bug*). Building on the idea from [7] that the items that get pronounced are selected from highly activated alternatives, [4,5] propose children may fail to inhibit the pronunciation of the *wh*-phrase when it is reactivated in intermediate [Spec,CP]. Psycholinguists have independently shown fillers are actively maintained in memory and receive a boost in activation in locations where successive-cyclic movement leaves copies [8,9,10]. [4,5] therefore predict MQs will be produced more frequently by children with worse cognitive IC. They included a measure of motor IC as a control. They found cognitive IC (not motor IC) predicts MQs from English-acquiring children, (2).

We test [4–5]'s hypothesis in BrP. We conducted three tasks: an elicited production task (cf. [1]) and two IC tasks (a Simon task to probe motor IC and a naming task to probe cognitive IC). In the Simon task, children had to press a key according to an onscreen image. Congruent trials required a keypress on the same side as the stimulus, and incongruent trials required a keypress on the opposite side. Participants tend to respond on the stimulus side and so need motor IC to inhibit this tendency on incongruent trials [11]. In the cognitive IC task [12], children had to quickly name objects in a picture book, but were forbidden from naming animals (distractors). Like [4,5], we expect cognitive IC, not motor IC, to predict MQ production.

31/70 BrP-acquiring children (4;1,06–6;6,2) produced at least one MQ, (3). We fit a logistic mixed-effects model with fixed effects for the motor IC and cognitive IC measures, predicting whether each trial of the production task elicited an MQ (Table 1). Figure 1 plots odds ratios for the fixed effects. MQs were 17.39 times more likely from participants who named distractors in the cognitive IC task ( $\beta=2.856, z=4.620, p<0.00001$ ), but motor IC (mean error on incongruent trials) didn't predict MQ production ( $\beta=-0.891, z=-0.891, p=0.373$ ).

This replicates [4,5], but with BrP-acquiring children. Attributing MQs to non-target grammars doesn't explain why this correlation with cognitive IC should be found in two different linguistic populations, nor does it explain how children come to have the target grammar. Instead, attributing these errors to the interaction of a target grammar and underdeveloped cognitive IC explains the correlations and suggests these errors are purged from the child's repertoire via the development of cognitive IC.

(498 words)

## Examples

- (1) **Who** do you think **who** was chasing the boys? (ER, 4;6)
- (2) **Long-distance Wh-questions in English:**  
a. Who do you think [CP ⟨who⟩ [TP ⟨who⟩ [VP fell ⟨who⟩]]]  
b. What do you think [CP ⟨what⟩ Mary bought ⟨what⟩]  
c. Where do you think [CP ⟨where⟩ Mary fell ⟨where⟩]
- (3) **Long-distance Wh-questions in Brazilian Portuguese (BrP):**  
a. Quem você acha [CP ⟨quem⟩ que [TP ⟨quem⟩ [VP caiu ⟨quem⟩ ]]]  
    who you think       ⟨who⟩ that       ⟨who⟩       fell ⟨who⟩  
b. O que você acha [CP ⟨o que⟩ que [TP a Maria comprou ⟨o que⟩ ]]  
    what you think       ⟨what⟩ that       the Mary bought ⟨ what⟩  
c. Onde você acha [CP ⟨onde⟩ que [TP a Maria caiu ⟨onde⟩ ]]  
    where you think       ⟨where⟩ that       the Mary fell ⟨where⟩

## References

- [1] Thornton, R. (1990) *Adventures in Long-distance Moving: The Acquisition of Complex Wh-questions*. Doctoral dissertation, University of Connecticut, Storrs. [2] McDaniel, D., Chiu, B. & Maxfield, T. L. (1995) Parameters for *Wh*-movement Types: Evidence from Child English. *Natural Language and Linguistic Theory* 13: 709-753. [3] De Villiers, J.; de Villiers, P. & Roeper, T. (2011) Wh-questions: Moving Beyond the First Phase. *Lingua* 121(3): 352–366. [4] E. Grolla et al. A Performance Account for Medial Wh-Questions in Child English. In: BUCLD 42: Proceedings of the 42nd Annual Boston University Conference on Language Development. Ed. by A. B. Bertolini et al. Somerville, MA: Cascadilla Proceedings Project, June 2018. [5] A. Liter et al. Cognitive Inhibition Explains Children’s Production of Medial Wh-Phrases. under review. [6] C. J. Lutken et al. Syntactic Creativity Errors in Children’s Wh-Questions. *Cognitive Science* 44.7 (July 2020). [7] Dell, G. S. (1986) A Spreading-Activation Theory of Retrieval in Sentence Production. *Psychological Review* 93: 283-321. [8] E. Gibson et al. Reading-Time Evidence for Intermediate Linguistic Structure in Long-Distance Dependencies. *Syntax* 7.1 (Apr. 2004), pp. 55–78. [9] G. Scontras et al. Syntactic Complexity Effects in Sentence Production. *Cognitive Science* 39.3 (Apr. 2015), pp. 559–583. [10] G. Scontras et al. Syntactic Complexity Effects in Sentence Production: A Reply to MacDonald, Montag, and Gennari (2016). *Cognitive Science* 41.8 (Nov. 2017), pp. 2280–2287. [11] Davidson, M.C., Amso, D., Anderson, L.C. & Diamond, A. (2006) Development of Cognitive Control and Executive Functions from 4-13 Years: Evidence from Manipulations of Memory, Inhibition, and Task Switching. *Neuropsychologia* 44: 2037 – 2078. [12] Kipp, K. & Poppe, S. (1997) The Development of Cognitive Inhibition in Streams-of-Consciousness and Directed Speech. *Cognitive Development* 12: 239-260.