

Why do you think why kids produce medial wh-phrases? Grammar or performance?

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Long-distance wh in acquisition

- ▶ Children sometimes produce medial wh-phrases in elicited production tasks (Thornton 1990, J. d. Villiers et al. 1990, Thornton 1995, McDaniel et al. 1995)
 - (1) Who do you think **who**'s in the box?
 - (2) What do you think **who**'s in that can?
- ▶ This is also reported for Dutch learners (van Kampen 1997, Jakubowicz & Strik 2008), Spanish learners (Gutiérrez Mangado 2006), and French learners (Oiry 2006, Jakubowicz & Strik 2008, Demirdache & Oiry 2008)

An example

Child: What do you think **who** popped the balloons?

The syntax of long-distance wh

Crosslinguistic variation

- ▶ There are wh-copying languages and partial wh-movement languages (examples from Felser 2004: 544, Klepp 2002: 112)

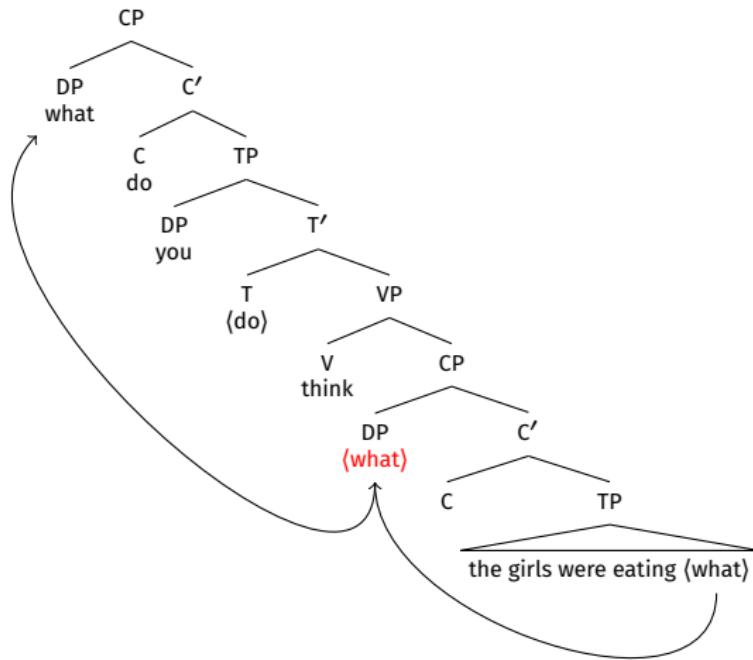
- (3) Wen glaubst du [wen sie getroffen hat]?
who think you who she met has
'Who do you think she met?' (German)
- (4) Was glaubte Miró [welches Bild Picasso gemalt hatte]?
what thought Miró which picture Picasso painted had
'Which picture did Miró think Picasso had painted?' (German)

The syntax of long-distance wh

Cyclicity

- ▶ Wh-movement is cyclic (e.g., Chomsky 1973, Torrego 1983)

(5)



Roadmap

1. Background

2. Developmental accounts

- 2.1 Non-target grammar accounts
- 2.2 A performance account

3. Experiment

- 3.1 Hypotheses and predictions
- 3.2 Different tasks
- 3.3 Participants
- 3.4 Results

4. Discussion

- 4.1 Grammar or performance?
- 4.2 Subject asymmetry

Non-target grammar accounts

- ▶ Children have temporarily landed on the wrong grammar (Thornton 1990, McDaniel et al. 1995, Roeper & de Villiers 2011, J. G. d. Villiers et al. 2011)

Difficulties for non-target grammar accounts

- ▶ Children produce sentences that would be ungrammatical in Frisian-like languages (Thornton 1995)
- (6) Which animal do you think what really says ‘woof woof’?

- ▶ Children accept sentences that would be ungrammatical in Frisian-like languages (McDaniel et al. 1995)
- (7) Who do you want who to cook dinner?

A performance account

- ▶ Children have the target grammar but fail to inhibit the pronunciation of the wh copy

A performance account

Perseveration

- ▶ “Slips of the tongue” are predicted to occur in places where an item is licit (cf. Dell 1986)
- ▶ For example, [bl] is a licit English onset, and *blue bug* is sometimes accidentally pronounced as *blue blug*

A performance account

Perseveration

- ▶ In (8), *who* is highly active (cf. Fadlon et al. 2019) and licit at the edge of the embedded clause (cf. Chomsky 1973)

(8) Who do you think **who**'s in the box?

A performance account

An upshot

- ▶ This could also explain children's production of resumptive NPs (cf. Labelle 1990, Botwinik et al. 2015)

Predictions of a performance account

Prediction 1

- ▶ Children with less inhibition control should produce more medial wh-phrases

Predictions of a performance account

Prediction 2

- ▶ Producing object wh-dependencies is costly for adults (cf. Gennari et al. 2012, Fadlon et al. 2019)
- ▶ Such dependencies are also hard for children to understand (e.g., Friedmann et al. 2009)
- ▶ So, with object questions in particular, as well as more generally, trying to produce the question could tax the executive control resources of the child

Predictions of a performance account

Prediction 2

- ▶ Taxed executive control would be indicated by the child producing a question other than the target question

(10) Intended Q: Who do you think the boy saw?

Actual Q: Who do you think was behind the fence?

Predictions of a performance account

Prediction 2

- ▶ On such trials, if the child's executive control resources are already tapped, we might see higher rates of medial wh-phrases

Predictions

	Performance account	Non-target grammar accounts
Child with less inhibition control	More medials	No correlation
Trial with switched argument structure	More medials	No correlation

Different tasks

- ▶ 4 different tasks were administered
 - (i) Elicited production task (cf. Thornton 1990)
 - (ii) Cognitive inhibition task (cf. Kipp & Pope 1997)
 - (iii) Motor ability task (cf. Carlson & Moses 2001)
 - (iv) Motor inhibition task (cf. Davidson et al. 2006)

Elicited production task

- ▶ Each child watched 6 different short animated videos from a cartoon show
- ▶ After each video, the child was encouraged to ask the puppet, Snuggles, between 2 and 4 different questions about the video
- ▶ There were 21 questions total across the 6 videos

Elicited production task

- ▶ If the participant failed to ask a multicausal question during any of the first 3 trials, the experimenter prompted the participant to ask a multicausal question
- ▶ 2 of the first 3 trials were subject questions, and 1 was an object question
- ▶ Of the remaining 18 trials, 6 were subject questions, 6 were object questions, and 6 were adjunct questions

Elicited production task

Elicited production task

Experimenter: We know that it was the girl that was chasing the boys, but let's ask Snuggles who he thinks

Child: Who do you think **who** was chasing the gi ... the boys?

Cognitive inhibition task

- ▶ Participant was asked to name items in a picture book (*Anno's Journey*) that the experimenter points to, as quickly as possible
- ▶ During the first two minutes, participant cannot name an item if it is an animal (“distractors”)
- ▶ During the last two minutes, participant should name everything the experimenter points to, including the distractors

Motor ability task

- ▶ Task uses a toy piano with four keys
- ▶ Participant was asked to play each key once in sequence as many times as they could in 10 seconds

Motor inhibition task

- ▶ A motor inhibition task with three different conditions was administered using PsychoPy (Peirce 2007, 2009)
- ▶ Participants pressed either the 'z' or 'm' key, depending on the condition and the side of the screen the object appeared on
- ▶ If the participant did not press any key, the stimulus disappeared after 2500 ms
- ▶ There was a familiarization period for the first two conditions

Motor inhibition task

Congruent condition



Everytime you see a heart, press on
the same side it appears. Let's
practice first.



Motor inhibition task

Incongruent condition



Everytime you see a flower, press
on the opposite side. Let's practice?

+



Motor inhibition task

Mixed condition



Now, you'll see hearts and flowers.



If you see a heart, press the same side.

If you see a flower, press on the opposite side.

+



+



Participants

Participant counting

- ▶ 96 participants have been tested so far
- ▶ The data from 76 participants is analyzed here

Participants

Participant counting

- ▶ Participants that were not included:
 - ▶ 1 was tested as a pilot participant
 - ▶ 1 was accidentally tested despite not meeting the criterion for the study that they hear at least 80% English at home
 - ▶ 12 participants did not complete all 4 tasks
 - ▶ 4 participants would not ask any multicausal questions at all
 - ▶ 2 participants only asked multicausal questions that were direct repetitions of the experimenter

Participants

Session information

- ▶ Participants either
 - ▶ completed the 4 tasks in a single session with a short break between the elicited production task and the other 3 tasks; or
 - ▶ they completed the elicited production task in one session, and the other 3 tasks in another session on another day

Participants

Session information

- ▶ The elicited production task was usually done first
- ▶ The mean number of days between the elicited production task and the other 3 tasks was 7.9 days (range: -7 to 68)

Participants

Sex and age information

- ▶ Again, $n = 76$ (39 female, 37 male)
- ▶ The average age during the session with the elicited production task was 4;9 (range: 3;7 to 6;3)
- ▶ The average age during the session with the other 3 tasks was 4;9 (range: 3;7 to 6;5)

Predictions

	Performance account	Non-target grammar accounts
Child with less inhibition control	More medials	No correlation
Trial with switched argument structure	More medials	No correlation

Results

Elicited production

- ▶ Average number of wh-questions with two clauses that each participant asked (range: 2–21):

	Adjunct	Object	Subject	Total
Produced	4.80	5.32	7.13	17.25
Elicited	6	7	8	21

Results

Elicited production

- ▶ 36 participants did not ask any questions with a medial wh-phrase

Results

Elicited production

- ▶ 40 participants asked at least one question with a medial wh-phrase
- ▶ On average, 18% of the questions they asked had a medial (range: 5%–53%)

Results

Elicited production

Let's look at participant 118 (4;0)

► Adjunct questions (1 out of 6 = 16.67%)

(11) Where that you think who was walking on the rope?

► Object questions (1 out of 6 = 16.67%)

(12) Who do you think who kissed the boy?

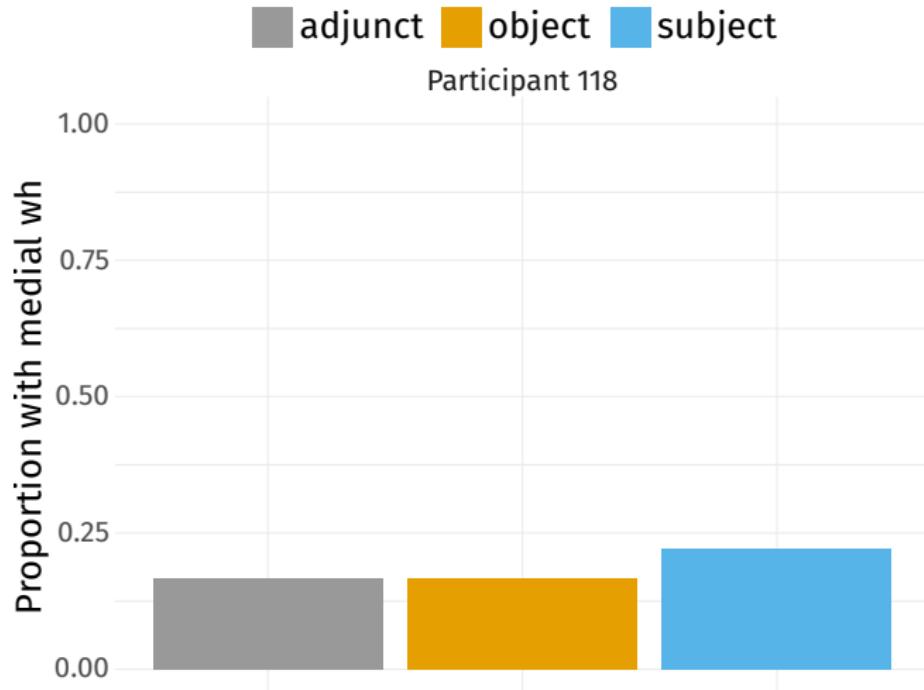
► Subject questions (2 out of 9 = 22.22%)

(13) Who do you think who kissed the boy?

(14) What do you think who fell?

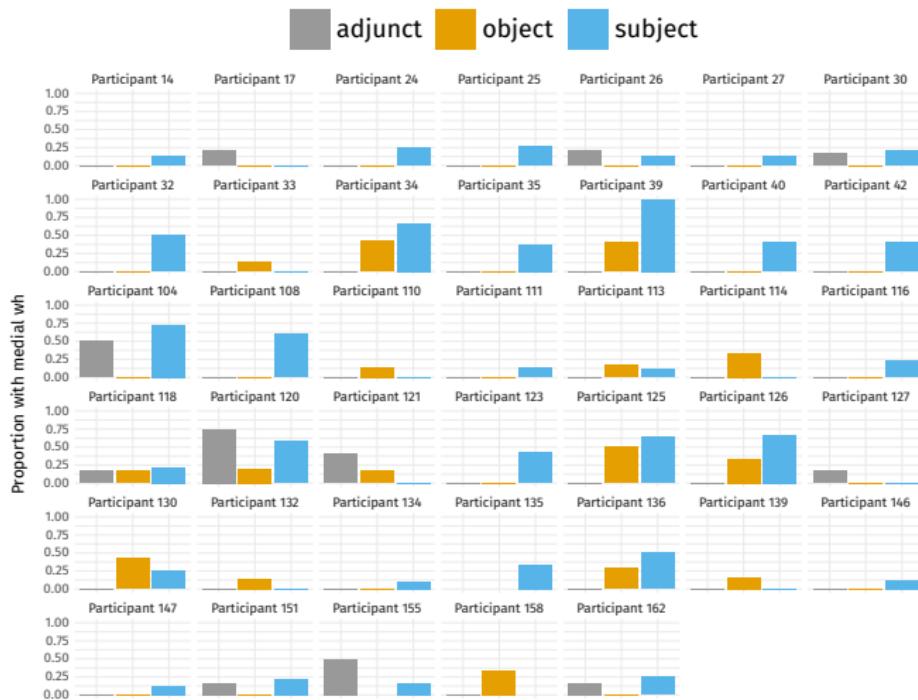
Results

Elicited production



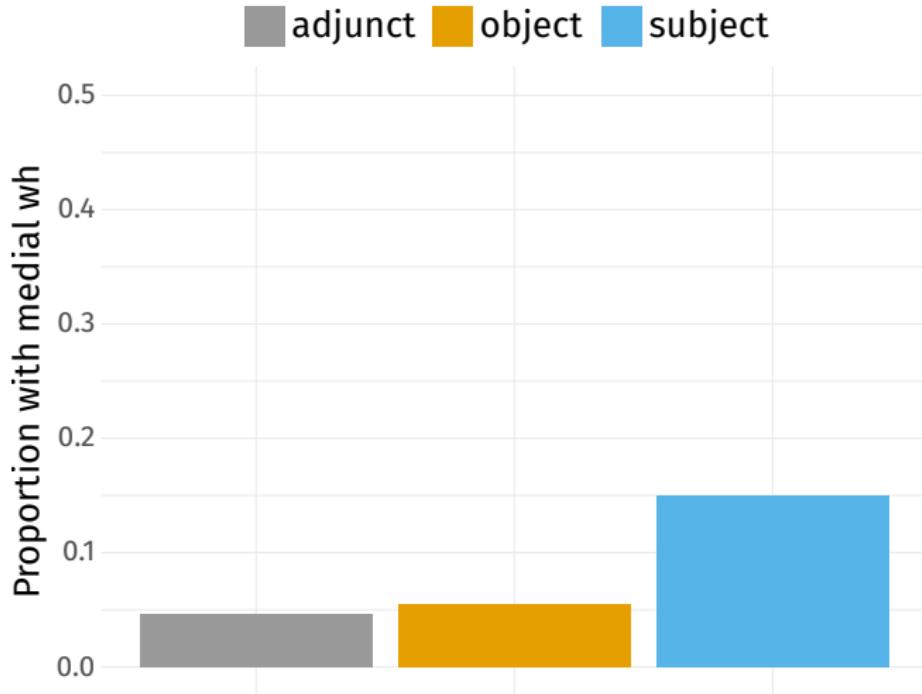
Results

Elicited production



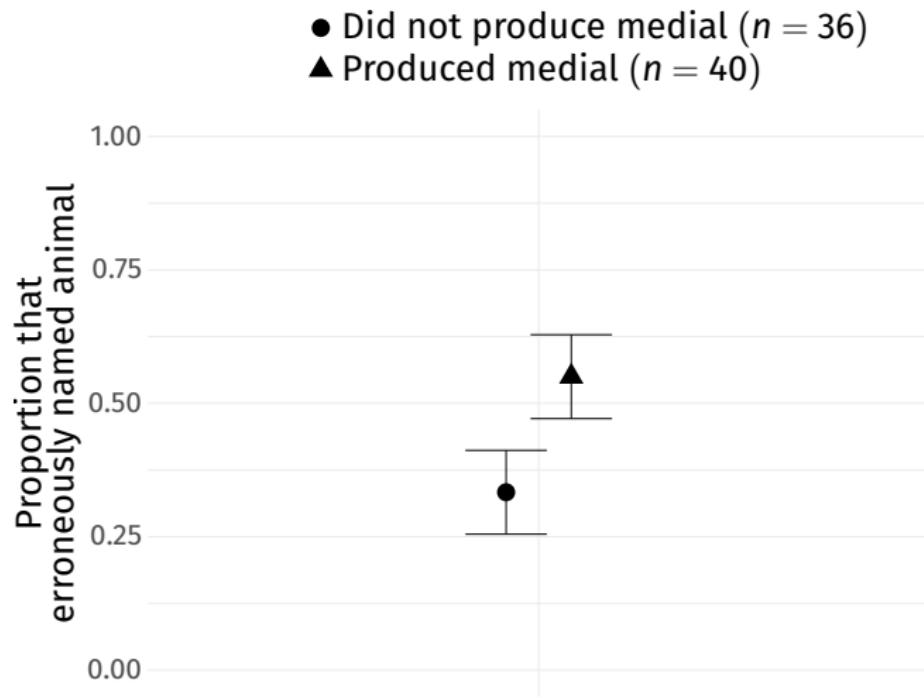
Results

Elicited production



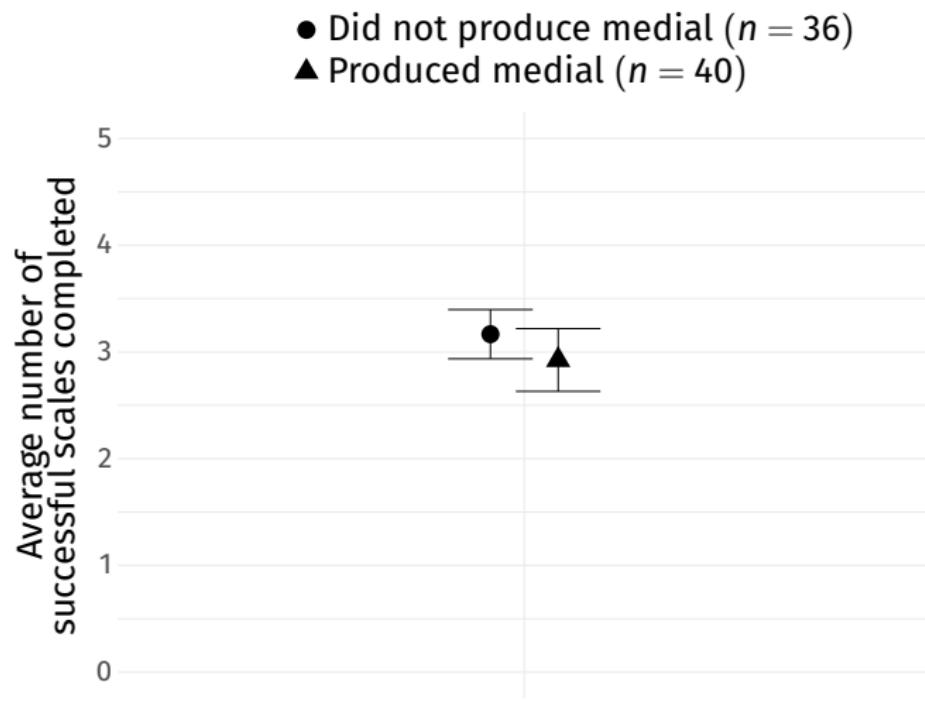
Results

Cognitive inhibition task



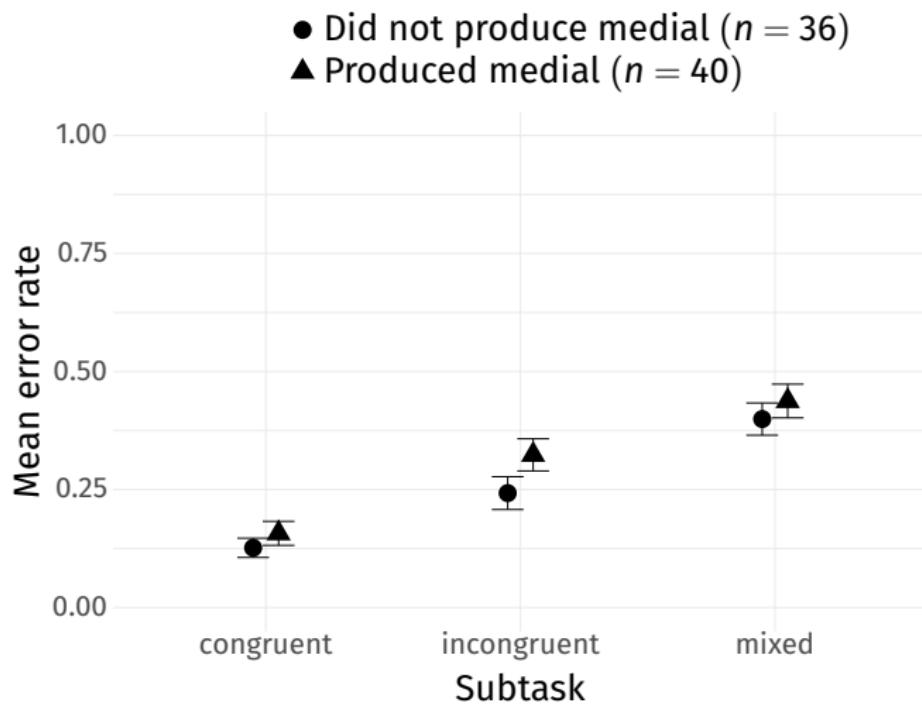
Results

Motor ability task



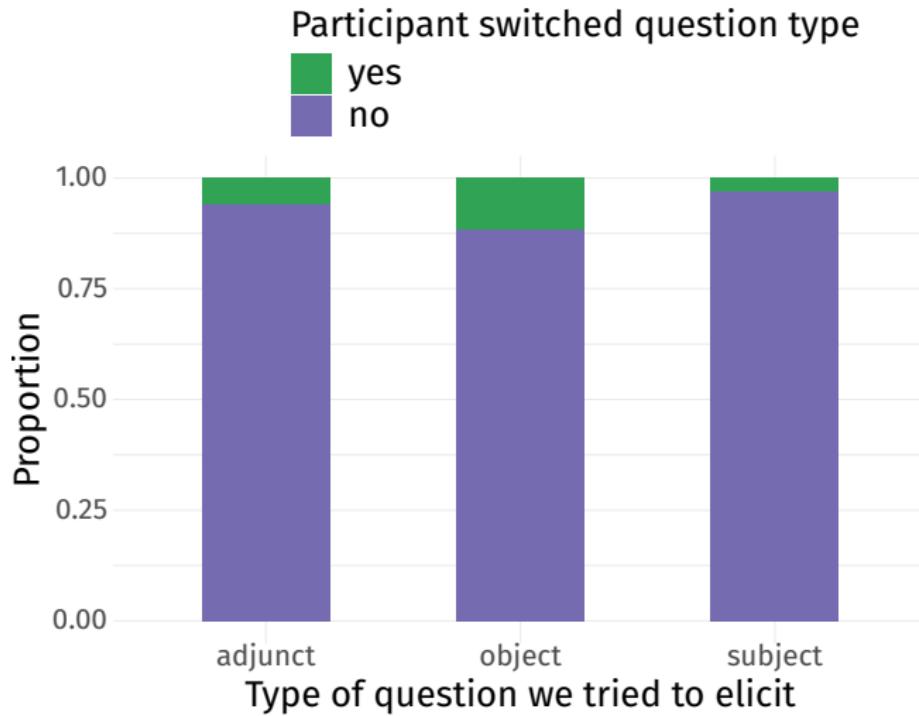
Results

Motor inhibition task



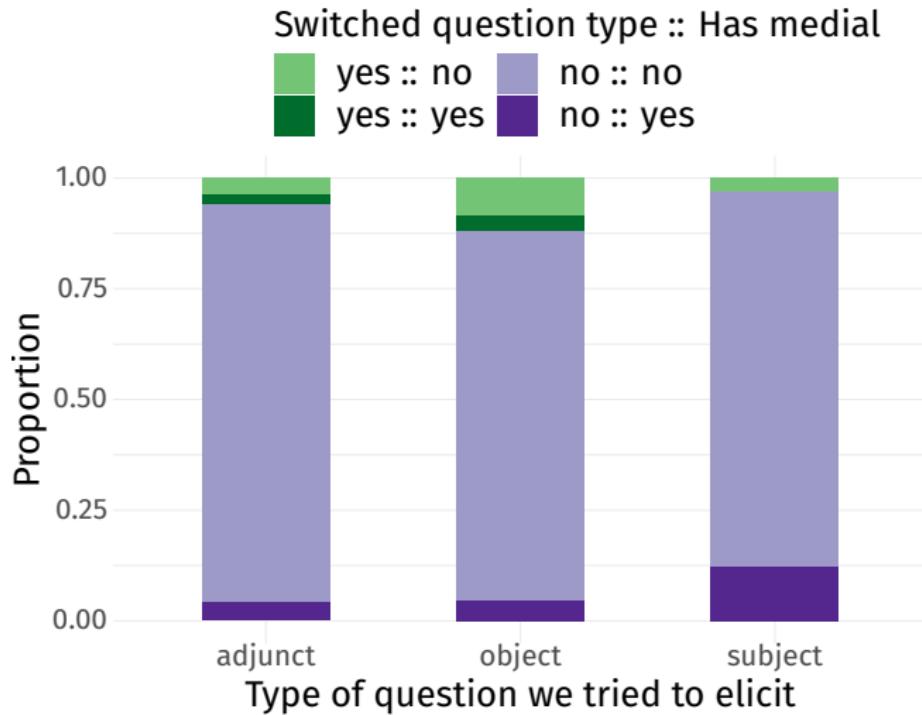
Results

Elicited production



Results

Elicited production



Analysis

- ▶ We fit several logistic mixed-effects model to the data
- ▶ The models predict whether or not a given a trial contained a medial wh-phrase on the basis of several predictor variables

Analysis

Models

- ▶ All models had random intercepts for both participant and trial

	QuestionType	QuestionSwitch	NamedDistractor	IncongruentAcc	NumberOfScales
m1	✓				
m2	✓	✓			
m3	✓	✓	✓		
m4	✓	✓	✓	✓	
m5	✓	✓	✓	✓	✓

Analysis

Model comparison

	AIC	ChiSq	Pr(>ChiSq)	
m1	671.05			
m2	668.66	4.041	0.0360	*
m3	665.94	4.391	0.0299	*
m4	666.05	1.770	0.1695	
m5	666.96	1.095	0.2946	

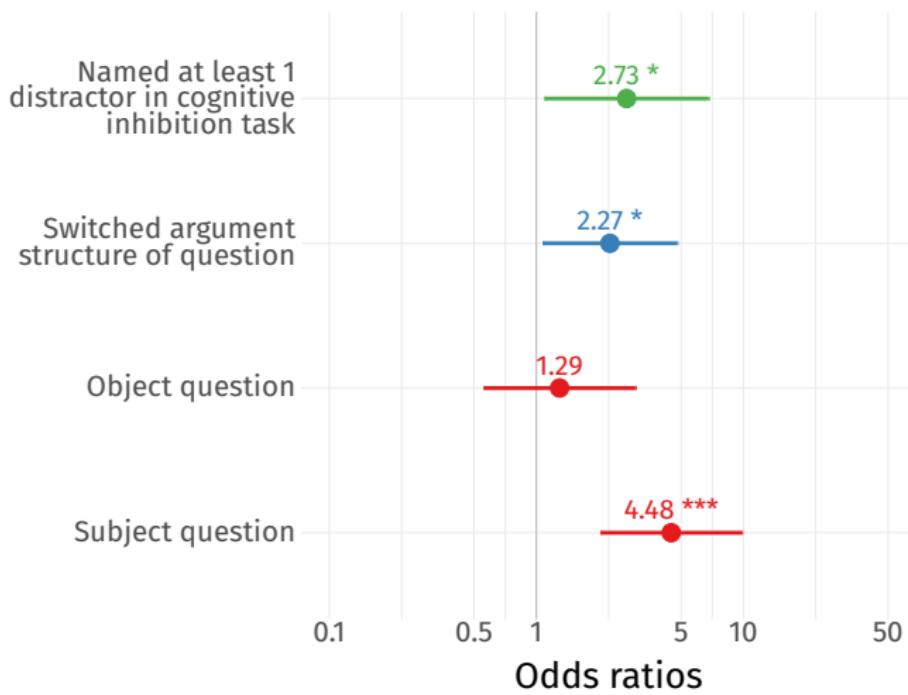
Analysis

Best fitting model

Fixed effect	Estimate	z-value	Pr(> z)	
Intercept	-4.504	-9.088	$1.80e-19$	***
QuestionType - object	0.256	0.597	0.5478	
QuestionType - subject	1.513	3.785	0.0002	***
QuestionSwitch	0.780	2.062	0.0316	*
NamedDistractor	0.944	2.089	0.0310	*

Analysis

Best fitting model – odds ratios



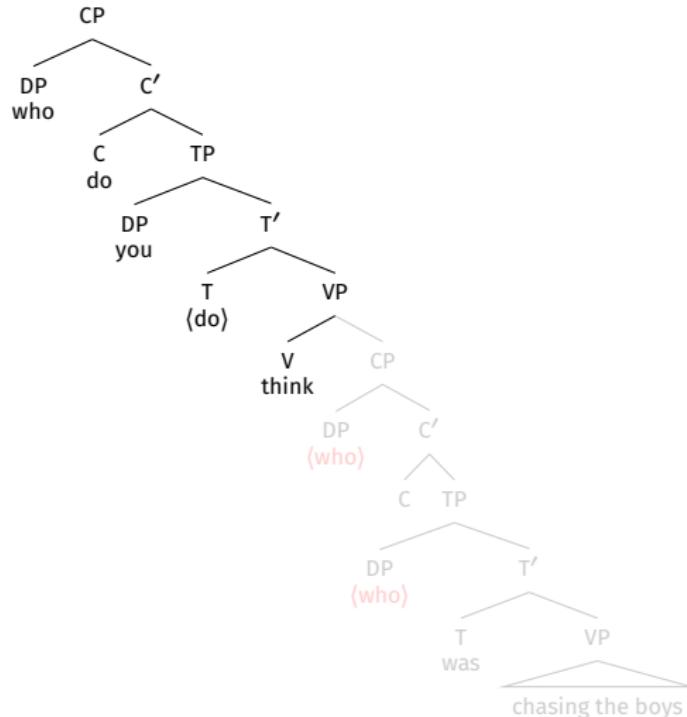
Discussion

Grammar or performance?

- ▶ Both predictions of the performance account were borne out in our study
- ▶ These correlations are surprising on any of the non-target grammar accounts

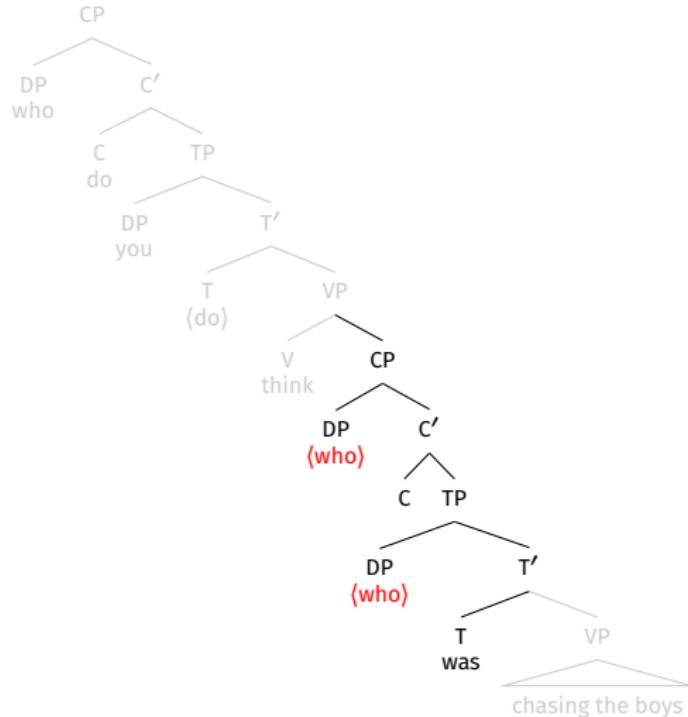
Discussion

Subject asymmetry



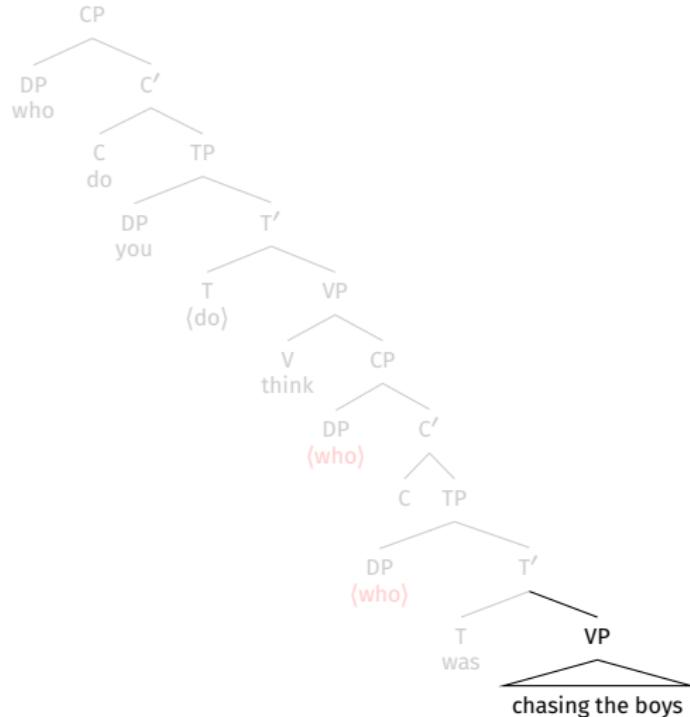
Discussion

Subject asymmetry



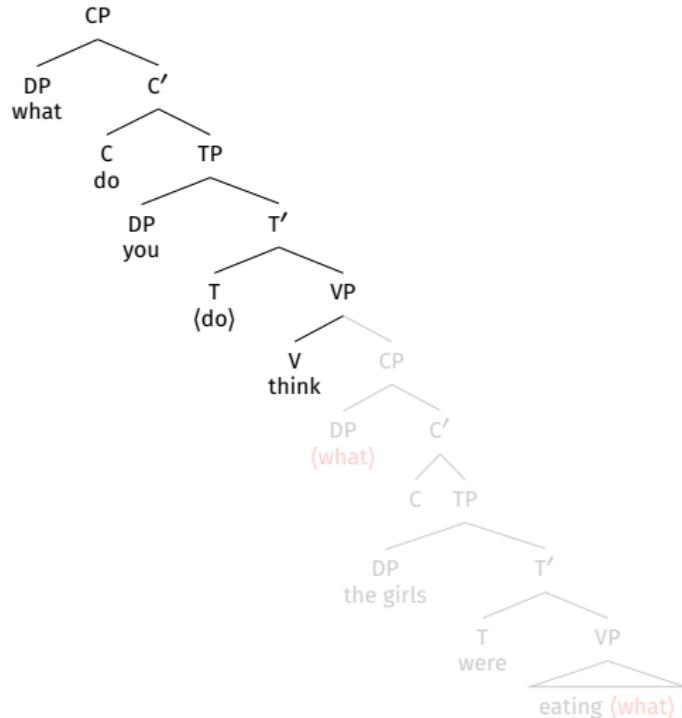
Discussion

Subject asymmetry



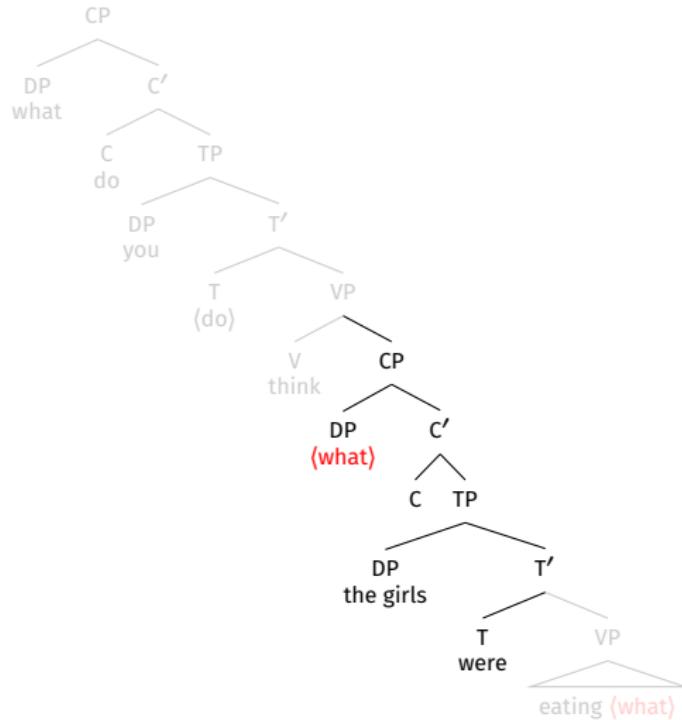
Discussion

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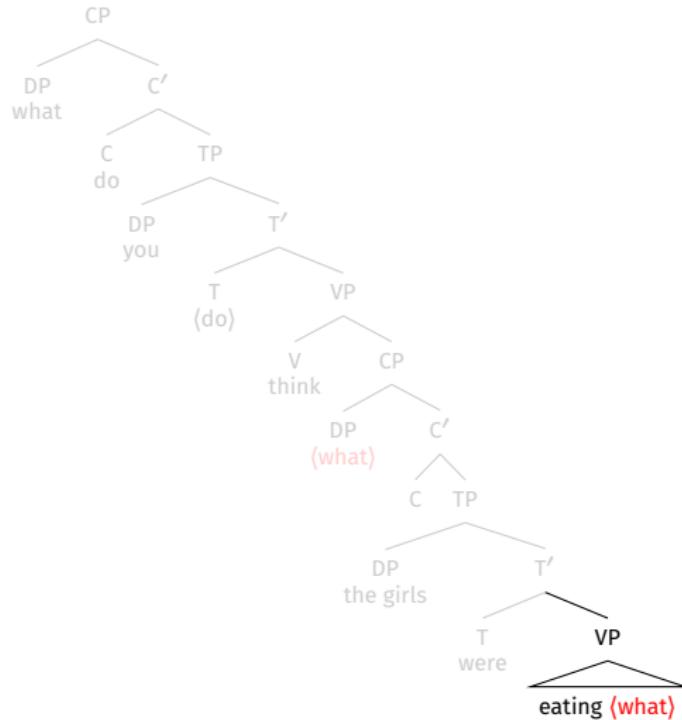
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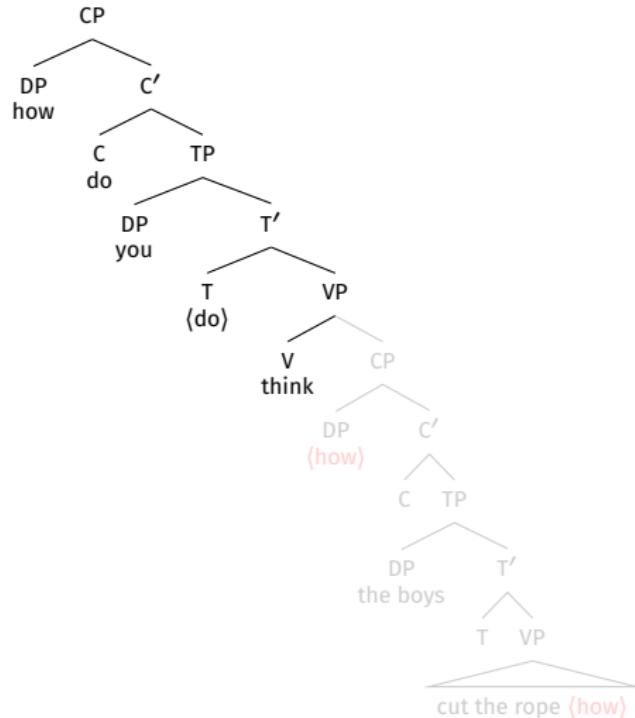
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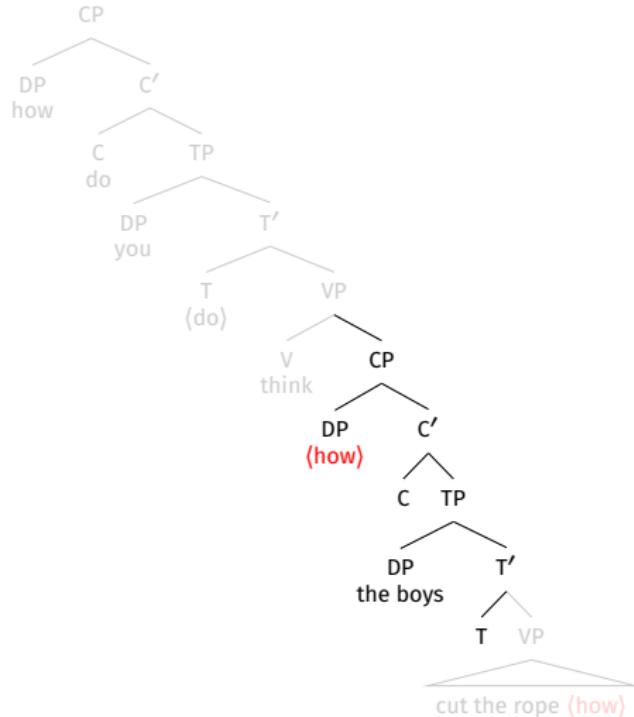
Discussion

Subject asymmetry



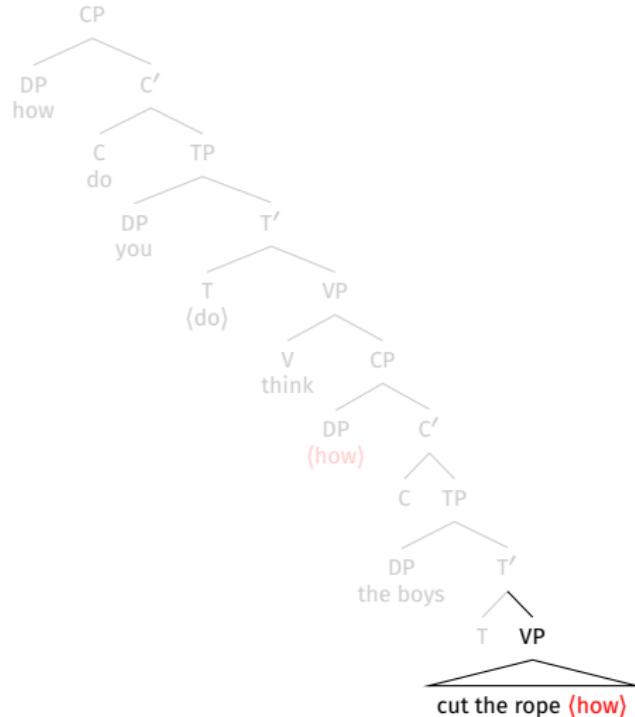
Discussion

Subject asymmetry



Discussion

Subject asymmetry



Conclusions

- ▶ This study provides evidence for a performance based account
- ▶ The subject asymmetry is expected if there is a production planning window that includes spec,CP and spec,TP to the exclusion of the VP

Acknowledgments

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Questions with argument resumption

- ▶ Further support for the idea that this is performance, not grammar, is that we saw several cases of “argument resumption” with a wh-phrase

- (15) Which kid do you think that it was really right? (4;5)
- (16) Who do you think he was really good at it? (4;7)
- (17) Who do you think the boy hide? (3;9)
- (18) Who do you think a kid jumped in the water? (3;9)
- (19) Who do you think the boy saw the girl? (3;8)
- (20) What do you think that the girl was holding a bunny? (4;11)
- (21) What do you think the girl kissed the boy? (4;11)
- (22) What did you think someone was walking on the rope? (5;5)
- (23) What do you think the boy got hit? (5;5)
- (24) Who do you think girl was chasing the boys? (4;8)

Questions with argument resumption

- (25) Snuggles, where do you think the girl was behind the fence?
(4;9)
- (26) Snuggles, how do you think the boy ... the yellow green boy it
was flying with balloons? (4;4)
- (27) Where do you think the green boy hided under the water?
(4;0)
- (28) Where do you think the girl was behind the fence? (4;0)
- (29) Who you thinks he's the good of soccer? (4;4)
- (30) Snuggles, how do you think the girl popped ... popped
[inaudible] watermelon seeds? (4;2)
- (31) Where ... where you think the boys was hiding in the water?
(4;2)
- (32) Snuggles, where do you think the boy was hiding over the
fence? (4;2)

Questions with argument resumption

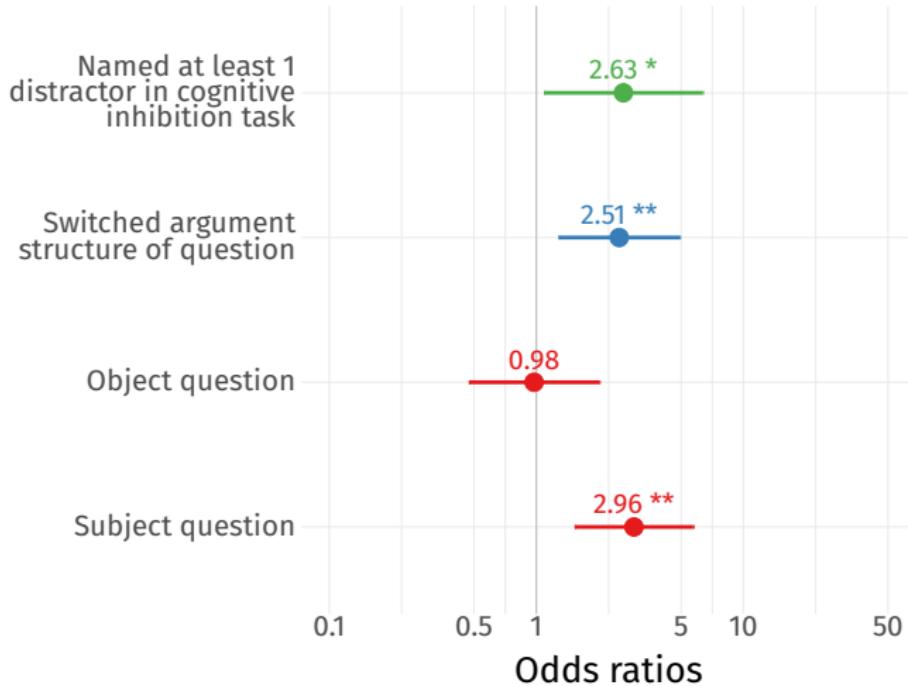
Best fitting model predicting medial wh-phrase or resumption

- ▶ New model with same predictors from best fitting model, predicting either a medial wh-phrase or a resumptive argument

Fixed effect	Estimate	z-value	Pr(> z)	
Intercept	-4.008	-8.850	$8.73e-19$	***
QuestionType - object	-0.025	-0.068	0.9461	
QuestionType - subject	1.086	3.230	0.0012	**
QuestionSwitch	0.921	2.684	0.0073	**
NamedDistractor	0.968	2.153	0.0313	*

Questions with argument resumption

Best fitting model predicting medial wh-phrase or resumption



Costly object wh-dependencies

Wh-element maintained in memory

- ▶ A speaker actively holds a wh-element in memory while producing a sentence (Fadlon et al. 2019)

Costly object wh-dependencies

Wh-element maintained in memory

- (33) Contextual domain: a boy wearing tap shoes; a boy wearing disco pants; a boy wearing cowboy boots
Q: Who would you choose as your dance partner?
A: The boy that is wearing cowboy boots
- (34) Contextual domain: a girl wearing tap shoes; a dog wearing disco pants; a boy wearing cowboy boots
Q: Who would you choose as your dance partner?
A: The boy, who is wearing cowboy boots

Costly object wh-dependencies

Wh-element maintained in memory

