Syntax

Pavel Caha

Sept 30, 2024

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- Why analyse English? What can we learn about Czech syntax when we analyse English?
  - The rules of combination are very similar across languages
  - You also understand what differences there are among languages
  - You are basically forced to apply some abstract tools to concrete examples

The content

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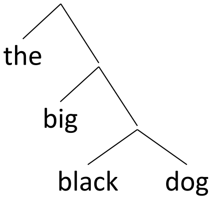
$\Rightarrow$ Phrase structure trees have more information

The two trees

(1) the big black dog

The two trees

(1) the big black dog



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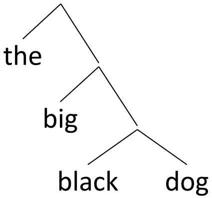

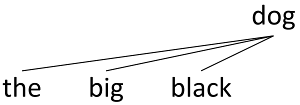

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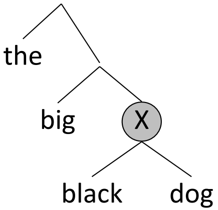

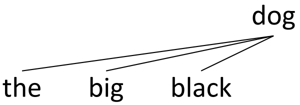

Studying syntax

- Language – human ability to communicate

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- Language – human ability to communicate
- Syntax – ‘putting words together’
- Using finite means to create potentially infinite range of sentences
- How can we characterize/describe this ability?
- What is it that humans have and animals don’t?

Humans

ELSEVIER

Physics of Life Reviews

Volume 11, Issue 3, September 2014, Pages 329-364

Review

Toward a computational framework for cognitive biology: Unifying approaches from cognitive neuroscience and comparative cognition

W. Tecumseh Fitch

(2) Humans have a multi-domain capacity and proclivity to infer tree structures from strings, to a degree that is difficult or impossible for most non-human animal species.

Ambiguity

Variation

Beyond humans

Language as a linear string

Conclusions

Ambiguity

(3) black cab drivers

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a. drivers of black cabs

Ambiguity

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a. drivers of black cabs

b. cab drivers who are black

Ambiguity

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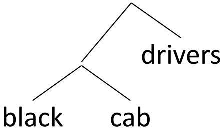
a. drivers of black cabs

b. cab drivers who are black



Ambiguity

(3) black cab drivers

a. drivers of black cabs

b. cab drivers who are black

Ambiguity

(4) black cab drivers

a. drivers of black cabs

b. cab drivers who are black

(5) $5 + 3 \times 2$

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a. $(5 + 3) \times 2 = 16$

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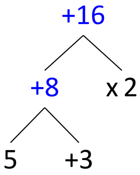

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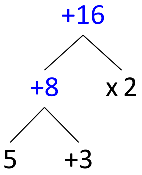

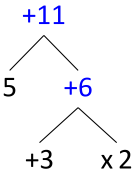

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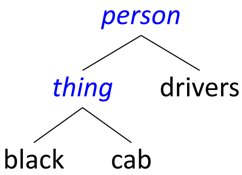

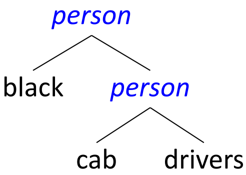

(7) hit the dog with a hat

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a. the dog has a hat on

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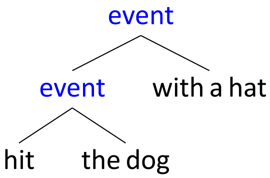

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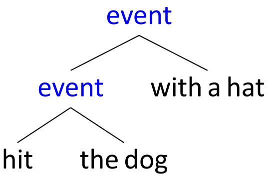
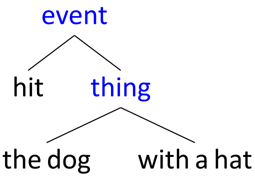
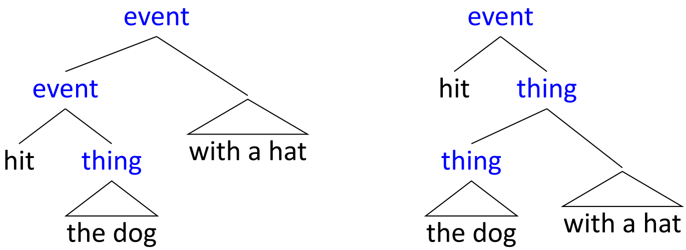




(8) hit the dog with a hat

a. the dog has a hat on
b. you use the hat



Ambiguity

Variation

Beyond humans

Language as a linear string

Conclusions

Meaning and ordering

(9) a. $1 + (2 \times 3)$

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(9) a. $1 + (2 \times 3)$
    b. $1 + (3 \times 2)$

Meaning and ordering

(9) a. 1 + (2 x 3)
b. 1 + (3 x 2)
c. (3 x 2) + 1

Meaning and ordering

(9)
a. $1 + (2 \times 3)$
b. $1 + (3 \times 2)$
c. $(3 \times 2) + 1$
d. $(2 \times 3) + 1$

Meaning and ordering

(1) a. 1 + (2 x 3) [123]
    b. 1 + (3 x 2)
    c. (3 x 2) + 1
    d. (2 x 3) + 1

Meaning and ordering

(1) a. 1 + (2 x 3) [123]
b. 1 + (3 x 2) [132]
c. (3 x 2) + 1
d. (2 x 3) + 1

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b. 1 + (3 x 2) [132]
c. (3 x 2) + 1 [321]
d. (2 x 3) + 1

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(10) SVO vs. SOV

a. (Hans says that) the dog **eats** the bone

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a. (Hans says that) the dog **eats** the bone

b. (Hans sagt dass) der Hund den Knochen **frisst**.
Hans said that the dog the.ACC bone.ACC eats
'(Hans says) that the dog eats the bone.'

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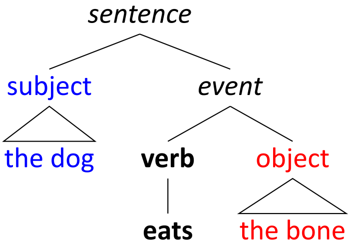

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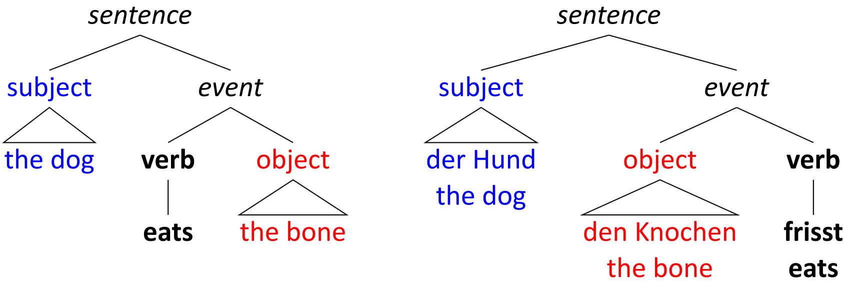

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How to study cognitive abilities

(11) Humans have a multi-domain capacity and proclivity to infer tree structures from strings, to a degree that is difficult or impossible for most non-human animal species.

- How can you figure out whether, e.g., monkeys have such structures?

How to study cognitive abilities

(11) Humans have a multi-domain capacity and proclivity to infer tree structures from strings, to a degree that is difficult or impossible for most non-human animal species.

- How can you figure out whether, e.g., monkeys have such structures?
- How can you figure out whether children have such structures?

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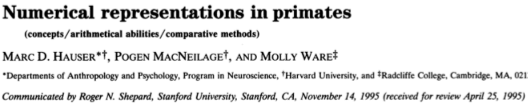
- How can you figure out whether, e.g., monkeys have such structures?
- How can you figure out whether children have such structures?
- Preferential looking paradigm

counting



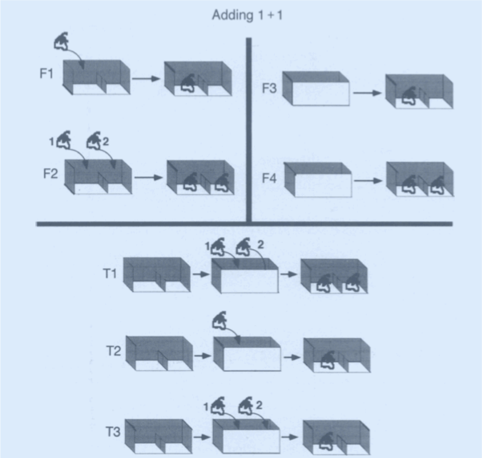
Numerical representations in primates

(concepts/arithmetical abilities/comparative methods)

MARC D. HAUSER*†, POGEN MACNEILAGE†, AND MOLLY WARE‡

*Departments of Anthropology and Psychology, Program in Neuroscience, †Harvard University, and ‡Radcliffe College, Cambridge, MA, 021

Communicated by Roger N. Shepard, Stanford University, Stanford, CA, November 14, 1995 (received for review April 25, 1995)



counting

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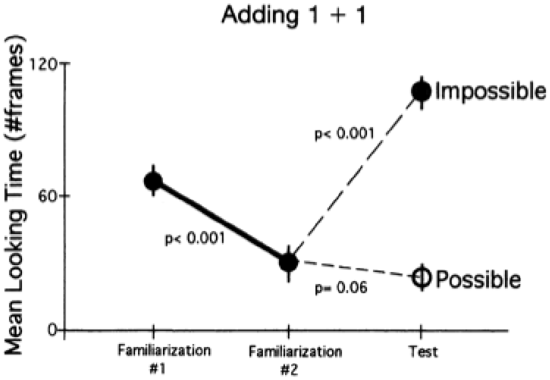
Adding 1 + 1
Mean Looking Time (#frames)
120
60
0
Impossible
Possible
p< 0.001
p< 0.001
p= 0.06
Familiarization
#1
Familiarization
#2
Test

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Strings

(12) a. Mary invited Sue
b. Sue invited Mary
c. AGENT > PATIENT

Strings

(12)	a.	Mary invited Sue
	b.	Sue invited Mary
	c.	AGENT > PATIENT
(13)	a.	John pushed Bill
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Strings

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WALS

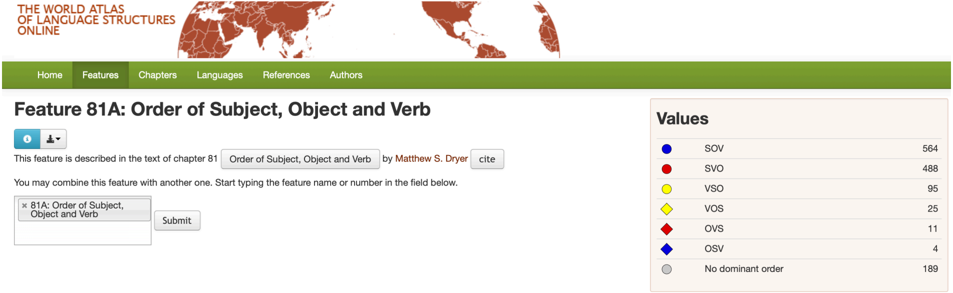

Figure: This is an image from WALS

Strings

(14) a. Mary turned Sue (around)

Strings

(14) a. Mary turned Sue (around)
     b. Mary and Sue turned (around)

Strings

(14) a. Mary turned Sue (around)

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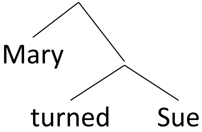

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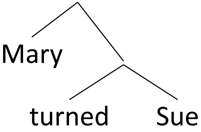

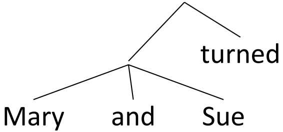

Kanzi

Dendrophobia in Bonobo Comprehension of Spoken English

ROBERT TRUSWELL

Kanzi

Kanzi

(1) 287. (C) *Kanzi, take the tomato to the colony room*. (Kanzi makes a sound like ‘orange’; he then takes both the tomato and the orange to the colony room.) [C is scored because it is assumed that Kanzi is announcing that he wants to take an orange and have it to eat.]

Our interest is in the distribution of ‘correct’ responses (coded C or C1–C5) versus incorrect responses (including PC and OE) across different syntactic structures. Savage-Rumbaugh *et al.* (1993, p. 77) give Kanzi’s overall accuracy across the corpus as 71.5%, slightly higher than the 66.6% accuracy of Alia, a human infant tested on a similar set of utterances over a 6-month period, starting when she was 18 months

Kanzi

(2) a. 525. (C) *Put the tomato in the oil.* (Kanzi does so.)
b. 528. (C) *Put some oil in the tomato.* (Kanzi picks up the liquid Baby Magic oil and pours it in a bowl with the tomato.)

There are 43 sentences presented in such alternations in the corpus—21 pairs, with one sentence repeated (Savage-Rumbaugh *et al.*, 1993, pp. 95–6). Kanzi responds accurately to 33 of them (76.7%), in line with his 71.5% overall accuracy across the corpus.

Kanzi

(9) a. 428. (PC) *Give the water and the doggie to Rose.* (Kanzi picks up the dog and hands it to Rose.)
b. 526. (PC) *Give the lighter and the shoe to Rose.* (Kanzi hands Rose the lighter, then points to some food in a bowl in the array that he would like to have to eat.)
c. 281. (C) *Give me the milk and the lighter.* (Kanzi does so.)

The same trials were presented to a human infant, Alia. Alia's accuracy across the whole corpus was slightly lower, at 66%, but her accuracy on the NP-coordination trials is indistinguishable from this baseline, at $\frac{13}{19}$, or 68.4%.[8] This suggests a species-specific, construction-specific deficit. Kanzi marginally outperforms Alia across the whole corpus, but he performs much worse than both his usual standard and the human control (Fisher exact test, $p = 0.008$), on this one construction.

Structure vs. Linearity

Cognition 124 (2012) 85–94

Contents lists available at SciVerse ScienceDirect

Cognition

journal homepage: www.elsevier.com/locate/COGNIT

Brief article

Predicted errors in children's early sentence comprehension

Yael Gertner, Cynthia Fisher *

University of Illinois at Urbana-Champaign, Champaign, IL 61820, United States

Event-Pair Accompanying Novel Verb 1

Simultaneous-action event *Causal event*

Transitive: The boy is gorping the girl!
Agent-first: The boy and the girl are gorping!
Patient-first: The girl and the boy are gorping!

The setup

a

(blank-screen interval)	Hey, watch! (3s)
	Look here. Watch this! (5s)
(blank-screen interval)	Oh, look! (2s)
	Look over here. Watch this! (5s)
(blank-screen interval)	Now watch. The boy and the girl are gonna eat. (6s)
 	The boy and the girl are eating. The boy and the girl are eating. See? (8s)
(blank-screen interval)	The boy and the girl were eating. Find eating! (6s)
 	The boy and the girl are eating. Find eating! Find eating! (8s)

The experiment

a

(blank-screen interval)	Hey, watch! (3s)
	Look here. Watch this! (5s)
(blank-screen interval)	Oh, look! (2s)
	Look over here. Watch this! (5s)
(blank-screen interval)	Now watch. The boy and the girl are gonna gorp. (6s)
 	The boy and the girl are gorping. The boy and the girl are gorping. See? (8s)
(blank-screen interval)	The boy and the girl gorped. Find gorping! (6s)
 	The boy and the girl are gorping. Find gorping! Find gorping! (8s)

The results

Y. Gertner, C. Fisher / Cognition 124 (2012) 85–94 91

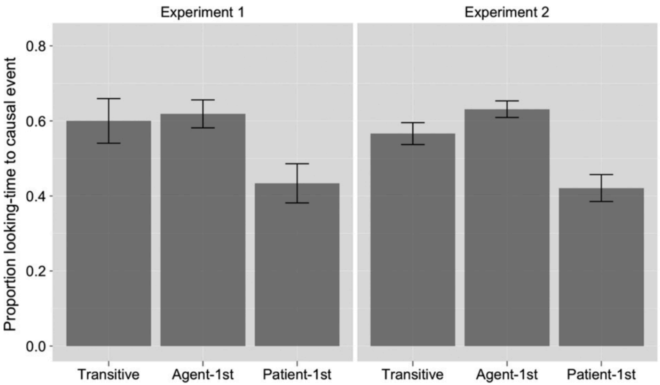

Fig. 6. Mean (se) proportion of time spent looking at the causal event, as a proportion of time spent looking at either the causal or simultaneous-action event, averaged across the four 8 s test-trials, Experiments 1 and 2.

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conclusions

(15) Humans have a multi-domain capacity and proclivity to infer tree structures from strings, to a degree that is difficult or impossible for most non-human animal species.

conclusions

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a. ambiguity

conclusions

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a. ambiguity

b. language variation

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a. ambiguity
b. language variation
c. little reliance on ordering cues

speculations (I believe this to be Chomsky's current position)

- Merge: an operation that (recursively) groups lexical items together

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- Merge: an operation that (recursively) groups lexical items together
- It may also group other things (the ability for math)
- Recursive Merge is the only thing specific to humans
- sidenote
  - Piraha has no "recursion" (Daniel Everett)

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  - even if the did not have recursion, this is completely irrelevant (Chomsky)

References