Executive function adaptation and syntactic priming

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INTRODUCTION

Executive Function (EF) adaptation: after a hard cognitive control trial, other tasks become easier, including language tasks.

Hsu and Novick (2016): after incongruent compared to congruent Stroop trials, participants are better at recovering from PP attachment garden paths (*Put the frog on the napkin onto the box*, in which *on the napkin* needs to be revised from a modifier of *frog* to the goal of *put*).

QUESTIONS

Question 1.
Can we replicate the EF adaptation effect with a different syntactic structure (reduced relative clauses)?
If so, reduced relatives (RRs) will be read more quickly at the point of disambiguation when the sentence is preceded by an incongruent vs. congruent Stroop task.

Question 2.
Does EF adaptation imply inhibition of the initial reading, that is, the main clause (MC) reading in the case of RR/MC ambiguities?
If so, when the RR prime sentence is preceded by an incongruent vs. congruent Stroop trial, a following RR/MC sentence (target sentence) will be processed…
2a. … even faster at the point of disambiguation towards an RR (since an MC reading may not be even considered) → larger RR to RR priming effect
2b. … slower at the point of disambiguation towards an MC (since the inhibition of the MC structure needs to be undone)

METHODS

Participants:
56 monolingually raised speakers of American English
Aged 18-35 years old
No history of dyslexia or other problems related to language or reading
Materials:
4 prime-target conditions, see example sentences below
18 prime-target pairs per experimental condition, Latin Squared
72 fillers (distractor items, some without Stroop, some with MC to balance number of MCs and RRs in the study)
Yes/No comprehension questions after 14% of the sentences (never after the prime in critical trials)
Task:
Self-paced reading paradigm (word-by-word non-cumulative moving window)
Interleaved with 2-word Stroop trials:
Instruction: Does the meaning of the first word match the color of the second?
Congruent Stroop: **BLUE** **BLUE** (Yes) ; **BLUE** **RED** (No)
Incongruent Stroop: **BLUE** **RED** (Yes) ; **BLUE** **BLUE** (No)

EXAMPLE SENTENCES

(1) *Congruent Stroop trial; RR prime; RR target*
Stroop: **BLUE** **BLUE** (Answer: Yes)
Prime: The | students | helped | **by** | **the** | **counselor** | were | grateful | for | the | aid.
Target: The | surgeons | helped | **by** | **the** | **resident** | were | exhausted | by | the | operation.

(2) *Incongruent Stroop trial; RR prime; RR target*
Stroop: **BLUE** **RED** (Answer: Yes)
Prime: The | students | helped | **by** | **the** | **counselor** | were | grateful | for | the | aid.
Target: The | surgeons | helped | **by** | **the** | **resident** | were | exhausted | by | the | operation.

(3) *Congruent Stroop trial; RR prime; MC target*
Stroop: **BLUE** **RED** (Answer: No)
Prime: The | students | helped | **by** | **the** | **counselor** | were | grateful | for | the | aid.
Target: The | surgeons | helped | **the** | **resident** | revive | the | dying | man | on | the | cot.

(4) *Incongruent Stroop trial; RR prime; MC target*
Stroop: **BLUE** **BLUE** (Answer: No)
Prime: The | students | helped | **by** | **the** | **counselor** | were | grateful | for | the | aid.
Target: The | surgeons | helped | **the** | **resident** | revive | the | dying | man | on | the | cot.

Q1: RR primes @ "by the N" read faster after incongruent than congruent Stroop?

Q2a: priming effect (RR primes-RR targets) @ "by the resident" larger after incongruent than congruent Stroop?

Q2b: MC targets @NP "the resident" read slower after incongruent than congruent Stroop?

Table 1: results from Stroop task

Stroop Condition	ACC	RT (msec)
Congruent-Yes	1.00	1013
Congruent-No	0.99	**1276**
Incongruent-Yes	0.98	1193
Incongruent-No	0.98	1203

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EXAMPLE TRIAL

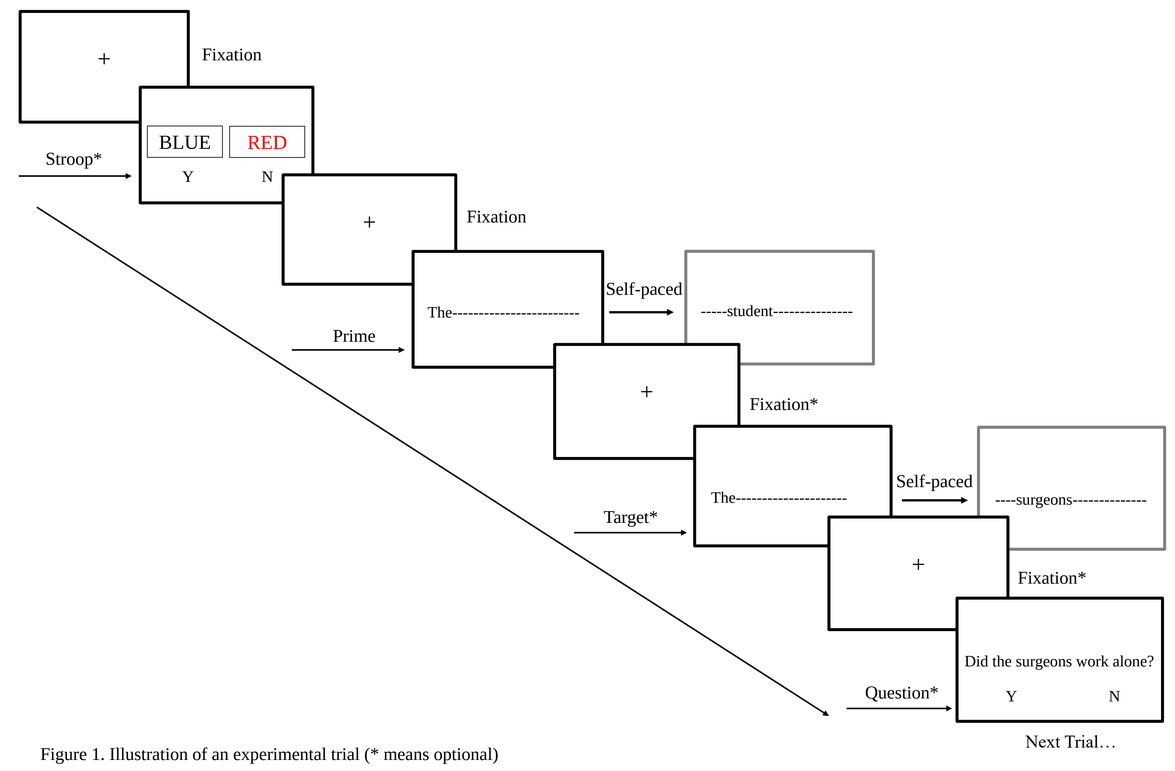
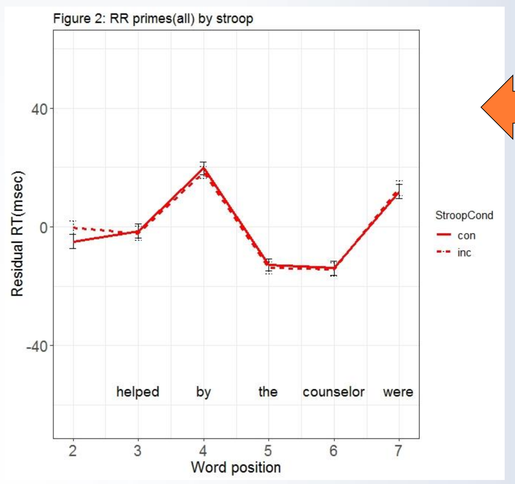
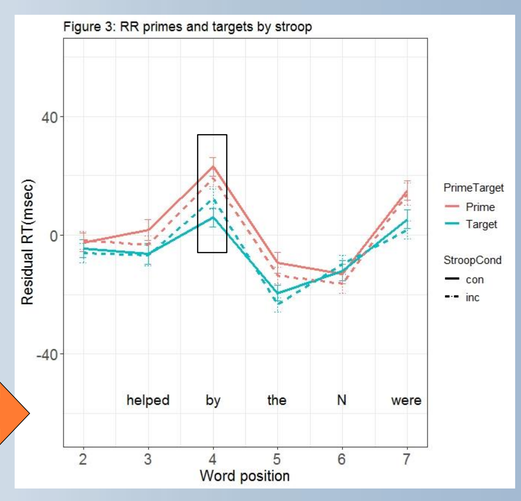


Figure 1. Illustration of an experimental trial (* means optional)

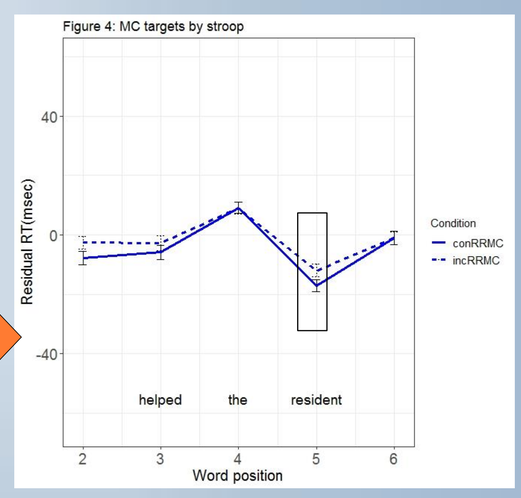
RESULTS



Q1: Are RR primes affected by preceding Stroop congruency?
Fig 2: No



Q2a: Is the RR Priming effect (RR primes vs. targets) modulated by preceding Stroop congruency?
Fig 3: Yes, but marginal: Priming x Stroop at "by" b=10.5, SE=6.2, T= 1.7, p<.09), but the priming effect is larger for trials following *congruent* than *incongruent* Stroop!



Q2b: Are the MC targets affected by preceding Stroop congruency?
Fig 4: Yes, but marginally (at the noun "residents", b = 7.9, SE = 4.6, T= 1.7, p < .09); the MC targets are read slower following incongruent than congruent Stroop

DISCUSSION AND CAVEATS

- Predictions were not borne out:
  No effects of EF adaptation at the prime.
  If anything, the RR priming effect is smaller after incongruent than congruent Stroop trials.
  No strong evidence for EF adaptation affecting the inhibition of the initial MC reading.
- Alternative explanation:
  An incongruent Stroop leads to sustained monitoring, resulting in slow-down of reading at points of disambiguation.
- Caveat:
  Our Stroop manipulation may not have been effective: RTs for congruent "NO" trials were longer than for incongruent trials (Table 1). The "congruent" trials may therefore not have differed much from incongruent trials in terms of EF engagement. We are currently running a study with a more traditional 1-word Stroop task: **RED** vs. **BLUE**.