No Evidence for Conflict Adaptation in the Processing of Reduced Relative Clause Ambiguities

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Conflict adaptation

- Cognitive conflict (*e.g.,* > > < > >) upregulates cognitive control
  - Thus, **facilitating** conflict resolution in following trial (*e.g.,* < < > < <)

- Can this adaptation cross domains, from linguistic to non-linguistic and *vice versa*?
  - If so, this could be evidence for **domain-general cognitive control** in language processing.

Botvinick, et al., 2001; Botvinick, 2007

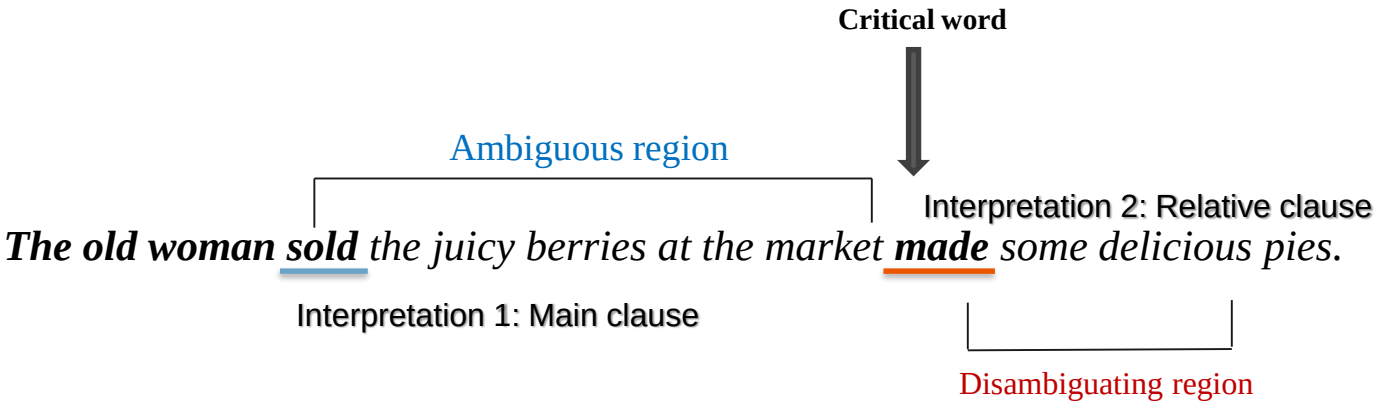
Results from Previous Studies

The evidence for cross-domain *conflict adaptation* has been mixed:

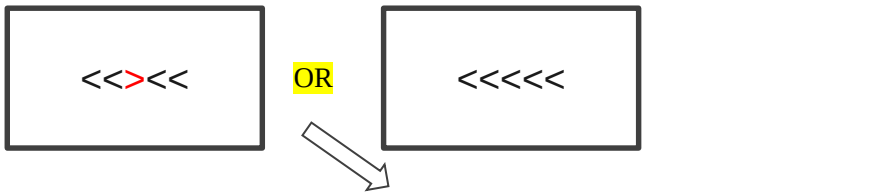
- Cross-task adaptation (Kan et al., 2013; Hsu & Novick, 2016; Hsu et al. 2020; Ness et al., AMLAP 2021)
  - Non-linguistic domain to linguistic domain (e.g. syntactic conflict – Stroop conflict)
  - Linguistic domain to non-linguistic domain (e.g. Stroop conflict - sentence ambiguity)
- No clear evidence (Kaan et al., AMLAP 2019; Kuz et al. CUNY 2021)
  - Non-linguistic domain to linguistic domain (e.g. Stroop conflict – reduced relatives ambiguity)

This study: tests a construction known to elicit large garden path effects (hence stronger conflict?)

Reduced Relative Clause



Research Questions



Q1:
Does congruency of flankers (in/congruent) affect the ambiguity resolution of following RRs?

P1:
Garden-path effect will be smaller for sentences preceded by incongruent vs. congruent flankers.

… **sold** | the | juicy | berries… (Ambiguous)

OR

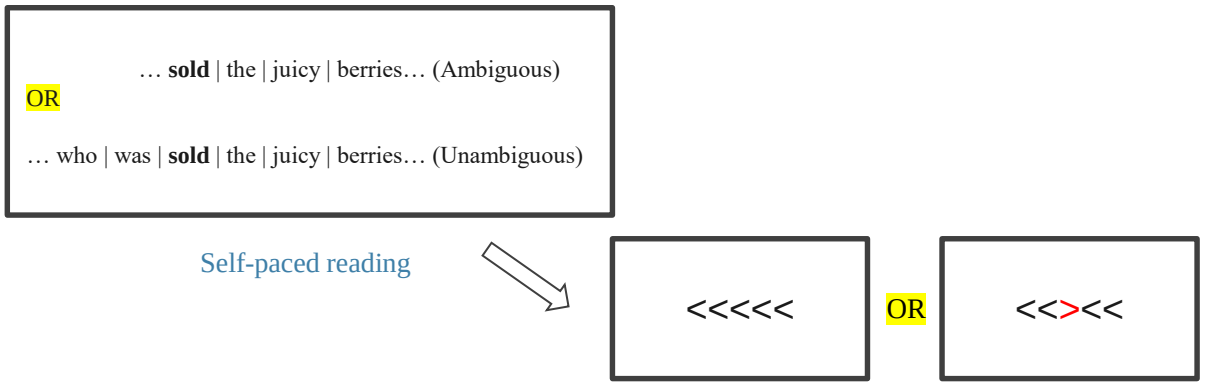
… who | was | **sold** | the | juicy | berries… (Unambiguous)

Self-paced reading

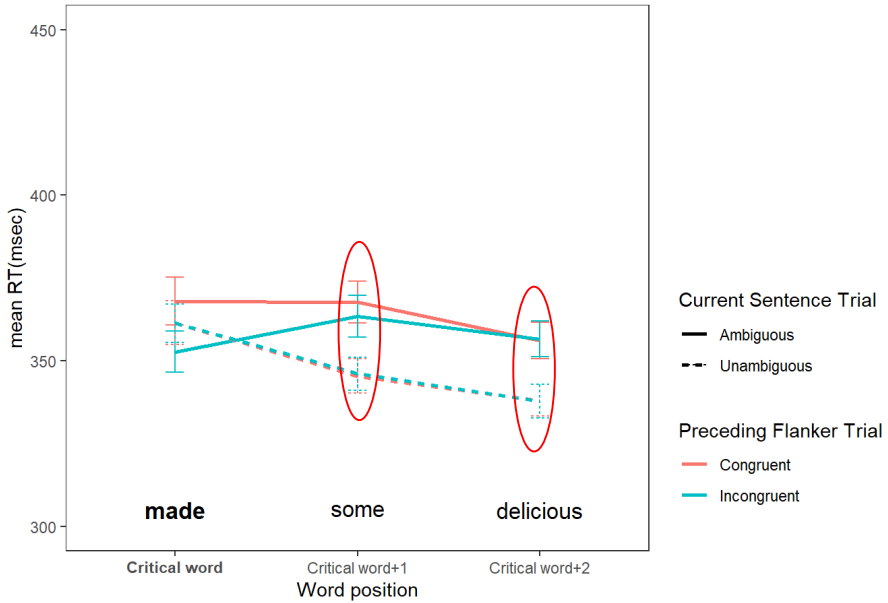
Research Questions

Q2:
Does sentence type (un/ambiguous) affect accuracy and RT to the following (in/congruent) Flankers?

P2:
Conflict effect will be smaller for flankers preceded by ambiguous vs. unambiguous sentences.



Results: Question 1

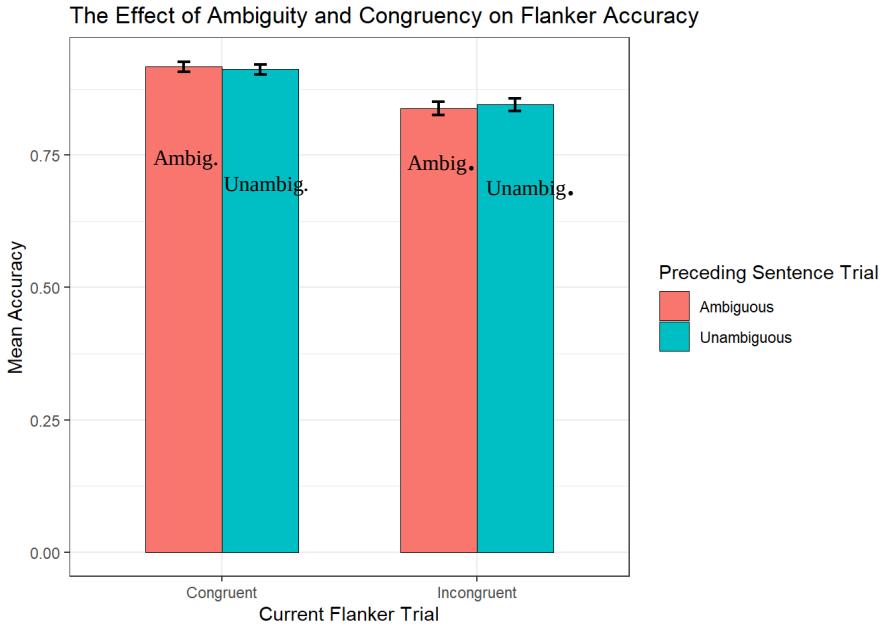


- Garden-path effect: RTs significantly longer for ambiguous vs. unambiguous sentences at the 2 words following the critical word (red circles on plot)

However,

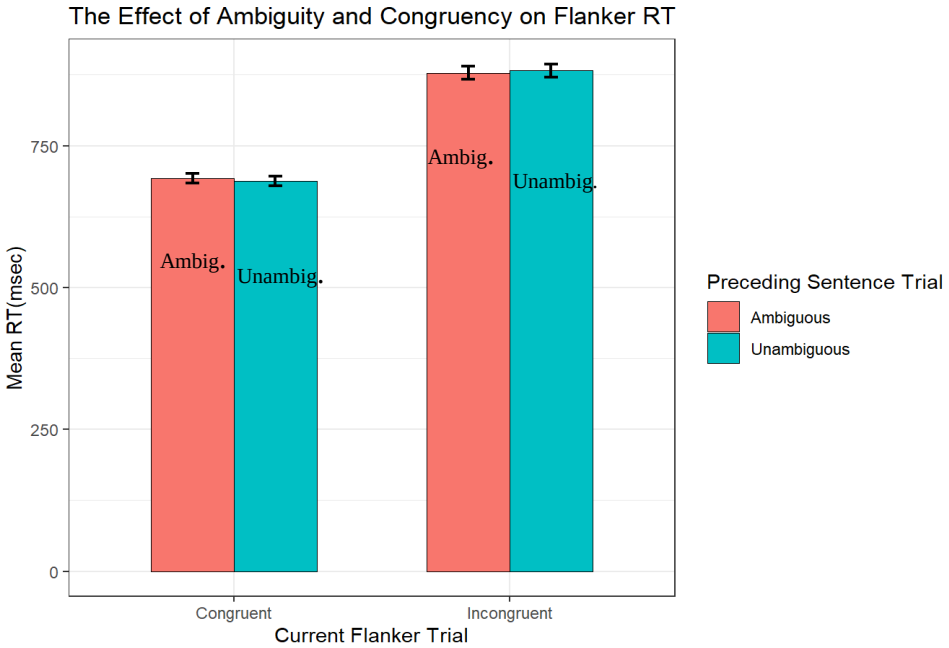
- No interaction between sentence ambiguity and Flanker congruency (b = 5.66, t = 0.59, p = 0.553).
- main effect of Flanker congruency is marginally significant at the critical word

Results: Question 2 Flanker Accuracy



- Conflict effect: accuracy is significantly higher for congruent than incongruent Flankers.
- No interaction between sentence ambiguity and Flanker congruency on Flanker Accuracy ($b = 0.17$, $t = 0.69$, $p = 0.491$)

Results: Question 2 Flanker RT



- Conflict effect: RT is faster for congruent than incongruent Flankers.
- No interaction between sentence ambiguity and Flanker congruency on Flanker RTs (b = 10.41, t = 0.69, p = 0.491)

Discussion

- Predictions were not borne out.
- Possible reasons for difference with prior studies:
  - Our RRs may be hard to revise, thus no conflicting interpretations, thus no effect on Flankers?
    - However, analysis on 46 participants that performed well (75% correct) on comprehension questions probing RR interpretation yielded no Conflict x Ambiguity interactions

Take-home message

In our study,

- We found no evidence for *conflict adaptation* in the processing of reduced relative clause ambiguities.
- No clear evidence supporting that *conflict adaptation* occurs between non-linguistic and linguistic domains.

Thank you!

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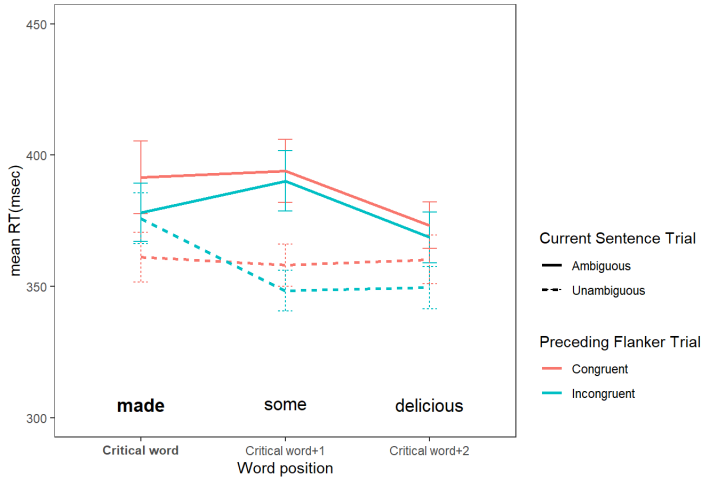
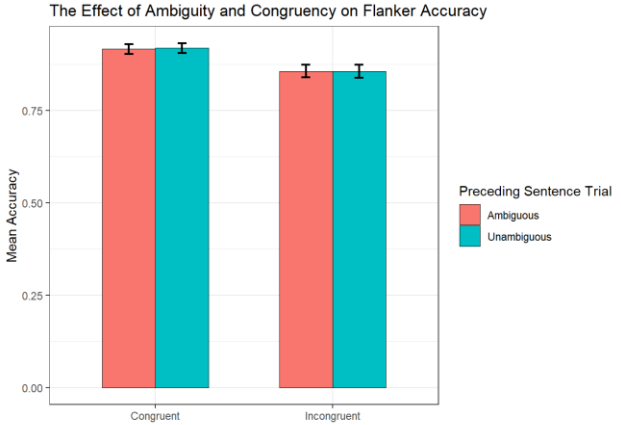
Participants

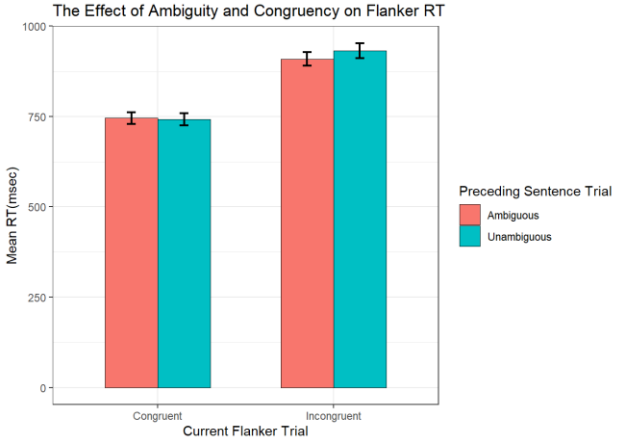
- **96 monolingual** of American English
- All recruited online from **Mturk** and **Prolific**
- Age: **18-70** years old (mean = 41)
- All have accuracy rate of answers on Flankers and questions after distractor sentences higher than 80%.
- 56 Experimental trials (14*4 conditions), 56 Fillers, 56 Flanker distractors.

Discussion plus

- “Good Readers”







Materials

Condition	Example sentence	Flanker
Unambiguous-incongruent	The old woman **who** was sold the juicy berries at the market made some delicious pies.	<<><<
Ambiguous-congruent	The old woman ___ sold the juicy berries at the market made some delicious pies.	>>>>>
Unambiguous-congruent	The generous leader **who** was donated the plot of land on the coast promised to protect it.	<<<<<
Ambiguous-incongruent	The generous leader ___ donated the plot of land on the coast promised to protect it.	>><>>

Model details: Question 1

Table 1. Linear Mixed-effects model for critical word RT

	Flanker ACC				
Parameters	*EStimate*	*95% CI*	*SE*	*t*	*p*
(Intercept)	7.22 *	0.43,14.01	3.47	2.08	0.037
cFlankerType	-7.95	-17.28,1.39	4.76	-1.67	0.095
cSentType	1.74	-7.58,11.07	4.76	0.37	0.714
cFlankerType:cSentType	5.66	-13.03,24.35	9.54	0.59	0.553
SD (Intercept)	24.50				
SD (Observations)	11.19				
Random Effects					
σ^2	15694.36				
$\tau_{00\ Subject}$	600.19				
$N_{Subject}$	96				
Observations	2795				
Marginal R^2 / Conditional R^2	0.001 / 0.038				

*$p<0.05$ **$p<0.01$ ***$p<0.001$

Table 2. Linear Mixed-effects model for critical word+1 RT

	Flanker ACC				
Parameters	*EStimate*	*95% CI*	*SE*	*t*	*p*
(Intercept)	7.25 *	0.80,13.70	3.29	2.20	0.028
cFlankerType	-0.60	-9.24,8.04	4.41	-0.14	0.892
cSentType	-23.81 ***	-32.44,-15.17	4.41	-5.40	<0.001
cFlankerType:cSentType	-0.35	-17.65,16.95	8.83	-0.04	0.969
SD (Intercept)	23.78				
SD (Observations)	10.78				
Random Effects					
σ^2	13497.81				
$\tau_{00\ Subject}$	565.66				
$N_{Subject}$	96				
Observations	2806				
Marginal R^2 / Conditional R^2	0.010 / 0.050				

*$p<0.05$ **$p<0.01$ ***$p<0.001$

Table 3. Linear Mixed-effects model for critical+2 word RT

	Flanker ACC				
Parameters	*EStimate*	*95% CI*	*SE*	*t*	*p*
(Intercept)	-0.78	-7.95,6.39	3.66	-0.21	0.831
cFlankerType	-0.45	-7.81,6.92	3.76	-0.12	0.905
cSentType	-18.59 ***	-25.97,-11.22	3.76	-4.94	<0.001
cFlankerType:cSentType	-0.01	-14.75,14.73	7.52	-0.00	0.999
SD (Intercept)	30.60				
SD (Observations)	9.96				
Random Effects					
σ^2	9858.00				
$\tau_{00\ Subject}$	936.46				
$N_{Subject}$	96				
Observations	2824				
Marginal R^2 / Conditional R^2	0.008 / 0.094				

*$p<0.05$ **$p<0.01$ ***$p<0.001$

Model details: Question 2

Table 4. Generalized Linear Mixed-effects model for Flanker Acc

	Flanker ACC				
Parameters	*EStimate*	*95% CI*	*SE*	*t*	*p*
(Intercept)	4.04 ***	3.31,4.78	0.37	10.85	<0.001
cFlankerType	-0.89 ***	-1.13,-0.64	0.12	-7.15	<0.001
cSentType	-0.01	-0.25,0.23	0.12	-0.08	0.935
cFlankerType:cSentType	0.17	-0.31,0.65	0.25	0.69	0.491
SD (Intercept)	0.19				
SD (Intercept)	2.15				
SD (Observations)	1.00				
Random Effects					
σ^2	3.29				
$\tau_{00\ Subject}$	0.04				
$\tau_{00\ Item}$	4.61				
N_{Item}	56				
$N_{Subject}$	96				
Observations	3464				
Marginal R^2 / Conditional R^2	0.024 / 0.596				

*$p<0.05$ **$p<0.01$ ***$p<0.001$

Table 5. Generalized Linear Mixed-effects model for Flanker RT

	Flanker ACC				
Parameters	*EStimate*	*95% CI*	*SE*	*t*	*p*
(Intercept)	784.89 ***	747.51,822.28	19.08	41.15	<0.001
cFlankerType	197.06 ***	182.23,211.89	7.57	26.04	<0.001
cSentType	-0.81	-15.67,14.06	7.58	-0.11	0.915
cFlankerType:cSentType	10.41	-19.26,40.07	15.14	0.69	0.492
SD (Intercept)	183.19				
SD (Observations)	14.37				
Random Effects					
σ^2	42687.16				
$\tau_{00\ Subject}$	33559.69				
$N_{Subject}$	96				
Observations	3000				
Marginal R^2 / Conditional R^2	0.113 / 0.503				

*$p<0.05$ **$p<0.01$ ***$p<0.001$

References

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