

Relative Clause Extraposition and Prosody

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Extrapolation of (Restrictive) Relative Clauses

- (1) a. Peter hat jemanden besucht, **der krank ist**. (RRC)
 'Peter has visited someone who is ill.'
- b. Peter hat niemandem gesagt, **dass er krank ist**. (CC)
 'Peter didn't tell anybody that he is ill.'
- (2) a. Peter hat jemanden, **der krank ist**, besucht. (RRC)
 Peter has visited someone who is ill.'
- b. *Peter hat niemandem, **dass er krank ist**, gesagt. (CC)
 'Peter didn't tell anybody that he is ill'

(Some) Factors affecting Extraposition of (R)RCs:

- ▶ **Length (of the RRC):**
Longer RCs tend to be extraposed. (e.g. Cullicover and Jackendoff, 2005)
- ▶ **Distance (between RRC and Head)**
The acceptability of RCE is inversely proportional to the distance between RC and head. (e.g. Hemforth et al., 2000; Uszkoreit et al., 1998)
- ▶ **Distance and Length interact:**
If distance is increased, even longer RCs tend to stay in situ. (e.g. Hemforth et al., 2000; Uszkoreit et al., 1998)
- ▶ **What is distance?**
Number of intervening words / syllables / new d-refs (...)?

(Some) Factors affecting Extraposition of (R)RCs:

Discourse Focus:

- ▶ Rochemont and Culicover (1990), Takami (1999):
Extraposition tends to occur when an RRC is in focus and expresses new information, while the matrix-VP is discourse given.
- ▶ Shannon (1992): Extraposition is more likely if the head of the RC is focused than if it represents the discourse topic.
- ▶ If the head is focused, subsequent material is backgrounded.

Prominence of the intervening material

Hypothesis I: (Contextual Prominence)

RC-extraposition improves if the intervening material is part of the background.

Hypothesis II: (Prosodic Prominence)

Extraposability correlates inversely with the prosodic prominence of intervening material.

Problem: How can we tease apart Hypothesis I and II?

Extraposition and RC-Type

- (3) (Emonds, 1979, p.234)
- a. Some men appeared at the door that Mary had been insulting. (RRC)
 - b. *These men appeared at the door, who Mary had been insulting. (ARC)
 - c. These men, who Mary had been insulting, appeared at the door. (ARC)

▶ **Strong Adjacency Requirement for ARCs**

High Syntactic Attachment (Emonds, 1979; McCawley, 1981): ARCs have to co-indexed with the head at the surface.
Bi-dimensional Logic (Potts, 2005a): Appositive Content cannot be moved.

- ▶ **Consequence:** Most of the previous studies only investigated the extraposition of RRCs.

But: Discourse Relations matter

(4) (Holler, 2005, p.150)

a. Ihre Lehrerin wollten die Kinder besuchen, die
Their teacher wanted the children visit, who
 aber nicht zu Hause war.
PART not at home was.

‘The children wanted to visit their teacher, who was not at home.’

b. Ihre Lehrerin, die aber nicht zu Hause war,
Their teacher, who PART not at home was,
 wollten die Kinder besuchen.
wanted the children visit.

‘The children wanted to visit their teacher, who was not at home.’

Moreover: Distance, Length and Focus matter

- (5) (Arnold, 2007, p.288)
- a. Someone came who Mary knew. [RRC]
 - b. ?John came, who Mary knew. [ARC]
 - c. Even John came, who everyone had expected would be too scared of potential publicity.

ARC Extraposition improves if ...

- ▶ ... distance is kept minimal. (Holler, 2005)
- ▶ ... the ARC is made heavier.(Arnold, 2007)
- ▶ ... the head of the ARC is focused. (Heringa 2012)

RC-Type and Extraposition

Hypothesis III:

STRONG VERSION: ARCs do not extrapose at all.

WEAK VERSION: ARCs are harder to extrapose than RRCs.

RC-Type and Prosody

- ▶ ARCs are prosodically less integrated than RRCs.
- ▶ ARCs have a strong boundary intonation (comma-intonation). (Selkirk, 2004; Potts, 2005b)
- ▶ RRCs form part of the focus-background-structure of the matrix clause.
- ▶ ARCs have their own focus- background-structure. (Holler, 2005; Riester, 2009)

RC-Type and Prosody

- ▶ No Focus-Projection from ARC to matrix-clause
 - (6) Which sister did Peter call?
 - a. Peter called MARIA, who is living in HAMBURG.
 - b. ?Peter called Maria, who is living in HAMBURG.
 - c. Peter called the sister who is living in HAMBURG.

- ▶ No Association with Focus between matrix-clause and ARC
 - (7)
 - a. Peter only called Maria, who is CARLA's best friend.
 - b. Peter called Maria, who is only CARLA's best friend.

Interaction of RC-Type and Focus

Hypothesis IV: Focus and RC-Type

The effects of Focus and RC-Type on WordOrder interact.

Experiments

Design:

- ▶ Number of Participants: 35
- ▶ Number of Experiments: 2
- ▶ Number of Items: 18
- ▶ Number of Conditions: 6

Factors:

- ▶ RC-Type (ARC / RRC)
- ▶ Focus (Object / Subject / Wide)
- ▶ WordOrder (extraposed / non-extraposed)

Type of Task:

- ▶ Production-Experiment
- ▶ Acceptability-Test (scale 1 - 7)

Example for a Testitem with RRC

- (8) a. War die Wanderung schwierig?
'Was the hike difficult?' (Wide-Focus)
- b. Wer hat das Riemannhaus erreicht?
'Who reached the Riemann house?' (Subject-Focus)
- c. Welches Ziel haben die Wanderer erreicht?
'Which goal did the hiker reach?' (Object-Focus)
- (9) a. (Nein,) jeder Wanderer, **der Schneeschuhe trug**, hat das Riemannhaus erreicht.
'(No,) every hiker who was wearing snow shoes has reached the Riemannhaus.'
- b. (Nein,) jeder Wanderer hat das Riemannhaus erreicht, **der Schneeschuhe trug**.
'(No,) every hiker has reached the Riemannhaus, who was wearing snow shoes.'

Example for a Testitem with ARC

- (10) a. War die Wanderung schwierig?
'Was the hike difficult?' (Wide-Focus)
- b. Wer hat das Riemannhaus erreicht?
'Who reached the Riemann house?' (Subject-Focus)
- c. Welches Ziel hat der Wanderer erreicht?
'Which goal did the hiker reach?' (Object-Focus)
- (11) a. (Nein,) der Wanderer, **der ja Schneeschuhe trug**,
 hat das Riemannhaus erreicht.
'(No,) the hiker, who was wearing snow shoes, has reached the Riemannhaus.'
- b. (Nein,) der Wanderer hat das Riemannhaus erreicht,
der ja Schneeschuhe trug.
'(No,) the hiker has reached the Riemannhaus, who was wearing snow shoes.'

Expected Focus-Pattern

(12) **Subject-Focus:**

A: Wer hat das Riemannhaus erreicht?

'Who reached the Riemann house?'

B: Der WANDERER hat das Riemannhaus erreicht, der ja Schneeschuhe trug.

'The HIKER has reached the Riemannhaus, who was wearing snow shoes.'

(13) **Object-Focus:**

A: Welches Ziel hat der Wanderer erreicht?

'Which goal did the hiker reach?'

B: Der Wanderer hat das RIEMANNHAUS erreicht, der ja Schneeschuhe trug.

'The hiker has reached the RIEMANNHAUS, who was wearing snow shoes.'

Step 1: Acceptability-Test

Predictions:

- ▶ **Hypothesis I (Contextual Prominence):**
Subject-Focus > Wide Focus > Object-Focus
- ▶ **Hypothesis II (Prosodic Prominence):**
Subject-Focus > Wide Focus > Object-Focus
- ▶ **Hypothesis III (RC-Type):**
extraposed RRCs > extraposed ARCs
- ▶ **Hypothesis IV (Interaction of RC-Type and Focus):**
RC-Type and Focus interact

Results Acceptability-Test

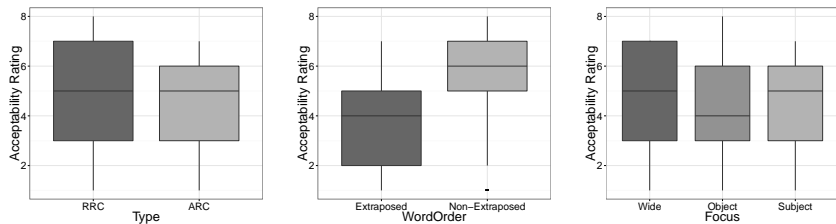


Figure : Responses by WordOrder, Focus, and RC-Type.

Results Acceptability-Test

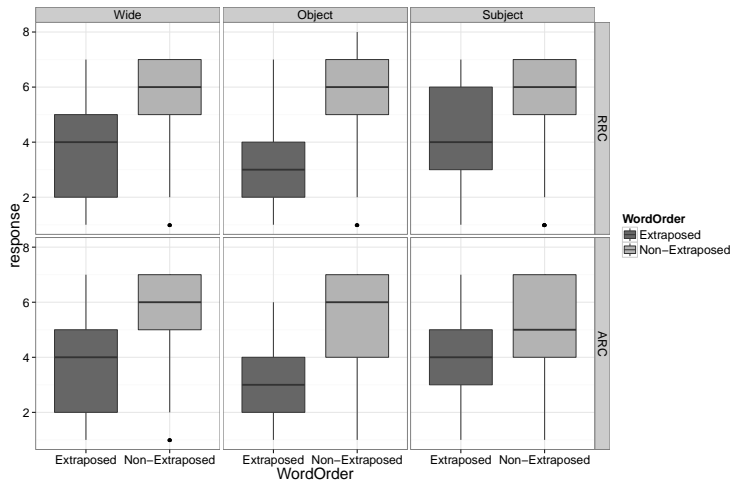


Figure : Responses by WordOrder, Focus, and RC-Type.

Results Acceptability-Test

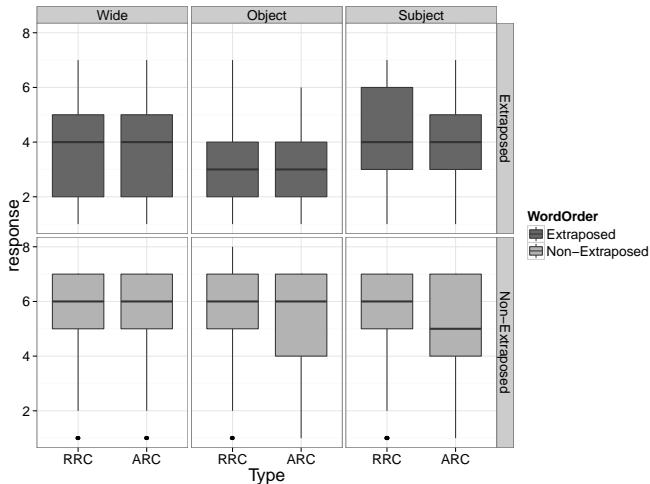


Figure : Responses by RC-Type, Focus, and Wordorder

Results Acceptability-Test

Table : Extraposability by RC-type, Focus, and WordOrder

	<i>Dependent variable:</i> Naturalness Rating
TypeRRC.vs.ARC	0.067 (0.055)
WordOrderExtraposd.vs.Non-Extraposd	-0.475*** (0.069)
FocusSubject.vs.Other	0.057 (0.060)
FocusWide.vs.Object	0.108 (0.069)
RRC.vs.ARC:Extraposd.vs.Non-Extraposd	0.045 (0.039)
RRC.vs.ARC:FocusSubject.vs.Other	0.042 (0.041)
RRC.vs.ARC:FocusWide.vs.Object	-0.027 (0.047)
Extraposd.vs.Non-Extraposd:FocusSubject.vs.Other	0.272*** (0.041)
Extraposd.vs.Non-Extraposd:FocusWide.vs.Object	0.027 (0.047)
RRC.vs.ARC: Extraposd.vs.Non-Extraposd:FocusSubject.vs.Other	-0.127 (0.081)
RRC.vs.ARC: Extraposd.vs.Non-Extraposd:FocusWide.vs.Object	-0.014 (0.095)
Constant	-0.013 (0.043)
Observations	1,127

Note:

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Results Acceptability-Test

Table : Results for Extraposed RCs

	<i>Dependent variable:</i> Naturalness Rating
RCRestrictive.vs.Non-Restrictive	0.087 (0.060)
FocusSubject.vs.Other	0.197*** (0.049)
FocusWide.vs.Object	0.138*** (0.051)
RRC.vs.ARC:FocusSubject.vs.Other	-0.038 (0.088)
RRC.vs.ARC:FocusWide.vs.Object	-0.060 (0.143)
Constant	-0.250*** (0.051)
Observations	552

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Results Acceptability-Test

Table : Results for Non-Extrapolated RCs

	<i>Dependent variable:</i>
	Naturalness Rating
TypeRRC.vs.ARC	0.012 (0.063)
FocusObject	-0.104*** (0.035)
FocusSubject	-0.128** (0.054)
TypeRRC.vs.ARC:FocusObject	0.015 (0.084)
TypeRRC.vs.ARC:FocusSubject	0.111 (0.108)
Constant	0.299*** (0.047)
Observations	575

Note:

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Main-Findings Acceptability-Test

- ▶ **Significant Effect of WordOrder**

In all conditions, extraposed RCs rated lower than non-extraposed RCs

- ▶ **Significant Interaction of Focus and WordOrder**

Under Extraposition, Subject-Focus rated higher than Wide and Wide Focus rated higher than Object-Focus

- ▶ **No Interaction of RC-Type and WordOrder**

Extraposed ARCs rated as high as extraposed RRCs

- ▶ **No Interaction of RC-Type and Focus**

But with in situ ARCs, Subject-Focus rated lower than Object and Wide Focus.

Step 2: Evaluation of the Acoustic Data

- ▶ **Hypothesis II:**

Can we tease apart the effects of Focus and Prosodic Prominence?

- ▶ **Hypothesis IV:**

Can we find any interaction between RC-Type and Focus?

RC Extraposition and Prosodic Prominence

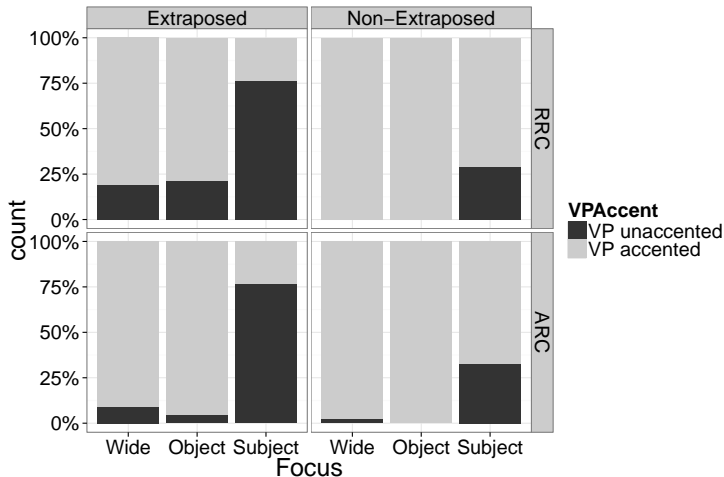


Figure : Proportion of utterances with unaccented VPs.

RC Extraposition and Prosodic Prominence

Table : Logistic Regression Model Testing for Effects on Prosodic Prominence

	<i>Dependent variable:</i>
	VP Accentuation
WordOrderExtrapolated.vs.Non-Extrapolated	-2.477*** (0.418)
Subject.vs.Other	-4.309*** (0.443)
Wide.vs.Object	0.198 (0.583)
RRC.vs.ARC	-0.499 (0.389)
Extrapolated.vs.Non-Extrapolated: Subject.vs.Other	-0.390 (0.633)
Extrapolated.vs.Non-Extrapolated: Wide.vs.Object	-0.390 (1.111)
Extrapolated.vs.Non-Extrapolated:RRC.vs.ARC	-1.443* (0.760)
FocusSubject.vs.Other: RRC.vs.ARC	0.938 (0.618)
FocusWide.vs.Object: RRC.vs.ARC	0.827 (1.105)
Extrapolated.vs.Non-Extrapolated:Subject.vs.Other:RRC.vs.ARC	1.960 (1.231)
Extrapolated.vs.Non-Extrapolated:Wide.vs.Object:RRC.vs.ARC	0.343 (2.210)
Constant	2.596*** (0.289)
Observations	1,133

Note: * p<0.1; ** p<0.05; *** p<0.01

RC-Extrapolation and Prosodic Prominence

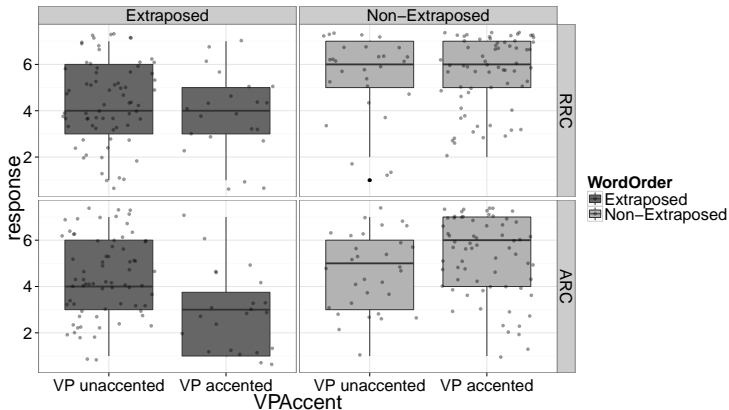


Figure : Acceptability rating in subject focus, both in extrapolated and non-extrapolated word orders.

RC-Extrapolation and Prosodic Prominence

Table : The Effect of Prominence on Naturalness in Subject Focus

	<i>Dependent variable:</i> Naturalness Rating
VPunaccented.vs.VPaccented	0.001 (0.063)
RRC.vs.ARC	0.137 (0.099)
Extrapolated.vs.Non-Extrapolated	-0.320*** (0.084)
VPunaccented.vs.VPaccented:RRC.vs.ARC	-0.093 (0.092)
VPunaccented.vs.VPaccented: Extrapolated.vs.Non-Extrapolated	0.305*** (0.098)
RRC.vs.ARC: Extrapolated.vs.Non-Extrapolated	0.011 (0.081)
VPunaccented.vs.VPaccented: RRC.vs.ARC:Extrapolated.vs.Non-Extrapolated	-0.297* (0.173)
Constant	-0.045 (0.055)
Observations	378

Note:

*p<0.1; **p<0.05; ***p<0.01

RC-Extrapolation and Prosodic Prominence

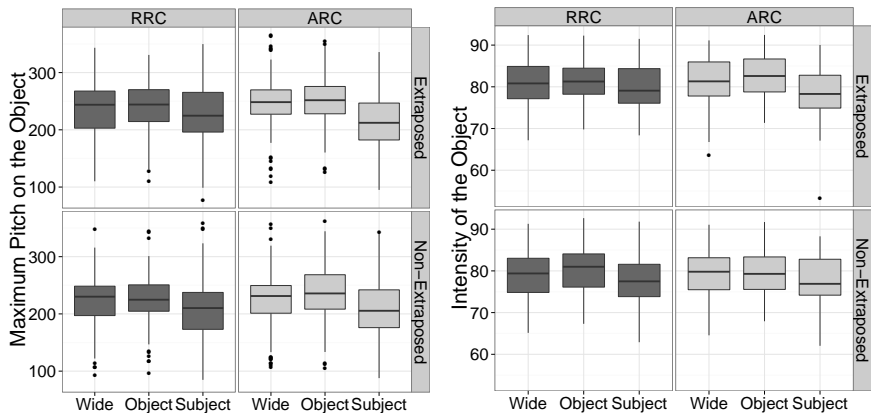


Figure : Maximum pitch (Hz) and maximum intensity (dB) on the object.

RC-Extrapolation and Prosodic Prominence

Table : Effect of Prosodic Prominence and Focus on Naturalness

	<i>Dependent variable:</i>
	Naturalness
cObjectPitch	-0.205 (0.125)
cObjectIntensity	-0.147** (0.065)
FocusSubject.vs.Other	0.0001 (0.095)
FocusWide.vs.Object	0.089 (0.183)
Constant	0.025 (0.053)
Observations	1,047

Note: *p<0.1; **p<0.05; ***p<0.01

RC-Extrapolation and Prosodic Prominence

- ▶ Hypothesis II: The Acceptability of RC- Extrapolation is inversely proportional to the Prosodic Prominence of the intervening material.
- ▶ Hypothesis IV: In non-extrapolated word-order, we find a significant interaction between RC-TYPE and FOCUS.

Comma-Intonation

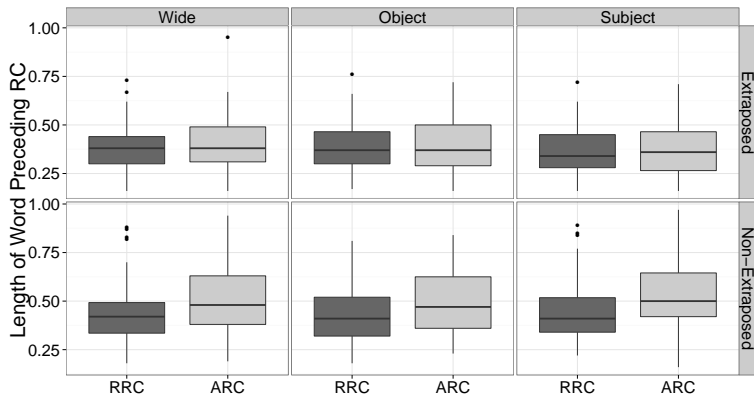


Figure : Duration of the word preceding the RC in non-extrapolated and extrapolated word order.

Comma-Intonation

Table : The length of the Word Preceding the RC.

	<i>Dependent variable:</i>
	z-score of log duration
Extrapolated.vs.Non-Extrapolated	-0.285** (0.144)
TypeRRC.vs.ARC	-0.123*** (0.036)
FocusSubject.vs.Other	0.004 (0.022)
FocusWide.vs.Object	0.001 (0.019)
Extrapolated.vs.Non-Extrapolated:RRC.vs.ARC	0.159*** (0.024)
Extrapolated.vs.Non-Extrapolated:FocusSubject.vs.Other	-0.099*** (0.025)
Extrapolated.vs.Non-Extrapolated:FocusWide.vs.Object	-0.017 (0.029)
RRC.vs.ARC:FocusSubject.vs.Other	-0.037 (0.025)
RRC.vs.ARC:FocusWide.vs.Object	-0.030 (0.029)
Extrapolated.vs.Non-Extrapolated:RRC.vs.ARC:FocusSubject.vs.Other	0.041 (0.050)
Extrapolated.vs.Non-Extrapolated:RRC.vs.ARC:FocusWide.vs.Object	-0.009 (0.058)
Constant	0.019 (0.125)
Observations	1,047

Note:

* p<0.1; ** p<0.05; *** p<0.01

Fall or Rise?

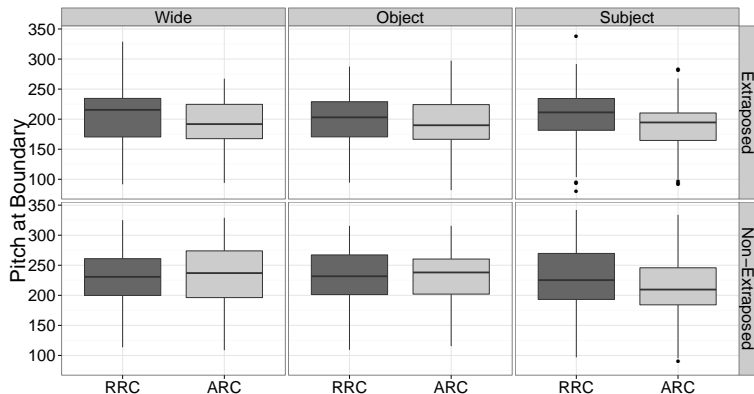


Figure : Mean pitch of the last quadrant of the word preceding the RC.

Fall or Rise?

Table : Mean pitch of the last quadrant of the word preceding the RC

	<i>Dependent variable:</i>
	z-score of mean pitch
WordOrderExtraposited.vs.Non-Extraposited	-0.236*** (0.072)
TypeRRC.vs.ARC	0.053** (0.024)
FocusSubject.vs.Other	-0.049 (0.030)
FocusWide.vs.Object	0.019 (0.057)
WordOrderExtraposited.vs.Non-Extraposited:TypeRRC.vs.ARC	0.087*** (0.031)
WordOrderExtraposited.vs.Non-Extraposited:FocusSubject.vs.Other	0.103*** (0.032)
WordOrderExtraposited.vs.Non-Extraposited:FocusWide.vs.Object	0.018 (0.038)
TypeRRC.vs.ARC:FocusSubject.vs.Other	0.112*** (0.032)
TypeRRC.vs.ARC:FocusWide.vs.Object	-0.019 (0.038)
WordOrderExtraposited.vs.Non-Extraposited:TypeRRC.vs.ARC:FocusSubject.vs.Other	-0.100 (0.065)
WordOrderExtraposited.vs.Non-Extraposited:TypeRRC.vs.ARC:FocusWide.vs.Object	-0.005 (0.075)
Constant	0.003 (0.071)
Observations	995

Note:

* p<0.1; ** p<0.05; *** p<0.01

Conclusions:

- ▶ Acceptability of RC extraposition is inversely proportional to the prominence of the material intervening between head and RC.
- ▶ Acceptability-ratings correlate not just with the *contextual* salience, but also with *prosodic* prominence.
- ▶ ARCs and RRCs are equally natural when extraposed. This challenges approaches which assume a strict adjacency requirement for ARCs (e.g. Potts 2005).
- ▶ Under extraposition, no interaction between RC-Type and Focus.
- ▶ In the non-extraposed case, however, significant interactions were found in the prosodic data, which shows that naturalness of an ARC decreases significantly if it separates accented from unaccented material.

THANK YOU!

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