

THE LIMITS OF PRINCIPLE C RECONSTRUCTION IN MULTI-GAP DEPENDENCIES

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ROADMAP

Today's goal:

Challenge the view that coreference resolution in multi-gap dependencies reflects principle C reconstruction and thus maps to the underlying syntactic derivation.

- Theoretical background
 - Multi-gap dependencies
 - Status of principle C reconstruction
 - Existing problems and how to approach them
- Experimental investigation
 - Research questions
 - Experiments: coreference judgments simple and multi-gap dependencies (English)
- What (I think) it all means and how we could move forward

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MULTI-GAP DEPENDENCIES

Across-the-board movement

An antecedent is related to a gap in each conjunct of a coordinate structure.

(Ross 1967)

- (1) Which paper did you file ___ and Sally read ___?

- Systematic exception to the Coordinate Structure Constraint.
- ⇒ Movement must target both conjuncts of a coordinate structure.

Parasitic gaps

An antecedent is related to a main gap and another (optional) gap that is dependent on the first. (Engdahl 1983)

- (2) Which paper did you file ___ without reading *pg*?

- ⇒ Appear in domains that are subject to island effects.
- ⇒ Require an Ā-moved antecedent that is related to a proper gap.

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Superficial resemblance ⇒ Syntactic resemblance?

First noted by Ross (1967), recently reopened discussion by Altshuler and Truswell (2022)

ANALYSES OF ATB AND PGS

		Unificational	Non-unificational	
			ATB	PGs
Symmetric		Parallel extraction (Haik 1985; Huybregts and van Riemsdijk 1985; Seguin and Thoms 2025; Williams 1990); Multidominance Citko (2013); HPSG (Pollard and Sag 1994)	Parallel extraction (Biskup 2018; Hein and Murphy 2020; Wilder 1994; Williams 1978); Multidominance (Citko 2005)	
	Initial	Operator movement (Munn 1993, 1994, 1999, 2001)	Operator movement (Bošković and Franks 2000); Null pronominal (Zhang 2010); Ellipsis (Salzmann 2012)	Operator movement (Chomsky 1986; Nissenbaum 2000); Null pronominal (Cinque 1990); Fission & Fusion (Assmann 2012)
Asymmetric	Non-initial	Sideward movement (Altshuler and Truswell 2022; Hornstein and Nunes 2002; Nunes 1995, 2001)	Ellipsis (Ha 2008)	

Table 1: A bit of an empirical crisis: there is evidence for and against each of these approaches, they remain to coexist.

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PGs are more constrained,
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In favor of unification

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Zooming in:

- **Principle C reconstruction** in ATB and PGs \Rightarrow Empirical facts?
- What do they imply for unification of ATB and PGs?
- What do they imply for symmetric vs. asymmetric derivations?

EVIDENCE: RECONSTRUCTION IN MULTI-GAP DEPENDENCIES

- Principle C: an R-expression must be free, i.e. must not be bound by a pronoun that c-commands it (Chomsky 1986) ⇒ **Disjoint reference!**

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(3) *Principle C reconstruction (Nissenbaum 2000, p. 33)*

- a. *Which picture of John_i did Mary buy ____ and not let him_i look at ____?
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	ATB	PGs
Nissenbaum (2000)	both gaps	only licensing gap
Citko (2005), Salzmann (2012)	only initial gap	NA
Bruening & Al Khalaf (2017)	both gaps ¹	both gaps ¹

1 Claim: Experimental data supports symmetry between conjuncts in ATB, but principle C reconstruction actually does not exist (no data for PGs provided, but claimed to behave like ATB)

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Problem no. 2: Incomplete data paradigms.

- Authors comparing ATB and PGs focus on non-initial gap across constructions.
 - Authors concerned with one of the two focus on both gaps within a construction.
- ⇒ We need to consider reconstruction to **both gaps in both constructions!**

A NOTE ON PRINCIPLE C RECONSTRUCTION

Recent experimental evidence:

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- ✗ Bruening and Al Khalaf (2019) ✓ (Salzmann et al. 2023)

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⇒ Quantitative evidence needed to evaluate claims!

EXPERIMENTAL FACTORS IN DETAIL

Factor 1: GRAMFUNC (object/subject)

Factor 2: CONSTRUCTION (ATB/PG)

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- (4) a. [Which cousin of Max's] did Mary greet ___ and he hug ___? object
 b. [Which cousin of Max's] ___ greeted Mary and ___ hugged him? subject

Factor 2: CONSTRUCTION (ATB/PG)

Factor 3: POSITION (initial/non-initial)

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- (5) a. [Which cousin of Max's] did Mary greet ___ and he hug ___? ATB
 b. [Which cousin of Max's] did Mary greet ___ before he hugged pg? PG

EXPERIMENTAL FACTORS IN DETAIL

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b. [Which cousin of Max's] ____ greeted Mary and ____ hugged him? *subject*

Factor 2: CONSTRUCTION (ATB/PG)

- (5) a. [Which cousin of Max's] did Mary greet ____ and he hug ____? *ATB*
b. [Which cousin of Max's] did Mary greet ____ before he hugged pg? *PG*

Factor 3: POSITION (initial/non-initial)

- (6) a. [Which cousin of Max's] did he greet ____ and Mary hug ____? *initial*
b. [Which cousin of Max's] did Mary greet ____ and he hug ____? *non-initial*

THE IMPOSSIBLE 2×2×2 DESIGN

ATB dependencies	PG dependencies
ATB, init, obj	PG, init, obj
ATB, noninit, obj	PG, noninit, obj
ATB, init, subj	PG, init, subj
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- (7)
- a. *Which cousin of Max's greeted him before *pg* hugged Mary?
 - b. *Which cousin of Max's greeted Mary before *pg* hugged him?
 - c. Which cousin of Max's greeted him before PRO hugging Mary?
 - d. Which cousin of Max's greeted Mary before PRO hugging him?

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Anti c-command and anti-locality

Ban on parasitic gaps c-commanded by their licensing gap (Engdahl 1983).
Ban on subject PGs in monoclausal adjuncts (Davis 2025).

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-
- ⇒ Pilot study with 60 native speakers of English
 - ~ Prolific, mean age 42.35
 - ⇒ **54 participants** after exclusions

METHOD

- Single session ⇒ 28 target items (8+8+12),² 12 distractors and 3 training items.

Task 1: Forced choice between two interpretations.

Task 2: Acceptability judgment on 7-point scale.³

2 8 items from an experiment on the acceptability of PGs in finite vs. infinitival clauses, see appendix.

3 Acceptability judgments relevant for control items, see appendix.

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Which client of Leo's tricked him?

What is this asking about?

- A client that tricked Leo. A client that tricked someone else.

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How acceptable is this sentence?

1 = completely unacceptable

7 = completely acceptable

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- Single factor GRAMFUNC with two levels (object/subject)

- 8 items in two conditions each

⇒ Counterbalanced, each item seen in only one of the conditions

(8) *Item structure experiment 1*

- a. Which client of Leo's did he trick?
- b. Which client of Leo's tricked him?

object
subject

EXP. 1: BASELINE FOR PRINCIPLE C RECONSTRUCTION

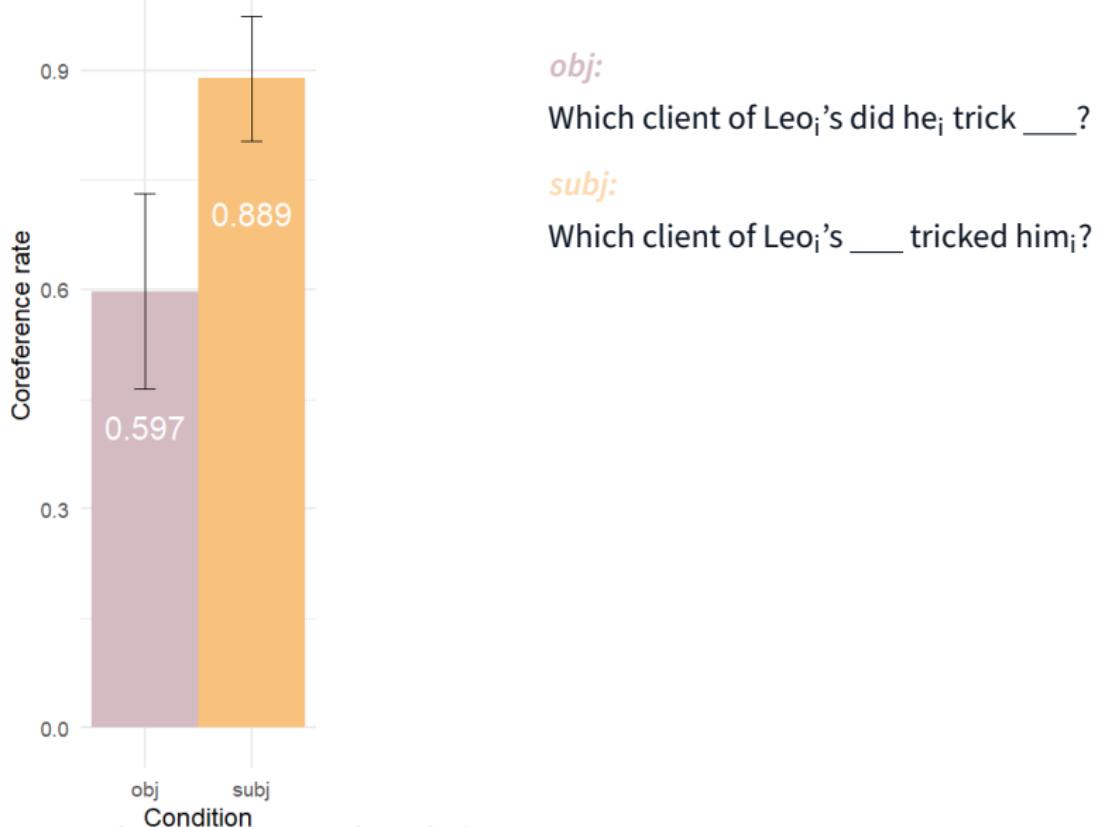


Figure 1: Overall proportion of responses indicating preference for the coreferent reading in experiment 1.

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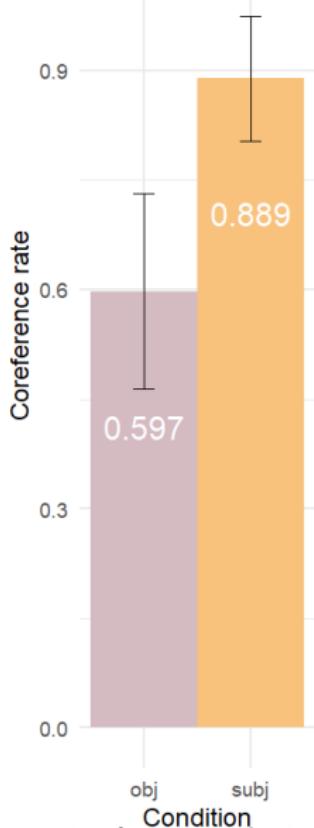


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obj:

Which client of Leo_i's did he_i trick ___?

subj:

Which client of Leo_i's ___ tricked him_i?

- GRAMFUNC (***) ⇒ evidence for principle C reconstruction.
- Above chance proportion of coreference ⇒ bias to resolve pronominal reference in the absence of a suitable alternative (Gordon and Hendrick 1998)

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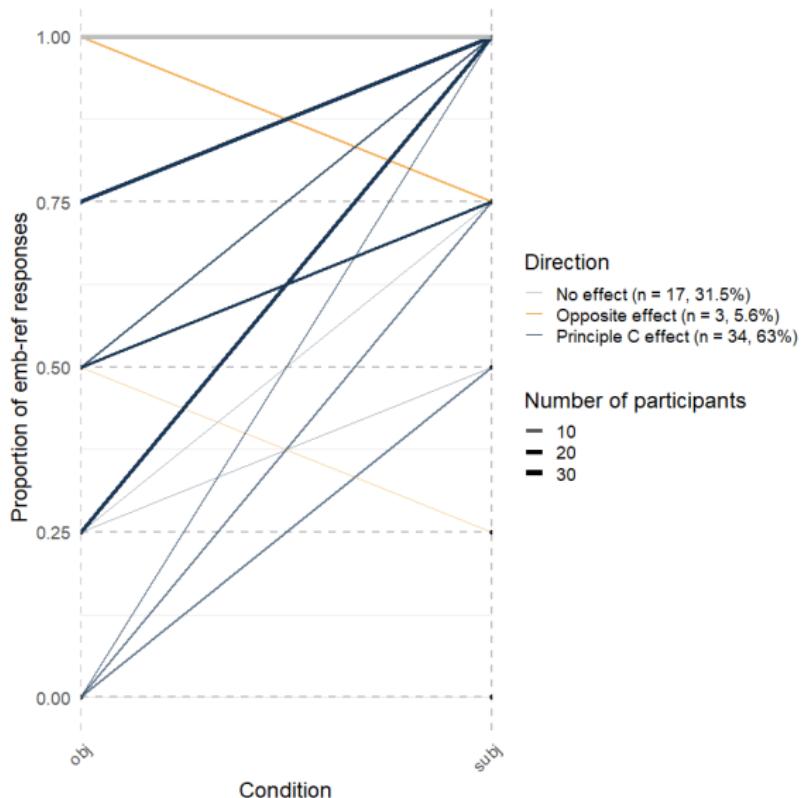


Figure 2: Individual participants' (n = 54) overall proportions of responses indicating coreference in experiment 1. Lines indicate individual participants' slopes between conditions.

EXP. 1: BASELINE FOR PRINCIPLE C RECONSTRUCTION

Finding 1: Evidence for principle C reconstruction in English wh-dependencies.

⇒ Preference for the coreferent reading is significantly decreased if the pronoun c-commands the base position of the R-expression.

Finding 2: No evidence for a strong syntactic violation forcing disjoint reference.

⇒ Reconstruction effect does not rule out coreference, it is still preferred overall (chosen in 59.7% of cases).

Finding 3: No evidence for universality of principle C reconstruction across speakers.

⇒ 37.1% of participants diverge from a principle C reconstruction effect.

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- Two factors with two levels each (POSITION: initial/non-initial; CONSTRUCTION: ATB/PG)
- 12 items, 4 conditions (Latin Square)⁴

4 Experiments 2.1 and 2.2 use the same materials, we are looking at 4 out of 6 conditions in total, meaning 2 observations per condition for each participant.

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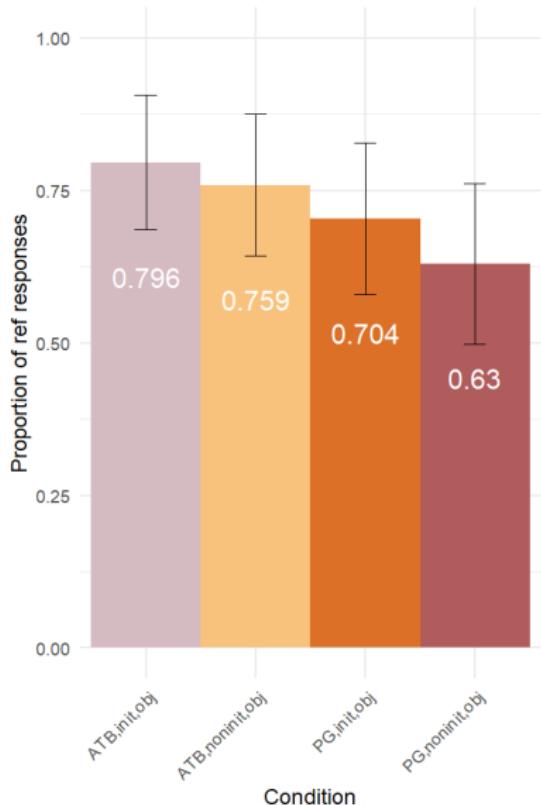
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(9) *Item structure experiment 2.1*

- Which cousin of Max's did he greet and Mary hug? ATB,init,obj
- Which cousin of Max's did Mary greet and he hug? ATB,noninit,obj
- Which cousin of Max's did he greet before Mary hugged? PG,init,obj
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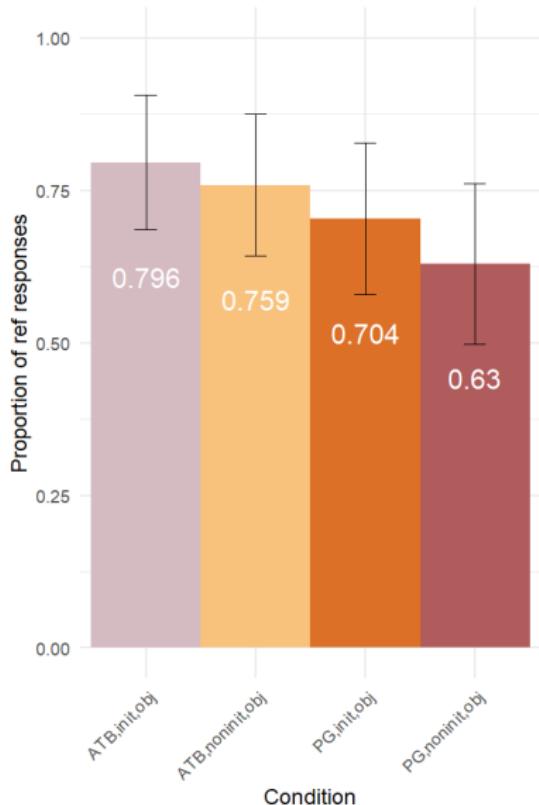
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PG,init,obj:

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- POSITION (*) CONSTRUCTION (.)
- Lower coreference in PG than in ATB dependencies!
- Lower coreference in non-initial than in initial gaps!

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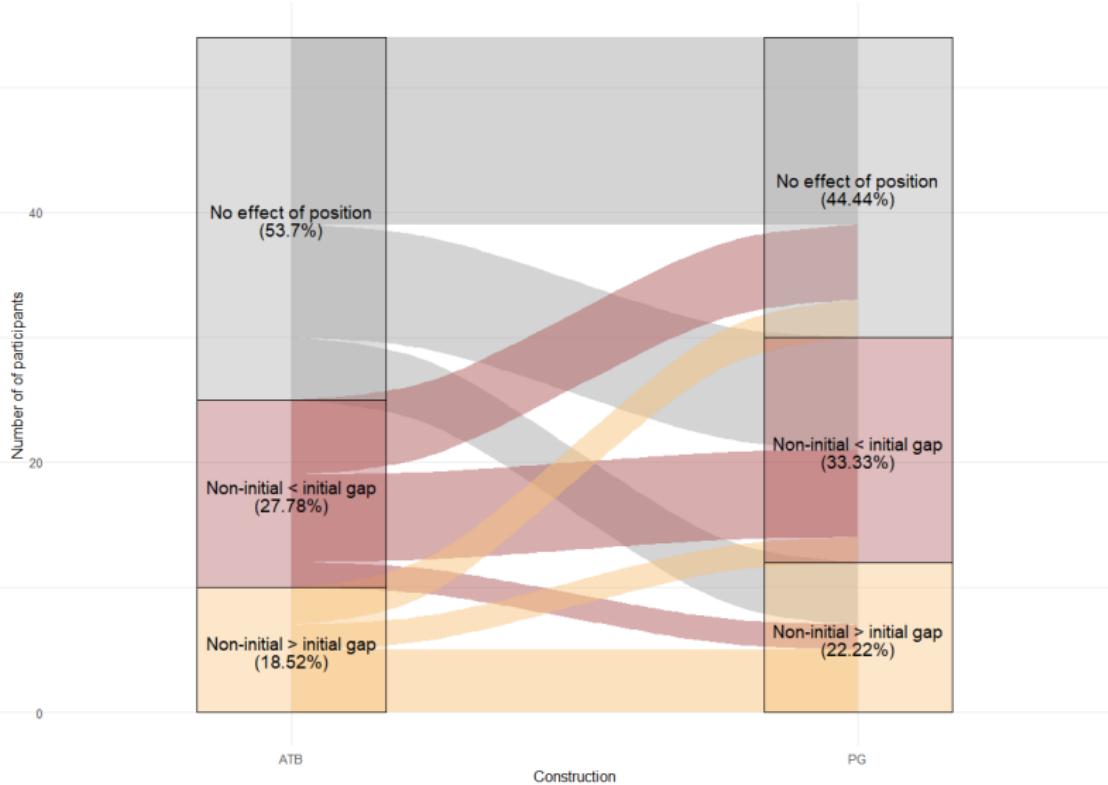


Figure 4: Participant migration between effect groups (POSITION) in ATB and PG dependencies. Flow indicates change in individual participants' response pattern from ATB conditions to PG conditions.

EXP. 2.1: DIFFERENCE BETWEEN GAPS IN ATB AND PGS

Finding 1: Evidence for a difference between initial and non-initial gap.

⇒ Coreference rates are higher when the pronoun precedes the initial gap across dependency types.

Finding 2: Limited evidence for difference between ATB and PG dependencies.

⇒ Marginally significant effect of CONSTRUCTION, with higher overall coreference rates in ATB than in PG conditions.

Finding 3: Evidence for effect of construction complexity.

⇒ Greater preference for coreference in ATB and PG dependencies than in object condition of simple wh-dependencies in experiment 1.

Finding 4: No evidence for clear speaker profiles.

⇒ About half the participants show a consistent effect of POSITION, with the other half switching between a positive, negative effect or no effect.

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Finding 2: Limited evidence for difference between ATB and PG dependencies.

⇒ Marginally significant effect of CONSTRUCTION, with higher overall coreference rates in ATB than in PG conditions.

Finding 3: Evidence for effect of construction complexity.

⇒ Greater preference for coreference in ATB and PG dependencies than in object condition of simple wh-dependencies in experiment 1.

Finding 4: No evidence for clear speaker profiles.

⇒ About half the participants show a consistent effect of POSITION, with the other half switching between a positive, negative effect or no effect.

EXP. 2.2: PRINCIPLE C RECONSTRUCTION IN ATB

RQ3: Is there evidence for principle C reconstruction in ATB dependencies?

⇒ Effect of GRAMFUNC × POSITION in ATB dependencies

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- Two factors with two levels each (GRAMFUNC: object/subject, POSITION: initial/non-initial)
- 12 items, 4 conditions (Latin Square)⁵

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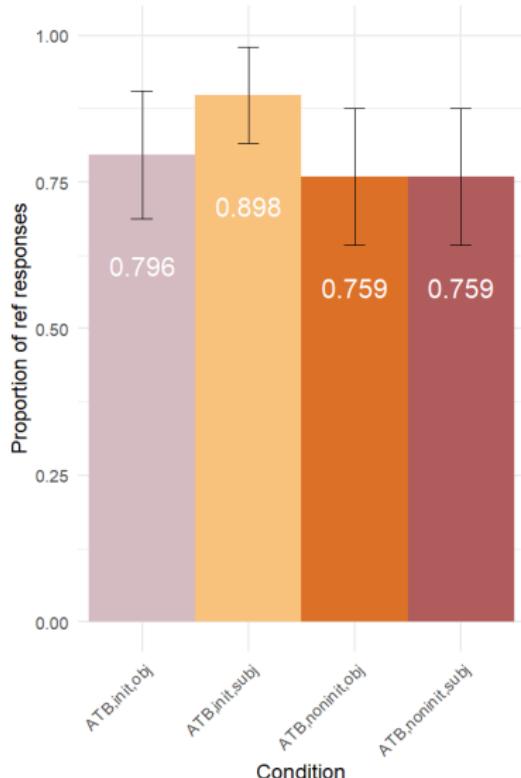
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(10) *Item structure experiment 2.2*

- Which cousin of Max's did he greet and Mary hug? *ATB,init,obj*
- Which cousin of Max's did Mary greet and he hug? *ATB,noninit,obj*
- Which cousin of Max's greeted him and hugged Mary? *ATB,init,subj*
- Which cousin of Max's greeted Mary and hugged him? *ATB,noninit,subj*

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Which cousin of Max_i's did he_i greet __ and Mary hug __?

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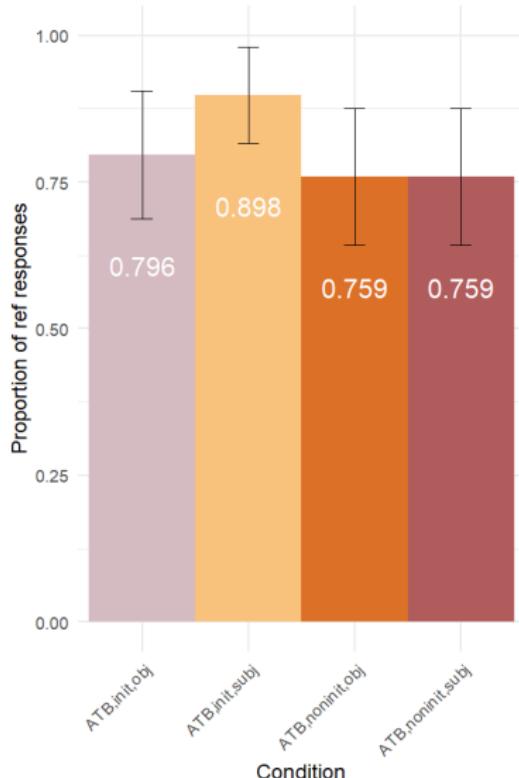
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Figure 5: Overall proportion of responses indicating preference for the coreferent reading in experiment 2.2.

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- POSITION (***) GRAMFUNC (***) POSITION × GRAMFUNC (*)
- Lower coreference in non-initial gap regardless of GRAMFUNC.
- Higher coreference in object condition compared to exp. 1 and PGs ⇒ even stronger bias to resolve pronominal reference.

Figure 5: Overall proportion of responses indicating preference for the coreferent reading in experiment 2.2.

EXP. 2.2: PRINCIPLE C RECONSTRUCTION IN ATB

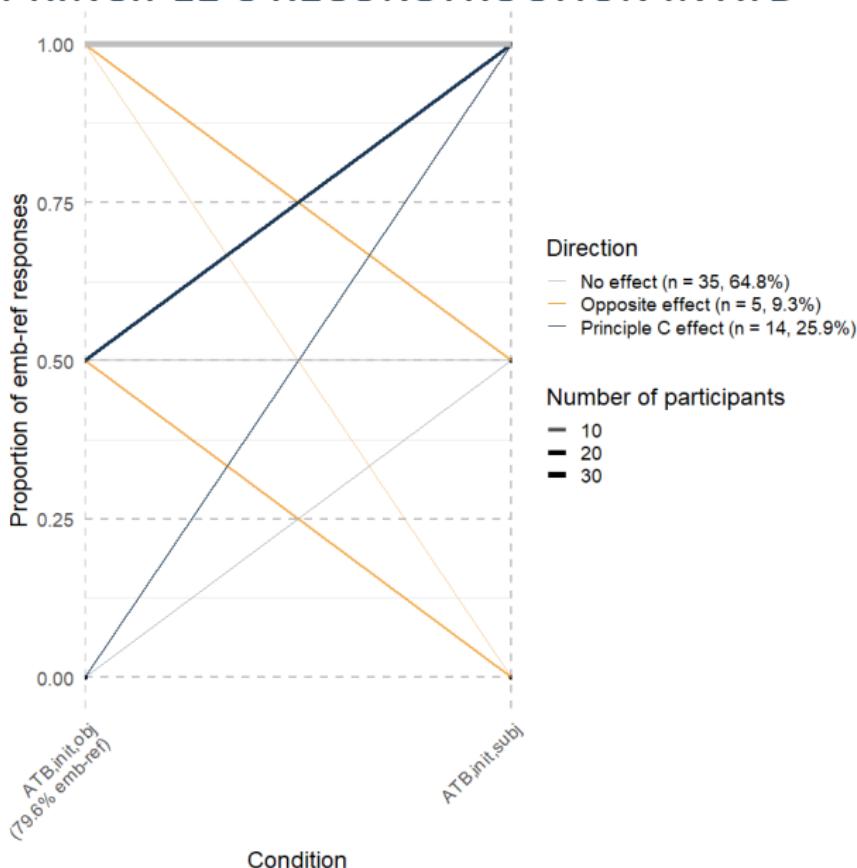


Figure 6: Individual participants' (n = 54) overall proportions of responses indicating coreference in experiment 2.2 in initial conjunct conditions. Lines indicate individual participants' slopes between conditions.

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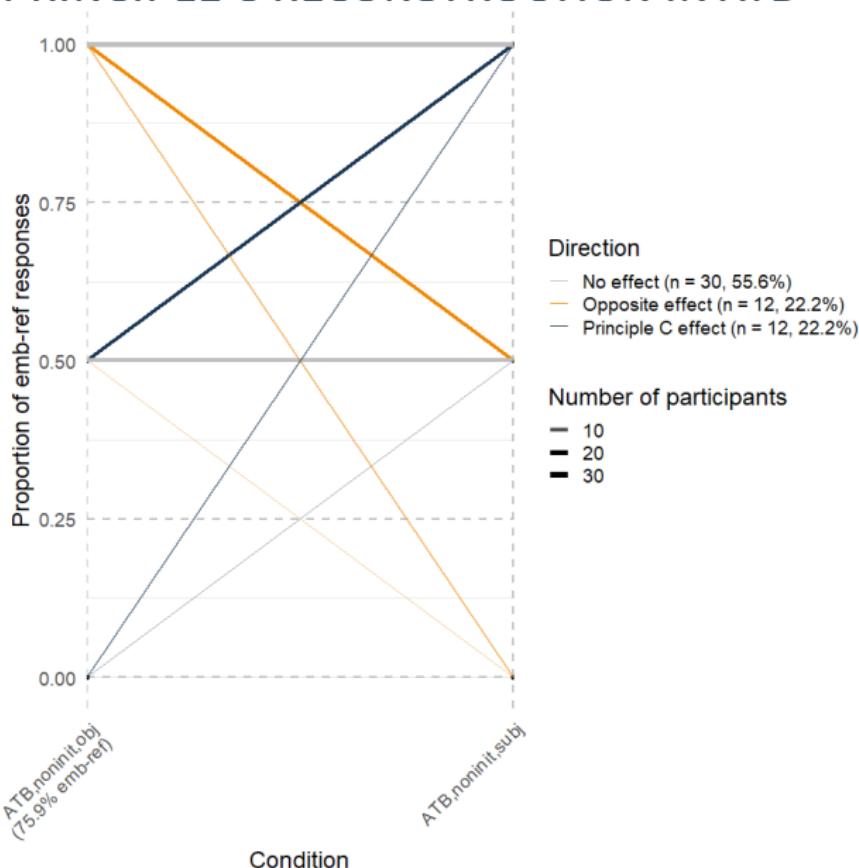


Figure 7: Individual participants' ($n = 54$) overall proportions of responses indicating coreference in experiment 2.2 in non-initial conjunct conditions. Lines indicate individual participants' slopes between conditions.

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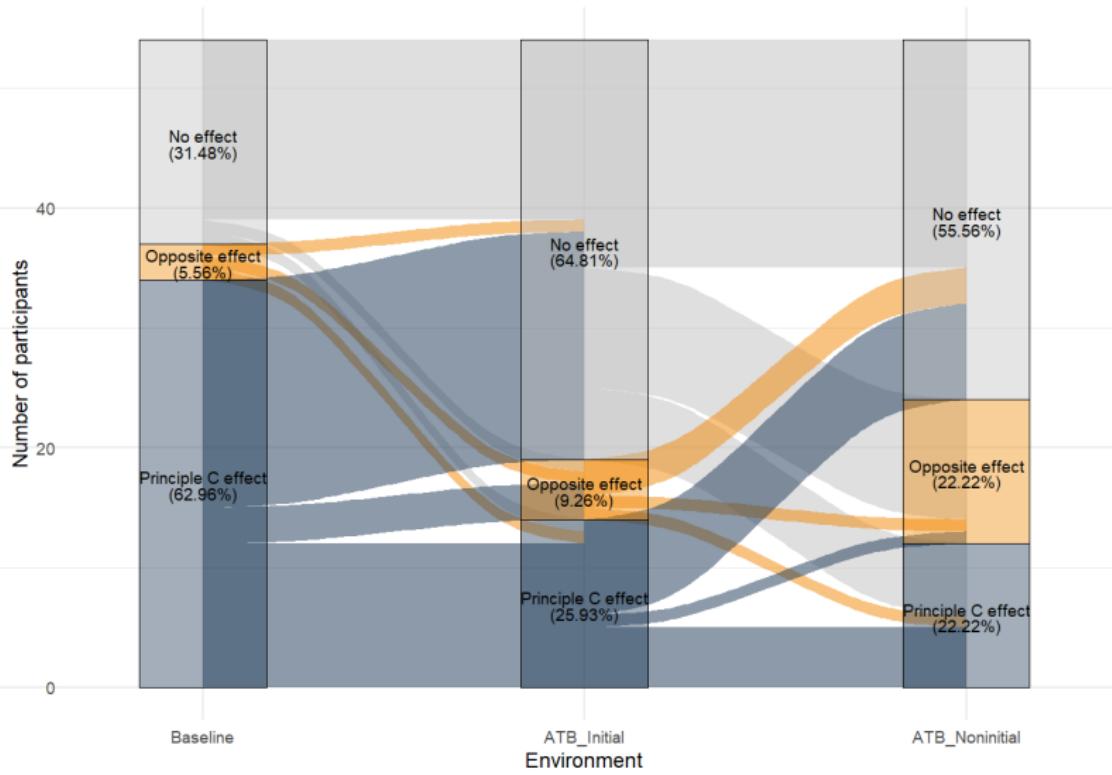


Figure 8: Participant migration between effect groups (GRAMFUNC) in wh-dependencies (baseline), initial and non-initial conjunct of ATB dependencies. Flow indicates change in individual participants' response pattern from experiment 1 to initial and non-initial conditions of experiment 2.2.

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Finding 1: Evidence for principle C reconstruction only in initial gap.

⇒ Strictly speaking, POSITION × GRAMFUNC is significant, and the direction of the effect matches the predictions of principle C reconstruction.

⇒ **Apparent lack of effect** in non-initial conjunct results from **increased variability!**

Finding 2: Evidence for effect of POSITION.

⇒ Reconstruction effects vanish at distance (cf. Adger et al. 2017; Stockwell et al. 2021).

Finding 3: No evidence for consistent speaker groups for reconstruction.

⇒ 14 + 12 participants show asymmetric effect, 5 show symmetric effect.

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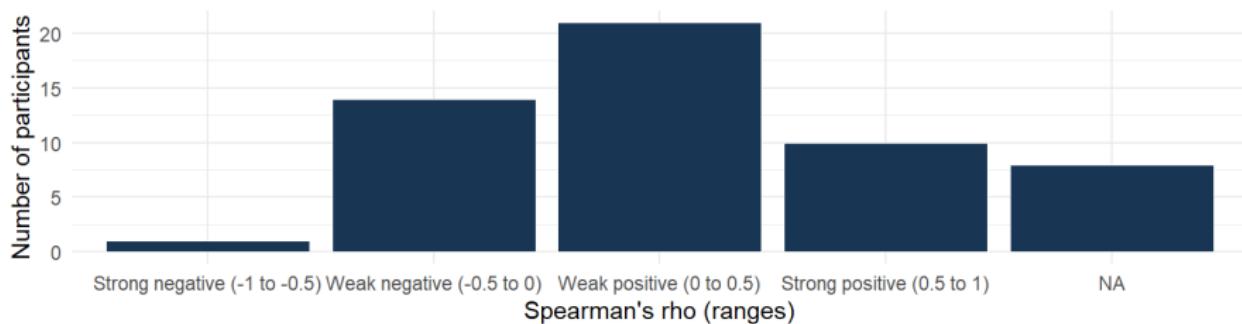
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Models reveal significant (***) effect of each response variable on the other!

⇒ Explains flipped pattern; easily avoided by presenting tasks in separate blocks.

KEY INSIGHTS

Empirical reports on similarities between ATB and PGs receive support.

Experiment 2.1: When only comparing cases *with a principle C violation under reconstruction*, the two gaps slightly differ within constructions.

But: this asymmetry does not arise due to principle C reconstruction.

Experiment 2.2: When *manipulating the presence of an underlying principle C violation*, we see that only 22-26% of speakers align with the predictions under ATB.

Experiment 1: Roughly 63% of participants align with the predictions in simple wh-dependencies, the effect size varies.

Related experiments on German depict the same pattern (Szarvas 2024a, 2025a).

Multiple roads lead to coreference.

General bias toward coreference, amplified by dependency complexity.

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WHAT WE WERE LOOKING FOR VS. WHAT WE FOUND

Conclusions about the underlying syntax of ATB and PGs are unjustified.

- The effect we observe is orthogonal to the question about the number of movement steps, the positions they target, and whether ATB and PGs are underlyingly derived in the same way.

If it is not reconstruction, what is it?

- Linear or structural distance between R-expression and pronoun: Can be disambiguated by varying the position of the adjunct clause (cf. Pesetsky 1982; Szarvas 2024b).

- (11)
- a. I know which neighbor of Henry's he invited ____ in order for Mary to meet pg.
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Evidence from principle C reconstruction is **orthogonal** ⇒ Study has neutral implications.

Claims formerly supported:

- (Non-)unification
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Diagnostic	ATB	Parasitic gaps
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- ⇒ Explicit discussion of potential cross-linguistic differences necessary!
- ⇒ Less item variability is desirable (D-linking, animacy, obliqueness of cases).

Thank you!

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APPENDIX – THEORETICAL DETAILS

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- **Empty operator movt. for PGs** ⇒ extraction only from matrix clause, empty operator has no internal structure

APPENDIX – EXP. 3: PARASITIC GAP ACCEPTABILITY

RQ4: Are parasitic gaps less acceptable in finite than non-finite adjunct clauses?

⇒ FINITENESS on acceptability rating in adjunct clauses with and without PG

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- Two factors with two levels each (Finiteness: finite/in infinitival; Gap: parasitic/pronoun)
- 8 items, 4 conditions (Latin Square)

(13) *Item structure experiment 4*

- | | | |
|----|--|-----------------|
| a. | Which movie did Sarah watch before she recommended? | <i>fin, pg</i> |
| b. | Which movie did Sarah watch before she recommended it? | <i>fin, prn</i> |
| c. | Which movie did Sarah watch before recommending? | <i>inf, pg</i> |
| d. | Which movie did Sarah watch before recommending it? | <i>inf, prn</i> |

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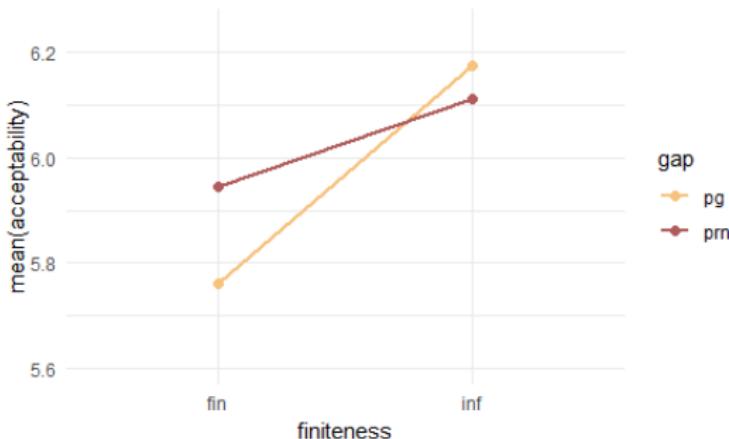


Figure 9: Mean acceptability rating by condition in exp. 3.

Finding 1: Increased acceptability of infinitival clauses is marginally significant.

Finding 2: Interaction is not significant: no evidence for increased acceptability of PGs in infinitival clauses.

APPENDIX – EXP. 3: PARASITIC GAP ACCEPTABILITY

Max model exp. 3	Estimate (std. error)
finiteness	0.41(0.24)
gap	0.04(0.29)
finiteness:gap	0.05(0.74)
Num. obs.	432
Groups (participant)	54
Groups (item)	8
Variance: participant: (Intercept)	2.64
Variance: participant: finiteness	0.13
Variance: participant: gap	0.70
Variance: participant: finiteness:gap	2.27
Variance: item: (Intercept)	0.64
Variance: item: finiteness	0.02
Variance: item: gap	0.16
Variance: item: finiteness:gap	2.41

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

Table 2: Estimates of the cumulative link mixed effects model with symmetrical thresholds for experiment 4, including fixed effects for FINITENESS, GAP, and the interaction of the two, as well as random intercepts and slopes for items and participants. Threshold structure estimates omitted due to space, all significant (***)�.

APPENDIX – MODEL ESTIMATES EXP. 1

Max model exp. 1	Estimate (std. error)
(Intercept)	-3.05*** (0.38)
gramfunc	2.39*** (0.41)
Num. obs.	432
Num. groups: participant	54
Num. groups: item	8
Var: participant (Intercept)	2.97
Var: participant gramfunc	0.90
Var: item (Intercept)	0.06
Var: item gramfunc	0.31

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

Table 3: Estimates of the generalized linear mixed effects model for experiment 1, including fixed effect for GRAMFUNC and random intercepts and slopes for items and participants.

APPENDIX – MODEL ESTIMATES EXP. 2.1

Max model exp. 2.1	Estimate (std. error)
(Intercept)	-2.45*** (0.50)
position	1.06* (0.46)
construction	0.93 (0.51)
position:construction	-0.22 (0.60)
Num. obs.	432
Num. groups: participant	54
Num. groups: item	12
Var: participant (Intercept)	4.34
Var: participant position	2.15
Var: participant construction	0.22
Var: participant position:construction	0.38
Var: item (Intercept)	0.77
Var: item position	0.18
Var: item construction	1.20
Var: item position:construction	1.08

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

Table 4: Estimates of the generalized linear mixed effects model for experiment 2.1, including fixed effect for POSITION, CONSTRUCTION, and the interaction of the two, as well as random intercepts and slopes for items and participants.

APPENDIX – MODEL ESTIMATES EXP. 2.2

Max model exp. 2.2	Estimate (std. error)
(Intercept)	-5.26*** (0.98)
position	3.42** (1.13)
gramfunc	2.90** (1.04)
position:gramfunc	-2.52* (1.13)
Num. obs.	432
Num. groups: participant	54
Num. groups: item	12
Var: participant (Intercept)	14.67
Var: participant position	9.02
Var: participant gramfunc	13.81
Var: participant position:gramfunc	10.52
Var: item (Intercept)	0.08
Var: item position	4.16
Var: item gramfunc	0.60
Var: item position:gramfunc	2.05

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

Table 5: Estimates of the generalized linear mixed effects model for experiment 2.2, including fixed effects for GRAMFUNC, POSITION, and the interaction of the two, as well as random intercepts and slopes for items and participants.