Locality domains in syntax: Evidence from sentence processing

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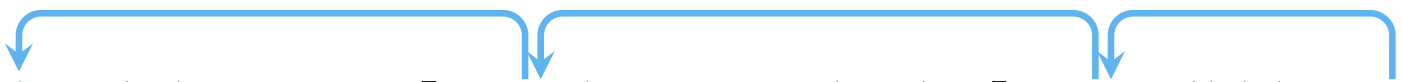
WCCFL 32

Introduction

Background

Long-distance movement is formed **successive-cyclically** (Chomsky 1973, 1977)

- **The traditional view:**
  Intermediate gap created in **Spec,CP**



(1) Who did Sue say [$_{CP}$ t that Sam thinks [$_{CP}$ t Bill likes t?

Extensions to vP

- More recently (Chomsky 1986, 2000, 2001), **vPs** have standardly been taken to also require successive-cyclic movement through their specifier

Phases

- C and v are phase heads
- Phase Impenetrability Condition requires intermediate landing site in specifier

This talk

Main point

Evidence from sentence processing can be used to locate intermediate landing sites and thereby phases

Main claims

- Reading time evidence for intermediate gaps created by successive cyclicity
- This evidence suggests that **only CPs host intermediate gaps; vPs do not**

Roadmap

1. Successive cyclicity in parsing: Previous evidence
2. Experiment: CPs vs. vPs
3. Previous evidence for intermediate gaps in Spec,vP

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Why sentence processing?

Syntactic constraints and sentence processing

Chomsky (2000, 2001, 2005):
Phases are the result of **constraints on computational resources**

- This directly leads one to expect to observe effects of **phases** in **online processing** → successive cyclicity

Why sentence processing?

Syntactic constraints and sentence processing

Chomsky (2000, 2001, 2005):
Phases are the result of **constraints on computational resources**

- This directly leads one to expect to observe effects of **phases** in **online processing** → successive cyclicity
- **Gibson & Warren (2004):**
  Reading time evidence for intermediate gaps in Spec,CP

Gibson & Warren (2004): Background

The role of filler–gap distance

The greater the **distance** between the filler and the gap, the greater the **reading time** at the position of the gap

(e.g., King & Just 1991, Gibson 1998, 2000, Gordon et al. 2001, Warren & Gibson 2002, Lewis & Vasishth 2005)

- **Rationale:**
  Filler has to be syntactically and semantically integrated at gap position → distance increases the difficulty of filler retrieval

Gibson & Warren (2004): The basic idea

- Movement out of CP compared to movement over complex subject DP

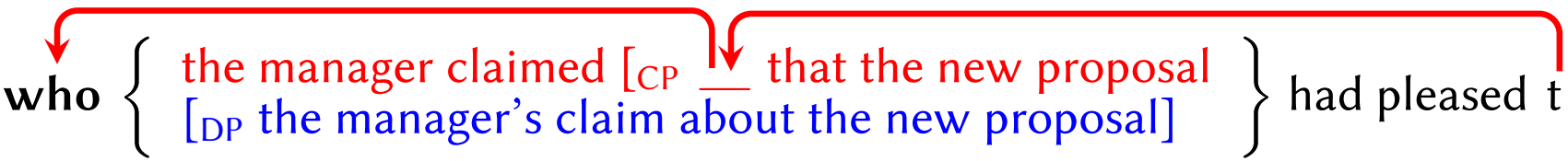
(2) **CP condition**
The consultant [**who** the manager claimed [$_{CP}$ that the new proposal had pleased ___]] will hire five workers tomorrow.

(3) **DP condition**
The consultant [**who** [$_{DP}$ the manager's claim about the new proposal] had pleased ___] will hire five workers tomorrow.

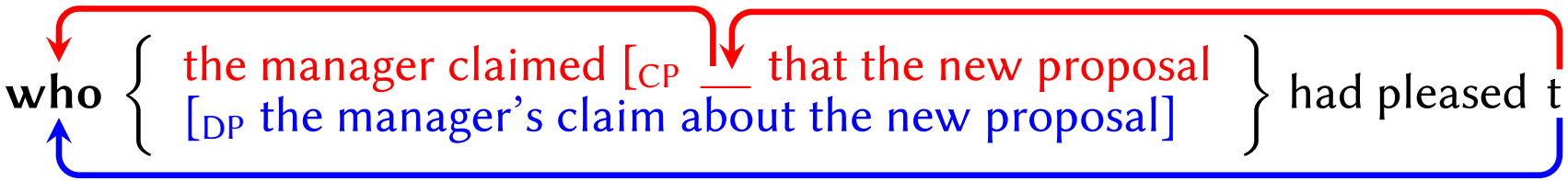
Structure of relative clause

who { the manager claimed [$_{CP}$ __ that the new proposal / [$_{DP}$ the manager's claim about the new proposal] } had pleased t

Structure of relative clause



Structure of relative clause



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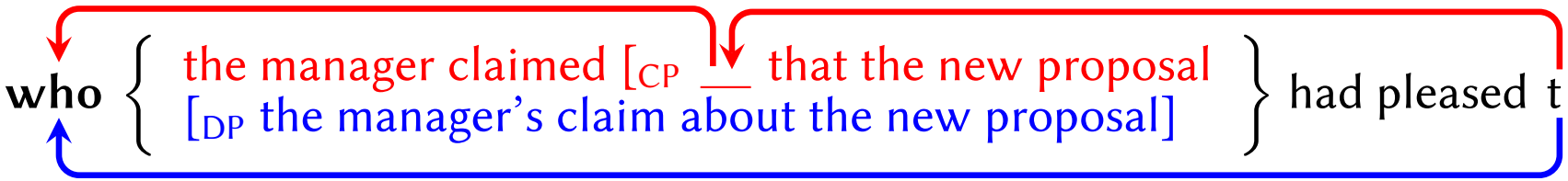

- **Expectation**
  Distance to closest antecedent is **smaller** in CP structure due to intermediate trace DP condition

→ This should manifest itself in the reading times at gap-hosting verb 'pleased'

Reading time: The crucial comparisons

(4) **CP condition**

a. The manager who the consultant claimed that the new proposals had pleased t will hire five workers tomorrow.

(5) **DP condition**

a. The manager who the consultant's claim about the new proposal had pleased t will hire five workers tomorrow.

Reading time: The crucial comparisons

(4) **CP condition**

a. The manager who the consultant claimed that the new proposals had pleased t will hire five workers tomorrow.
b. The consultant claimed that the new proposals had pleased the manager who will hire five workers tomorrow.

(BASELINE)

(5) **DP condition**

a. The manager who the consultant's claim about the new proposal had pleased t will hire five workers tomorrow.
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Gibson & Warren (2004): Results

Finding

Reading time increase between movement structure and baseline was **smaller** in CP condition than in DP condition

- → Intermediate gap in Spec,CP facilitates processing at gap site
  - No such facilitation in DP condition due to lack of intermediate gap

CP and vP?

- **What we know:**
  Gibson & Warren (2004)'s results show successive-cyclic movement through Spec,CP
- **Question:**
  Is there successive-cyclic movement through Spec,vP as well?

'CP only' hypothesis

Intermediate trace only in Spec,CP

'CP+vP' hypothesis

Intermediate trace in both Spec,CP and Spec,vP

Intermediate gaps on the CP+vP hypothesis

The limits of Gibson & Warren (2004)'s results

Gibson & Warren (2004)'s results are compatible with both 'CP only' and 'CP+vP' hypothesis

Intermediate gaps on the CP+vP hypothesis

The limits of Gibson & Warren (2004)'s results

Gibson & Warren (2004)'s results are compatible with both 'CP only' and 'CP+vP' hypothesis

CP structure:

who the manager [$_{vP}$ t claimed [$_{CP}$ t that the new proposal had [$_{vP}$ t pleased **t**

DP structure:

who [$_{DP}$ the manager's claim about the new proposal] had [$_{vP}$ t pleased **t**

- **3** intermediate gaps CP structure; only **1** in DP structure
- Relative easiness of CP structure follows if no only distance to closest gap matters but also **number of intermediate reactivations** (e.g., Vasishth & Lewis 2006)

Roadmap

1. Successive cyclicity in parsing: Previous evidence
2. Experiment: CPs vs. vPs
3. Previous evidence for intermediate gaps in Spec,vP

Expectations

'CP only' hypothesis

CPs have facilitatory effect on ultimate gap, vPs do not

'CP+vP' hypothesis

Both **CPs** and **vPs** have facilitatory effect

→ Different predictions for structures that contain an **additional vP layer but no CP layer**

Design

- Extension of Gibson & Warren's experiment with additional **TP structure**, all compared to no-movement control

(6) **CP structure**
The witness **who** the prosecutor proved [$_{CP}$ that the bloody footprint had conclusively incriminated **t**] admitted the truth.

(7) **DP structure**
The witness **who** [$_{DP}$ the prosecutor's proof about the bloody footprint] had conclusively incriminated **t** admitted the truth.

(8) **TP structure**
The witness **who** the prosecutor proved [$_{TP}$ the bloody footprint to have conclusively incriminated **t**] admitted the truth.

Movement in the three structures

CP structure:

who the prosecutor [$_{vP}$ __ proved [$_{CP}$ __ that the bloody footprint had
[$_{vP}$ __ conclusively incriminated **t**

DP structure:

who [$_{DP}$ the prosecutor's proof about the bloody footprint] had
[$_{vP}$ __ conclusively incriminated **t**

TP structure:

who the prosecutor [$_{vP}$ __ proved [$_{TP}$ the bloody footprint to have
[$_{vP}$ __ conclusively incriminated **t**

Movement in the three structures

CP structure:

who the prosecutor [$_{vP}$ __ proved [$_{CP}$ __ that the bloody footprint had
[$_{vP}$ __ conclusively incriminated **t**

INTERMEDIATE GAPS: **CP only: 1**

DP structure:

who [$_{DP}$ the prosecutor's proof about the bloody footprint] had
[$_{vP}$ __ conclusively incriminated **t**

INTERMEDIATE GAPS: **CP only: 0**

TP structure:

who the prosecutor [$_{vP}$ __ proved [$_{TP}$ the bloody footprint to have
[$_{vP}$ __ conclusively incriminated **t**

INTERMEDIATE GAPS: **CP only: 0**

Movement in the three structures

CP structure:

who the prosecutor [$_{vP}$ __ proved [$_{CP}$ __ that the bloody footprint had [$_{vP}$ __ conclusively incriminated **t**

INTERMEDIATE GAPS: **CP+vP: 3**

DP structure:

who [$_{DP}$ the prosecutor's proof about the bloody footprint] had [$_{vP}$ __ conclusively incriminated **t**

INTERMEDIATE GAPS: **CP+vP: 1**

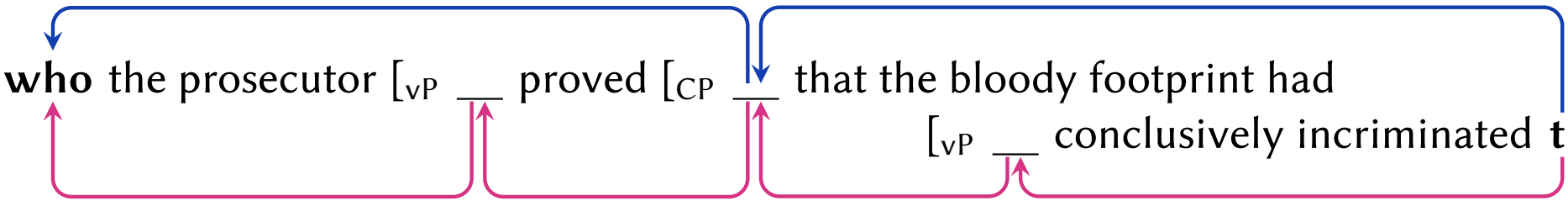
TP structure:

who the prosecutor [$_{vP}$ __ proved [$_{TP}$ the bloody footprint to have [$_{vP}$ __ conclusively incriminated **t**

CP+vP: 2

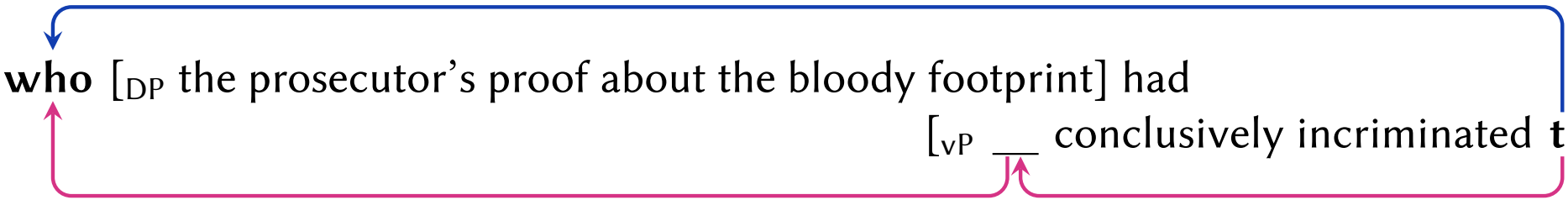
Movement in the three structures

CP structure:



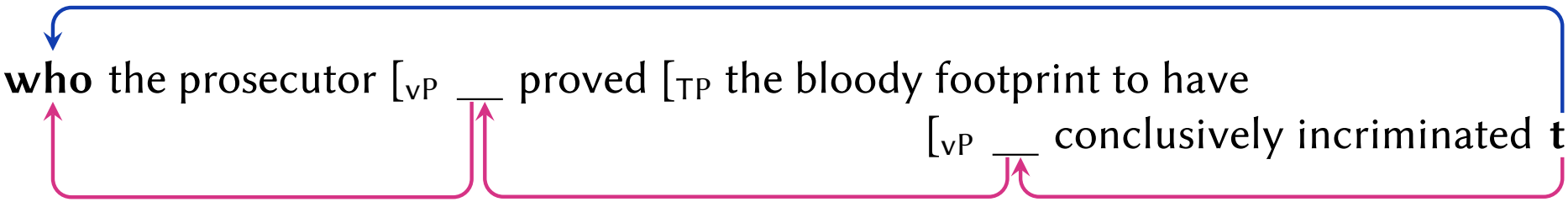
INTERMEDIATE GAPS: **CP only: 1**; **CP+vP: 3**

DP structure:



INTERMEDIATE GAPS: **CP only: 0**; **CP+vP: 1**

TP structure:



CP only: 0; **CP+vP: 2**

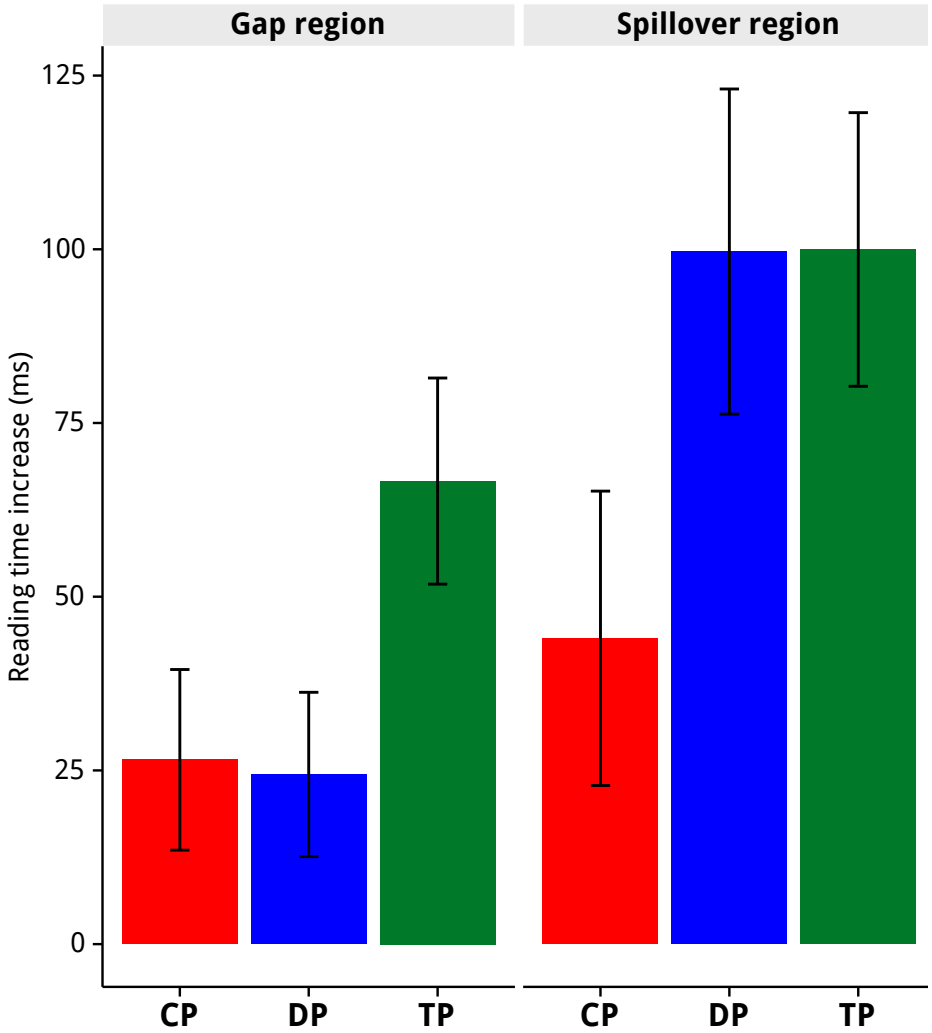
Predictions

	CP only	CP+vP
CP structure	1	3
DP structure	0	1
TP structure	0	2
Prediction:		
Reading time increase:	{DP, TP} > CP	DP > TP > CP

Method

- 2 x 3 design (crossing MOVEMENT and STRUCTURE)
- 162 participants recruited on MTurk
- 30 plausibility-controlled items
- Latin Square
- 60 filler sentences

Results



Gap region

- increase in TP condition **greater** than in CP and DP condition ($\hat{\beta} = -.05$, $t = -2.2$)
- no difference between CP and DP condition ($\hat{\beta} = -.00$, $t = -.04$)

Spillover region

- increase in DP and TP structures **greater** than in CP structure ($\hat{\beta} = .06$, $t = 2.1$)
- no difference between DP and TP condition ($\hat{\beta} = -.02$, $t = -.7$)

Results vs. predictions

Predictions: Reading time increase

- **CP only:** {DP, TP} > CP
- **CP+vP:** DP > TP > CP

Results:

- Gap region: {CP, DP} > TP
- Spillover region: CP > {DP, TP}

} TP > DP > CP

Conclusion

Results vs. predictions

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Conclusion

- Filler easiest to retrieve in CP structure
  - → **successive cyclicity through Spec,CP**

Results vs. predictions

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Conclusion

- Filler easiest to retrieve in CP structure
  → **successive cyclicity through Spec,CP**
- No facilitation in TP structure
  → **no successive cyclicity through Spec,vP**
- **Evidence for 'CP only' and against CP+vP hypothesis**

The role of structural distance

A remaining question:

Why is retrieval of the filler hardest in the TP structure?

Answer:

This is plausibly due the **structural** distance between the filler and the trace

The role of structural distance

- **TP structure:**
  Movement is **cross-clausal** ➛ particularly hard
- **CP structure:**
  Movement is **intra-clausal**, thanks to successive cyclicity
- **DP structure:**
  Movement is **intra-clausal**

The role of structural distance

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  Movement is **cross-clausal** → particularly hard
- **CP structure:**
  Movement is **intra-clausal**, thanks to successive cyclicity
- **DP structure:**
  Movement is **intra-clausal**

Upshot

- Movement in TP structure is cross-clausal only if there is **no** intermediate gap in Spec,vP

→ Additional evidence for 'CP only' hypothesis

Summary

- Reading time increase: TP > DP > CP
- Accounted for under 'CP only' hypothesis plus structural distance
  - Intermediate gap in Spec,CP → facilitation in CP structure
  - No intermediate gap in Spec,vP → no facilitation in TP structure
- Pattern is not accounted for under CP+vP hypothesis

Conclusion

Successive cyclicity through Spec,CP but not through Spec,vP

Roadmap

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'Wh'-expletives

- In, e.g., Hindi, wh-expletives occur before every verb between a wh-phrase and its scope position:

(9) Sita-ne kyaa socaa ki Ravi-ne kis-ko dekhaa?
Sita-ERG EXPL think that Ravi-ERG who-ACC saw
'Who did Sita think that Ravi saw?'

- Manetta (2010): Connector between phase-internal wh-phrase and scope position

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- Manetta (2010): Connector between phase-internal wh-phrase and scope position
- **Alternative account: Indirect dependency approach** (Dayal 2010)

(10) What does Sita think? Who did Ravi see?

Reconstruction

- Fox (1999): Wh-movement in (11) must proceed through via vP to bind the pronoun and obviate Principle C

(11) [Which of the books that he_1 asked $Ms.\ Brown_2$ for] did every student$_1$ [$_{vP}$ ✓ get from her_2 * ?

Reconstruction

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(11) [Which of the books that he_1 asked $Ms.\ Brown_2$ for] did $every\ student_1$ [$_{vP}$ ✓ get from her_2 * ?

- Den Dikken (2006): only **pair list** reading
- If every student raises above the wh-moved element (Kiss 1993), **no reconstruction** whatsoever is necessary

(12) $[every\ student]_1$ [which of the books that he_1 asked $Ms.\ Brown_2$ for]$_3$ did t_1 get from her_2 t_3

Copy spellout

- A wh-element is realized in several spots: Spellout of lower copy

(13) **Wen** hat er gesagt **wen** Maria mag?
who has he said who Maria likes
'Who did he say that Maria likes?' (GERMAN)

Copy spellout

- A wh-element is realized in several spots: Spellout of lower copy

  (13) **Wen** hat er gesagt **wen** Maria mag?
  who has he said who Maria likes
  'Who did he say that Maria likes?' (GERMAN)

- **A curious gap:**
  A standard CP+vP account predicts a much more striking version of this phenomenon: Copy spellout in CPs and vPs

  (14) **Who** do you **who** think **who** that Mary **who** likes?

→ **unattested**

Conclusion

- Sentence processing constructs movement dependencies successive-cyclically
  - ➙ Evidence **for** successive cyclicity through **Spec,CP**
  - ➙ Evidence **against** successive cyclicity through **Spec,vP**
- Consistent with working memory motivation for phases
- Phases are larger than commonly thought
  - ➙ **C is a phase, v is not**
- At least several of the previous arguments for vP phases do not in fact entail vP phases

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Appendix 1: Stimuli

(____ = gap region; ~~~~ = spillover region)

(15) **CP structure**

The witness **who** the prosecutor proved [$_{CP}$ that the bloody footprint had conclusively incriminated **t**] admitted the truth.

control: The prosecutor proved that the bloody footprint had conclusively incriminated the witness who admitted the truth.

(16) **DP structure**

The witness **who** [$_{DP}$ the prosecutor's proof about the bloody footprint] had conclusively incriminated **t** admitted the truth.

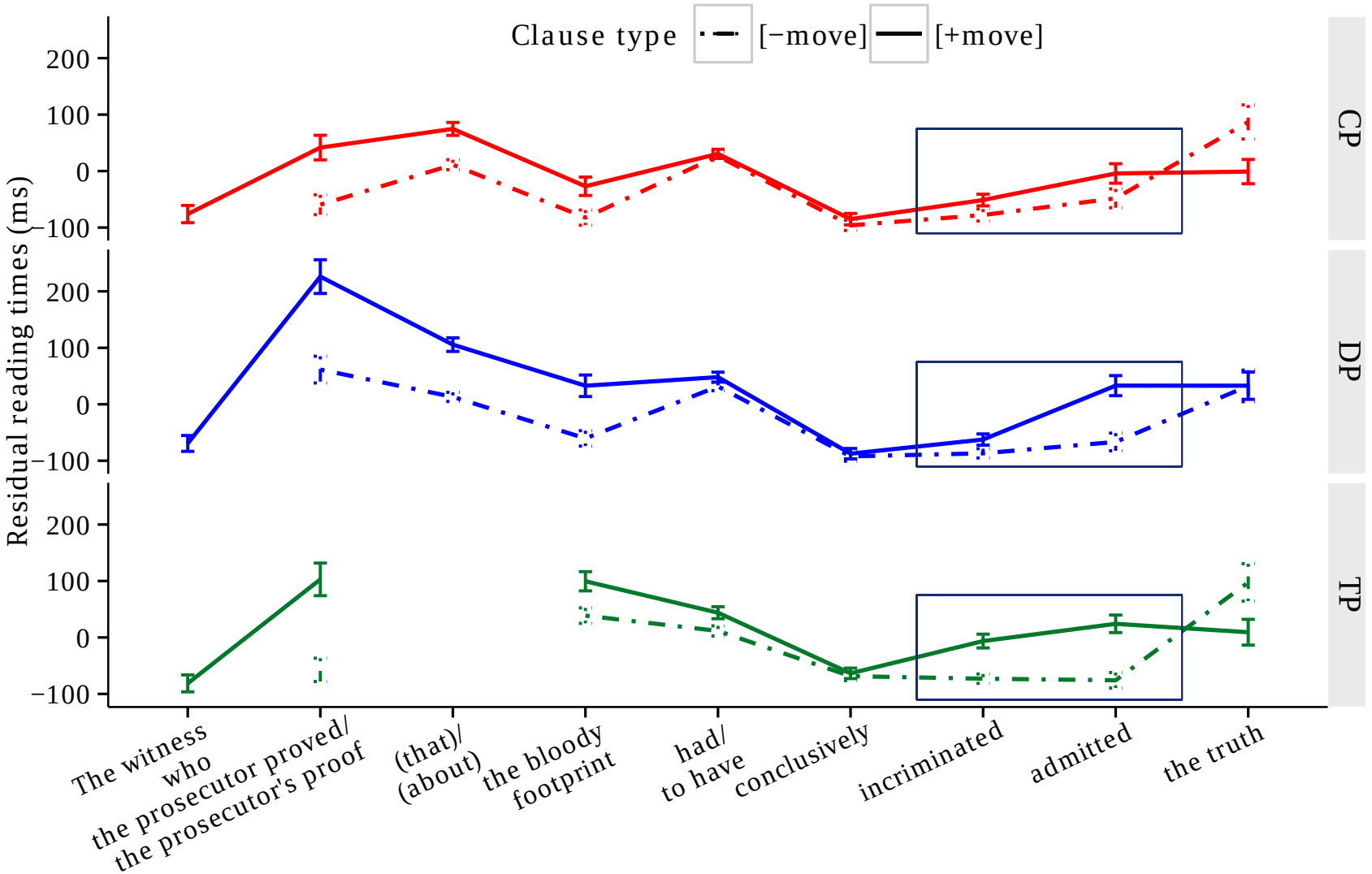
control: The prosecutor's proof about the bloody footprint had conclusively incriminated the witness who admitted the truth.

(17) **TP structure**

The witness **who** the prosecutor proved [$_{TP}$ the bloody footprint to have conclusively incriminated **t**] admitted the truth.

control: The prosecutor proved the bloody footprint to have conclusively incriminated the witness who admitted the truth.

Appendix 2: Complete reading times



Appendix 3: Linear and structural distance

CP structure:

who the prosecutor [$_{vP}$ proved [$_{CP}$ ___ that the bloody footprint had [$_{vP}$ conclusively incriminated **t**

LINEAR DISTANCE: **small**; STRUCTURAL DISTANCE: **small** → **fastest**

DP structure:

who [$_{DP}$ the prosecutor's proof about the bloody footprint] had [$_{vP}$ conclusively incriminated **t**

LINEAR DISTANCE: **large**; STRUCTURAL DISTANCE: **small** → **slower**

TP structure:

who the prosecutor [$_{vP}$ proved [$_{TP}$ the bloody footprint to have [$_{vP}$ conclusively incriminated **t**

LINEAR DISTANCE: **large**; STRUCTURAL DISTANCE: **large** → **slowest**