KING'S College LONDON

4th UK Cognitive Linguistics Conference (UK-CLC4)

Modeling domain minimization
A multifactorial approach to PP ordering in English

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Context

Syntactic variation:
Speakers can often choose between different constituent orders
(dative alternation, particle placement, etc.)

Efficiency-based explanation (Hawkins, 1994, 2004)**:**
Language user prefers minimal domains in which relations of combination and dependency are processed

Present study:
- look at **PP-ordering**
- present corpus-based empirical validation of **Hawkins's** theory of **processing-efficiency** and **principles of domain minimization**

Overview

1. **Introduction**

   Phenomenon: Constituent ordering – PP order

   Explanation investigated here:

   Minimize Domains (Hawkins 2004)

   - *Minimize Phrasal Combination Domains*
   - *Minimize Lexical Dependency Domains*

   Additional factors

   - *Manner > Place > Time – generalization*
   - *Information Status*

   Expectations from prior research

2. Data & Methods
   - Corpus data from ICE-GB
   - Binomial regression models without intercept

3. Results & Conclusion

Phenomenon: PP-ordering

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The astronomer $_{VP}$[gazed ...

i. ... **PP1**[into the sky] **PP2**[through his telescope]]
ii. ... **PP2**[through his telescope] **PP1**[into the sky]]

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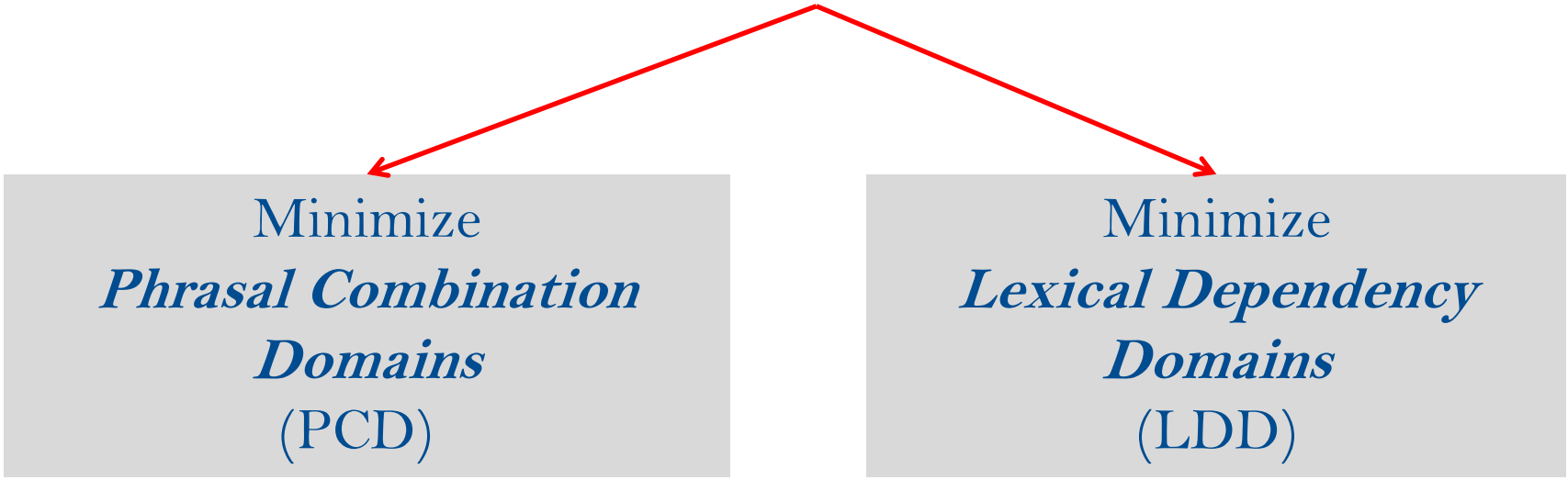
MINIMIZE DOMAINS

"*The human processor prefers to* ***minimize the connected sequences of linguistic forms*** *[…]* ***in which relations of combination and dependency are processed***."

Hawkins (2004: 31)



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Phrasal Combination Domain (PCD) Minimization

Minimize Phrasal Combination Domains

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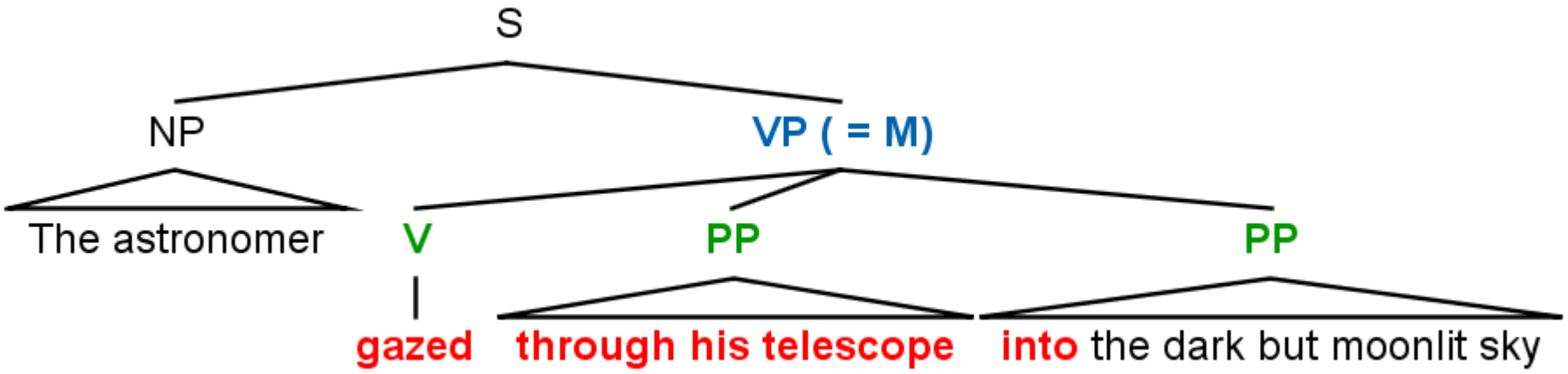
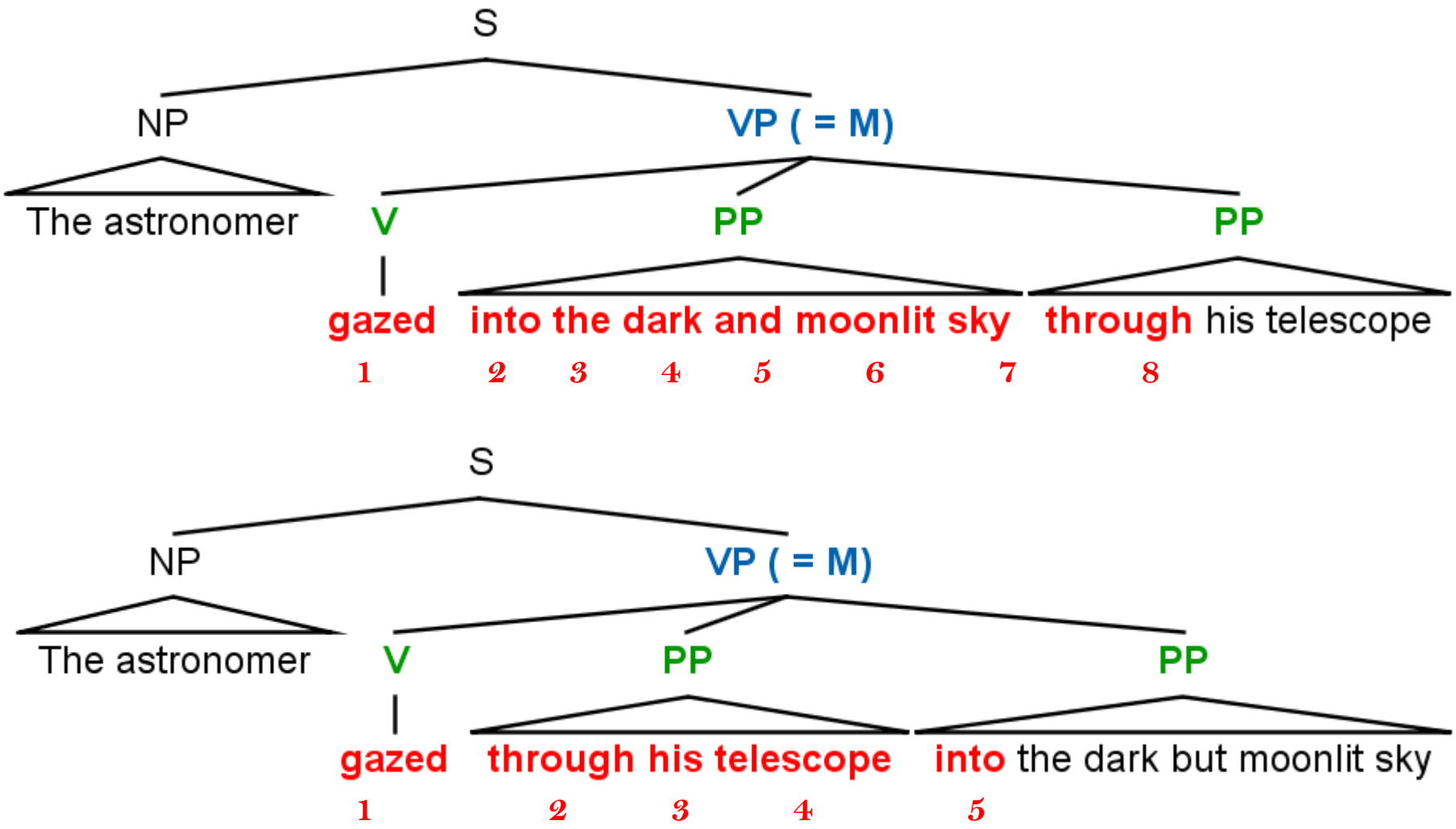
Definition: **Phrasal Combination Domain (PCD)**

The **PCD** for a **mother node M** and its **I(mmediate) C(onstituent)s** consists of the smallest string of terminal elements […] on the basis of which the processor can construct **M** and its **ICs**



Minimize Phrasal Combination Domains



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Lexical Dependency Domain (LDD) Minimization

Minimize Lexical Dependency Domains

Lexical dependency between V & PP is present when semantics of the predicate can only be understood, when PP has been perceived

- test for semantic dependencies (via semantic entailment tests).
- assess difference between dependency domains

i. *John* ***counted*** $\mathrm{PP}_{\mathrm{dep}}$ ***[on your support]*** $\mathrm{PP}_{\mathrm{indep}}$ *[in his old age.]*

1 2 3 4

ii. *John* ***counted*** $\mathrm{PP}_{\mathrm{indep}}$ *[in his old age]* $\mathrm{PP}_{\mathrm{dep}}$ ***[on your support.]***

1 2 3 4 5 6 7 8

Minimize Lexical Dependency Domains

Test 1: **Verb entailment test**

Does **[X V PP] entail [X V]**?

If so, then assign PP_{indep}.

If not, then assign PP_{dep}

i. *John* ***counted [on your support]*** *[in his old age.]*

SUBJ ***V*** ***PP_{dep}*** *PP_{indep}*

ii. *John* ***counted*** *[in his old age]* ***[on your support.]***

SUBJ ***V*** *PP_{indep}* ***PP_{dep}***

Minimize Lexical Dependency Domains

Test 2: **Pro-verb entailment test (Pro-V e.g.** X *did something* PP)

Does **[X V PP] entail [X Pro-V PP]**

If so, then assign PP_{indep}.

If not, assign PP_{dep}.

i. *John accounted* [***for this fact***] [*in his book*]

SUBJ ***V*** ***PP*** $_{dep}$ PP_{indep}

ii. *John accounted* [*in his book*] [***for this fact***]

SUBJ ***V*** PP_{indep} ***PP*** $_{dep}$

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Methods & Data

Data

Construction	…VP [V PP PP] …
Corpus	ICE-GB
Time-span	1990s
Variety	British English
Medium	Written and Spoken
Sample size	1,256

Coding of Variables

PCD: Difference (in number of words) of length actual & non-actual PCD

LDD: Difference (in number of words) of length actual & non-actual LDD

MPT: 0 whenever MPT made no prediction
1 whenever MPT was applicable and respected
-1 when it was applicable but violated

INF. STATUS:

Statistical Analysis

Binomial logistic regression w/o intercept
→ Adaptation for type-identical constituents
(Benor & Levy 2006, Levy in progress)

Model tries to predict the *ACTUAL* PP-order as a function of four predictors:

1. PCD
2. LDD
3. MPT
4. INFORMATION STATUS

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Expectations from prior research

Expectations from prior research

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Minimize PCD	• Corpus study (Hawkins 2000): PCD is the most **general** and the **strongest** constraint
Minimize LDD	• Corpus study (Hawkins 2000): **2nd most important** constraint • Sentence recall experiments (Marblestone 2007): semantic dependencies are **strongest** constraint
MPT	**Strong** predictor of PP-order ▪ typological parameter (Boisson 1981)
INF. Status	**Strong** predictor ▪ Given > New (*communicative dynamism*, Firbas 1963)

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Results

Classification accuracy

(number of correctly predicted cases in %)

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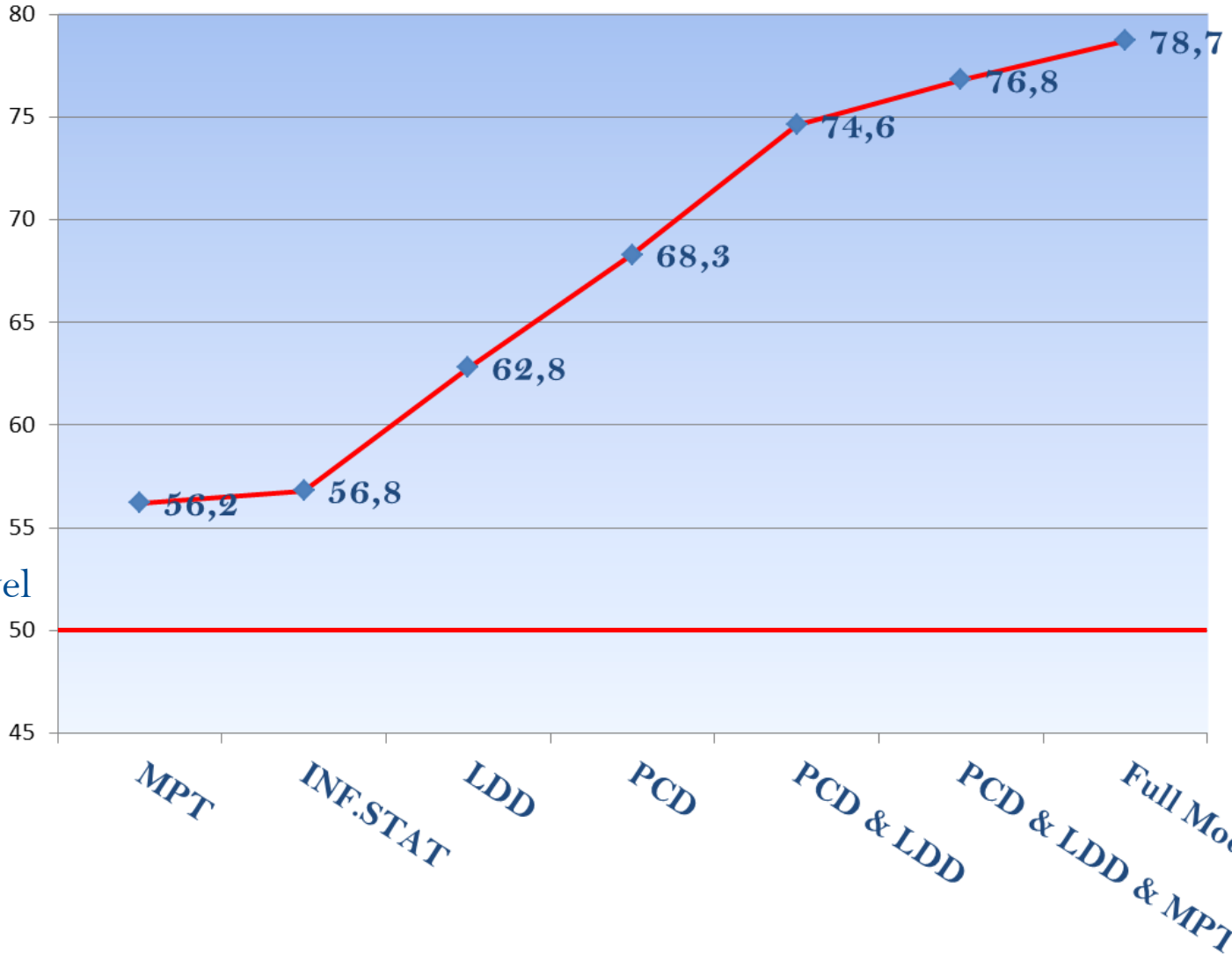
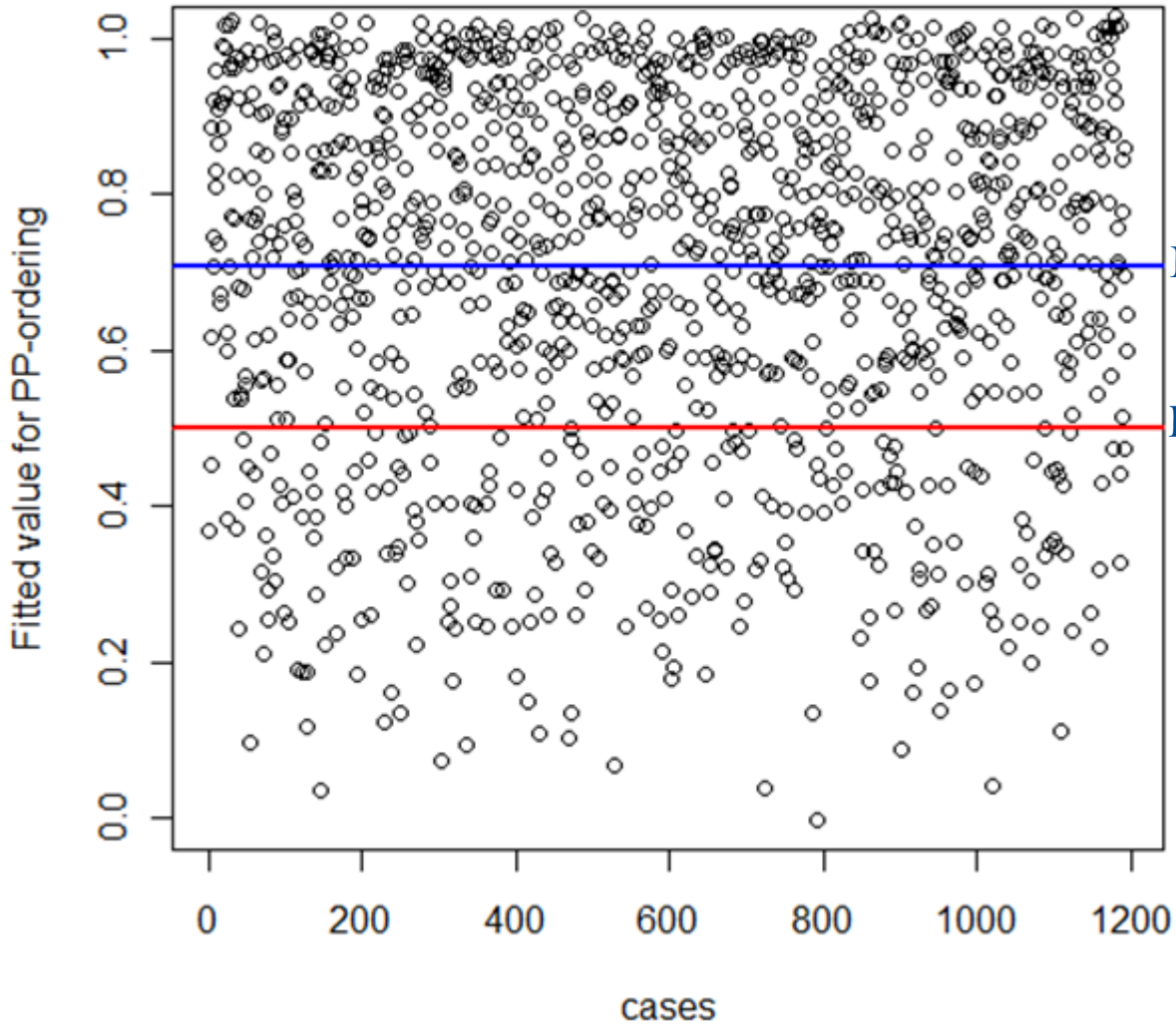


chance-level baseline

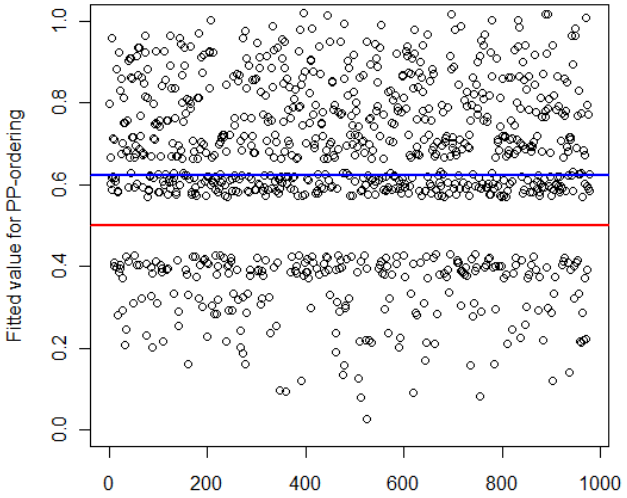
Predicted values:
Full model



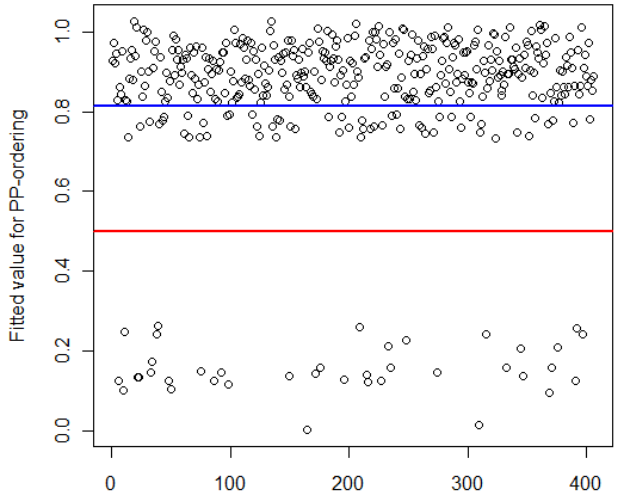
Cases with predicted probability = 0.5 removed

Predicted values:
Single-predictor models

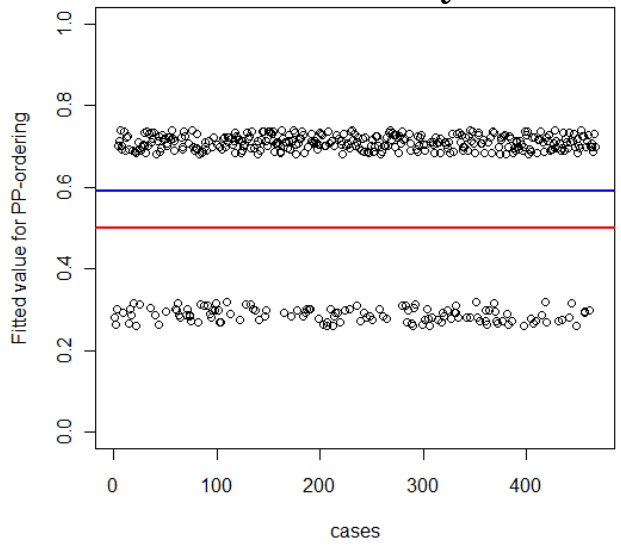
PCD only



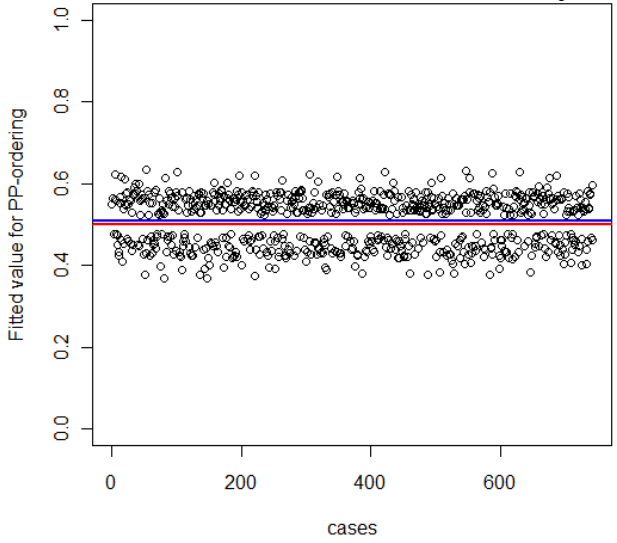
LDD only



MPT only



Information Status only



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Revisiting Expectations from prior research

Expectations from prior research

Minimize PCD	• Corpus study (Hawkins 2000): PCD is the most **general** and the **strongest** constraint
Minimize LDD	• Corpus study (Hawkins 2000): **2nd strongest** constraint • Sentence recall experiments (Marblestone 2007): semantic dependencies are **strongest** constraint
MPT	**Strong** predictor of PP-order ▪ psychological parameter (Boisson 1981)
INF. Status	**Strong** predictor ▪ Given > New (*communicative dynamism*, Firbas 1963)

Conclusion

- Overall predictive success rather limited
  (< 80% correct predictions)

- DOMAIN MINIMIZATION explains most
  - LDD: not so much coverage but largest effect size
  - PCD: greatest coverage but not as strong as LDD

- MPT & INFORMATION STATUS add to explanatory power
  but play only minor roles

→ **Supports the idea that constituent order is strongly co-dertermined by processing-efficiency**

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Thank you!

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