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# The role of retrieval interference in recovery from ungrammaticality

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## Background

▶ Subject-verb number agreement is affected by *attraction* (e.g. Wagers et al (2009, JML); Lago et al (2015, JML)):

▶ Processing difficulty for ungrammatical agreement is reduced in presence of matching attractor:

### Easier (matching distractor) [from Lago et al, 2015]

The players that the coach **were** always praising very enthusiastically decided to leave the team.

### Harder (mismatching distractor) [from Lago et al, 2015]

The player that the coach **were** always praising very enthusiastically decided to leave the team.

- ▶ In cue-based retrieval models (e.g. Lewis & Vasishth, 2015, Cognitive Science), this attraction effect is due to occasional mis-retrieval of the matching distractor (e.g. *players*).
- ▶ Lago et al (2015) argued that attraction affects *error-based processing* following the initial encounter with the ungrammatical verb, rather than initial retrieval
  - ▶ Lago et al found evidence of an earlier onset of basic grammaticality effect (*was* vs. *were*), relative to attraction effect.
- ▶ However, Lago et al's analysis was based on spill-over region in self-paced reading
  - ▶ Hard to judge true onset of grammaticality effect, due to different verbs in critical verb region (*was* vs. *were*)

## The current experiment

### 1a. Ungrammatical: Matching distractor

The nurse who the widows relied on definitely/ **were**/ reluctant/ to work/ long shifts.

### 1b. Ungrammatical: Mismatching distractor

The nurse who the widow relied on definitely/ **were**/ reluctant/ to work/ long shifts.

### 1c. Grammatical

The nurses who the widow relied on definitely/ **were**/ reluctant/ to work/ long shifts.

- ▶ Eye-tracking experiment designed to compare onset of grammaticality effect ((1a,1b) > 1c) and attraction effect (1a>1b)
- ▶ Critical verb (*were*) identical in all three conditions, allowing examination of earliest possible evidence of grammaticality effect
- ▶ Items adapted from Dillon et al (2013, JML), but altered to have distractor in subject position (deliberately designed to maximize attraction effect)
- ▶ Design focused on attraction in ungrammatical sentences, so included only one grammatical condition
- ▶ 16 items per condition (48 items overall), so reasonable power to detect effect
- ▶ 39 participants; 48 sentences; Eyelink 1000

## Analysis measures

### First-pass Reading Time

Sum of fixation durations from first entry into region until first exit

### Go-Past time (main measure of interest)

The time taken to "go past" a region: sum of fixation durations from the first entry into the region from the left, to the first exit to the right

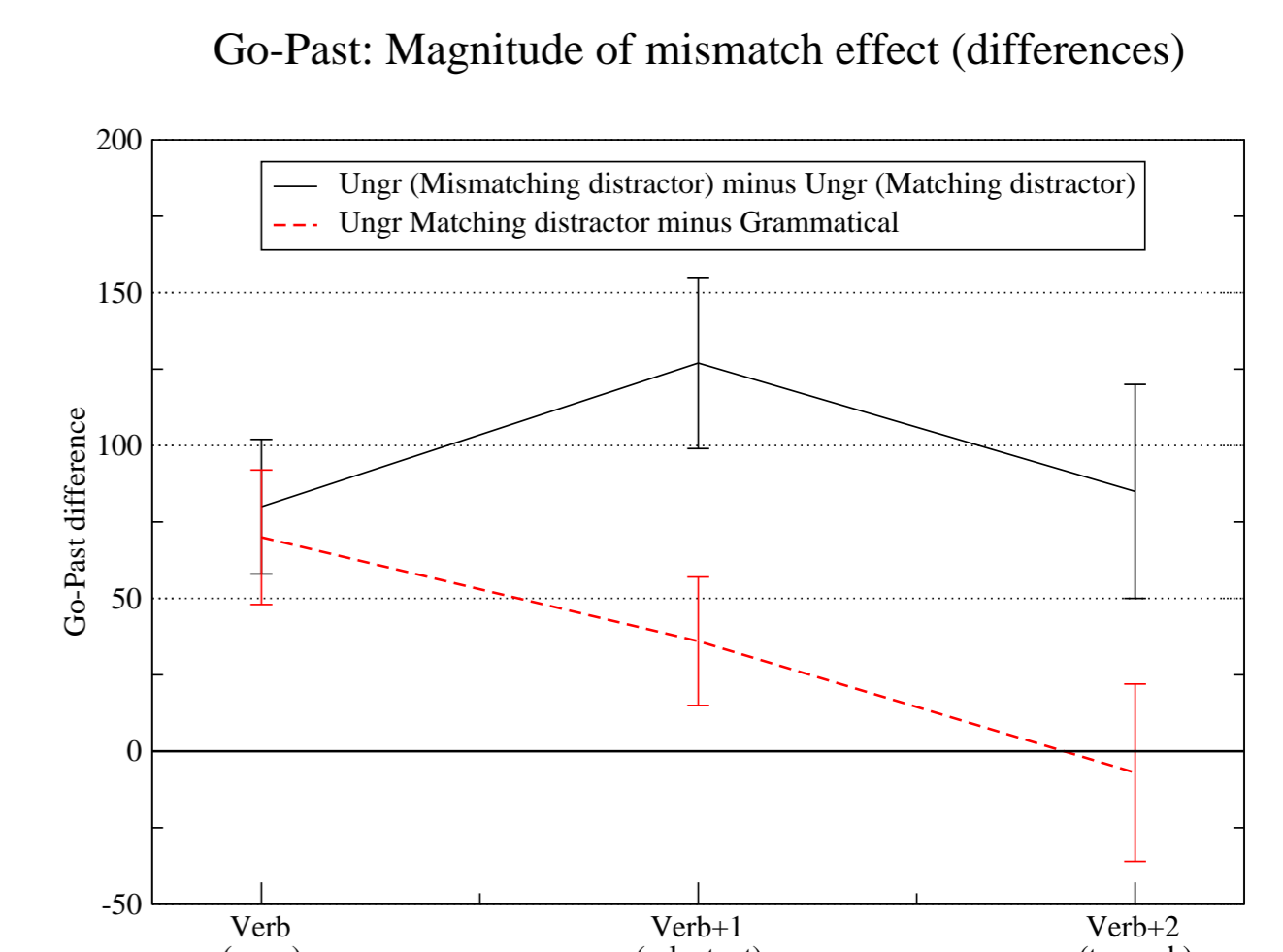
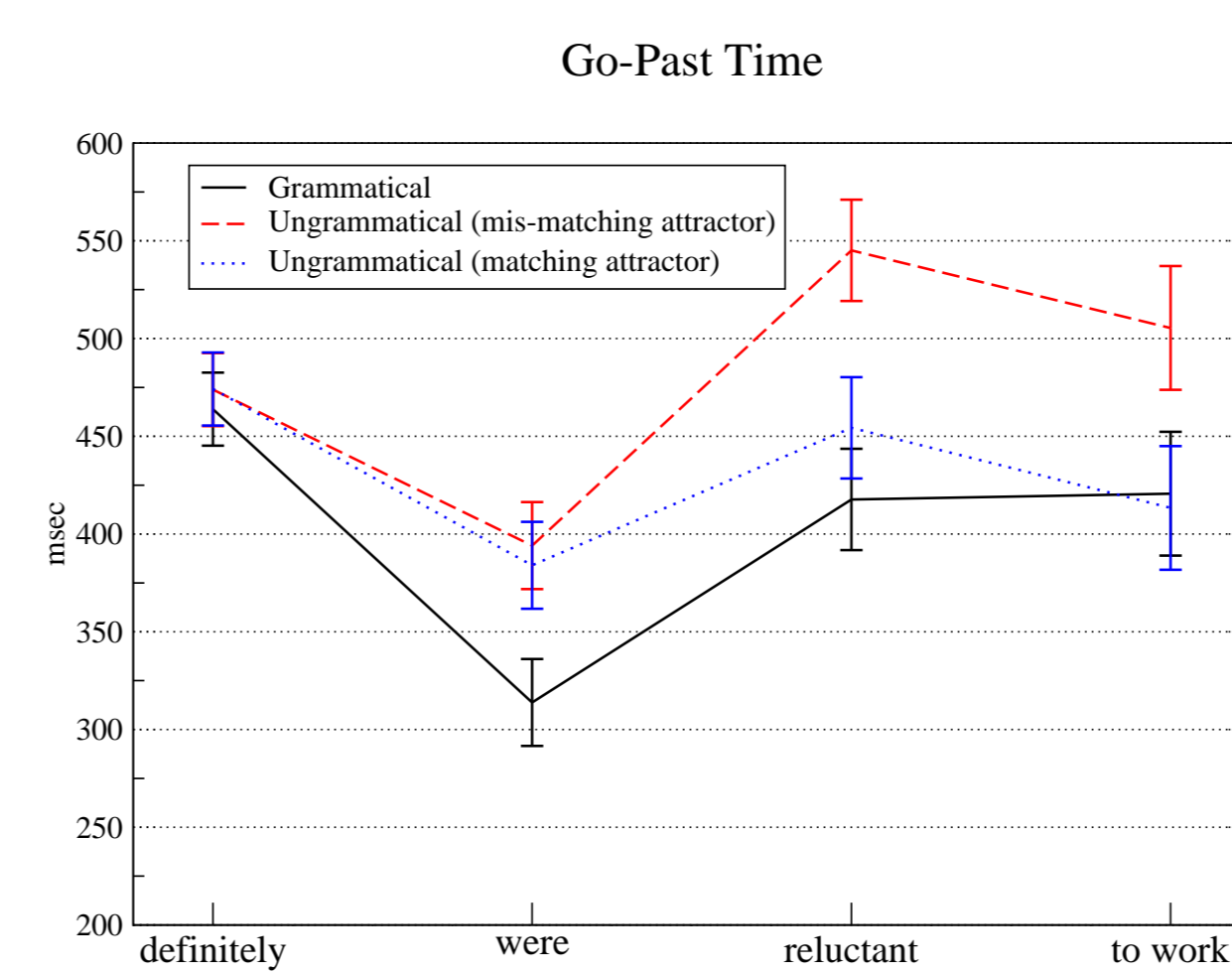
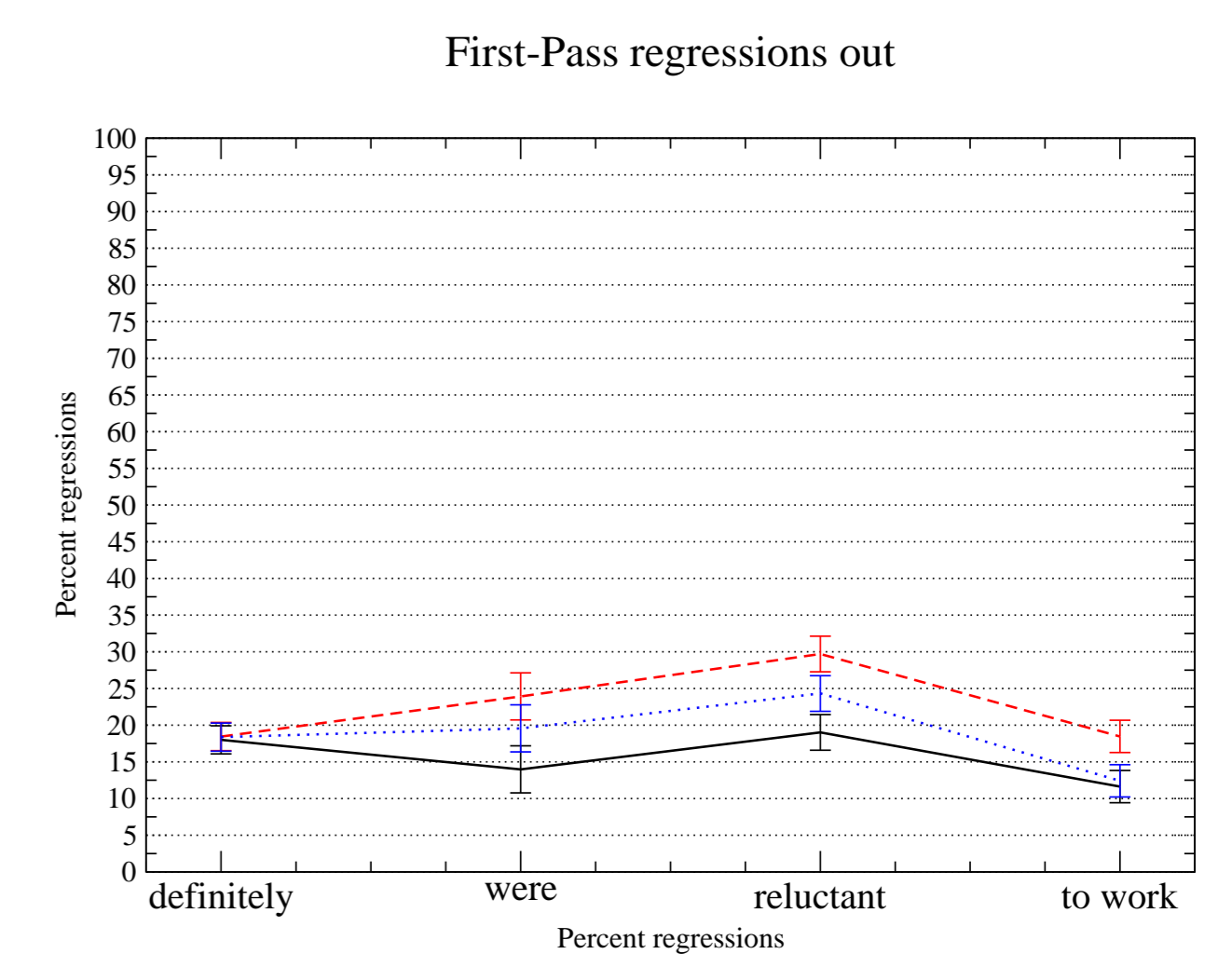
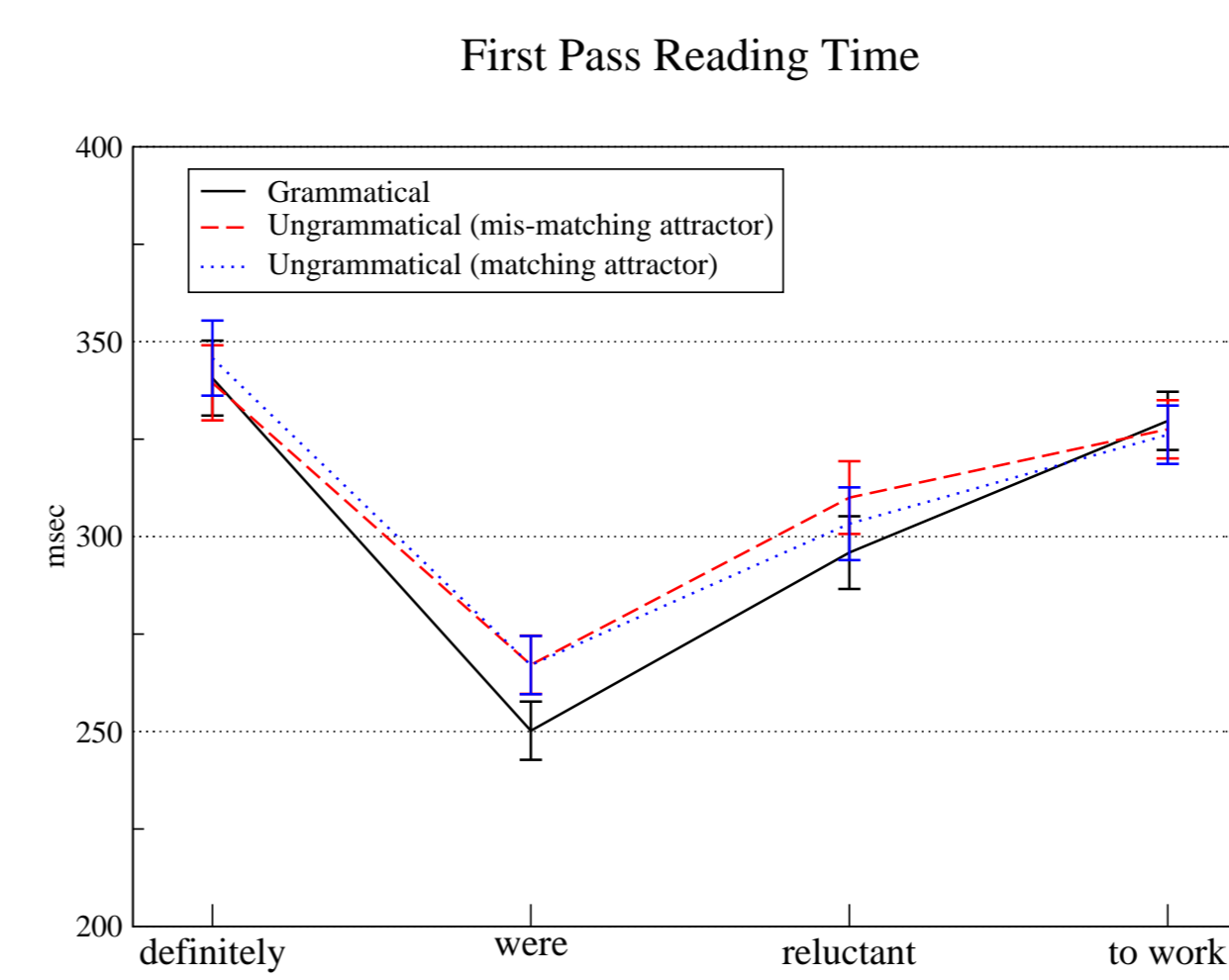
### Proportion of First-pass regressions

Proportion of trials where the first exit from the region is a regression.

### Leftward shifting procedure

- ▶ Because of short, high frequency critical word (*were*) left boundary of region could be iteratively moved to left, if no first-pass fixation in region (up to maximum of 4 characters) [see also Sturt (2003)]
- ▶ Procedure increased 1st-pass fixation rate 60% → 86%

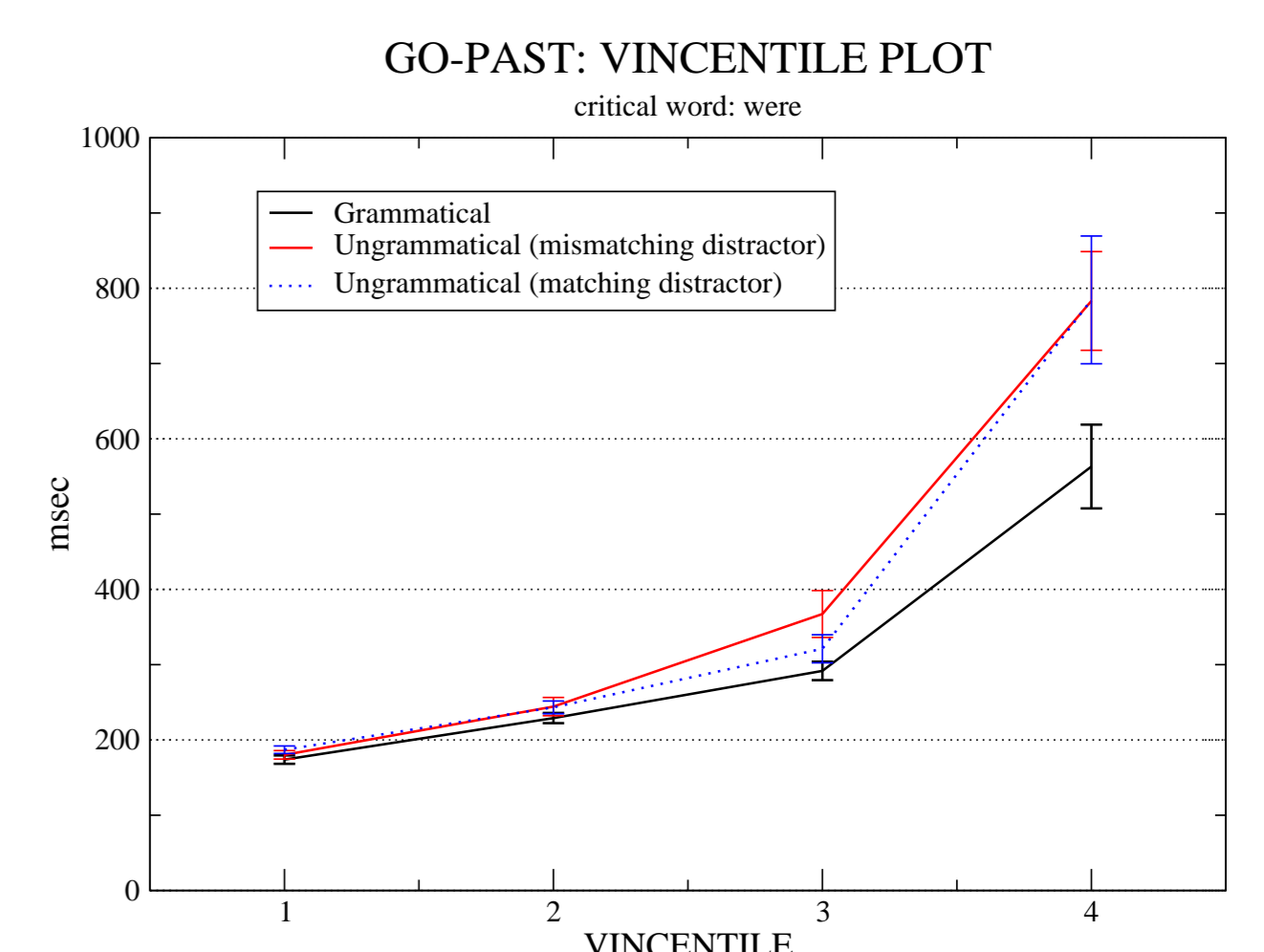
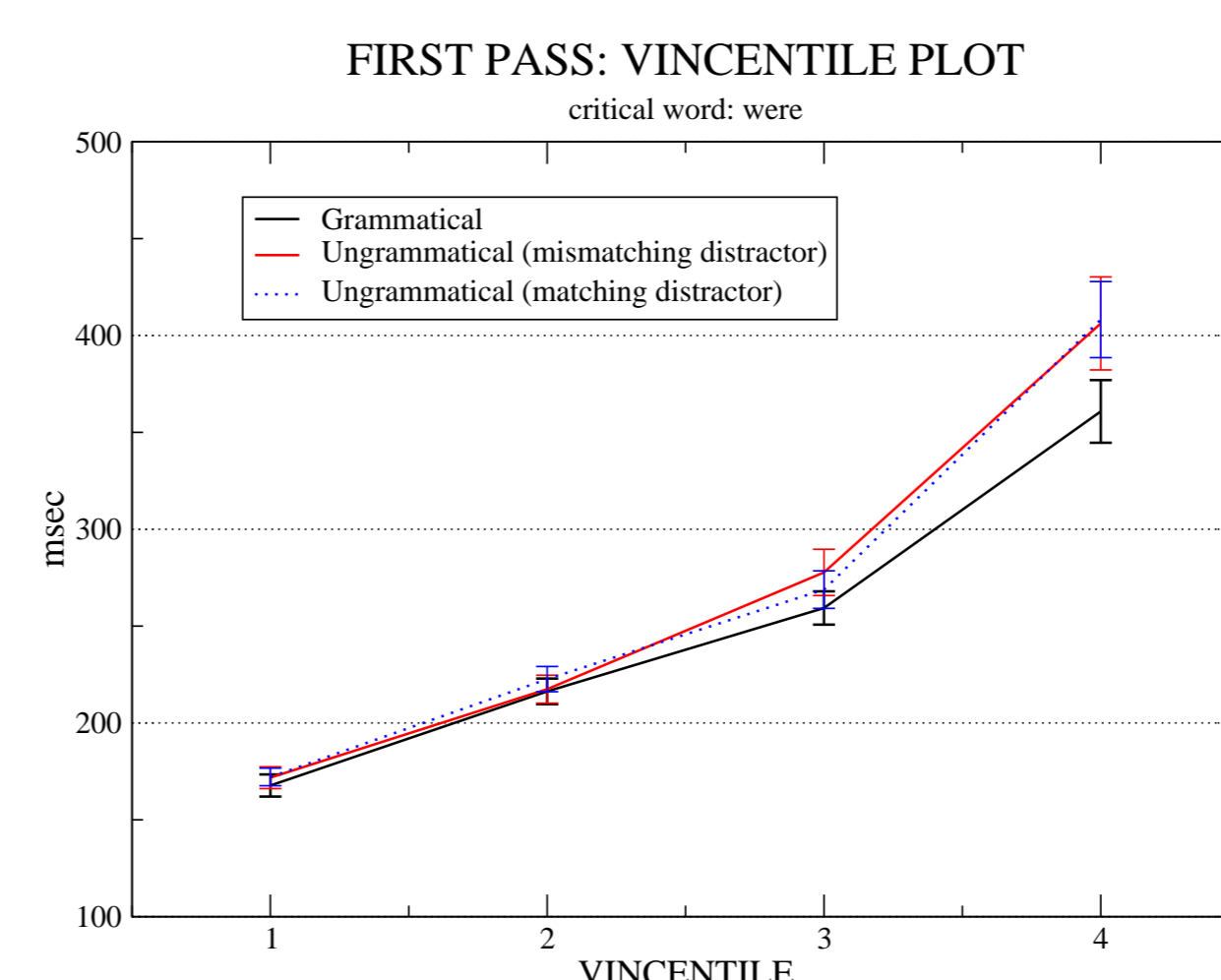
## Eye-movement measure results



- ▶ Early grammaticality effect in reading time measures in critical region (Ungrammatical conditions > grammatical)
- ▶ Attraction effect in later regions (Mismatching distractor > Matching distractor)
- ▶ In go-past (reflecting reader's progression through sentence), attraction effect increases across regions
  - ▶ Suggests that matching distractor reduces the duration of processing difficulty, not its onset.
- ▶ However, marginal attraction effect in critical region in first-pass regressions

## Vincentile Plots for critical word "were"

- ▶ Vincentile plots: divide data of critical region for each participant into four quartiles per subject per condition (see also Lago et al)
- ▶ Plot each quartile collapsing over participants



- ▶ Vincentile × condition interaction for both measures ( $p$ 's < .05)
  - ▶ Shows that grammaticality effect first emerges in relatively slow trials (late vincentiles)
- ▶ No reliable difference between two ungrammatical conditions (i.e. similar time-course, regardless of matching of distractor)

## Summary

- ▶ Onset of mismatch cost not reliably affected by matching of distractor in duration-based measures
- ▶ Long duration of processing difficulty in mismatching distractor ungrammatical condition
- ▶ Quick recovery in matching distractor condition
- ▶ Attraction seems to affect recovery from ungrammaticality (as argued by Lago et al)
- ▶ However, equivocal results for first-pass regressions

## Acknowledgements

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