

# Passives are not inherently more complex than actives

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*AG 2: The syntax of argument structure:  
empirical advancements and theoretical relevance*

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# Passives & Complexity

## Background:

- Various fields take passives to be more complex than actives
- ⇒ Active/passive as a minimal pair for investigating syntactic complexity

Puzzle: healthy adult data only shows difficulty offline not online

- ⇒ Previous studies did not control for various factors relevant to passive processing, including verbal semantics and adjectival/verbal ambiguity

## Aim:

- Online processing experiment, controlling for verbal semantics and auxiliary type (amongst other factors)
- ⇒ Evidence that passives are more difficult to process online than actives

# Overview

- Previous research on passives: Evidence that they are more complex than actives offline but not online
- Problems with previous psycholinguistic studies
- Current studies: Addressing the problems
- Future directions
- Conclusions

# Previous literature: Passives more complex

- Theoretical literature: passives often seen as derivative of, and therefore more complex than, actives (Chomsky, 1957)
- Language development literature: passives are acquired later than actives (Guasti, 1994)
- Aphasia literature: passives are impaired as are other, non-canonical, movement derived structures (Bastiaanse & van Zonneveld, 2004; Grodzinsky, 2000; Caplan et al., 2007)
- Psycholinguistic literature: offline, more errors on passives than actives (Ferreira, 2003, Street Dabrowska, 2010)

# Parsing model

(Bever 1970, Townsend & Bever, 2001, Ferreira, 2003, a.o.)

*the girl was rejected by the pianist*

Agent First Heuristic

Girl= AGENT  
Pianist= PATIENT

Fast, but  
INCORRECT  
interpretation

Algorithmic Processes

Slow but  
Correct  
interpretation

# Problem: Online Psycholinguistic Evidence

Faster RTs in passives than actives (Carrithers 1989, Rhode 2003, Traxler et al., 2014):

Passive:

*The farmer was tricked by the cowboy into selling the horse.*

Active:

*The farmer tricked the cowboy into selling the horse.*

This is neither consistent with heuristics or with a standard algorithmic analysis that says "movement is complex"

# Summary of Psycholinguistic literature

Study	Measure and effect
Ferreira, 2003	Offline → passive <b>worse</b> than actives
Street and Dąbrowska, 2010	Offline → passive <b>worse</b> than actives
Carrithers, 1989; Rohde 2003	Online → passive <b>faster</b> than actives
Traxler et al., 2014	Online → passive numerically <b>faster</b>

# Asymmetric picture

## Offline Results

### Passives more complex

- Unimpaired adults (Ferreira, 2003)
- Child Language (Guasti 2004, but see Volpato, Verin & Cardinaletti 2015)
- Language impairment (Grodzinsky 2000, a.o.)

## Online Results

### Passives read faster

- Carrithers (1989)
- Rohde (2003)
- Traxler et al. (2014)



# Probabilistic parsing

(Konieczny 2000, Hale 2001, Jurafsky 1996, Staub & Clifton 2006, Levy 2008, Jaeger 2010 a.o.)

Speakers are sensitive to probability distributions



strong prediction  
for a DP

The girl was rejected by the pianist



strong prediction  
for a predicate

Passive morphology reduced surprisal of following words  
This doesn't explain comprehension!

# 4 factors overlooked in previous studies

I. Verb semantics

II. Auxiliary type

III. Late complexity effect

IV. Auxiliary as strategy

# I. Lexical semantics: events vs. states

- Eventive predicates (eg, *hire*) and stative predicates (eg, *admire*) may differentially affect passive processing both within and across languages

# I. Lexical semantics: events vs. states

- States do not easily derive verbal passives;
  - Object experiencers only derive adjectival passives in Italian (Belletti & Rizzi 1988):
    - \*Gianni viene preoccupato da tutti  
*Gianni comes worried by everybody*
  - Unambiguous verbal passives of subject-experiencers also restricted.
  - Only allow generic by-phrases, a restriction typically found in the adjectival domain
    - Gianni viene apprezzato da tutti i suoi amici  
*Gianni comes appreciated by all his friends*
    - ??Gianni viene apprezzato da Maria (only ok as inchoative state)  
*Gianni comes appreciated by Mary*

# I. Lexical semantics: events vs. states

Using mixed predicate types might have confounded previous results, given their different interaction with passivization.

- problem in Ferreira, 2003; Traxler et al., 2014 (among others)

The interpreter was confused (obj. exp.) by the diplomat during the treaty negotiations.

The baker was hired (eventive) by the woman to help out with the wedding.

The professor was admired (subj. exp.) by the students in the biology class.

The coal miner was pushed (eventive) by the bartender and the people at the bar laughed.

# I. Lexical semantics: events vs. states

- No morphological distinction between English adjectival and verbal passives
- Passives of states allow adjectival interpretation (at least until *specific by*-phrase)
- Faster RTs at the verb might index lower complexity of adjectival parse than active verbal parse

# II. Ambiguous auxiliary

- Effects of verb type particularly problematic in English because of adjectival/verbal ambiguity of BE passives
  - The boy was upset
- This might cause selective difficulty in interpretation (which would only be registered late in the clause, i.e. at or after the *by*-phrase)
- Not an issue in all languages (e.g. German, *werden* ‘become’ instead of *sein* ‘be’)

# III. Location of Complexity Effect

Theories predict locus of complexity at different locations:

- *At the by-phrase*: Contrary to A' movement (Active Filler Hypothesis, Frazier 1987) subjects of passives can only be recognized as fillers when the past-participle/*by-phrase* is encountered, i.e. complexity at the past participle or *by-phrase*.
- *After the by-phrase*: Complexity arises at the copy of the moved VP (located after the *by-phrase* Collins, 2005; Gehrke & Grillo, 2007, 2009), i.e. complexity after the *by-phrase*.



# III: Complexity tested too early in previous studies?

Short *by*-phrases: not enough time to detect complexity/revision effect (ie, identify filler and complete dependency/revise heuristic).

Complexity not assessed after *by*-phrase, as some theories predict problem in Traxler et al., 2014

- The painter was **hired**... item 7a
- The child was **upset** ... item 24b

(Examples from Traxler et al. 2014)

# IV. Auxiliary Strategy in Previous Studies

Presence of auxiliary *only* in passive might present participant with strategy to expect passive early on; easing processing.  
problem in Carrithers, 1989; Traxler et al., 2014

The policeman found the lost child ...

The farmer tricked the cowboy ...

The professor **was** admired by the students ...

The mayor approached the councilman...

The baker hired the woman ...

(Examples from Traxler et al., 2014)

# New Studies

- 4 self-paced reading studies
- 2 in English
- 2 in German
- Two follow-up studies are under way in both languages

# New studies: Addressing the Problems

- I Problem: Verb type manipulation (Eventive vs. stative)
- II Problem: Cross linguistic Experiments (Ambiguous English vs. Unambiguous German verbal passives)
- III Problem: Longer *by*-phrases (prenominal modification) followed by 2 PPs.
- IV Problem: Auxiliary present in both passives and actives (progressive or perfect auxiliary, in English)

# Predictions of previous accounts

1. Algorithmic → **slower** than active and less accurate because of movement
2. Only heuristic processing → **equally fast** as actives, but **incorrect** (floor levels on passives) interpretation on passives
3. Heuristic + revision by algorithmic processing → **slower** than actives, and lower accuracy on passives than actives (but relatively accurate)
4. TODAY: No heuristic at play; algorithmic/probabilistic parsing → Interaction of verb-type and language specific properties (e.g. aux type)

# New Predictions

algorithmic/probabilistic parsing → Interaction of verb-type and language

- A. Eventive: **equally fast/faster** than actives, and **correct** interpretation (high accuracy to comprehension questions) across languages
- B. Stative passives: in **English** *fast at verb slower at following regions and lower accuracy* (early adjectival analysis + reanalysis)
- C. Stative passives: in **German** *equally fast/faster than actives and high accuracy* (no adjectival/verbal ambiguity, no reanalysis)

# (English) Experiment I: Method

- Self-paced reading (word by word, non-cumulative, moving window)
- 1 within-subject factor: syntax (active vs passive)
- 30 experimental sentence pairs
- 60 filler sentences of comparable complexity
- Comprehension questions after each sentence

# English Experiment I: Materials

- Passive

*The guitarist was rejected by the attractive and talented singer in the hall next to the pub*

- Progressive

*The guitarist was rejecting by the attractive and talented singer in the hall next to the pub*

- Active

*The guitarist rejected the attractive and talented singer in the hall next to the pub*

- All sentences controlled for plausibility of thematic role assignment (online questionnaires: 70 participants, Native English speakers)
- 60 filler sentences of comparable complexity (15 actives; 15 passives; 15 sentences with negation; 15 garden-path “while...” constructions)



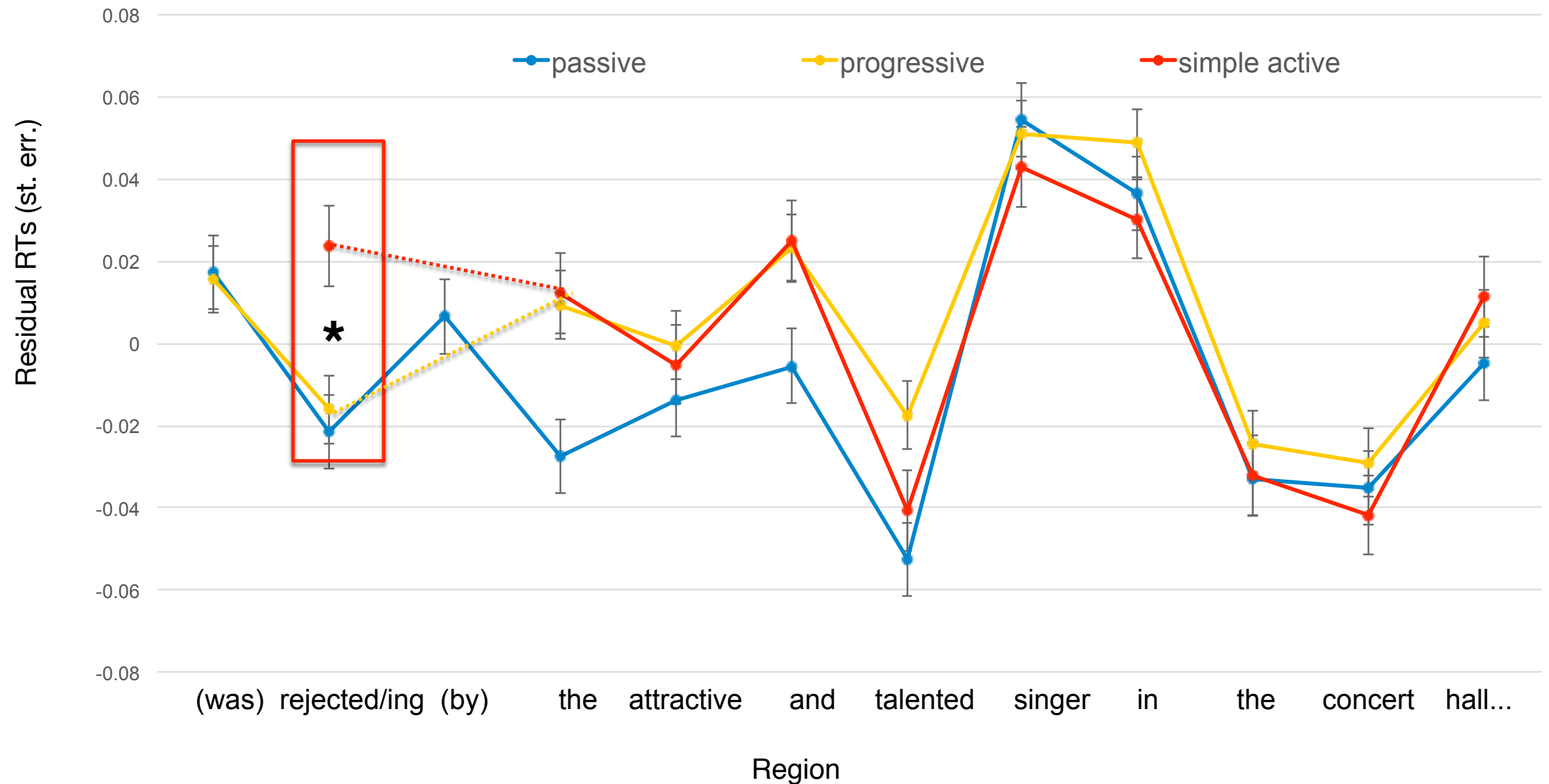
# English Experiment I: Participants

- 35 British English native speakers
  - 24 females; age: 28.6
- 5 excluded from analysis due to overall accuracy <75%

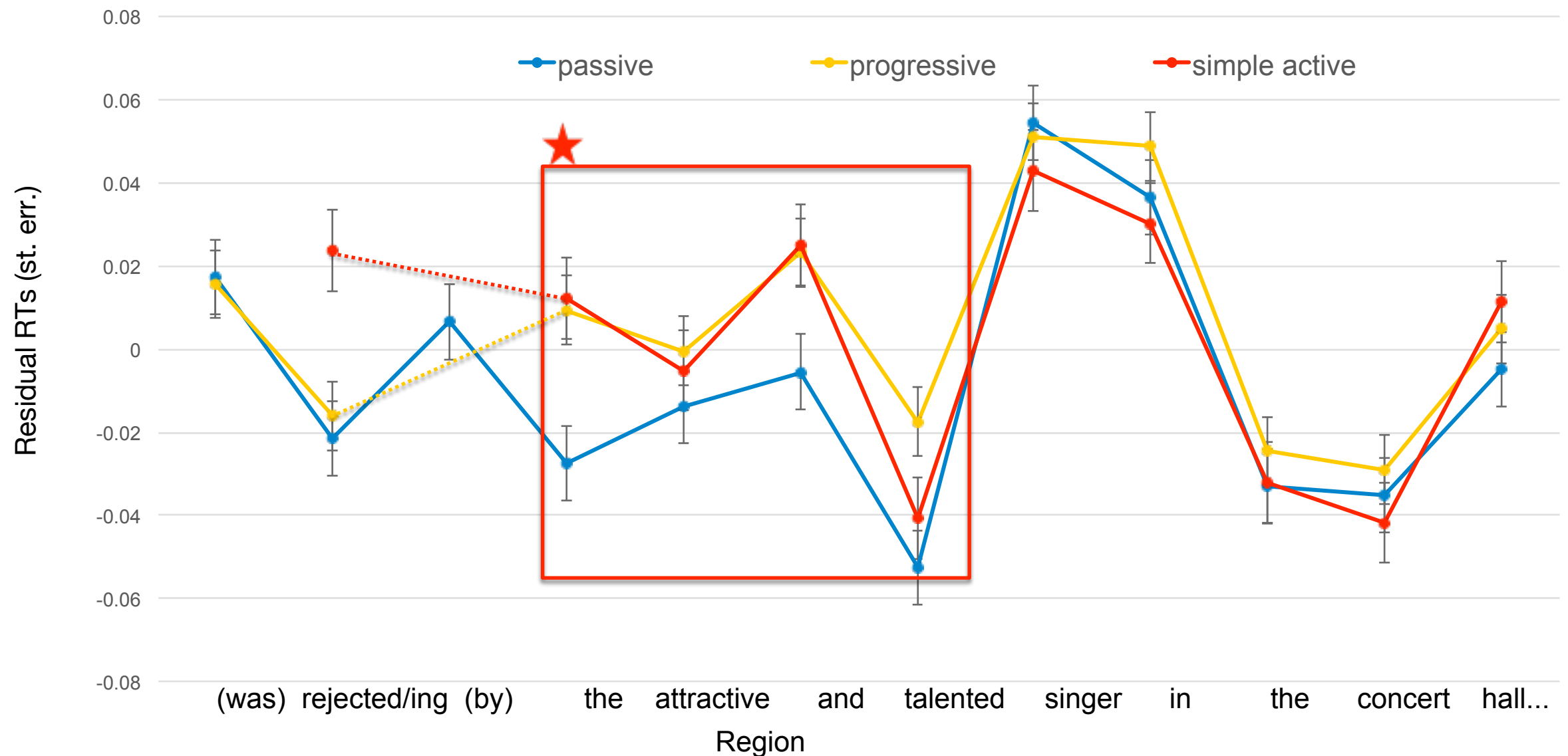
# English Experiment I: Results

- Outcome measures: accuracy and reaction times to comprehension questions and reading times.
- Analysis: Residual logRTs (word length/position)
- Linear mixed effects model (fixed effect: syntax; random effects: subjects and items).
- Contrasts used: passive vs. actives (simple active + progressive); simple active vs. progressive.

# English Experiment I: Average RT per region



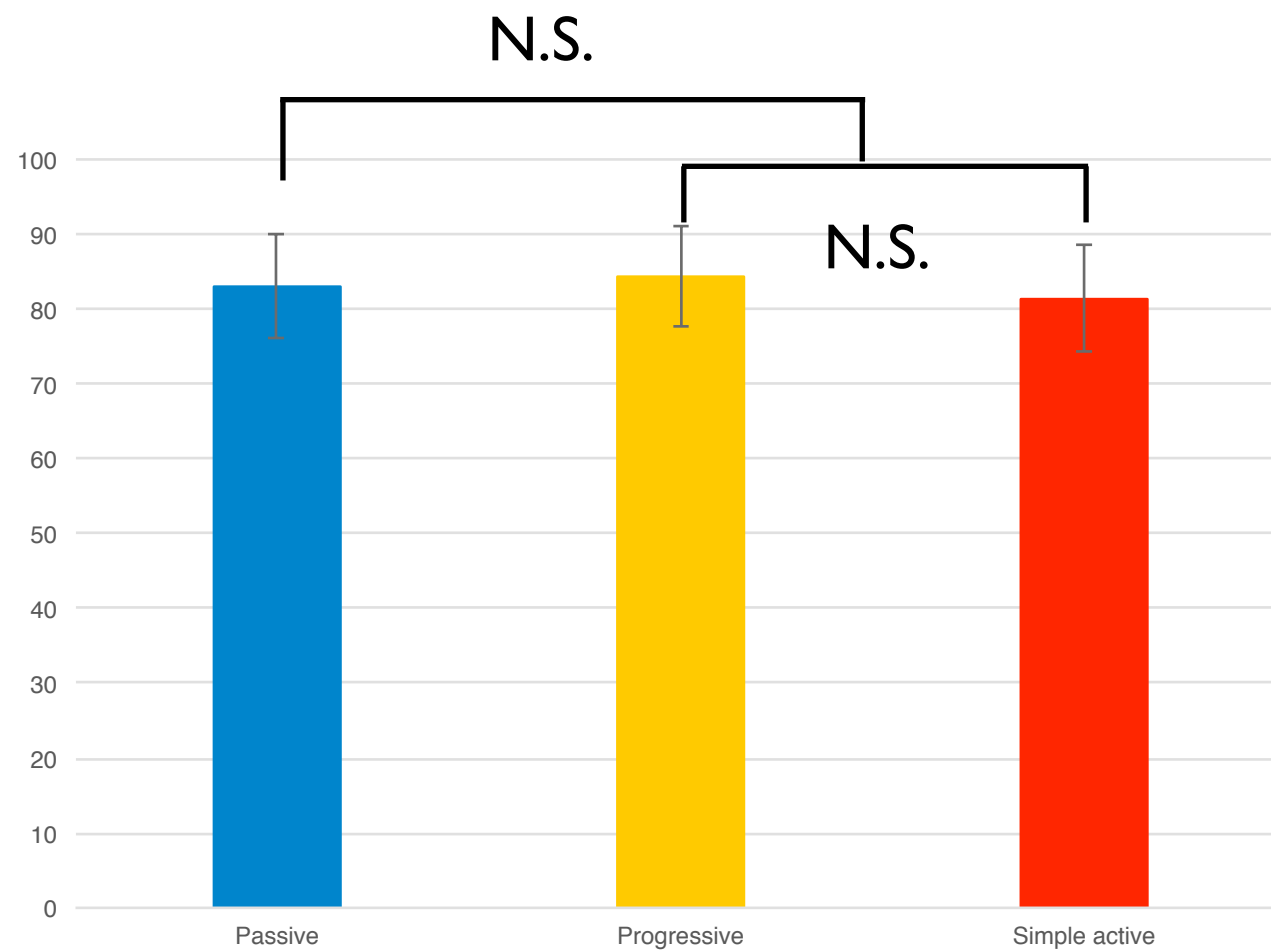
# English Experiment I: Average RT per region



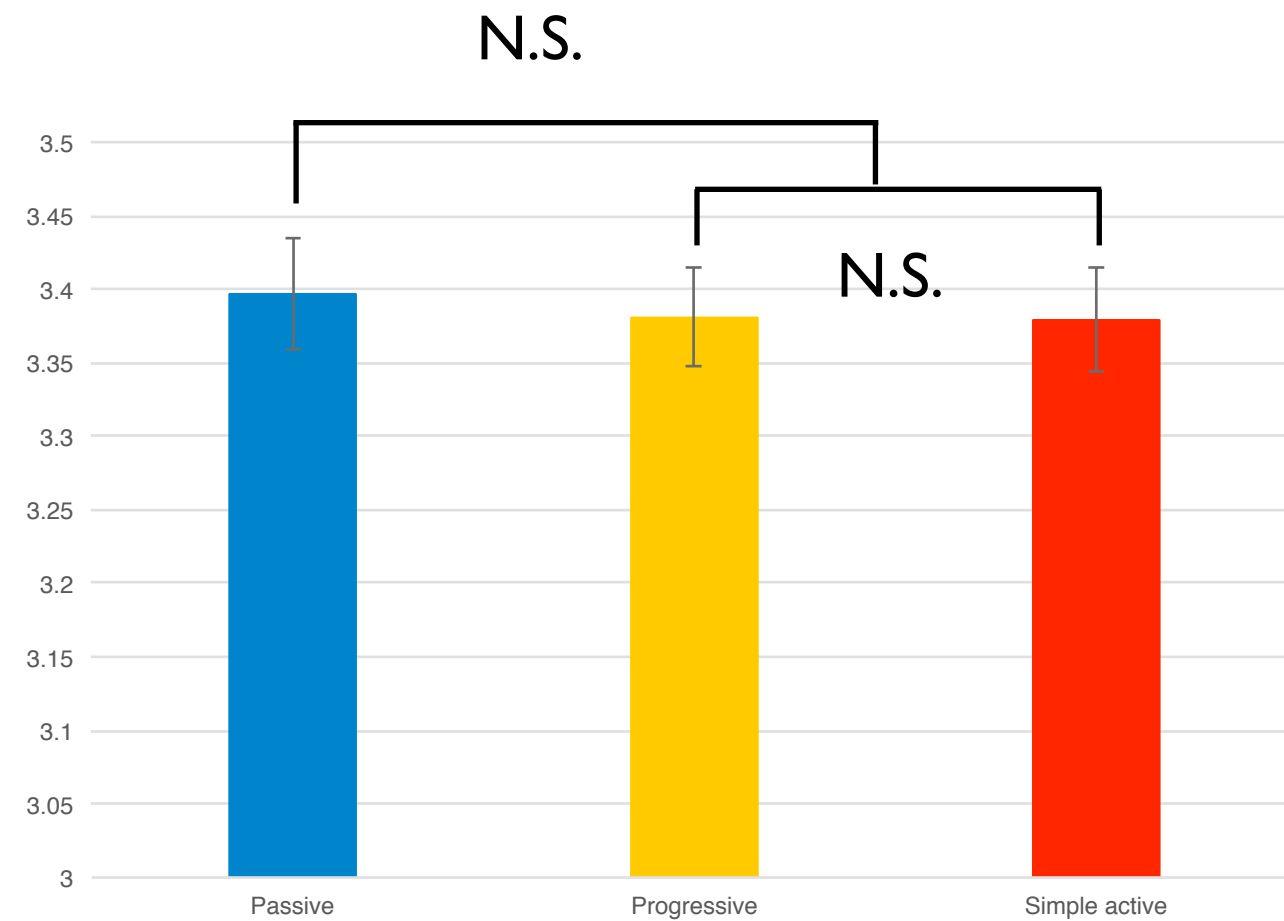
★ Frequency of surface structure did not significantly correlate with the results, indicating that it did not significantly affect processing.

# English Experiment I: Comprehension Questions

Accuracy in Comprehension Questions



RTs to Comprehension Questions



# English Experiment I: Results Recap

- Auxiliary eases processing at the verb due to smaller surprisal effect (auxiliary creates expectation for a verb to follow + tense already processed)
- Passives are faster to process (within the *by*-phrase: at the determiner, conjunction and second adjective)
- Passives are not harder to understand

# Experiment 2:

## German eventive passives

- Self-paced reading (word by word, non cumulative, moving window)
- 1 within-subject factor: syntax (active vs passive)
- 30 experimental sentence pairs
- 60 filler sentences of comparable complexity
- Comprehension questions after each sentence
- Sentences normed for plausibility of thematic-role assignment
- 34 native German-speakers

# Experiment 2: Stimuli

*A. Der Gitarrist wurde von der attraktiven und talentierten Sängerin in der Konzerthalle zurückgewiesen, während es zu regnen begann.*

The guitarist was rejected by the attractive and talented singer in the concert hall as it began to rain.

*B. Der Gitarrist hat die attraktive und talentierte Sängerin in der Konzerthalle zurückgewiesen, während es zu regnen begann.*

The guitarist had rejected the attractive and talented singer in the concert hall as it began to rain.



# Experiment 2:

## Analysis

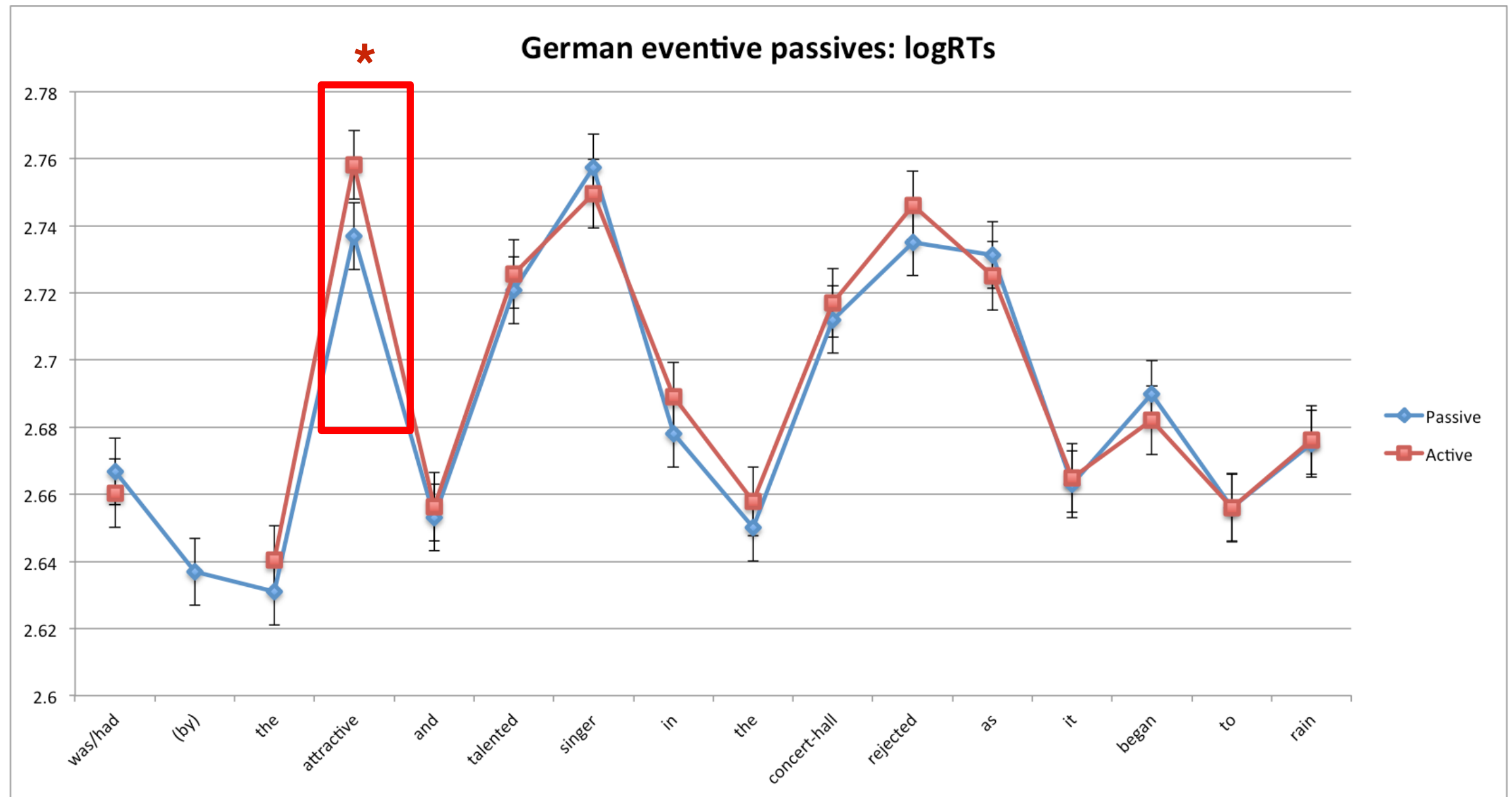
- Outcome measures: accuracy and reaction times to comprehension questions and reading times.
- Analysis: Residual logRTs (word length/position)
- Linear mixed effects model (fixed effect: syntax; random effects: subjects and items).
- Contrasts used: passive vs. actives

Same model also computed on raw RTs, Log Transformed RTs and more complex residual calculation (Jaeger et al. 2008, 2010; Hofmeister 2010), no difference in results

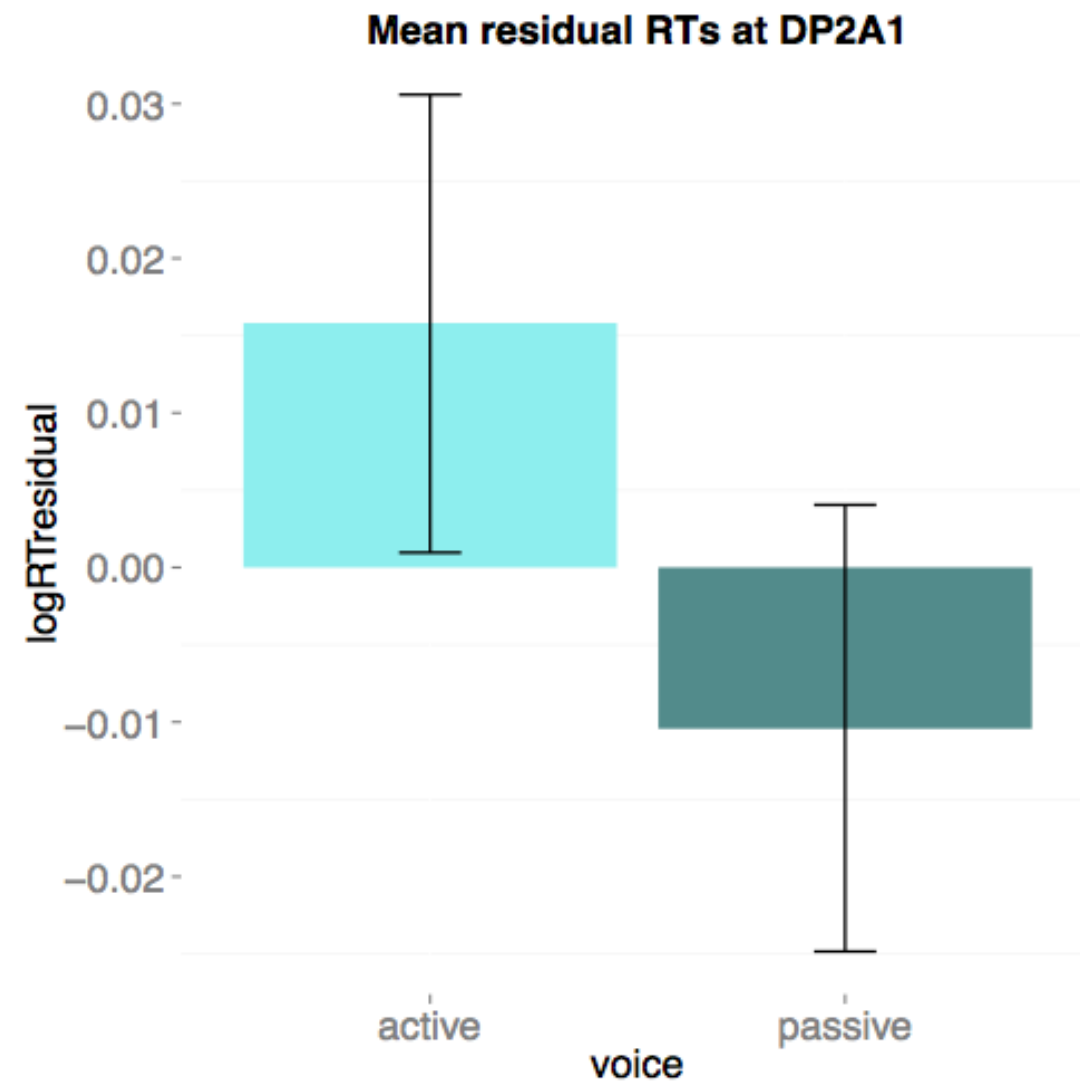
# Experiment 2:

## Results

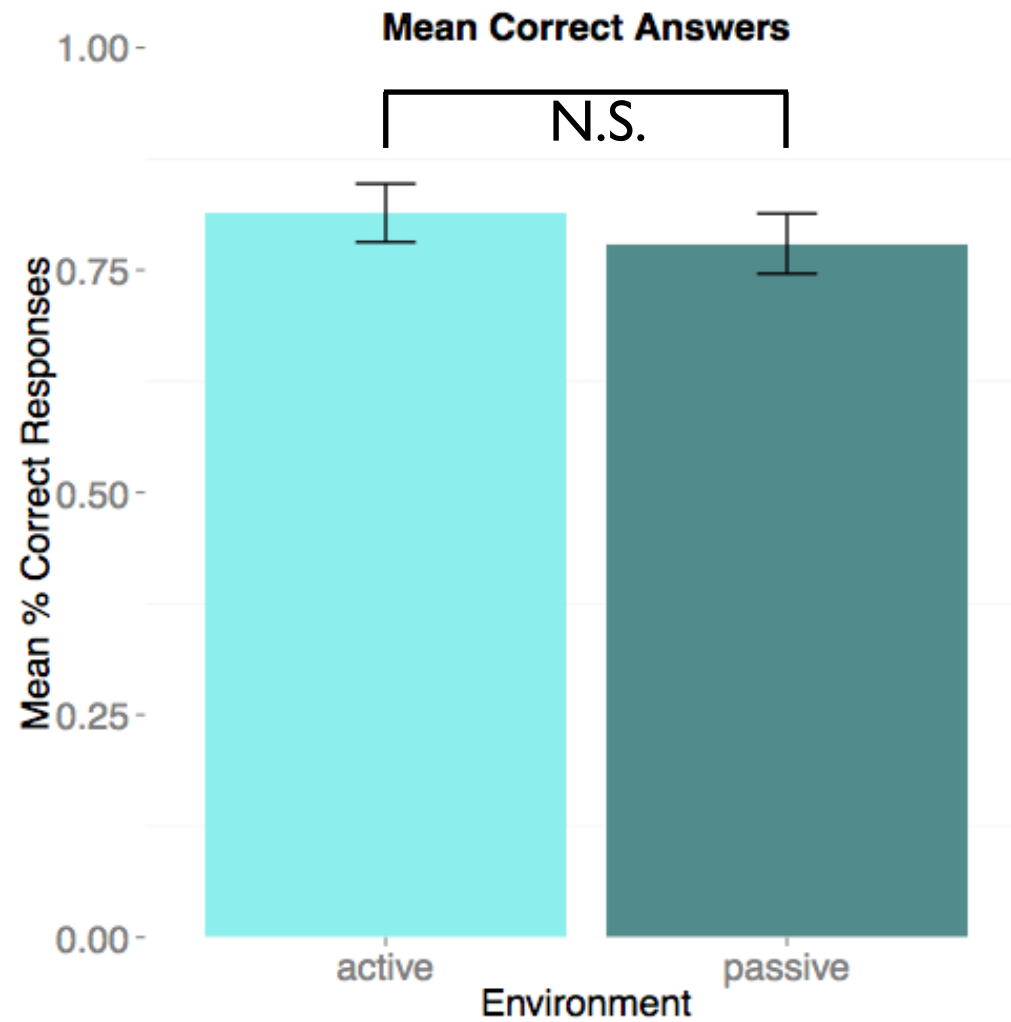
- **OFFLINE:**
  - No difference in Accuracy scores (83.5% for passives vs 86.1 for actives) and Response Times in comprehension questions.
- **ONLINE:**
  - No difference in RTs at the verb.
  - RTs significantly shorter for passives than actives at the 1st adjective (*attraktive/attractive*,  $p < .05$ ).



# RTs at Adjective I



# Accuracy

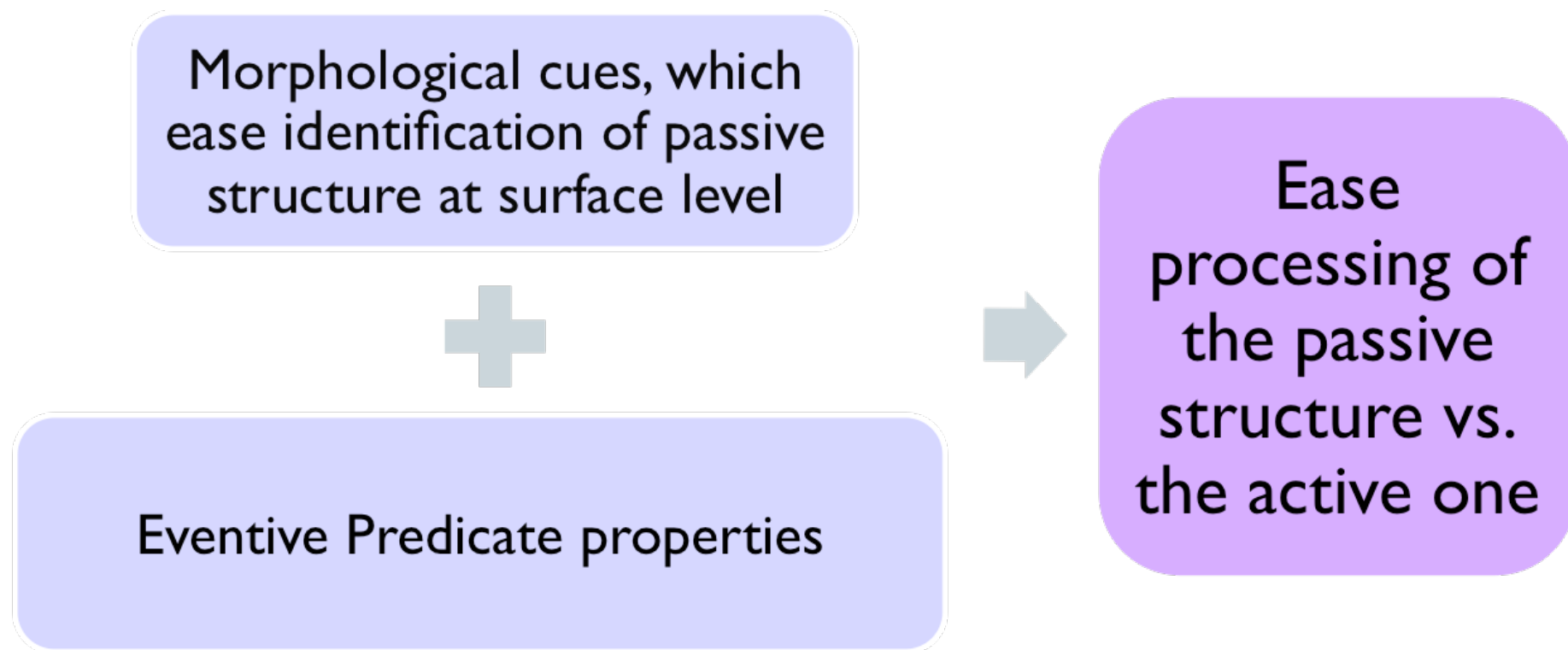


# Experiment 2: Results Recap

1. *By/von* eases processing at the DP due to smaller surprisal effect (*by* creates expectation for a DP to follow)
2. Passives are faster to process
3. Passives are not harder to understand

# Intermediate Discussion

- Non- canonical structures are not more difficult to process than canonical ones across the board
- Why are passives *faster* than actives?



# Enter States



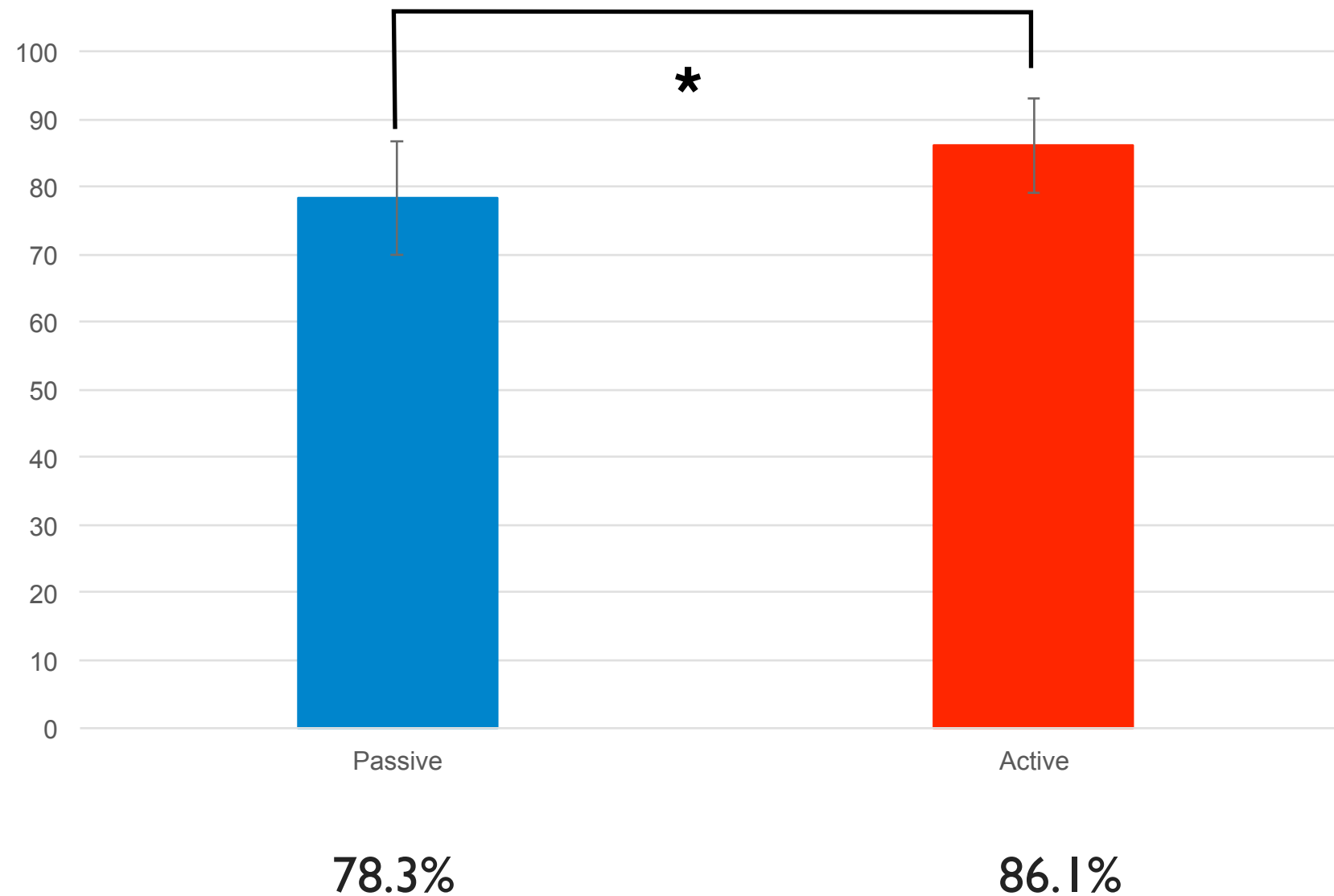
# Experiment 3:

## English Stative Passives

- Same method as above, contrast:
  - Active of states vs. Passives of states
- 40 Native British English Speakers

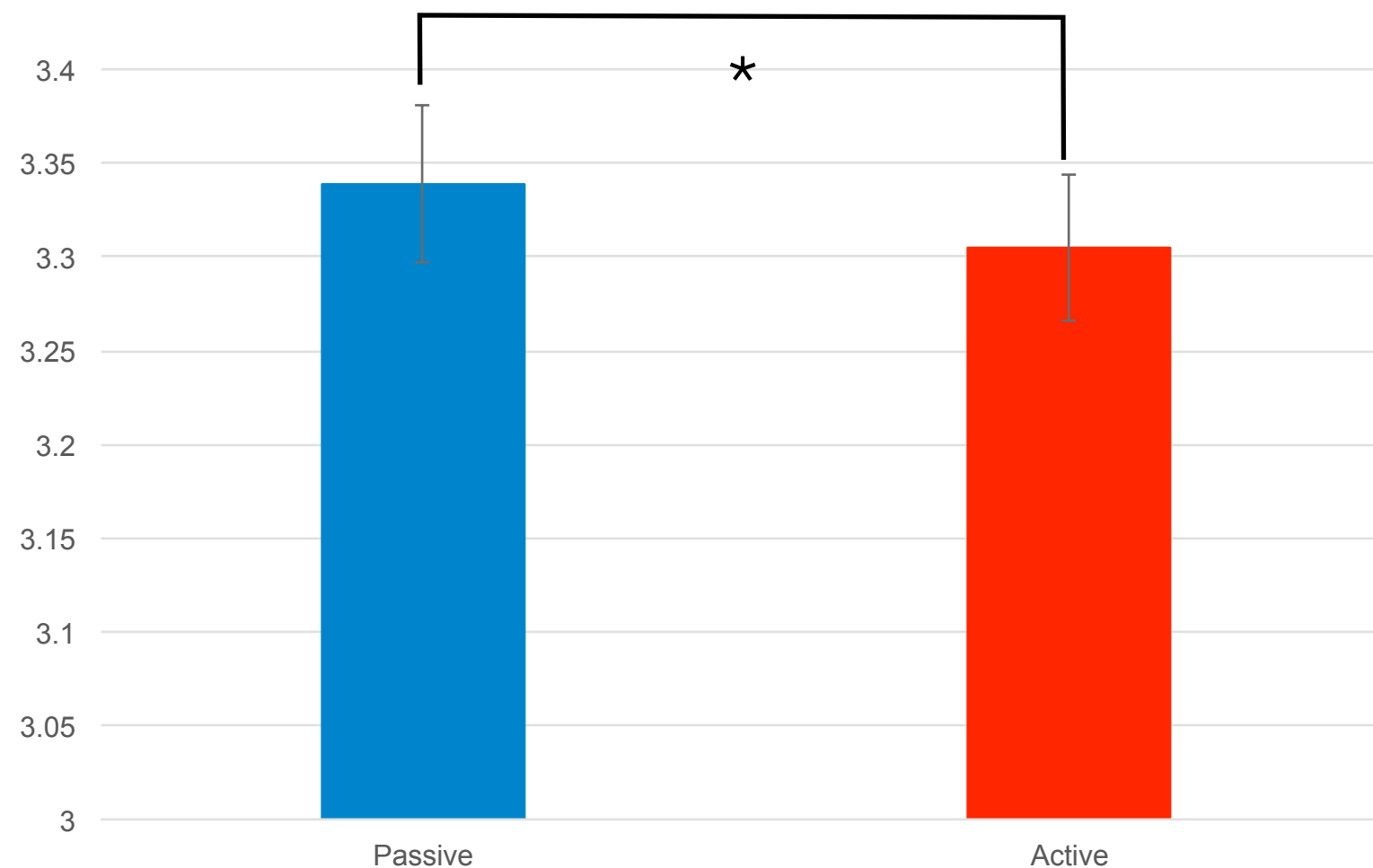
# English States:

## Accuracy in comprehension questions

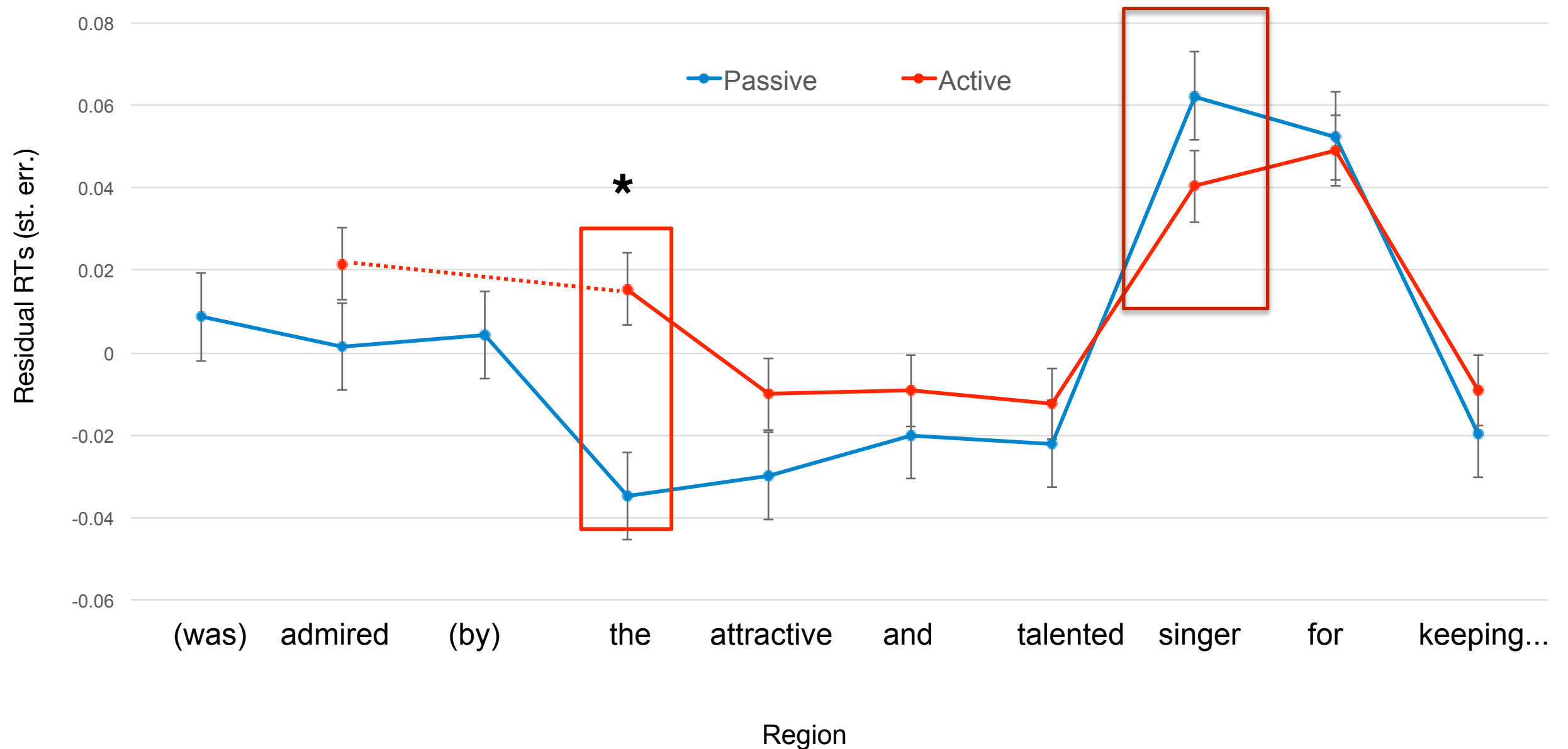


# English States: Response Time

RTs to Comprehension Questions



# English Results: Reading Times



As for the first experiment, frequency of surface form could explain the results (average: 30.46,  $t=0.69$ )

# English Experiment 3: Results & Analysis

- Same Analysis
- Lower accuracy in comprehension for passives (78.3%) than actives (86.1%)
- Slower Response Time for Passives than Actives ( $t=3.18$ ) and
- Numerically, but not significantly, faster RTs for passives than active **up to the 2nd adjective** (difference only significant at determiner,  $t=3.56$ ),
- The pattern was reversed after this region (i.e. at the head noun of the *by*-phrase)

# English Experiment 3: Discussion

- Stative passives are harder, and slower, to comprehend than stative actives
- The advantage observed in eventive passives disappears in stative passives
- English passive auxiliary is initially compatible with adjectival interpretation
- Reanalysis is required when specific *by*-phrases are used
- This is evidenced by both longer RTs at the head noun of the *by*-phrase and worse performance with comprehension questions
- The effect supports the idea that previous results in English were confounded by verb-type and the asymmetric availability of adjectival passive reading with stative predicates

# Experiment 4:

## Passives of states in German

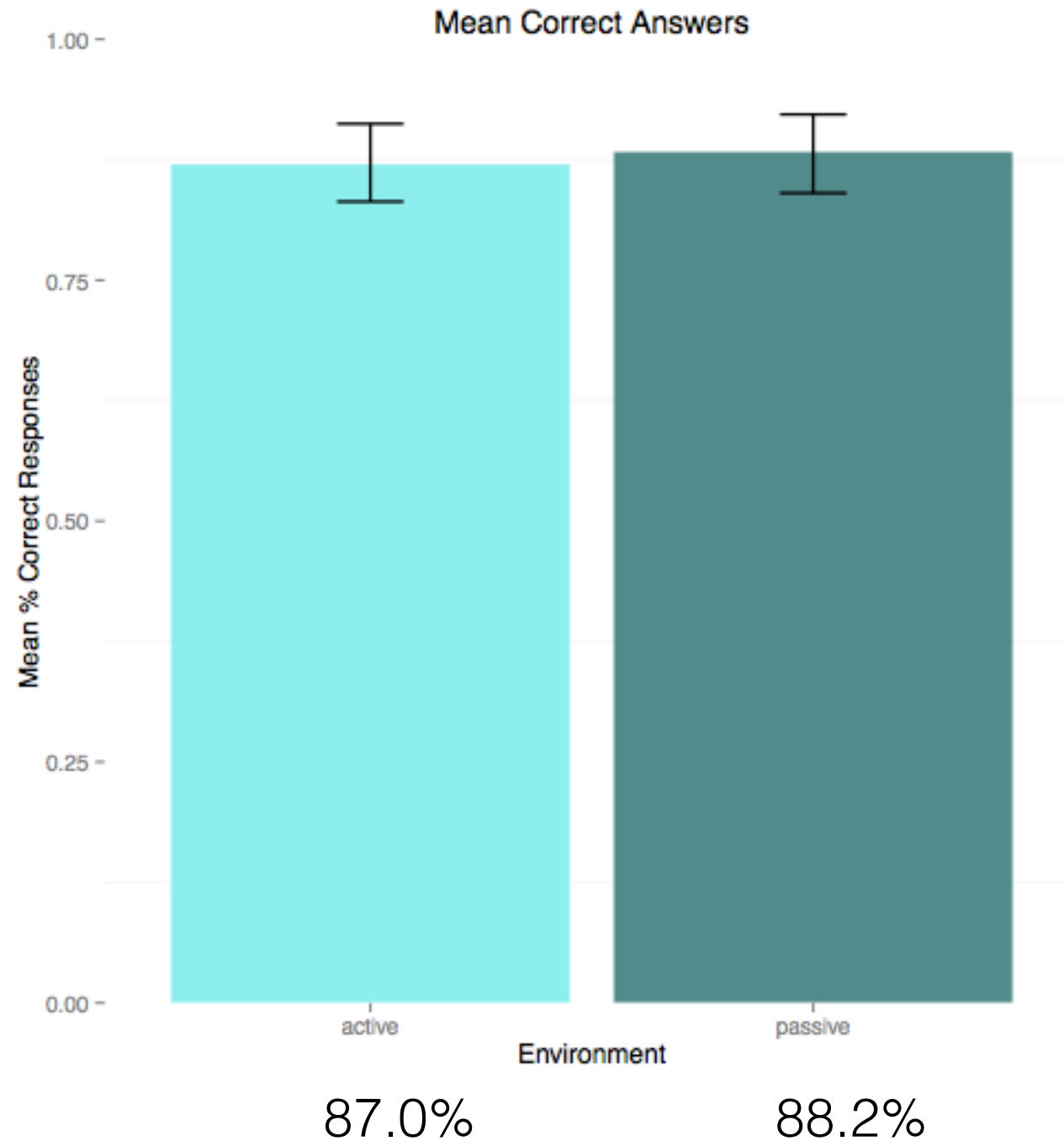
- English: Stative passives allow for an adjectival interpretation (locally)
- German: Stative passives under *werden* ‘become’ can only be interpreted as **verbal passives** in German
- German, therefore, offers a perfect testing ground for the previous account
- Given the lack of adjectival/verbal ambiguity, verbal passives of states should not be harder than actives in German

# Experiment 4: Stimuli

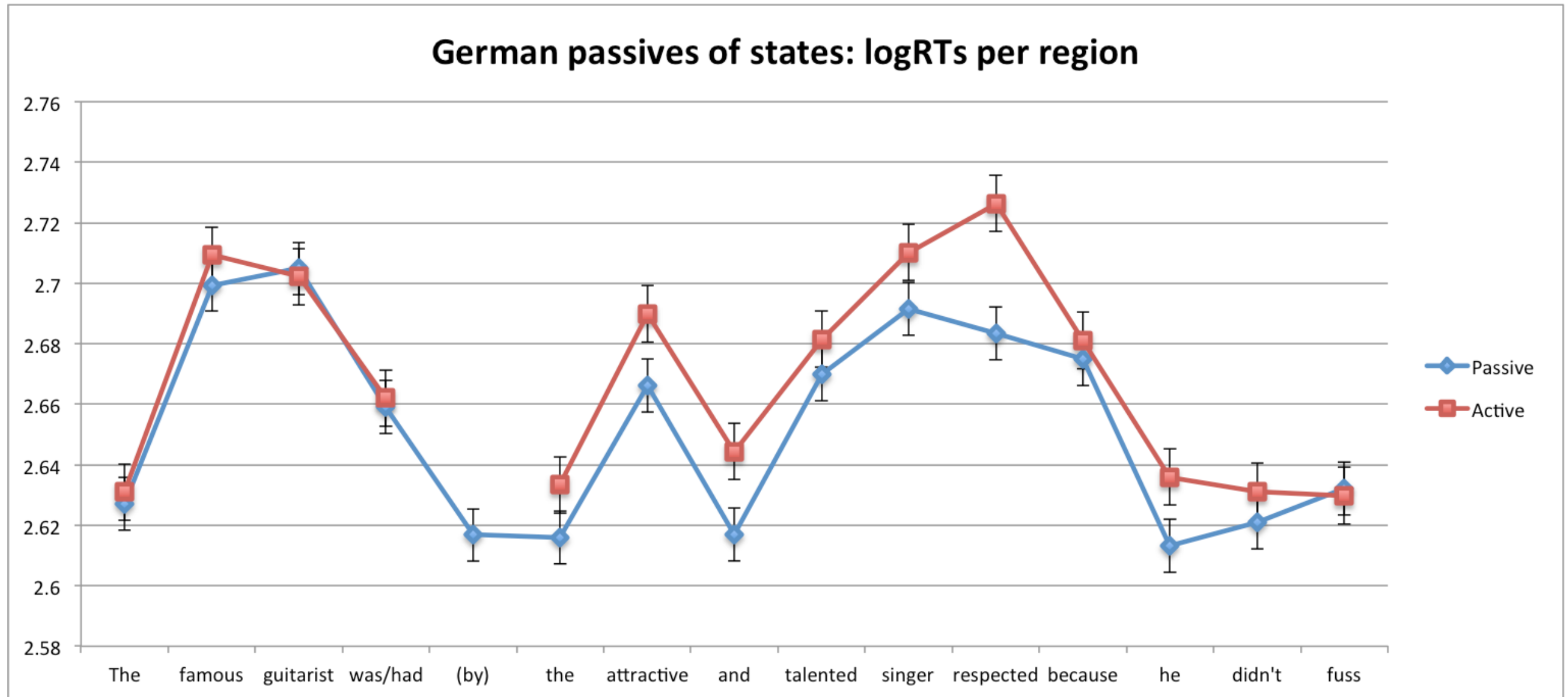
- A. Der eigenwillige Schriftsteller wurde von seinem seltsamen und wortkargen Kollegen **respektiert**, obwohl er ihn nicht mochte.  
*The headstrong writer was respected by his strange and taciturn colleague, even though he didn't like him. [with verbal passive auxiliary]*
- B. Der eigenwillige Schriftsteller hat seinen seltsamen und wortkargen Kollegen **respektiert**, obwohl er ihn nicht mochte  
*The headstrong writer respected his strange and taciturn colleague, even though he didn't like him. [with perfect auxiliary]*



# Experiment 4: Offline Results



# Experiment 4: Results



# Experiment 4: Analysis RTs

- Significantly faster RTs for Passives than Actives at:
  - verb ( $t\text{-value} = -2.13, p = -0.039$ )
  - conjunction ( $t\text{-value} = -2.7, p = -0.023$ ).
  - two regions downstream from the verb ( $t\text{-value} = -2.29, p = -0.018$ )
- RTs are also numerically faster for Passives than Actives at several regions.

# Experiment 4: Discussion

- No interaction between verb type and Voice in German
- As predicted, the processing of unambiguous verbal passives in German is not affected by verb type in the same way as English
- Unambiguous *werden* prevents the parser from considering the erroneous adjectival parse
- This supports our interpretation of the English results (Experiment 3)

# Discussion

## Relation to other studies:

- Acquisition: when verbs similarly controlled, passives are found to be acquired as easily as actives across languages (Portuguese: Estrela, 2011; English: Crawford, 2012; Italian: Volpato, Verin, Cardinaletti, 2015)
- Different predictions for German? i.e. no effect of verb type in acquisition?

# Conclusions I

- Passives are not necessarily harder to parse than actives
- When eventive predicates are used ACROSS LANGUAGES:
  - passives are processed faster than (or at the same speed as) actives
  - No difference in accuracy between passives/actives
- Evidence against heuristic processing (agent-first strategy) in both English and German

# Conclusions II

- When stative predicates are used, we observe LANGUAGE DEPENDENT COMPLEXITY EFFECTS:
  - ENGLISH: Ambiguity between adjectival and verbal interpretation of passive auxiliary leads to slower RTs and poor comprehension
  - GERMAN: Unambiguous verbal auxiliary *werden* leads to faster RTs and no difference in comprehension wrt actives
- Contrasting offline/online results in previous studies likely stemmed from use of heterogeneous sets of verbs
- States do not easily form/are not easily parsed as verbal passives

# Future Directions

## Theoretical:

- States under *werden* in German
- Contribution of generic vs. specific by phrases in German verbal passives of states
  - Der Politiker wurde von allen respektiert  
*The politician comes by all respected*
  - #Der Politiker wurde von Anne respektiert  
*The politician comes by Anne respected*
- Distinction between *werden*/*venire*

## Experimental:

- Within subject study (ongoing)
- Eye-tracking
- Italian:
  - unambiguous verbal auxiliary (*venire*)
  - contrary to *werden*, *venire* does not tolerate stative interpretation, i.e. forced eventive reading of states
  - Allows distinguishing effects of reanalysis & coercion



# Thank you!

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