

# Individual Differences and Stress Variation in English Complex Words

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idéntifiable

tríumphant

eváluative

discríminatory

identifíable

triúmphant

evaluátive

discriminátory

# Variable stress in English complex adjectives

embedded base	stress preserving derivative variant	stress non-preserving derivative variant
idéntify	idéntifiable	identifíable
tríumph	tríumphant	triúmphant
eváluate	eváluative	evaluáitive
discríminate	discríminatory	discriminátory

The phenomenon: primary stress of embedded base is not always preserved within the same morphological category

What factors can account for this variation?

# Previous research on stress variability

**Stratum-based** approaches  
(Kiparsky 1982 et seq., 2005, 2015, Fudge 1984)

- ▶ strict division into three categories
  - ▶ **stress shifting (stem level):** -  
ory > óscillate > oscillátory,  
oscíllatory, \*óscillatory
  - ▶ **stress preserving (word level):**  
-ness > alért > alértness,  
\*álertness
  - ▶ **variable (dual level):** -able >  
jústify > jústifiable ~ justifiáble

**Structural** approaches  
(Trevian 2003, 2007, Bauer, Lieber  
& Plag 2013, Newell 2020)

- ▶ **segmental phonological features** of  
derivative assumed to influence  
stress position
  - ▶ célèbre > célebr[ə]tory ~  
celebr[éɪ]tory

**Paradigmatic** approaches  
(Steriade 1999a, 1999b, Stanton &  
Steriade 2014, 2021,  
Breiss 2021)

- ▶ suggests **broader paradigmatic  
relationships** may be at play
- ▶ **embedded base is not  
considered the only  
influential base**
- ▶ —démonstrate démonstrative >  
démonstrable ?

# Issues of structure-based accounts

## Stratum-based accounts

- ▶ empirical **evidence against uniform behavior of stem and word level**  
→ stress preservation as well as stress shift underpredicted (*oscillátory* ~ *óscillatory*)

## Structural accounts

- ▶ **effect** said to be **variable** (*áanalyze* > *áanal[ai]zable* ~ *anal[ái]zable*)
- ▶ can indentify a possible reason for stress shift but **cannot account for variability of stress shift**

## Paradigmatic approaches

- ▶ does not take full extent of **morphological relationships** in paradigm into account
- ▶ **does not take psycholinguistic factors** such as lexical frequency seriously enough
- ▶ **all accounts purely phonological even though we are talking about a morpho-phonological phenomenon**

# Processing-based accounts: a possible solution?

- ▶ based on **Hay's dual-route model of lexical access** (Hay 2001, 2003, Hay & Baayen 2003)
- ▶ relationship between **derivative frequency and base frequency** is crucial
- ▶ if derivative frequency < **embedded base frequency** → **decomposition route**
  - ▶ *anticipatory* = *antícipate* + -ory → *antícipatory*
  - ▶ **stress preserved**
- ▶ if **derviative frequency** > embedded base frequency → **whole-word route**
  - ▶ *derogatory* = *derogatory* (~~*dérogate* + -ory~~) → *derogátory*
  - ▶ **stress not preserved**
- ▶ see Collie 2007, 2008, Bermúdez-Otero 2012, Dabouis 2017 for pertinent studies based on this approach

# Issues of processing-based accounts

- ▶ processing-based accounts have also not fully implemented all assumptions that come with taking a morphological approach such as **individual differences in processing**
  - ▶ exclusive **reliance on corpus frequencies to account for processing effects**
  - ▶ **not compatible with individual differences**
  - ▶ previous studies (Arndt-Lappe & Sanz 2017; Ganster 2019) have shown that not all speakers reflect corpus frequency in the same way
- ▶ **individual differences generally marginalized**, to date mainly only studied in reading acquisition (e.g. McCutchen et al. 2009) and second language acquisition (e.g. Coxhead et al. 2015)

# Towards more individual models of morphological processing

- ▶ more individual measures of morphological processing are needed
- ▶ correlates that emerged as important in other fields
  - ▶ individual **awareness of morphological structure** (e.g. McCutchen et al. 2009)
  - ▶ **vocabulary size** (e.g. Brysbaert et al. 2016, Mainz et al. 2017)
- ▶ These measures **need to be tested for their effects on stress production in complex words**



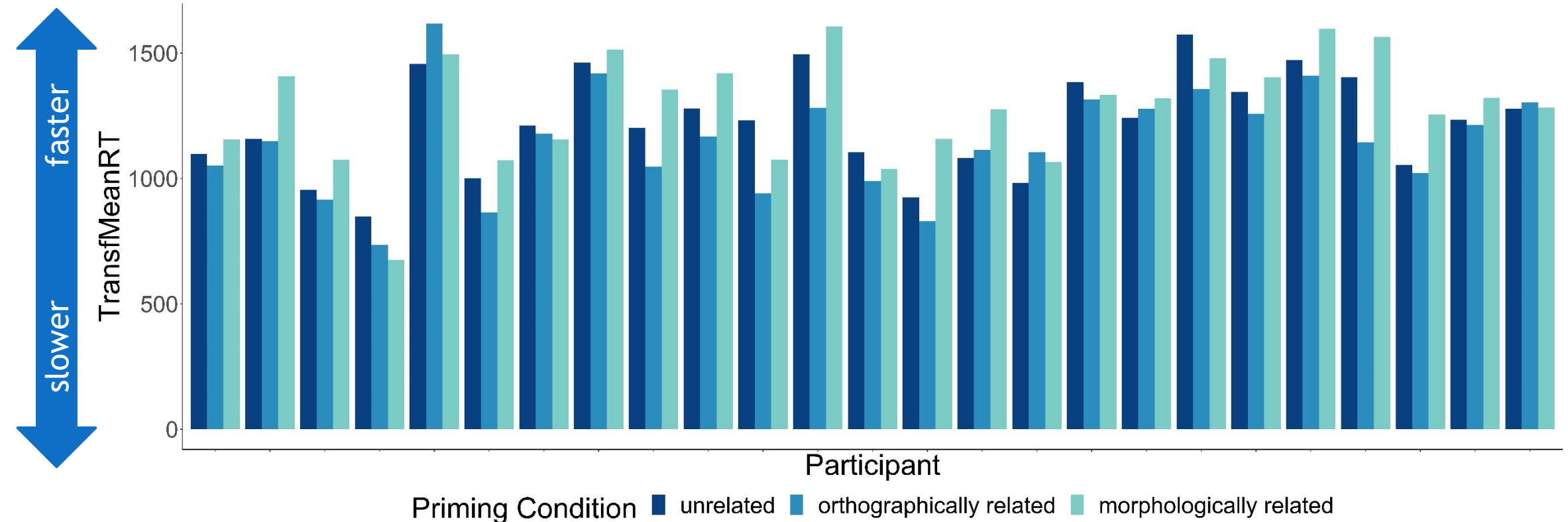
# Experiment

- ▶ remote online experiment
- ▶ 153 native speakers of British English
  - ▶ age: 18-77 yrs, mean: 25, median: 29.98 / 93 females, 60 males
  - ▶ recruited via the online platform Prolific
- ▶ multi-task experiment
  - ▶ **PROCESSING**
    - ▶ morphological sensitivity task (masked priming with lexical decision)
    - ▶ vocabulary size test (standardized test, Coxhead et al. 2015, Nation & Beglar 2007 )
  - ▶ **SOCIO-DEMOGRAPHIC DATA**
    - ▶ meta questionnaire (education, languages, geography, socio-economic status...)
  - ▶ **STRESS**
    - ▶ production task (read out test sentences with complex adjectives in them)
    - ▶ perception task (imitation task)

# Data overview

morphological sensitivity task	vocabulary size test	production task
<p>3,467 observations</p> <p>masked priming experiment with lexical decision task</p> <p>measured <b>reaction time</b> to <b>three different priming conditions</b>:</p> <p>complex words primes - simplex words targets</p> <ul style="list-style-type: none"><li>▶ <b>morphologically related</b> prime-target pairs (<i>subversion</i> - <i>subvert</i>)</li><li>▶ <b>orthographically related</b> prime-target pairs (<i>chargeable</i> - <i>charisma</i>)</li><li>▶ <b>unrelated</b> prime-target pairs (<i>inventive</i> - <i>remorse</i>)</li></ul>	<p>15,300 observations</p> <p>standardized and multiply validated forced choice test (Nation &amp; Beglar 2007)</p> <p>100 questions</p> <p>Example</p> <p><i>see: They SAW it.</i></p> <p><i>a) closed it tightly</i></p> <p><i>b) waited for it</i></p> <p><i>c) looked at it</i></p> <p>score from 0 - 20,000 (estimates number of <b>known word families</b>)</p>	<p>will be explained later</p>

# Individuality in morphological sensitivity

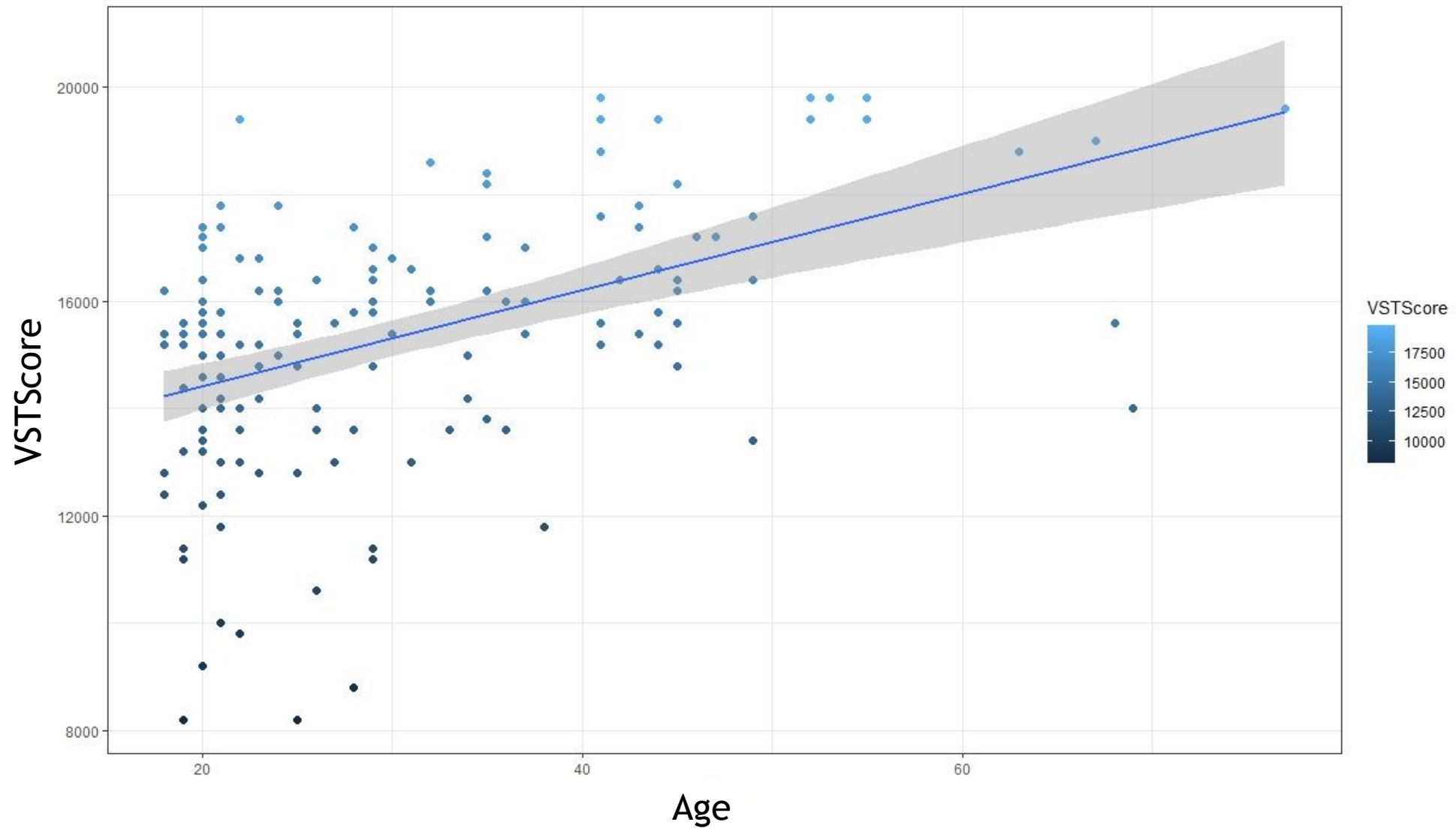


random sample of 25 out of 129 participants

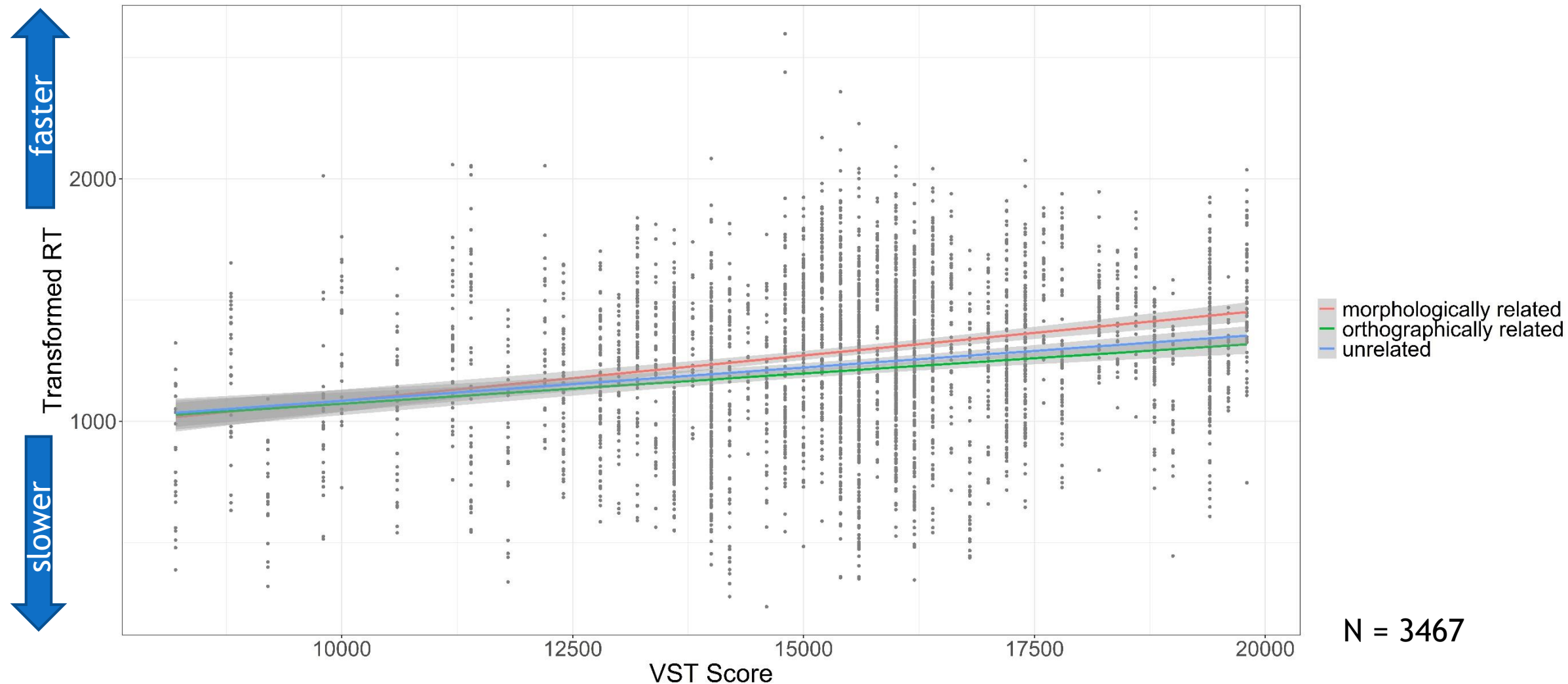
Separate model:  $\text{lmer}(\text{RTtr} \sim \text{Condition} + \text{VSTScore} + (1 + \text{Condition} \mid \text{Participant}), \text{data} = \text{MSfinal})$

→ showed priming condition has significant effect on RT

# Variation in vocabulary size



# Variation in the effect of vocabulary size



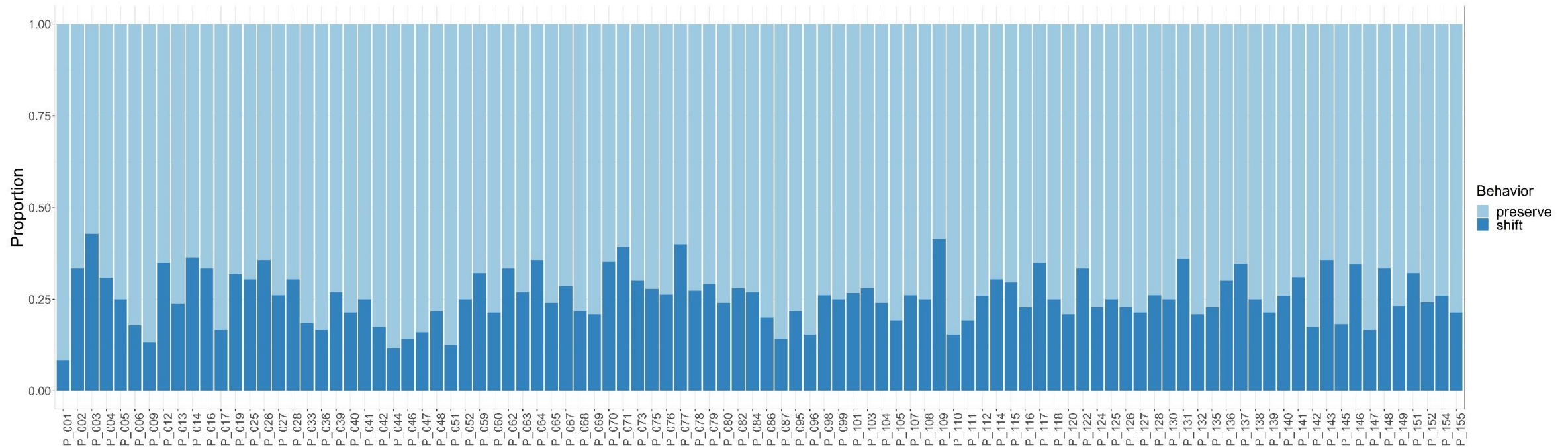
# Relating individual differences in morphological processing to stress variation

- ▶ Hypothesis 1: greater sensitivity to morphological structure
  - ▶ more decomposition
  - more stress preservation
- ▶ Hypothesis 2: greater vocabulary size
  - ▶ more decomposition → more preservation?
  - ▶ paradigmatic effects → paradigmatically dominant stress preferred?

# Experiment: Stress Production

- ▶ **production task**
- ▶ **3,400** observations from 153 native speakers of British English
- ▶ test sentences from Corpus of American Soap Operas (Davies 2011) with complex **-able, -ant, -ive, -ory adjectives**
- ▶ each participant read out **30 test sentences**
  - ▶ *We're trying to do something a little more innovative.*
  - ▶ *Well, actually, this move was anticipatory.*
  - ▶ *Is there an address or a name or something else that's identifiable?*
- ▶ each recording **assessed by three trained raters** (raters **agree in 77% of cases, only agreement cases taken into account** in analyses)

# Individuality in stress variation



For all 98 participants who have  
lived in the UK all their lives

N = 2316

min proportion of non-preservation = 8%

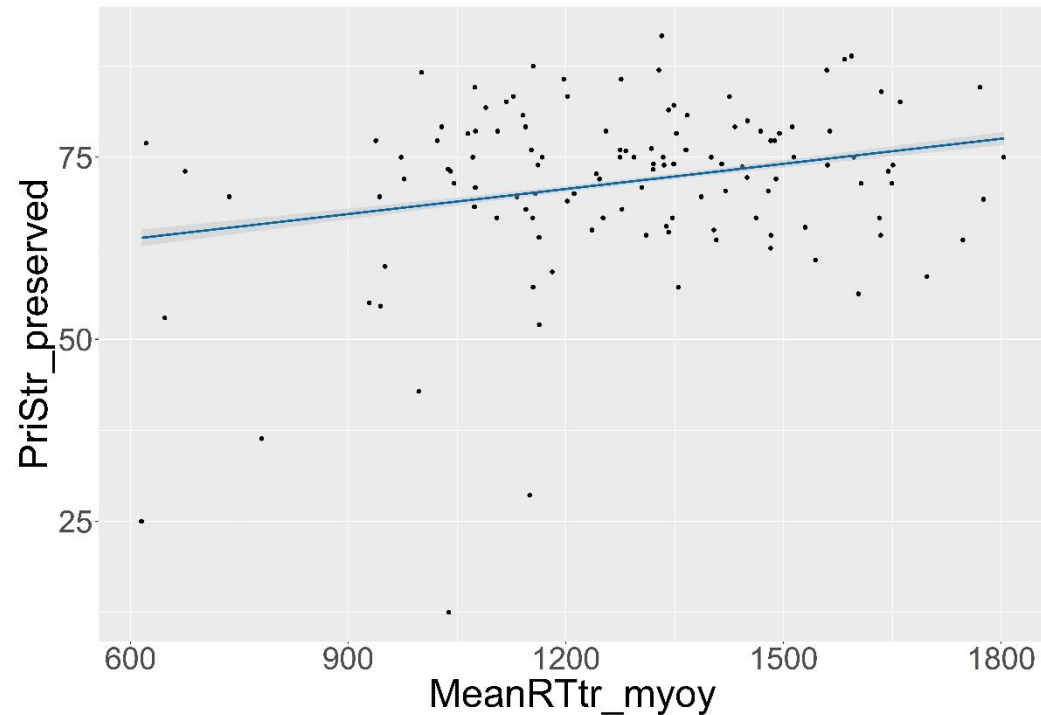
max proportion of non-preservation = 43%

*SD* in proportion of non-preservation = 7%

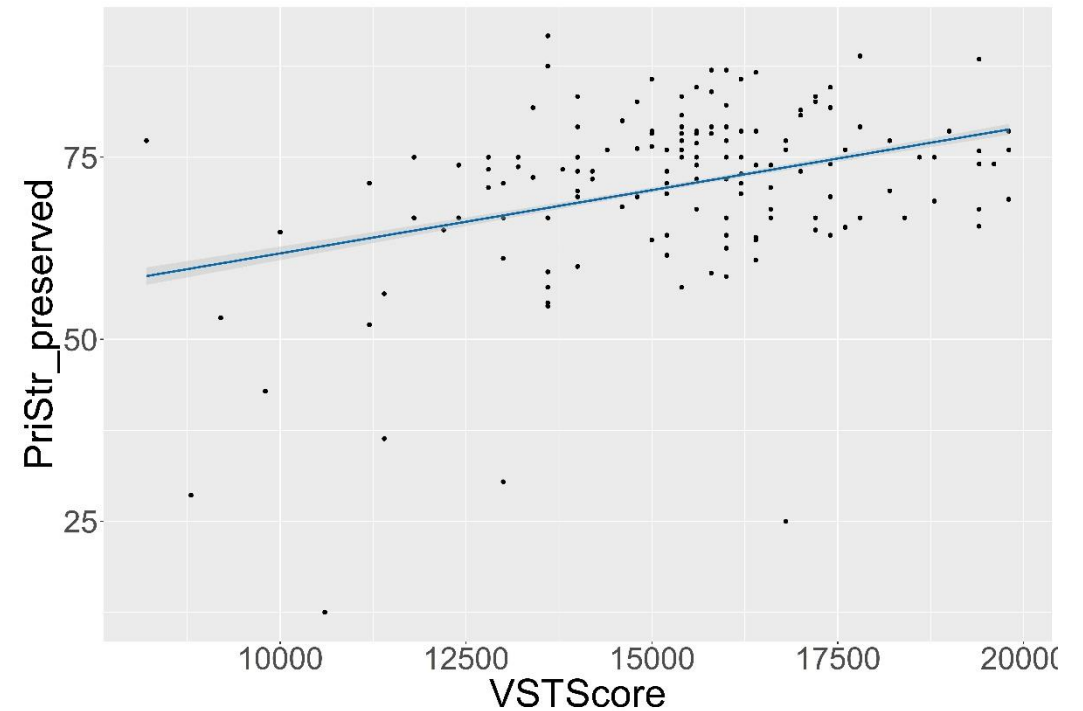


# Individual processing and primary stress preservation

N = 2919

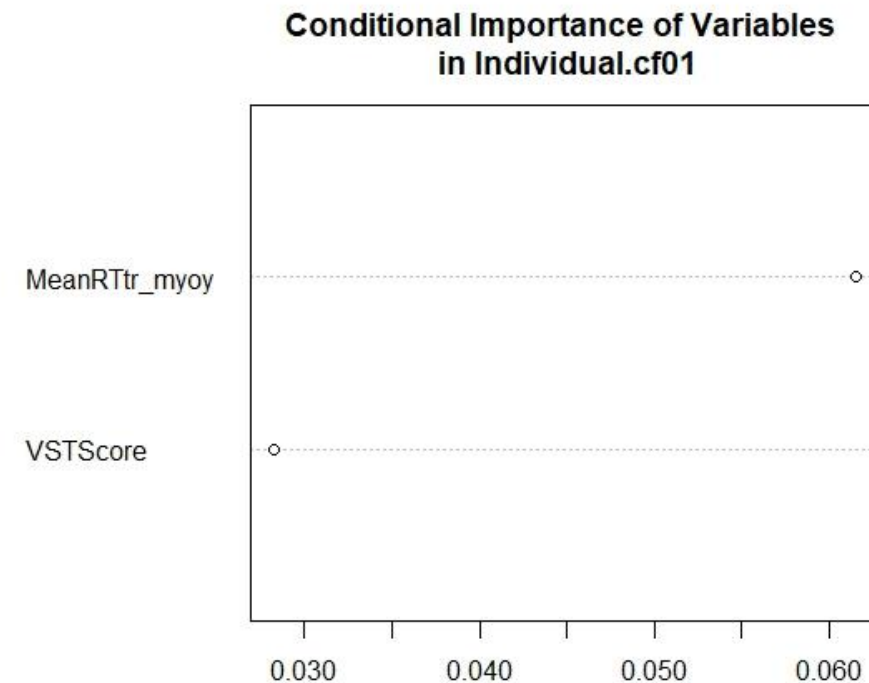


N = 3442



# Individual processing and primary stress preservation

- ▶ transformed **mean reaction time** to morphologically related prime-target pairs and **vocabulary size test score** are **moderately correlated**
  - ▶ correlation coefficient: 0.34
  - ▶ condition number: 19 (moderate correlation)
- ▶ **conditional random forest analysis**
  - ▶ less sensitive to correlated predictors
  - ▶ cforest::partykit (Hothorn & Zeileis 2015; Hothorn et al. 2006, Zeileis et al. 2008)
- ▶ OOB accuracy of cforest 0.72

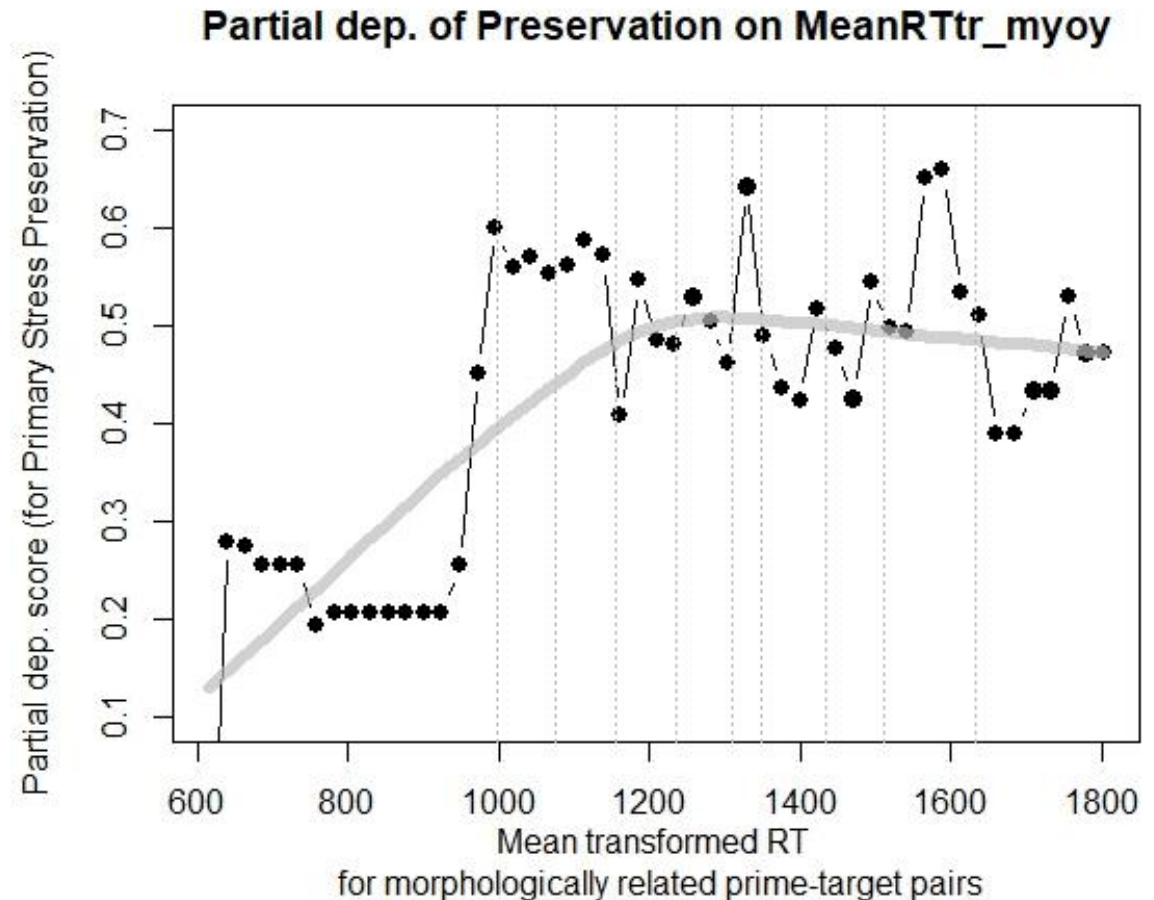


PriStrPreservation ~ MeanRTtr\_myoy + VSTScore, data = AS\_RTs,  
ntree = 500, perturb=list(replace=TRUE), mtry = 2

non-conditional variable importance yielded same result

# Morphological Sensitivity and Stress Preservation

- ▶ partial dependence scores can be used to determine the **nature and direction of effects** in a random forest model
- ▶ see Gries 2021: Chpt 7 for more information



# Conclusion

- ▶ **individual differences** in morphological processing, vocabulary size and stress placement preferences
- ▶ **larger vocabulary size facilitates** morphological processing
- ▶ **morphological sensitivity** emerged as **more important predictor**
  - ▶ partial dependence scores of random forest model indicate **a faster reaction time to morphologically related prime-target pairs boosts stress preservation in speakers**
  - ▶ **more exploration and validation with other models needed**

**Thank you/Ευχαριστώ πολύ  
for your attention!**

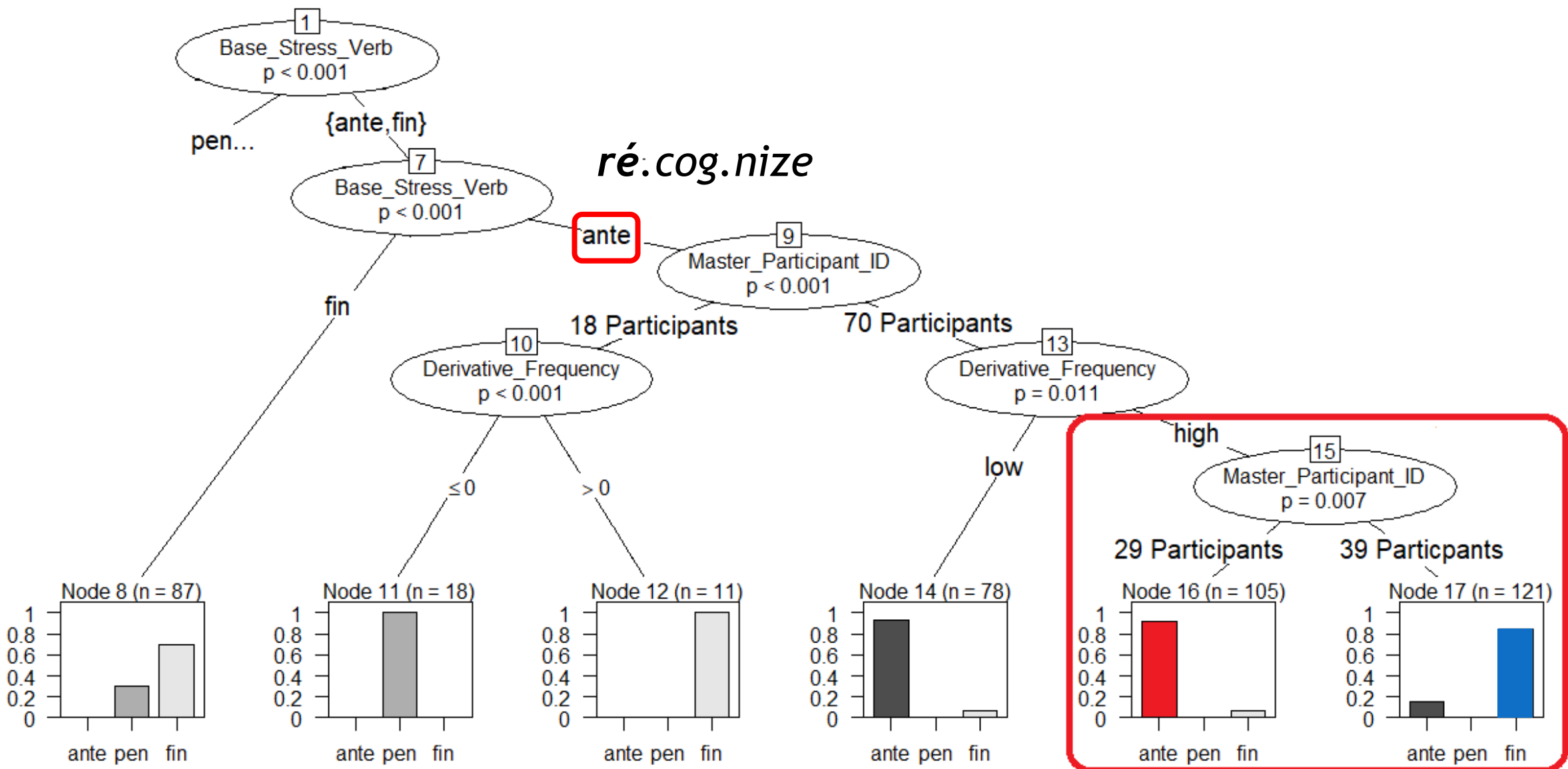
Feel free to contact me: [ganster@uni-trier.de](mailto:ganster@uni-trier.de)

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(N = 711, 31 types; goodness-of-fit = 90%, from Ganster 2019, see also Arndt-Lappe & Sanz 2017 for complementary effect with base frequency)

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