The Psycholinguistic Markers of Single Word Recognition for Adult Learners of Literacy

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Question?

DDM focusses on per subject model parameters and their variation to describe influence of person-level variables

Q: Is it feasible to perform a DDM for item words, to be able to use the language level variables as predictors

(Scraping data from megastudies for contrast...)

Does language experience help?

Main study:

- 218 participants
  - 11-12 yrs
  - 16-19 yrs
  - Adults
- 3 time points
  - 6 ability measures
  - 4 tasks

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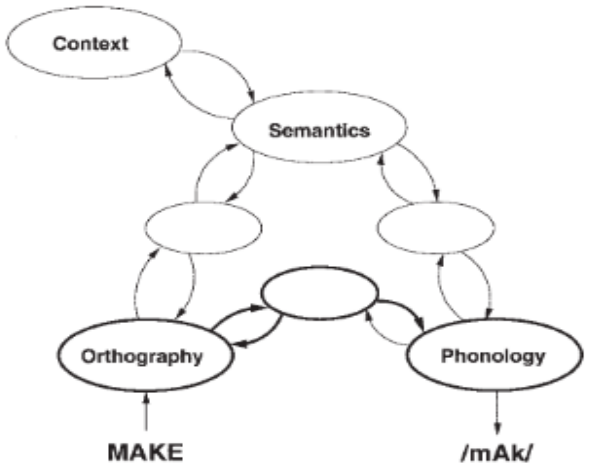
4 Tasks

- Letter search
- Lexical decision
- Word naming
- Sentence completion

Variables: Person & Language Level

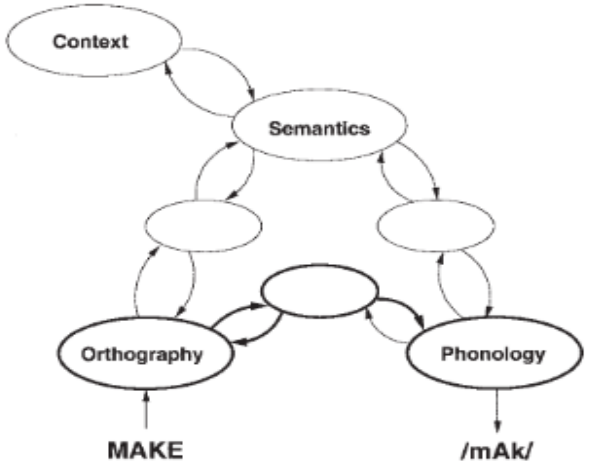


Seidenberg & McClelland, (1989)

Variables: Person & Language Level

Phonological

TOWRE nonword
Spelling
Phonological awareness
No. of phonemes
Bigram frequency



Seidenberg & McClelland, (1989)

Semantic

Vocabulary
No. of synonyms
Semantic diversity
Imageability / Concreteness

Orthographical

TOWRE word

Frequency
No. of letters
Consistency
Neighbourhood rating

Drift Diffusion Modelling

Assumptions:

Binary decision tasks
Continuous sampling of information over time
Single stage decisions
Consistency of parameter values over time

Relevance...

- DDM provides simultaneous modelling of response times and accuracy values
- Can handle conditions within one analysis
- May give an insight into approaching word reading because of the different parameters AND the variables of influence

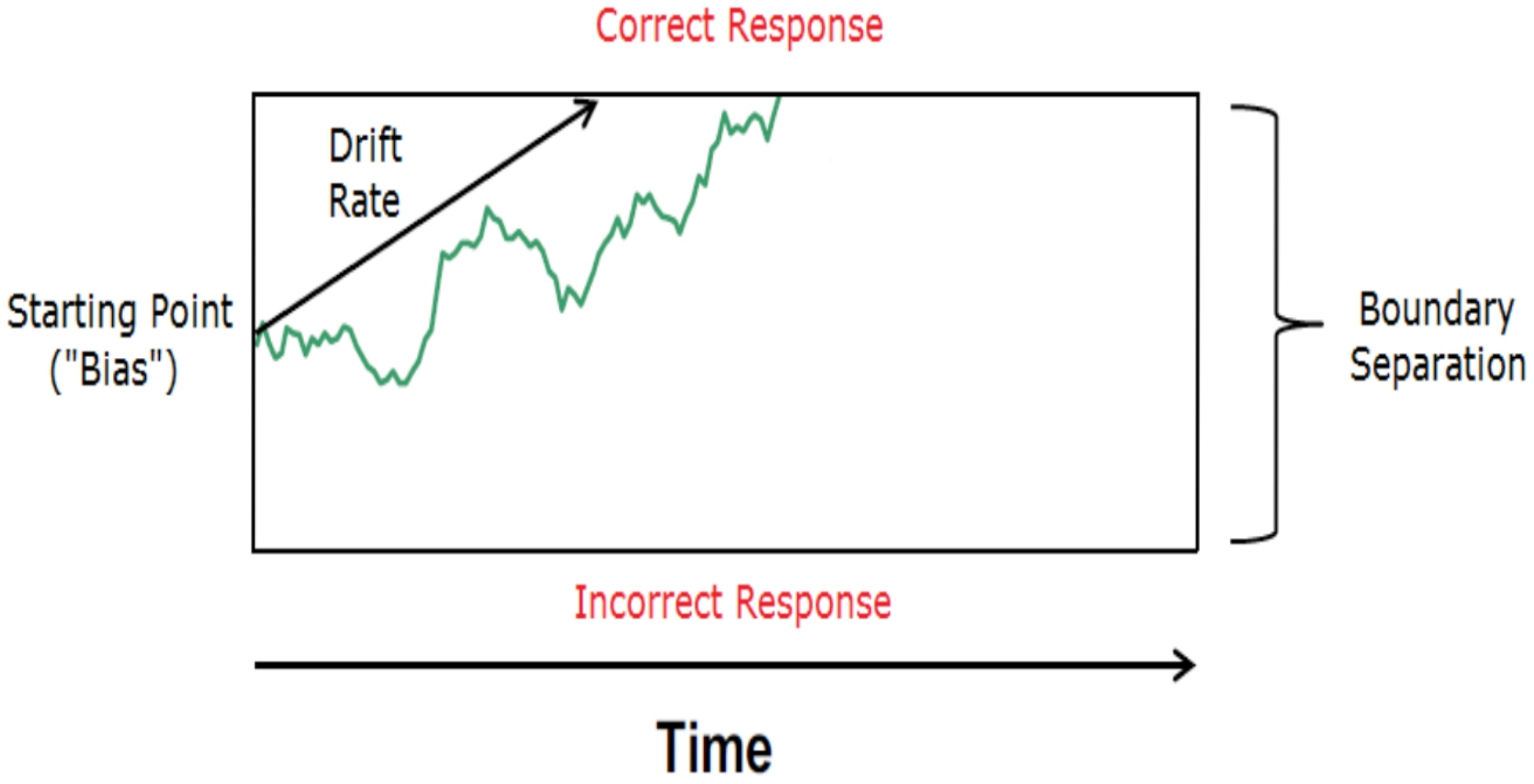


Image from https://jimgrange.files.wordpress.com/2014/05/diffusion-model.png

Model parameters...

- Drift rate
- Boundary separation or Threshold
- Starting point
- Non-decision component

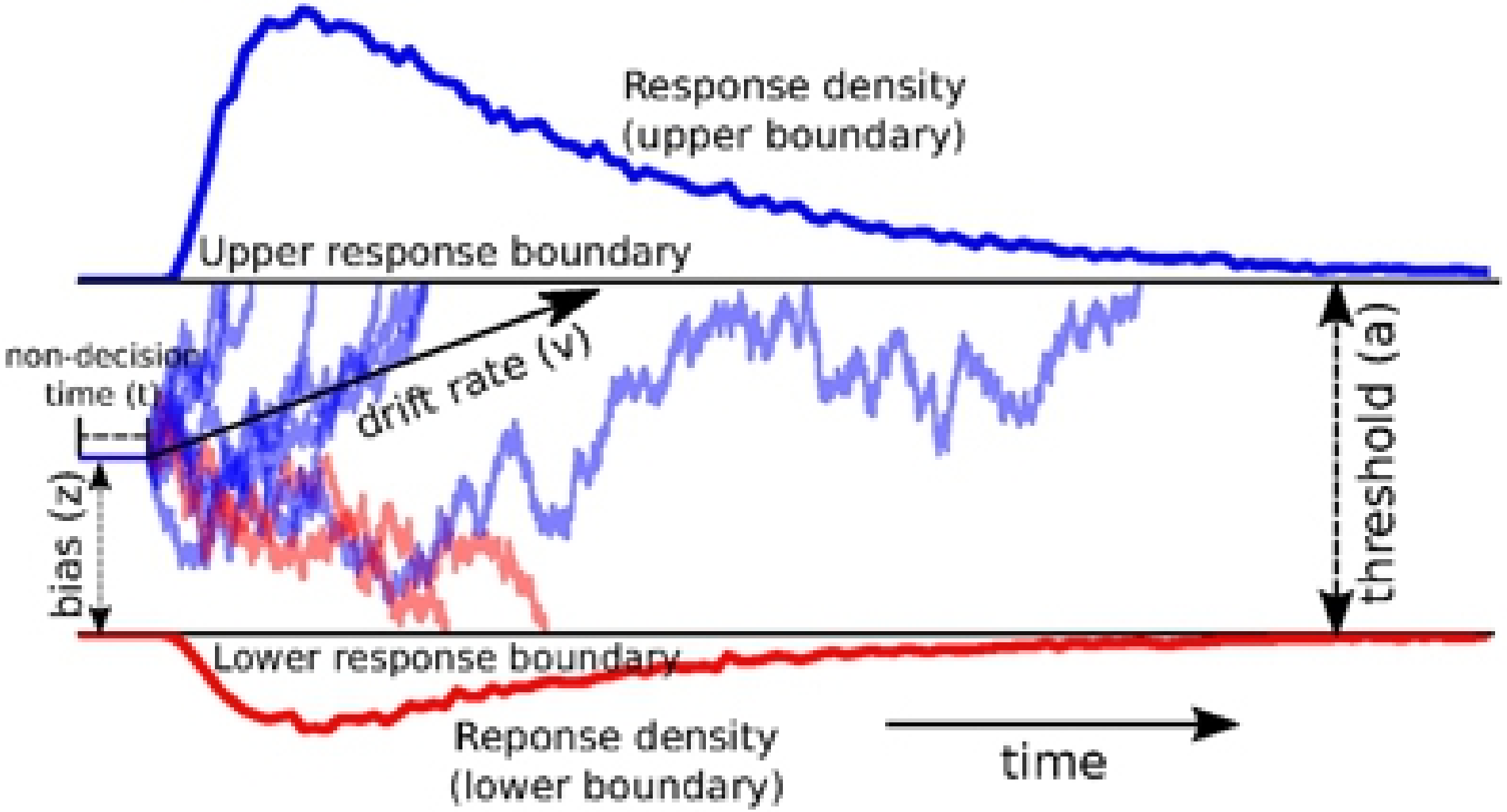


Image from Pedersen, Frank & Biele (2017),
The drift diffusion model as the choice rule in reinforcement learning.

Pilot study data

- 16-19 yrs (n = 12) – Summer 2016
- Adult data (n = 18) – Summer 2016
- 11-12 yrs (n = 14) – Summer 2017
- 6 ability measures

Pilot Study Data

- Lexical decision task
- Fast-dm software (Voss, Voss & Lerche, 2015)
- Linear regression in R (2018), using 'LanguageR', 'gvlma' and 'effects' packages

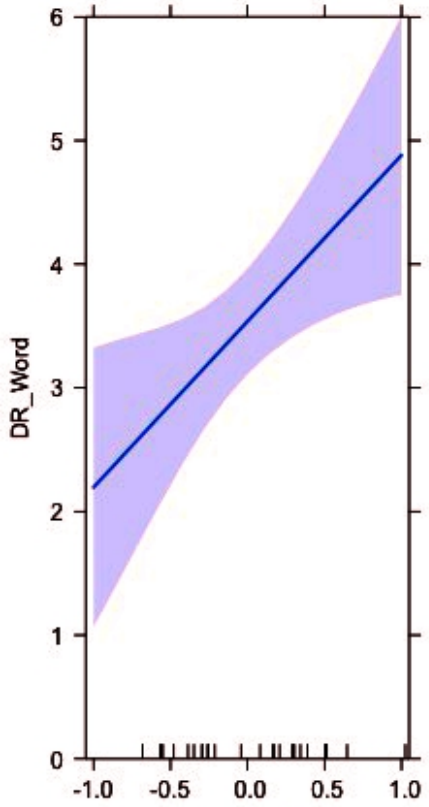
Modelling steps

- Lexical decision responses are reduced to parameter values per subject = sparse data
  - Drift rate for words and non-words
  - Starting point
  - Boundary values
  - Non-decision component
- Passed to linear regression models as outcomes with ability measures are predictors
- Model selection using AIC and principles of parsimony

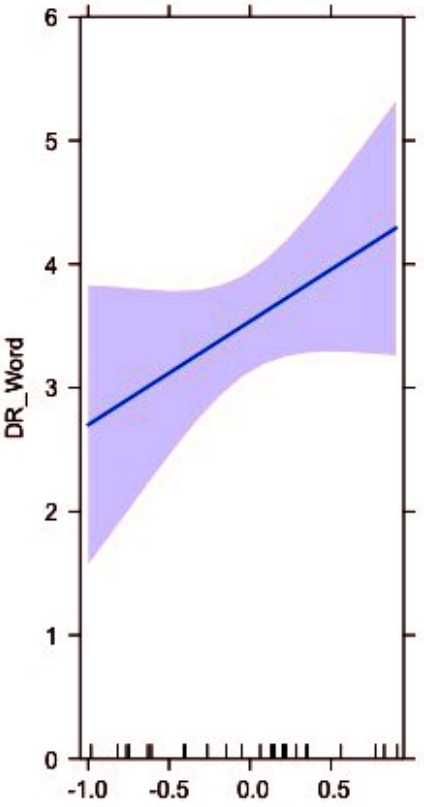
Drift Rate for Words

16 yrs & Adults

Word Reading

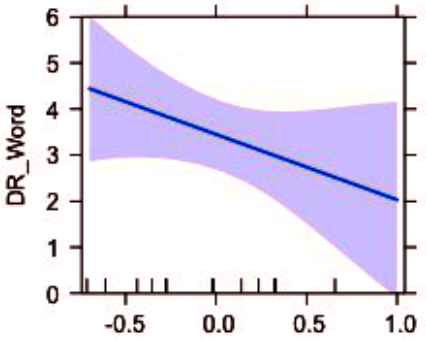


Spelling

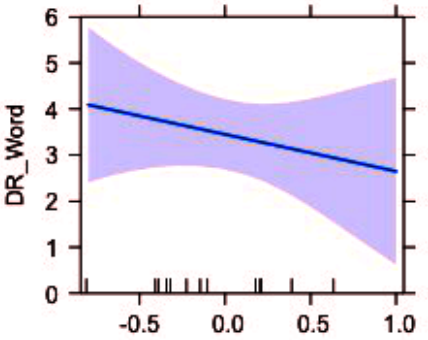


11-12 yrs

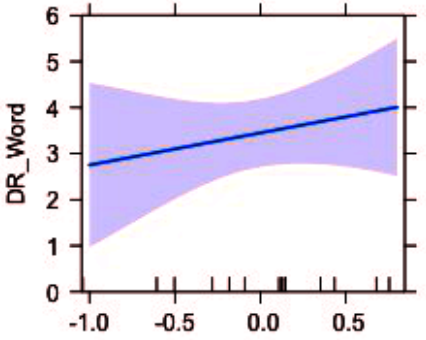
Age



Rapid Naming

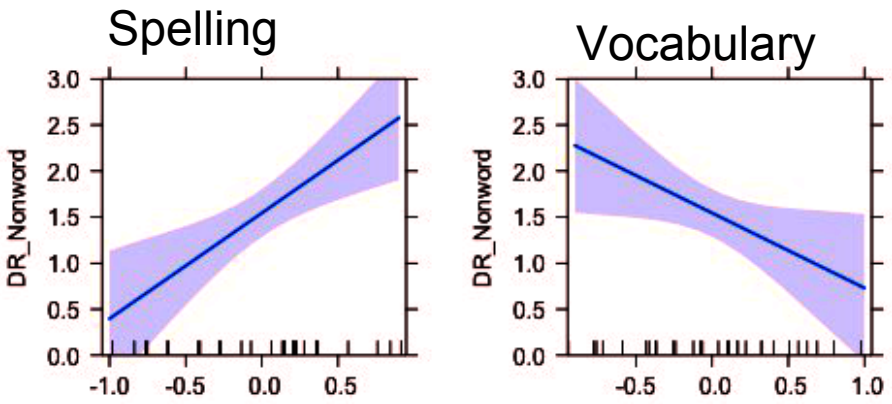


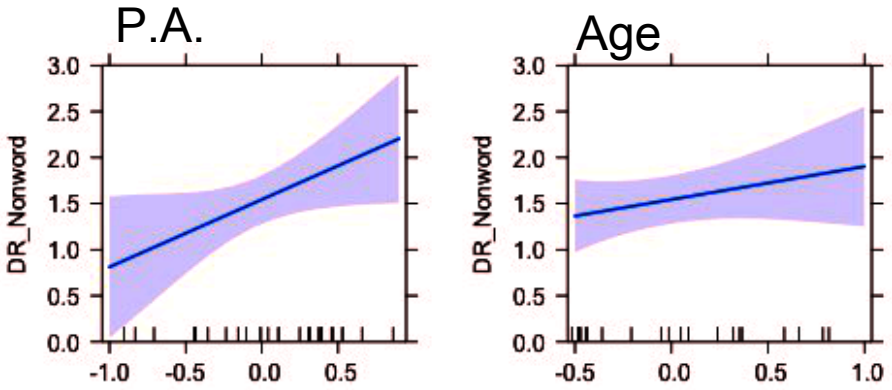
Vocabulary



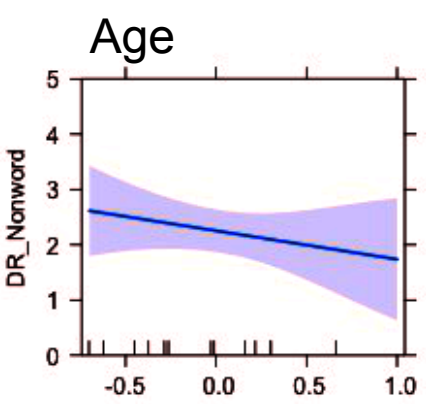
Drift Rate for NONwords...

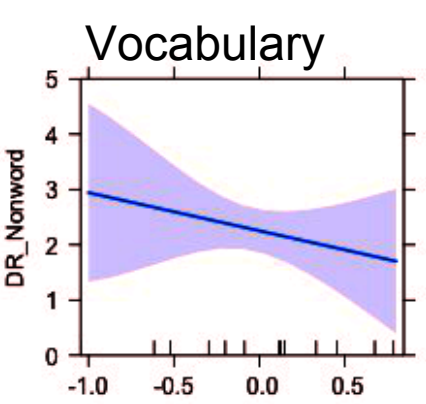
16 yrs & Adults

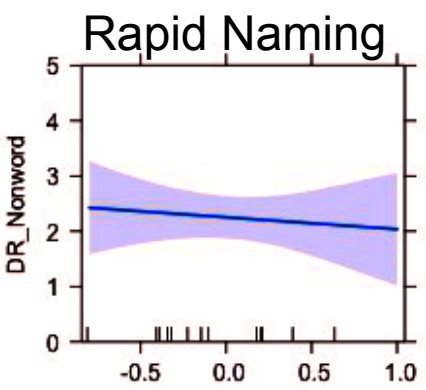


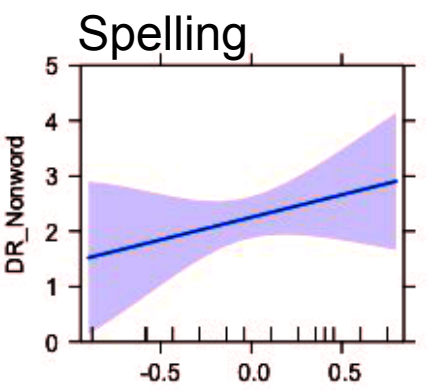


11-12 yrs









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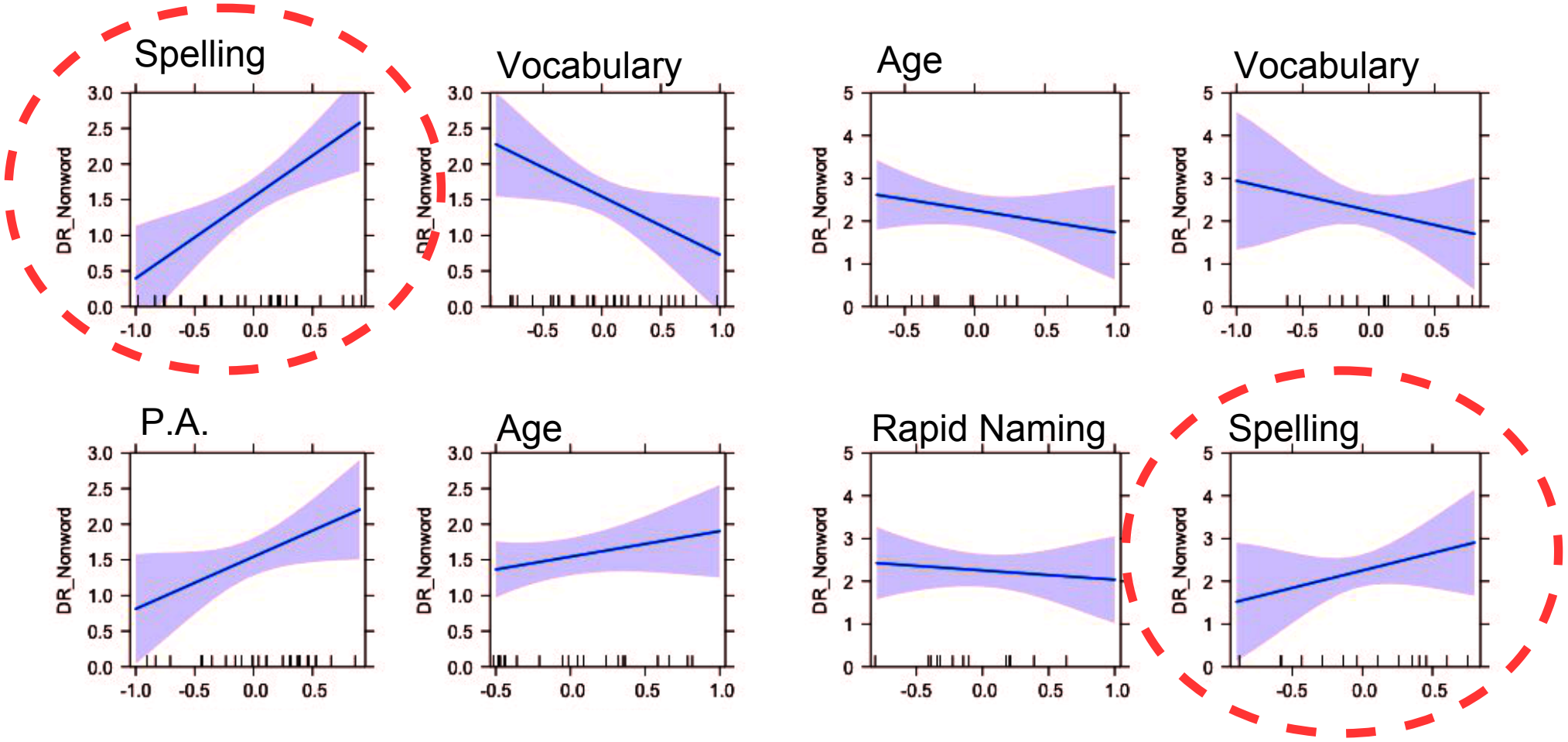

11-12 yrs

Drift Rate for NONwords...

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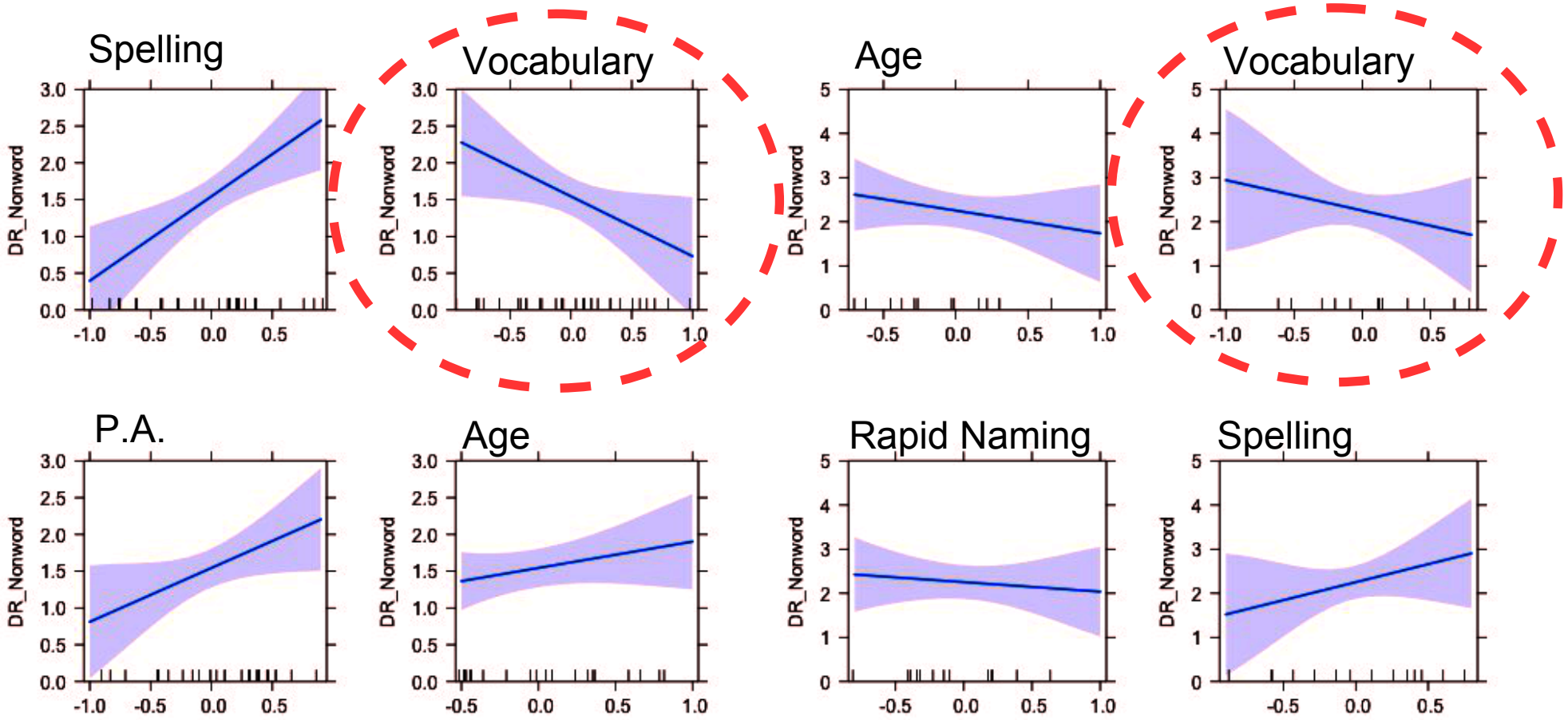
11-12 yrs



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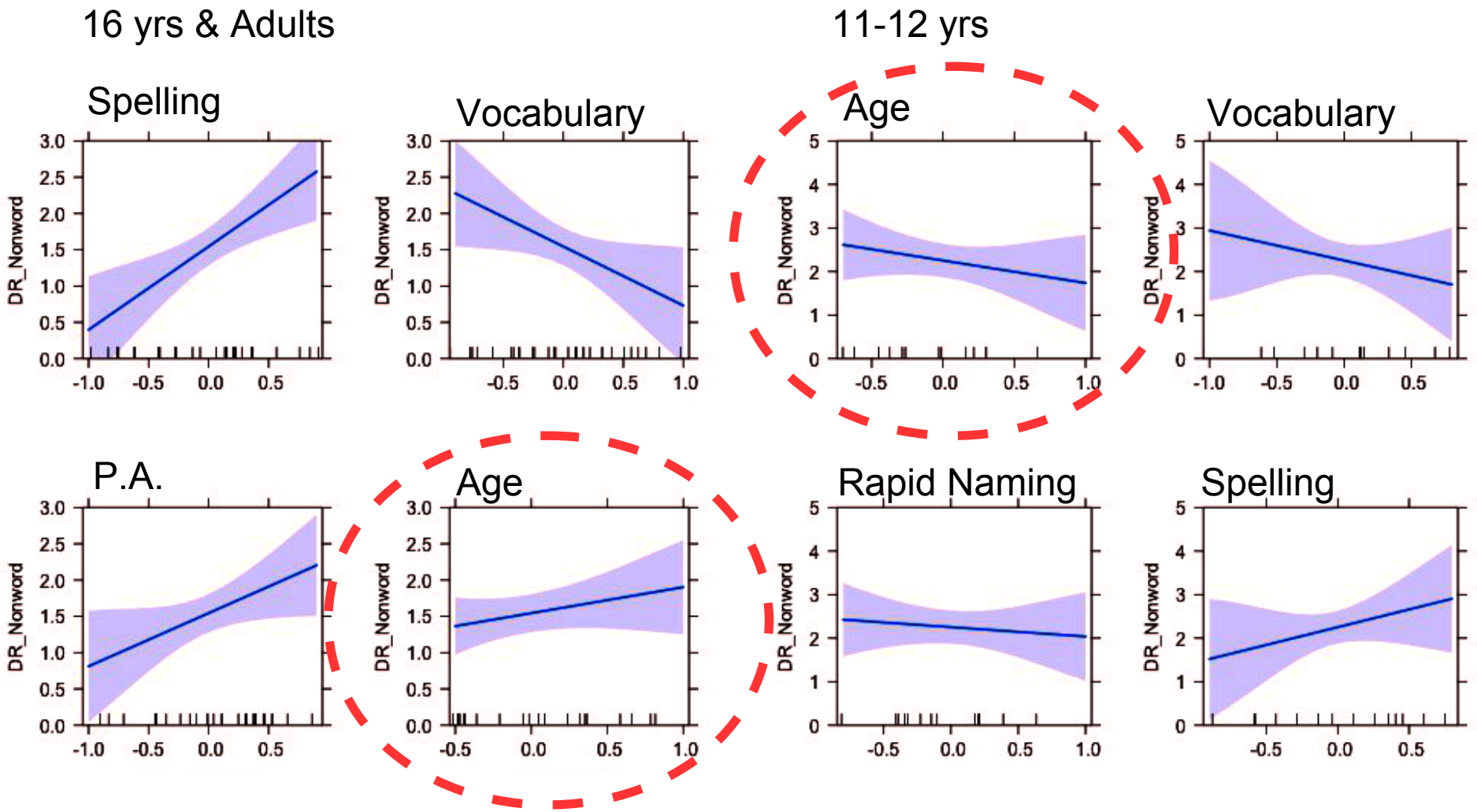
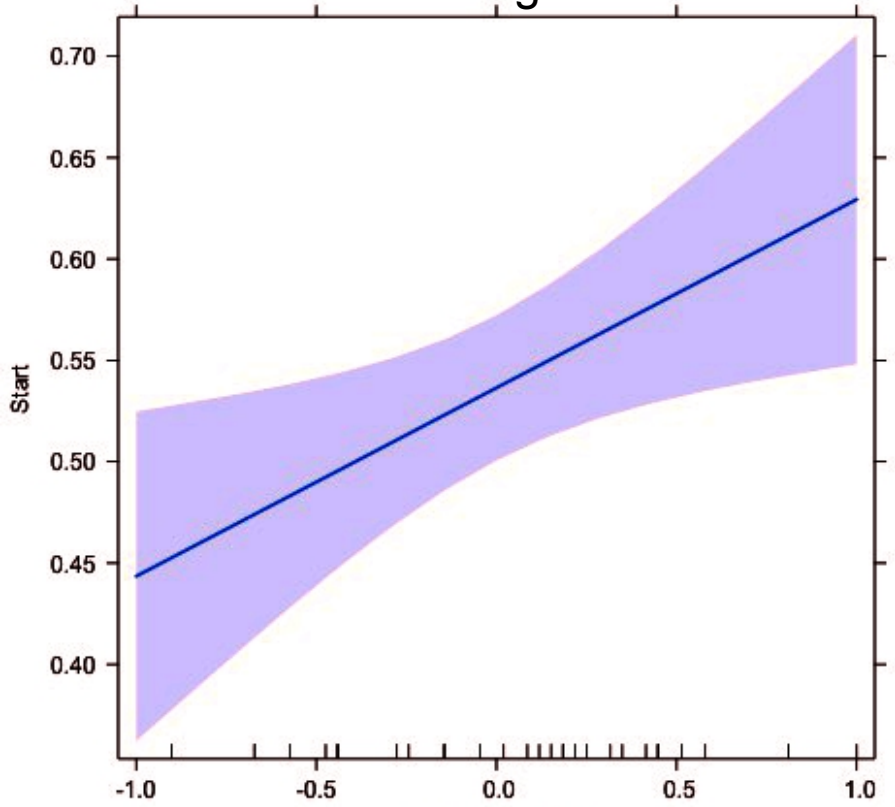


Starting Position

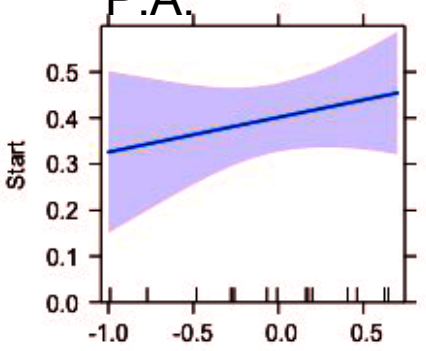
16 yrs & Adults

Non Word Reading.

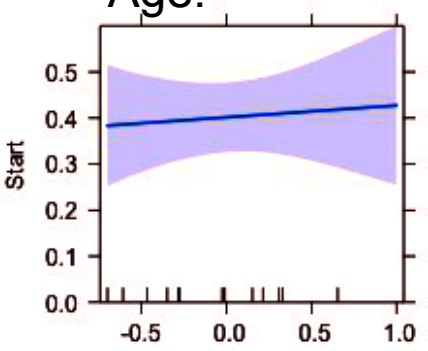


11-12 yrs

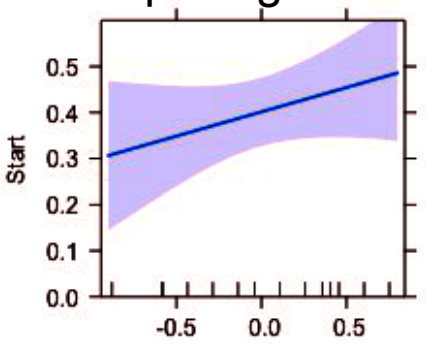
P.A.



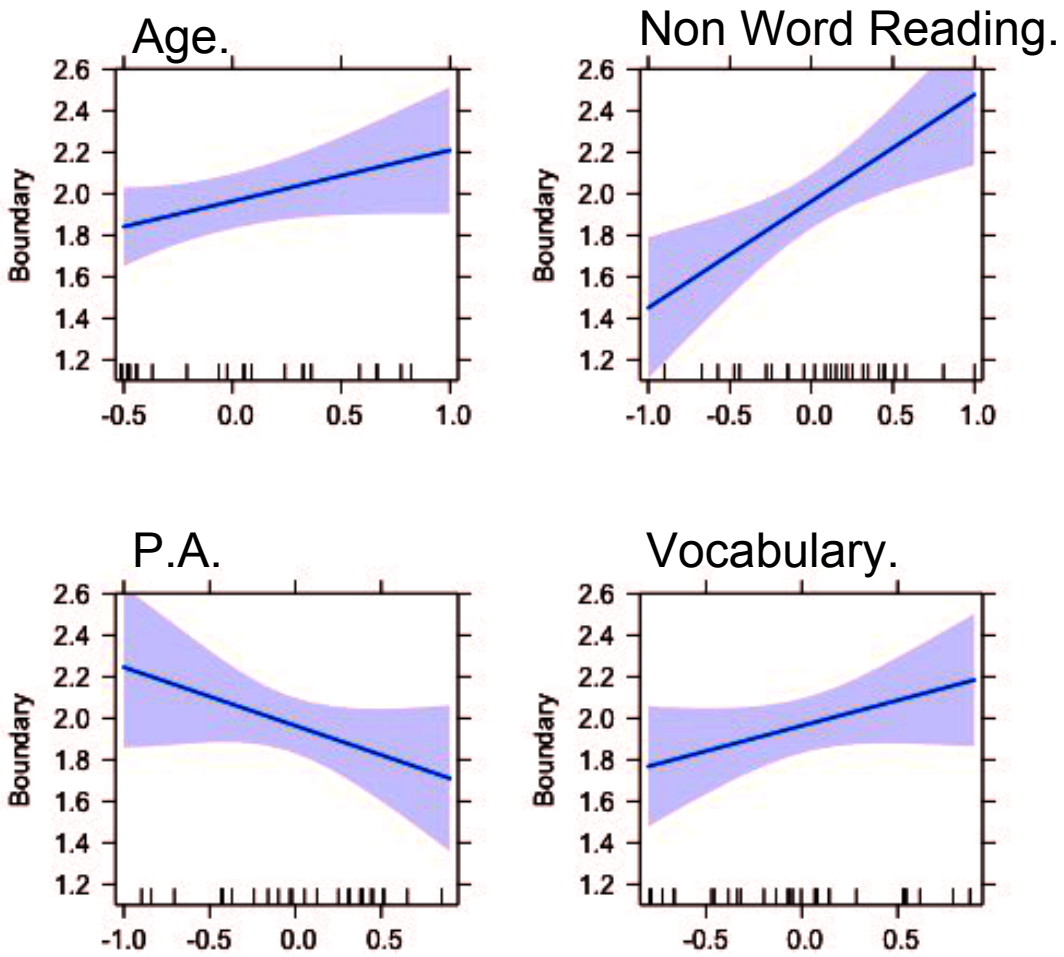
Age.



Spelling.



Boundary Values...16 & Adults



Boundary Values...11-12 yrs

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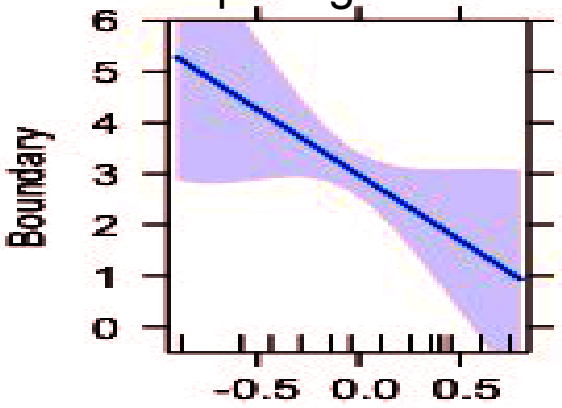

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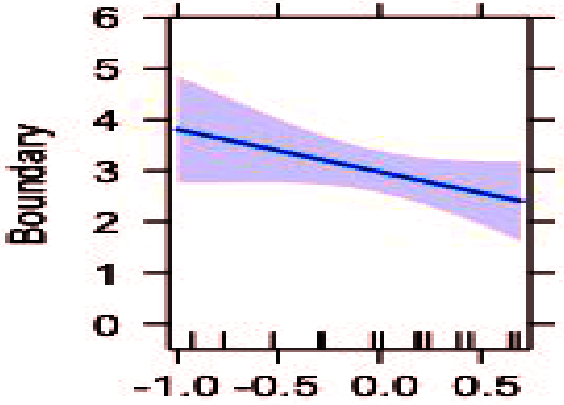
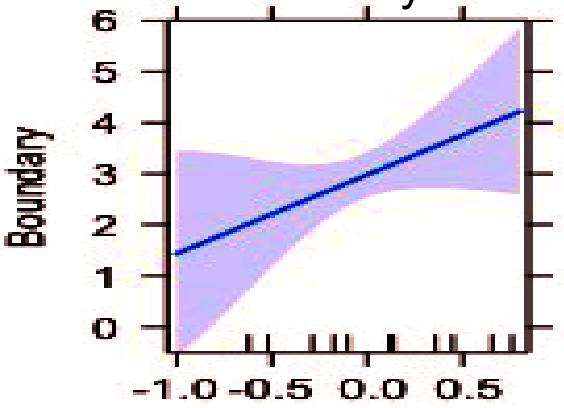


Vocabulary.



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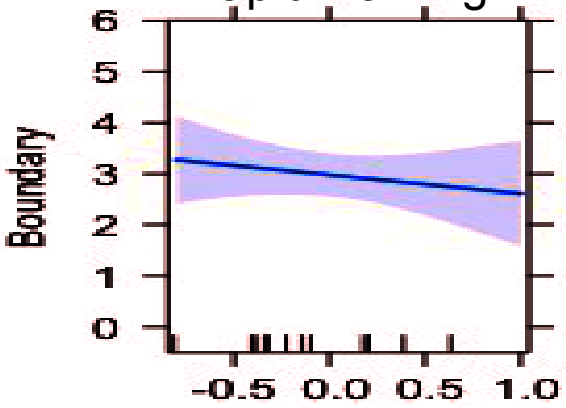
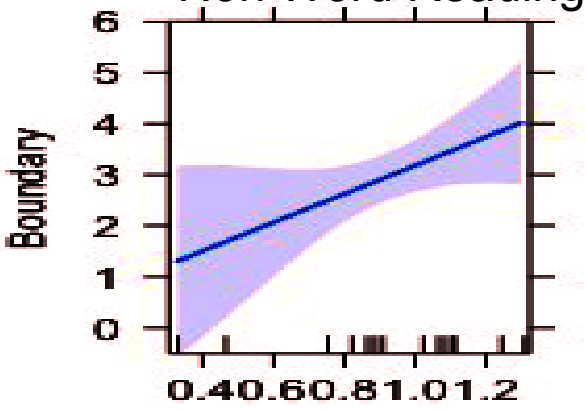
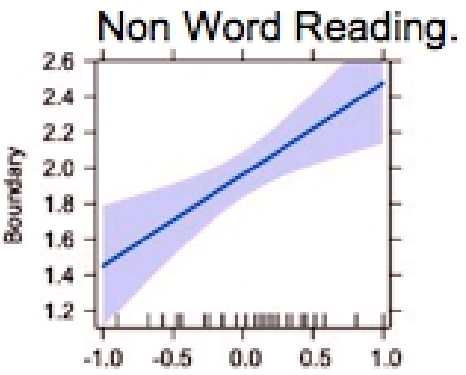


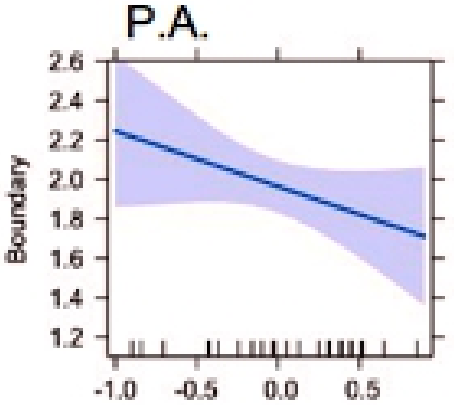
Non Word Reading.

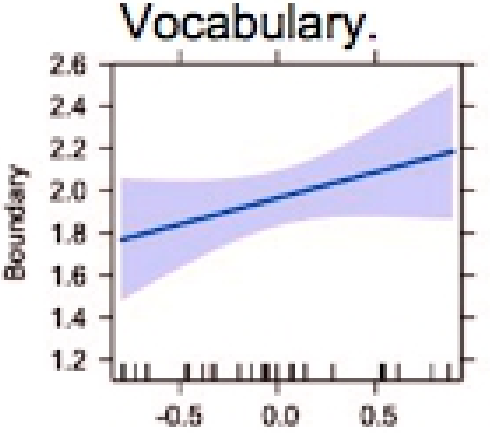


Boundary comparison

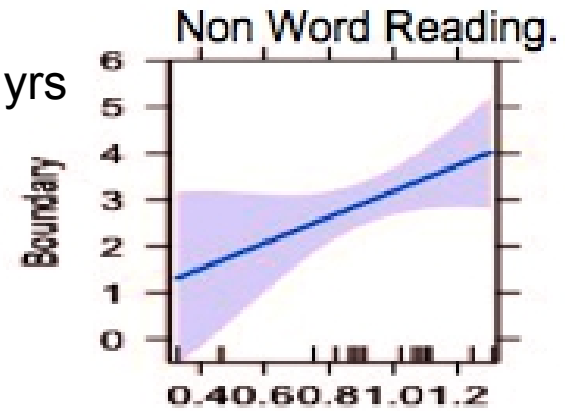
16 yrs & Adults

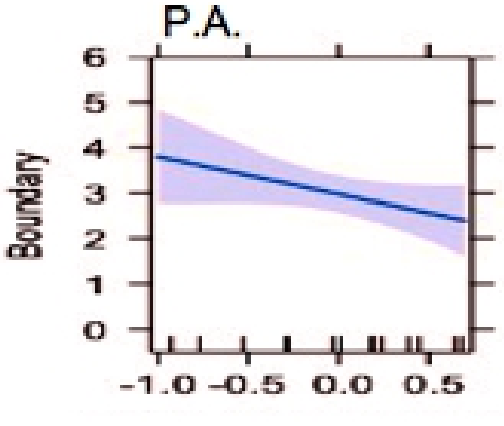


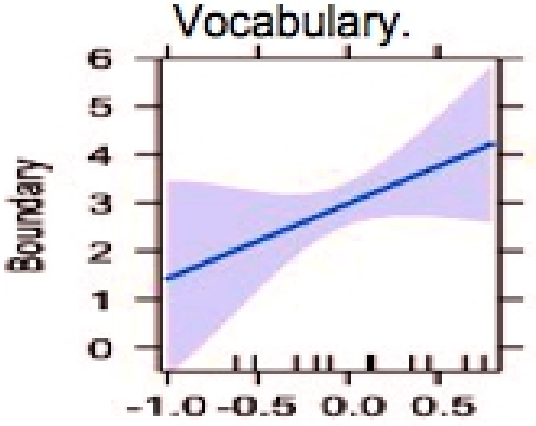




11 – 12 yrs



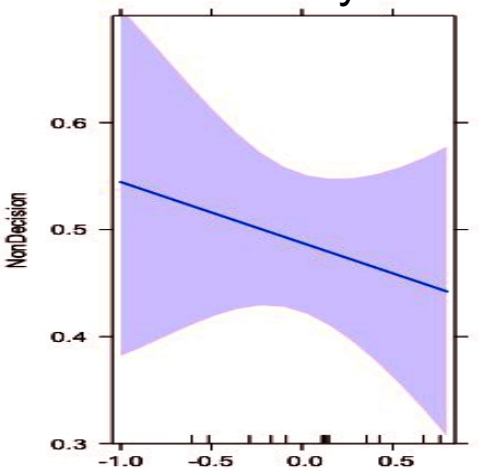




Non-Decision Component...

11-12 yrs only

Vocabulary.



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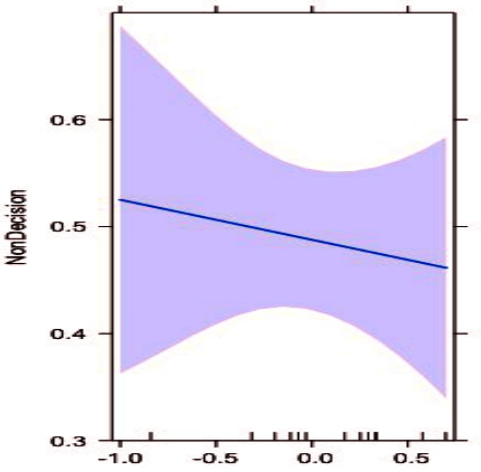

To summarise...think broad brush strokes

- There appears to be group differences in predictors for the Word Drift Rate and Start Position....
- In Start Position, nonword reading for older people and phonological awareness plus spelling for younger people may reflect a developmental trajectory in grain size
- Age, Vocabulary and Spelling are shared for NonWord Drift Rate – with the older participants able to use it more efficiently
- The shared predictors for Boundary appear to be similar in effect

Questions: Q-Diffusion Model...

$$P(x_{pi} = 1|\theta_p, \gamma_p) = \frac{\exp(\frac{\gamma_p \ \theta_p}{a_i \ v_i})}{1 + \exp(\frac{\gamma_p \ \theta_p}{a_i \ v_i})} \text{ with } \gamma_p, a_i, \theta_p, v_i \in \mathbb{R}^+$$

Molenaar, Tuerlinckx, van der Maas (2015)

Question?

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Q: Is it feasible to perform a DDM for item words, to be able to use the language level variables as predictors

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