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

Emma Mills
Lancaster University, England

Dr. Robert Davies  Dr. Anna Woollams
Lancaster University  Manchester University
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

**Semantic**
- Vocabulary
- No. of synonyms
- Semantic diversity
- Imageability / Concreteness

**Orthographical**
- TOWRE word
- Frequency
- No. of letters
- Consistency
- Neighbourhood rating

Seidenberg & McClelland, (1989)
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
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

Spelling

Vocabulary

Age

11-12 yrs

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P.A.
Drift Rate for NONwords...

16 yrs & Adults

- Spelling
- Vocabulary

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Drift Rate for NONwords...

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Starting Position

16 yrs & Adults

Non Word Reading.

11-12 yrs

P.A.

Age.

Spelling.
Boundary Values... 16 & Adults

- Age.
- Non Word Reading.
- P.A.
- Vocabulary.
Boundary Values...11-12 yrs

- Spelling.
- P.A.
- Vocabulary.
- Rapid Naming.
- Non Word Reading.
Boundary comparison

16 yrs & Adults

11 – 12 yrs
Non-Decision Component...
11-12 yrs only

Vocabulary.

Non Word Reading.
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...

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

Molenaar, Tuerlinckx, van der Maas (2015)
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