Influential predictors of single word recognition: a research synthesis

1 September 2017

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Literacy skills

Literacy rates for UK Adults

- Literate
- Illiterate
Literacy skills

Literacy rates for UK adults

D-G GCSE English Grades 2007 - 2017

Literate
Illiterate

D-G Grades
Simple view of reading

(Gough & Tunmer, 1986)
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Simple view of reading

- Dyslexia
- Skilled reading
- Functional illiteracy

(Gough & Tunmer, 1986)
Cognitive models of reading:

(Seidenberg & McClelland, 1989)
Proxy measures at two levels:

**Phonology:**
- P: Sound – letter knowledge
- W: Pronunciation
Proxy measures at two levels:

*Orthography:*
P: Spelling ability

W: Frequency

*Phonology:*
P: Sound – letter knowledge

W: Pronunciation
Proxy measures at two levels:

**Semantics:**
P: Vocabulary knowledge
W: Imageability

**Orthography:**
P: Spelling ability
W: Frequency

**Phonology:**
P: Sound – letter knowledge
W: Pronunciation
A research synthesis: Method

1. Scoping search
   - 3 databases
   - “Individual differences” and word-level predictors e.g. frequency
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2436
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   - duplicates removed
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3. Full text review
   - studies included if:
     • contrast groups AND
     • word naming OR lexical decision task AND
     • word-level predictor included in the experiment
   - data extraction

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2436  275  87
How many effects and for whom?

WORD NAMING RT

- Vocabulary
- N_Size
- Length
- Imageability
- Frequency
- Ability
- Age
- AoA
- BG_Freq
- Consistency
Word naming studies

WORD NAMING RT

WORD NAMING ACCURACY

- N_Size
- Length
- Imageability
- Frequency
- Consistency
- AoA
- Age
- Ability
Lexical decision studies

LEXICAL DECISION RT

- Vocabulary
- Ability
- Age
- AoA
- BG_Freq
- Comprehension
- Concreteness
- Consistency
- Emotion
- Exposure
- Familiarity
- Frequency
- N_Size
- Length
- Imageability
- Features
Lexical decision studies

Lexical Decision RT

Lexical Decision Accuracy

- Vocabulary
- Ability
- Age
- Emotion
- Exposure
- Frequency
- N_Size
- Length
- Features
All studies: no of effects = 433

WORD NAMING RT

LEXICAL DECISION RT

ACCURACY

ACCURACY
Person-level effect sizes

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**Response times (r)**

<table>
<thead>
<tr>
<th>Ability</th>
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<tbody>
<tr>
<td>0.62</td>
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</tr>
<tr>
<td>0.56</td>
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Person-level effect sizes

**Response times (r)**

- ABILITY: 0.62, 0.56, 0.61
- AGE: 0.72, 0.36, 0.34

**Accuracy (odds ratio)**

- ABILITY: 2.84, 1.96, 1.79
- AGE: 3.46, 3.05, 3.12
Person-level effect sizes

Response times ($r$)

Accuracy (odds ratio)
Person-level effect sizes

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Word-level effect sizes: Response times
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AOA | CONSISTENCY | FREQUENCY | IMAGEABILITY | LENGTH | NSIZE
---|-------------|-----------|-------------|--------|--------
0.4 | 0.5         | 0.7       | 0.8         | 0.7    | 0.5
0.3 | 0.4         | 0.6       | 0.5         | 0.6    | 0.4
0.2 | 0.3         | 0.4       | 0.3         | 0.4    | 0.3
0.1 | 0.2         | 0.1       | 0.2         | 0.1    | 0.2
0    | 0.0         | 0.0       | 0.0         | 0.0    | 0.0
Word-level effect sizes: Response times

AOA  CONSISTENCY  FREQUENCY  IMAGEABILITY  LENGTH  NSIZE
Word-level effect sizes: Response times
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Word-level effect sizes: Accuracy (log OR)
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Word-level effect sizes: Accuracy (log OR)
Interaction effect sizes

Response Times ($r$)

Accuracy (log odds ratio)
Effect size ranges are ‘embarrassingly large’
Model diagnostics: Heterogeneity - $I^2$

What does it mean?

- $I^2$ reflects how much variation would remain if sampling error was removed (Borenstein, 2017)
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What does it mean?

- $I^2$ reflects how much variation would remain if sampling error was removed (Borenstein, 2017)
- Points at 0 are interaction effect $I^2$ values
- Greater proportion of effect sizes are in the ‘high’ range
- Polarised values need more investigation taking sampling error variance into account
Model diagnostics: method of analysis

76% Mixed ANOVA

- Within-subjects analysis
  - assuming word-level effects are the same for all participants
- Aggregating outcome variables
- Factors are examined individually
  - manipulated stimuli
  - the cognitive model assumes parallel processes
  - appearance of absolute effects
Can we take a different approach?

76%  *Mixed ANOVA*
• Within-subjects analysis
  – assuming word-level effects are the same for all participants

*Simultaneous Regression*
• Within-subjects analysis
  – varying intercepts & slopes for differences
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Simultaneous Regression

- Within-subjects analysis
  - varying intercepts & slopes for differences
- No aggregation – greater power
- Factors are examined at the same time
  - stimuli from relevant texts
  - reflecting the processes within the model
  - relative effects modelled together
Pool our resources

1. Replicate
   1. Within your own study AND

2. Join forces
   1. Same protocols
   2. Same stimuli
   3. Same analysis

3. Go long
   1. Look for causal interpretation rather than correlational for model processes and theory development
Thanks

Partners – local schools, colleges and residents

Quick note:

Bayesian Methods Day – Nottingham Trent University, Friday 29 Sept – I can forward link to interested persons. 😊