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Morpheme knowledge is shaped by information available through orthography

ESCoP @ Sheffield
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UKRI Economic and Social Research Council

ROYAL HOLLOWAY UNIVERSITY OF LONDON

What is morpheme knowledge for?

- Most English words are built by **recombining stems and affixes**

clean<u>er</u>, clean<u>ly</u>, un<u>clean</u>

teach<u>er</u>, bank<u>er</u>, build<u>er</u>

- Morpheme knowledge enables rapid access to the meanings of **familiar** words
- It is also crucial for computing the meanings of **unfamiliar** words

bright + -ify → brightify

- Limited time for explicit instruction, so morpheme knowledge must be acquired primarily through **text experience**

Many complex words in children's books

7-9 years

10-12 years

13+ years

CYP-LEX: The Children and Young People's Books Lexicon

1,200 popular books

400 books per age band

Over 70 mln words

Over 100,000 distinct words

- Roughly **half of all distinct words** are complex
- **Few** complex words are **used repeatedly** or in many books
- Children are **likely to see** a complex word but **unlikely to see** this word **again**

Korochkina et al., 2024, *QJEP*
Korochkina & Rastle, 2025, *njp Sci Learn*

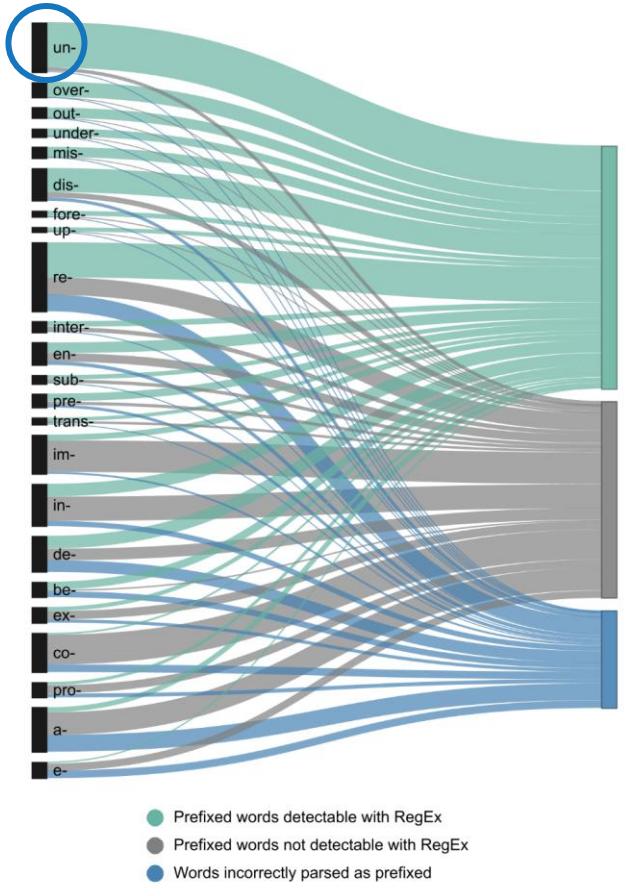
Pre-requisites for morpheme learning

unknown	deactivate
unfair	decode
unafraid	decompose
unlikely	demand
unconvinced	deceive
unsure	depend
unwell	deliver (de- + -liberare)

- Must have **consistent meaning** transformation
- Must occur with a **high number of distinct stems** (type frequency)
- Must be **detectable**

Tamminen et al., 2015, *Cogn Psychol*
Ulicheva et al., 2020, *Cognition*
Korochkina & Rastle, 2025, *npj Sci Learn*

Few affixes are easy to detect



Korochkina & Rastle, 2025, *npj Sci Learn*

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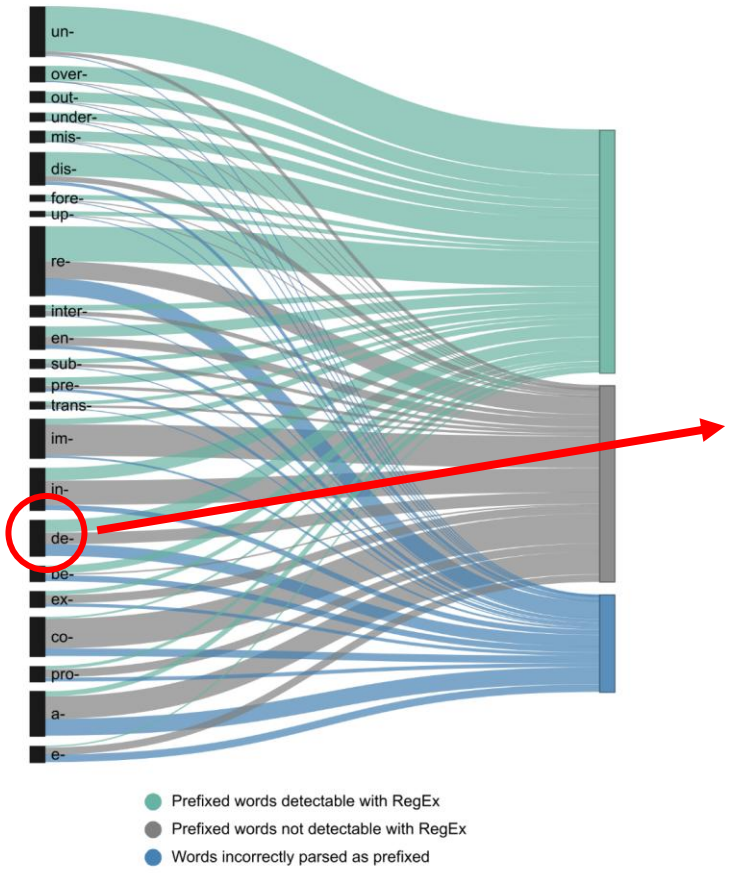

1/3 detectable
deactivate, *decode*, *decompose*

1/3 undetectable
demand, *deceive*, *depend*

1/3 false alarms
deliver, detail, defeat

Korochkina & Rastle, 2025, *npj Sci Learn*

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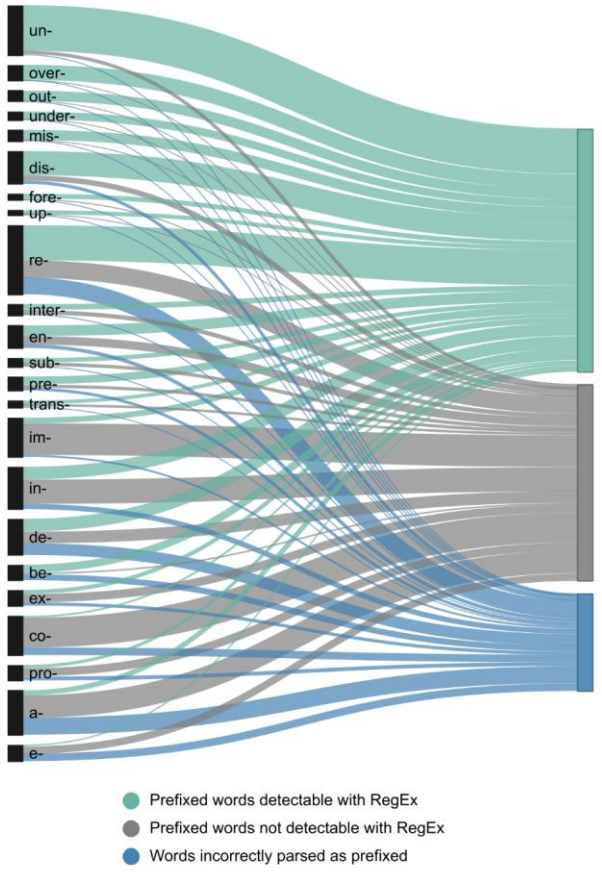

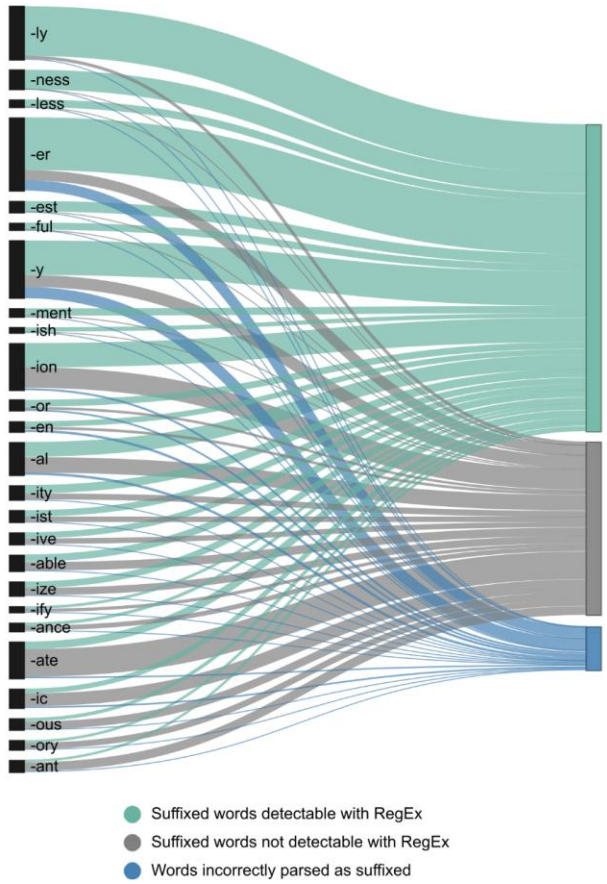

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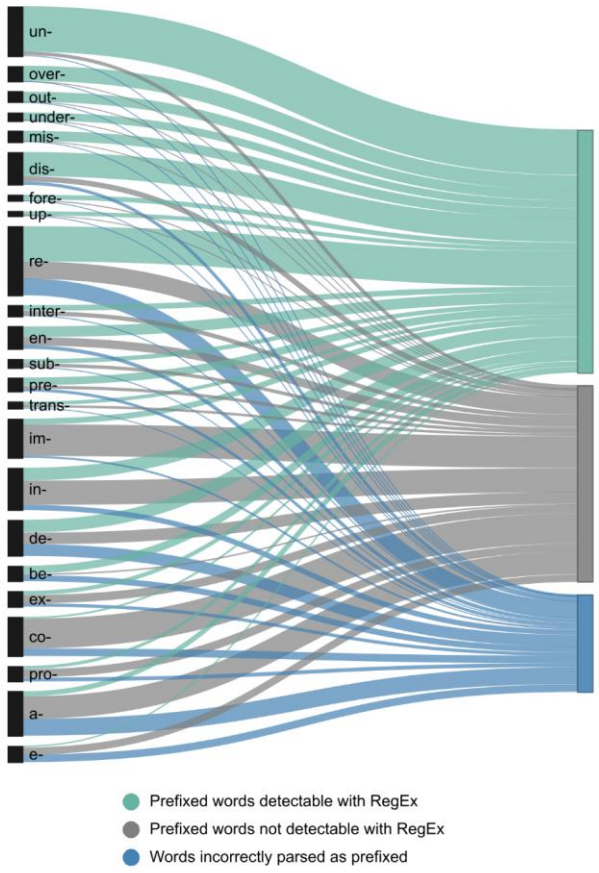
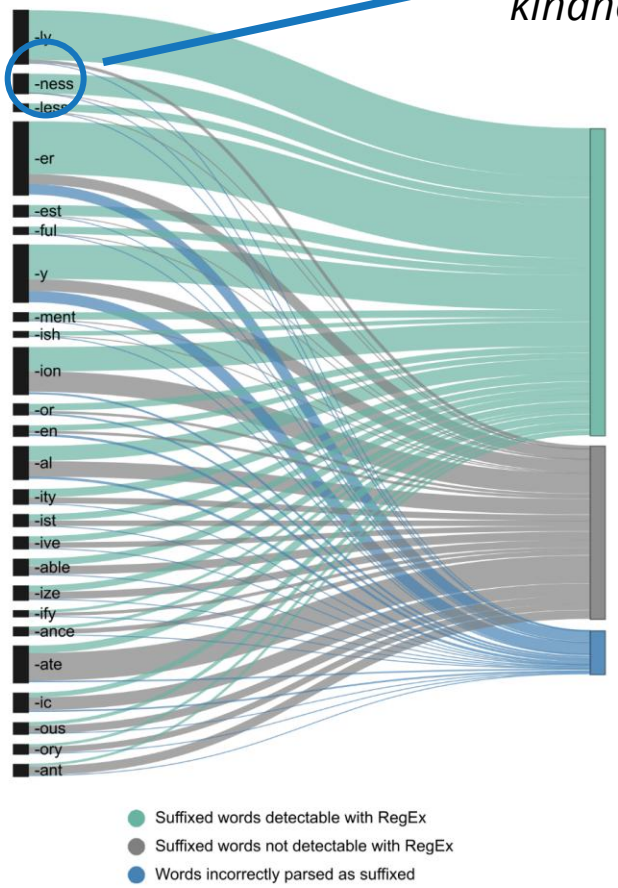


Easy to detect
kindness, weakness, sadness



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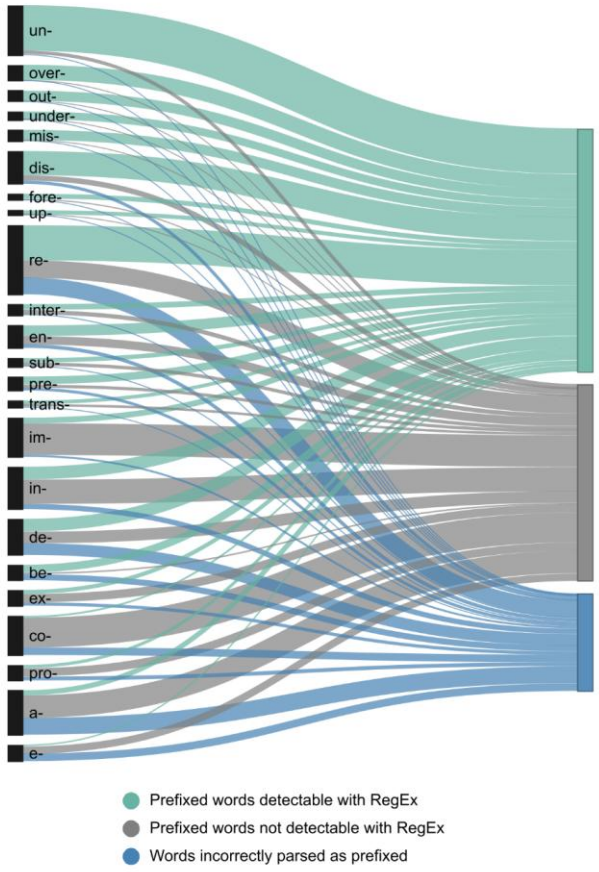
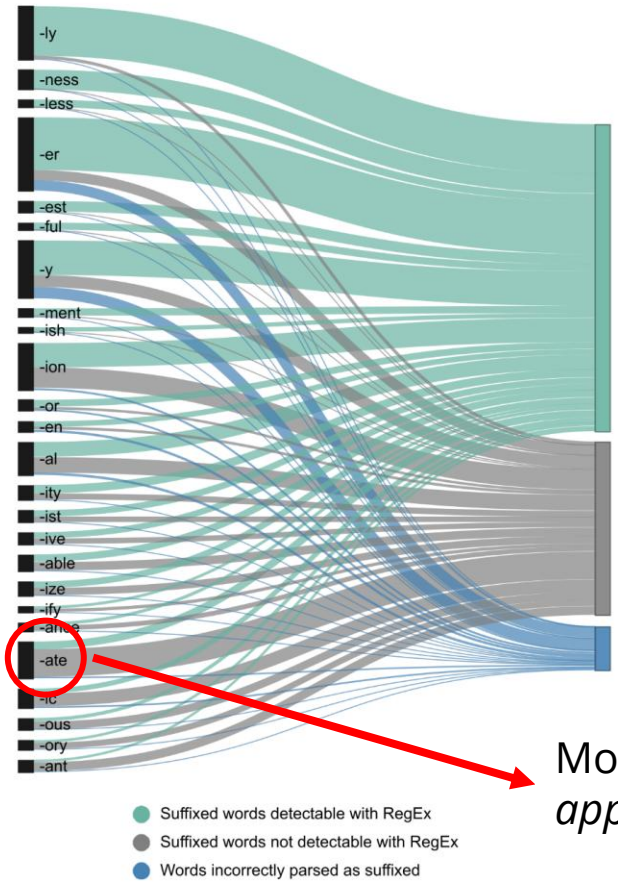
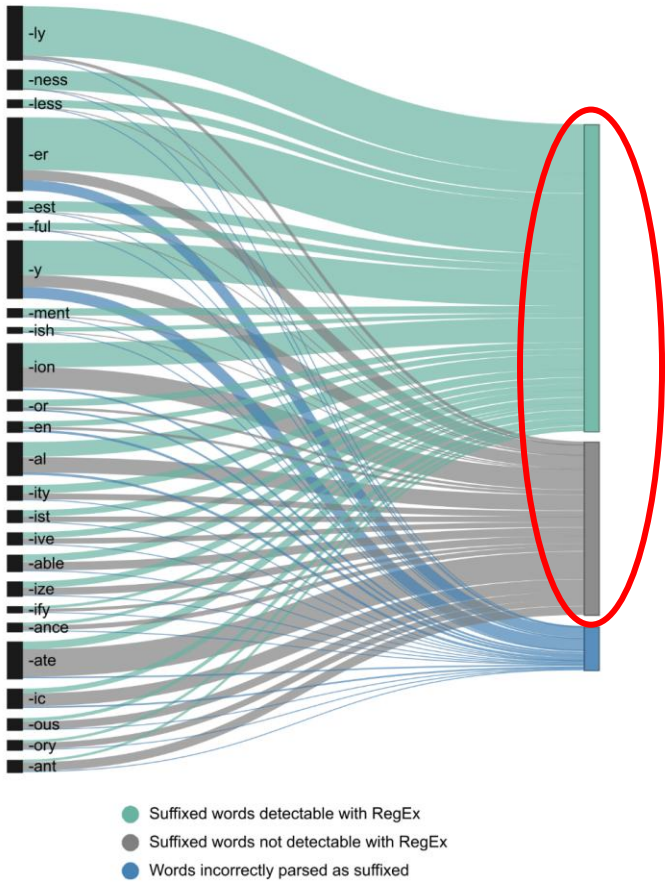




Mostly undetectable
appreciate, *generate*, *integrate*

Korochkina & Rastle, 2025, *npj Sci Learn*

What constitutes morpheme experience?



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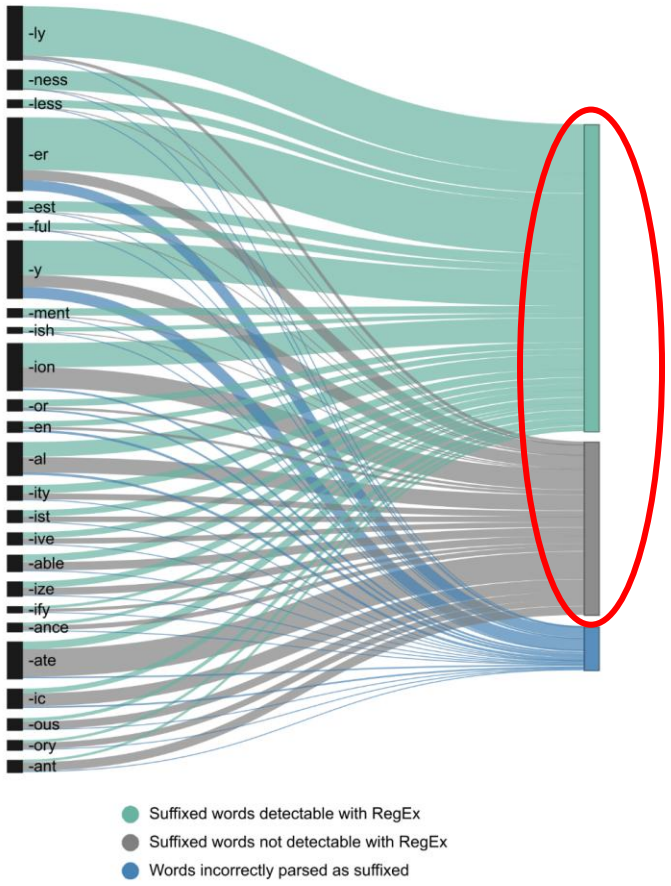

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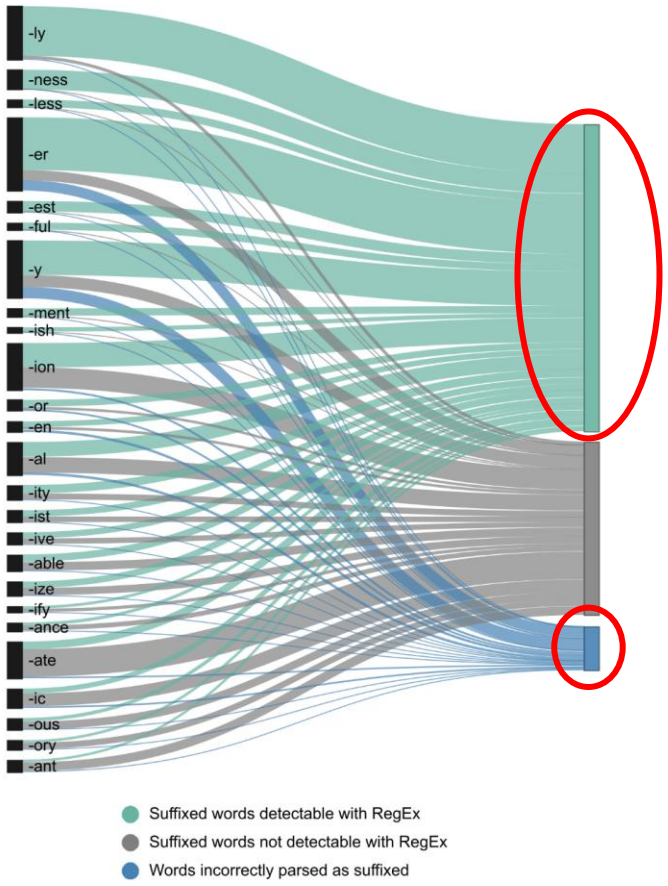

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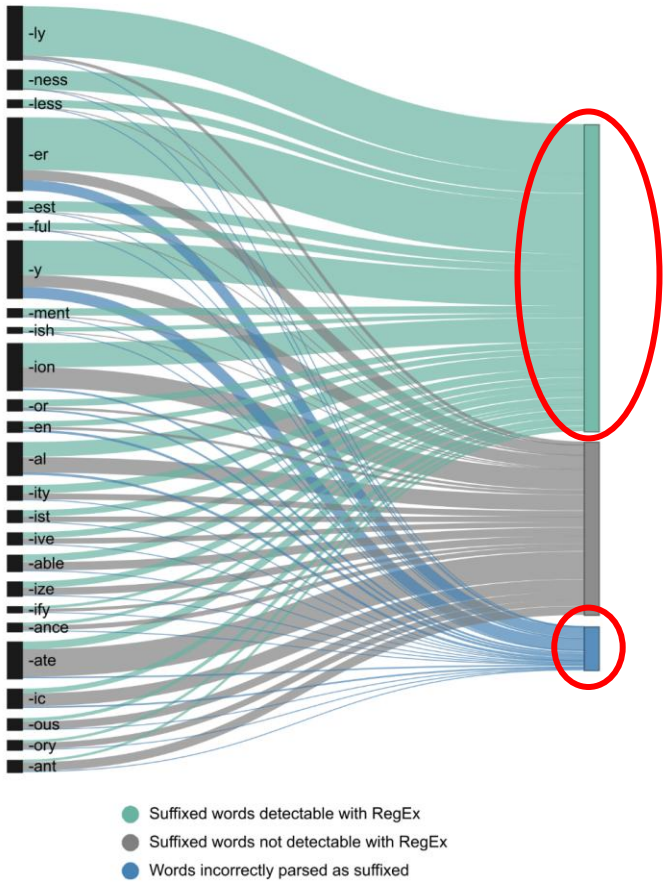

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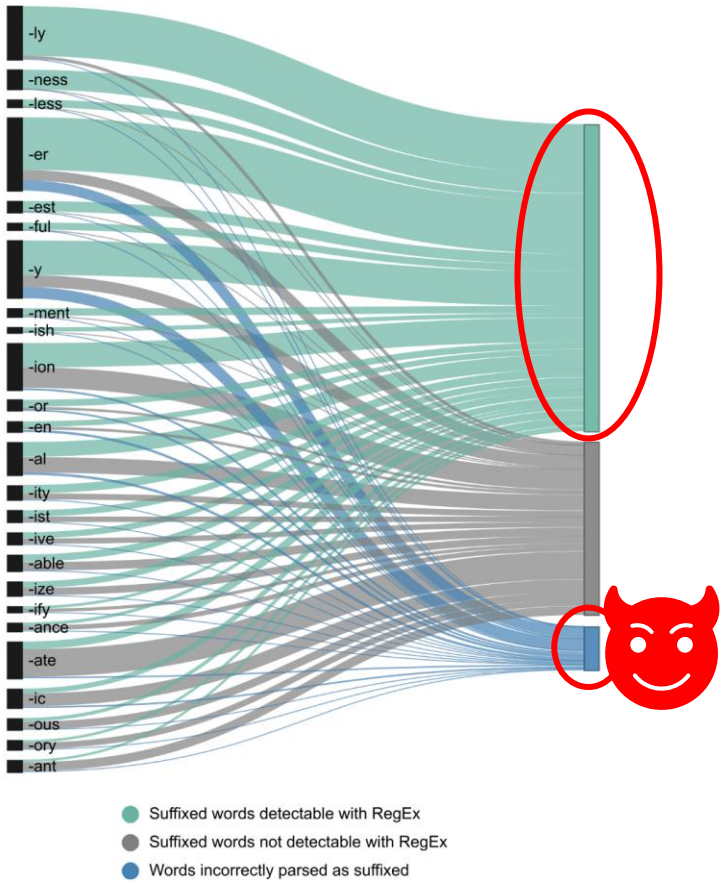

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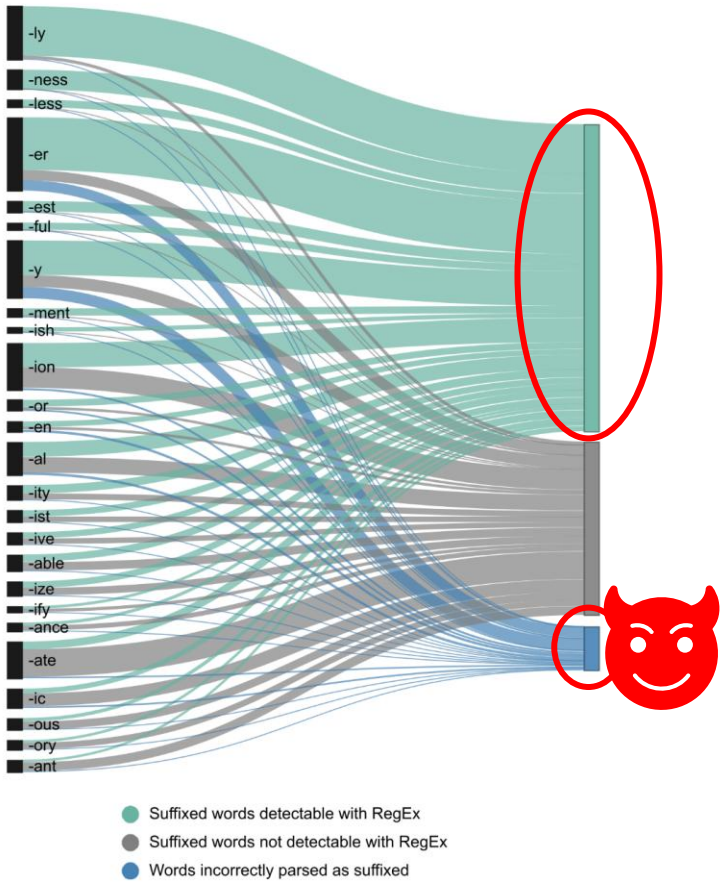

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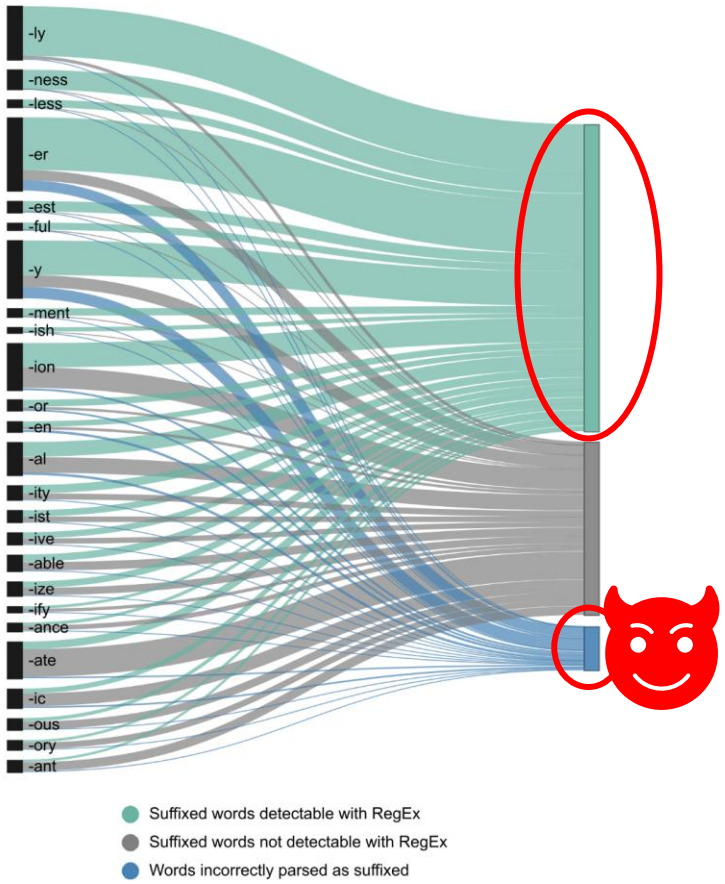
The false alarm penalty

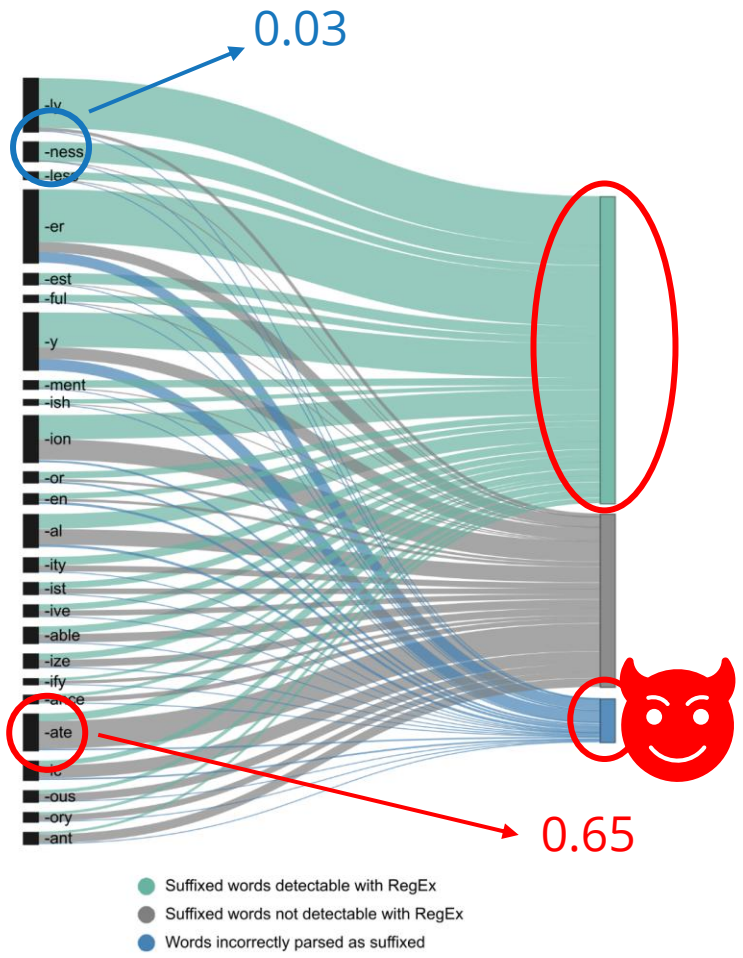


Shannon entropy

Quantifies the **uncertainty about the function** of the orthographic pattern associated with an affix

Shannon, 1948, *Bell Syst Tech J*

The false alarm penalty



Shannon entropy

Quantifies the **uncertainty about the function** of the orthographic pattern associated with an affix

Low entropy → little uncertainty → low penalty

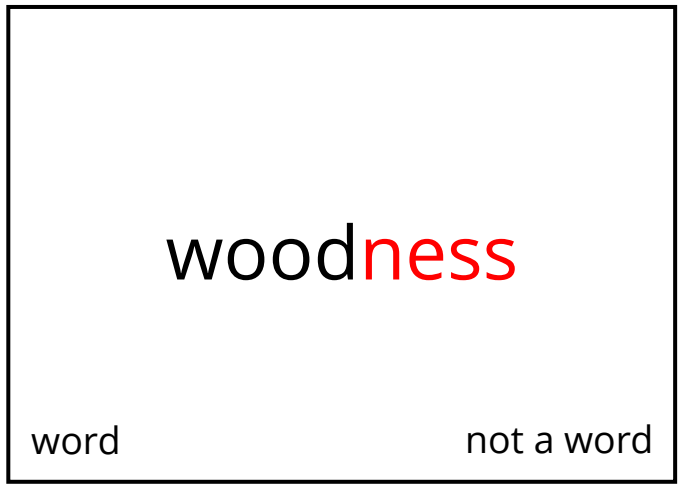
High entropy → more uncertainty → high penalty

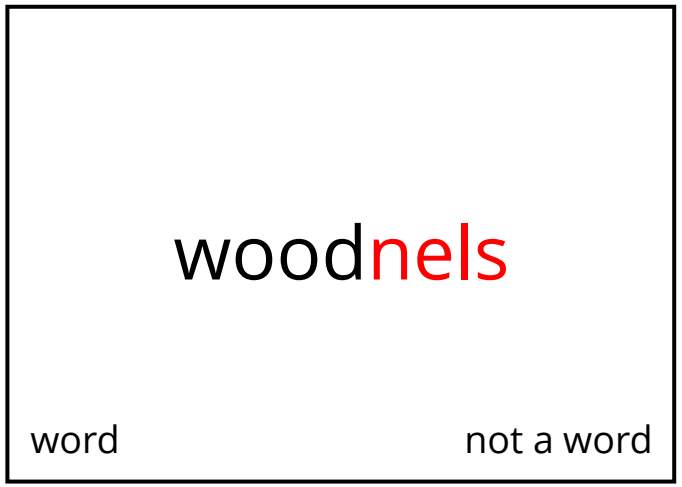
Shannon, 1948, *Bell Syst Tech J*

Theories in action

Which definition best explains human behaviour?

The morpheme interference effect





- Morphologically-structured nonwords are more difficult, and take longer, to reject
- Skilled readers segment complex-looking words into morphemes

Taft & Forster, 1975, *J of Verb Learn & Verb Behav*
Crepaldi et al., 2010, *Mem & Cogn*

Stimuli

- 6 prefixes
  - *un-*, *mis-*, *dis-*, *pre-*, *de-*, *re-*
- 6 suffixes
  - *-ness*, *-ly*, *-able*, *-er*, *-ic*, *-ate*

- Morphologically structured nonwords
  - *<u>un</u>wood*, *wood<u>ness</u>*
- Nonwords without morphological structure
  - *<u>ub</u>wood*, *wood<u>nels</u>*

- Each participant saw…
  - Each affix with 10 stems (120 morphologically structured nonwords)
  - Orthographic controls (120 nonwords with no morphological structure)
  - 120 morphologically complex + 120 morphologically simple words

Korochkina et al., 2025, *In press*

Stimuli

- 6 prefixes
  - *un-*, *mis-*, *dis-*, *pre-*, *de-*, *re-*
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  - *-ness*, *-ly*, *-able*, *-er*, *-ic*, *-ate*

- Morphologically structured nonwords
  - *un*wood, wood*ness*
- Nonwords without morphological structure
  - *ub*wood, wood*nels*

- Each participant saw 480 letter strings
  - Each affix with 10 stems (120 morphologically structured nonwords)
  - Orthographic controls (120 nonwords with no morphological structure)
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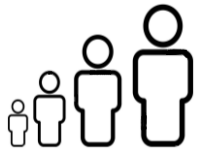
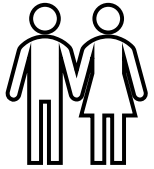
Korochkina et al., 2025, *In press*

Participants

120 participants



18 – 40 years old

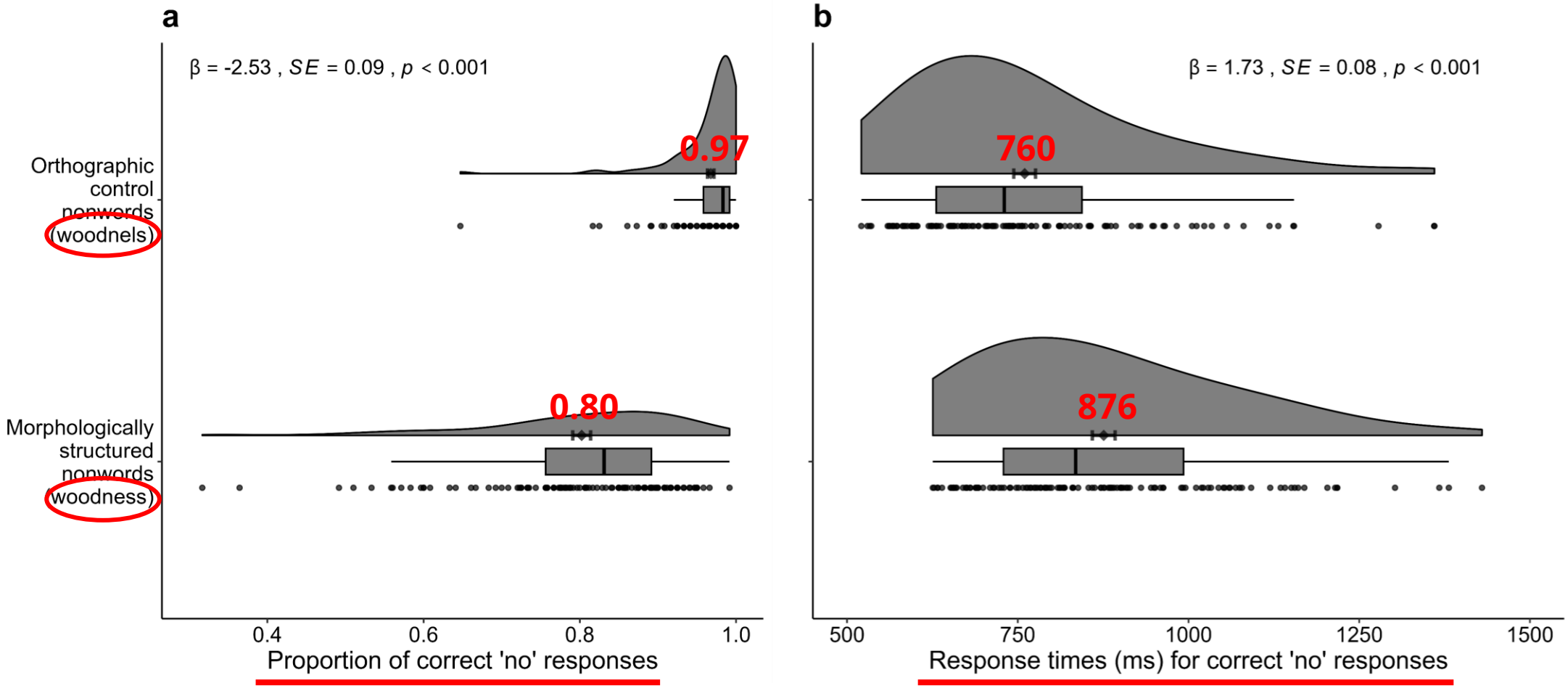


63 female
56 male
1 non-binary

UK based
English as a first language
No language disorders

Korochkina et al., 2025, *In press*

Readers are sensitive to morphological structure



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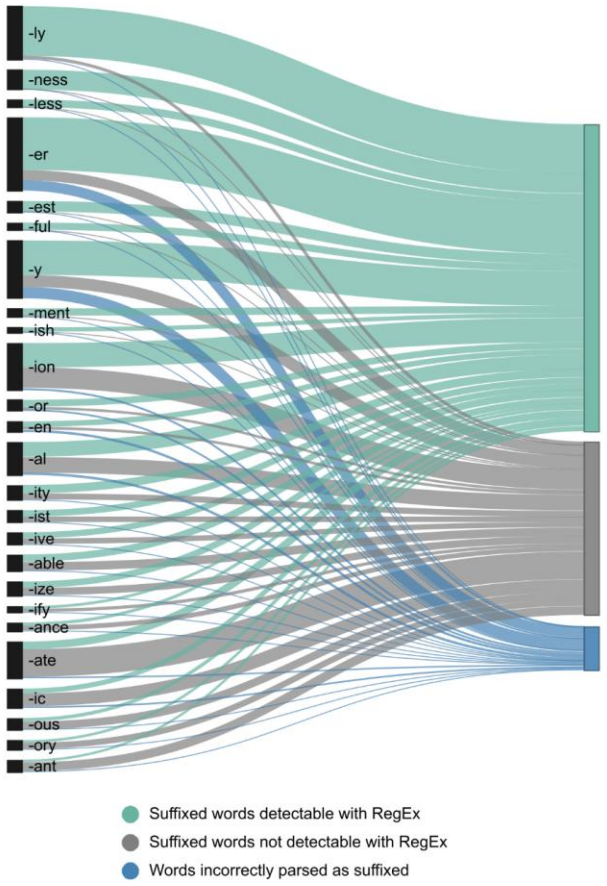

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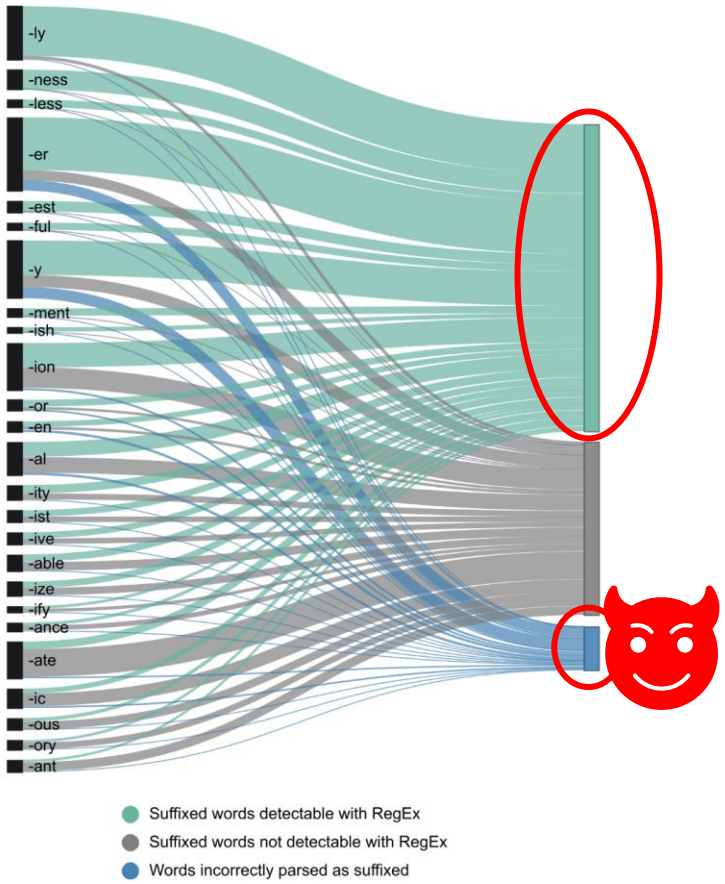
Korochkina et al., 2025, *In press*

Theory 3 explains data best!



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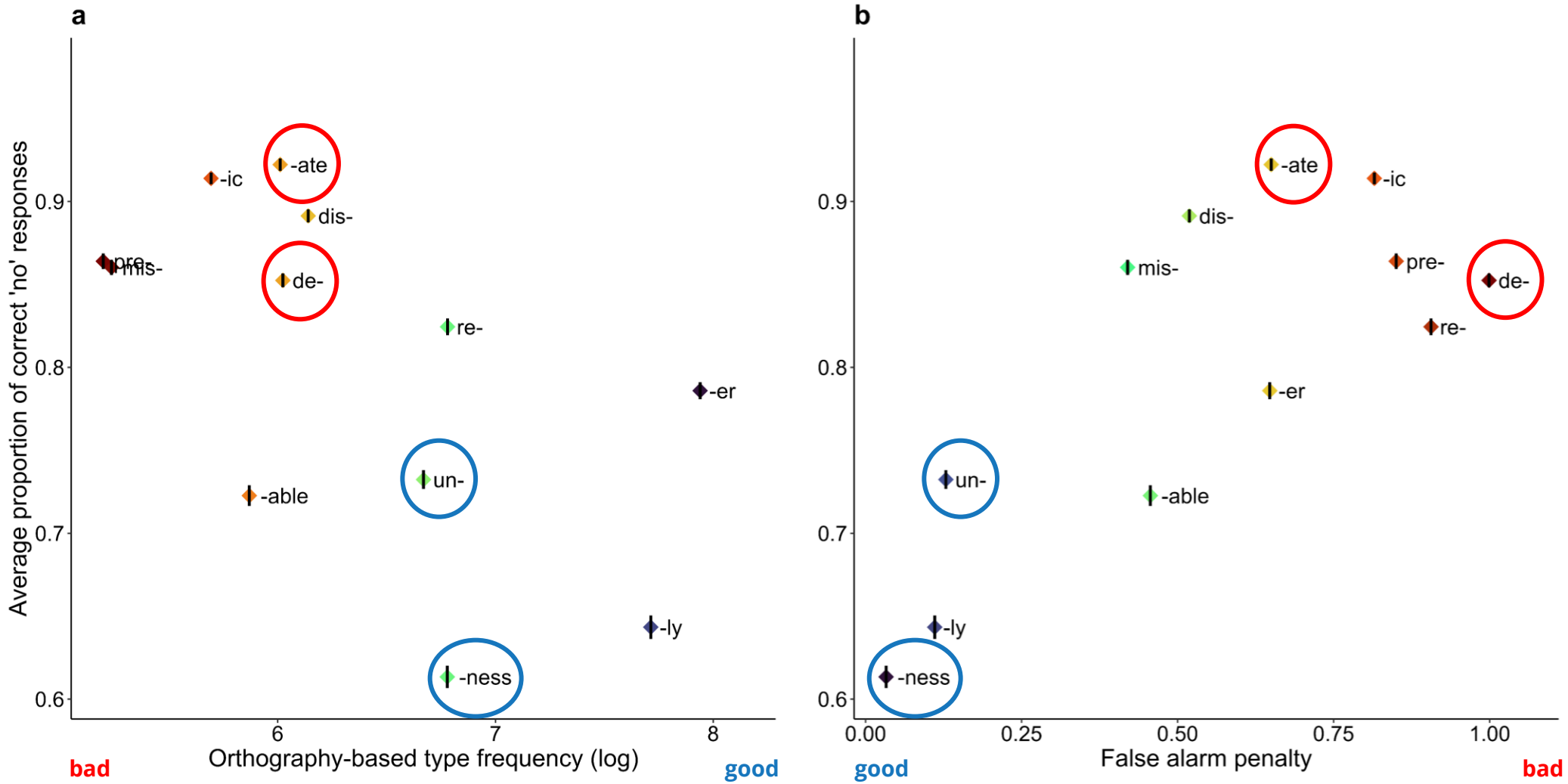
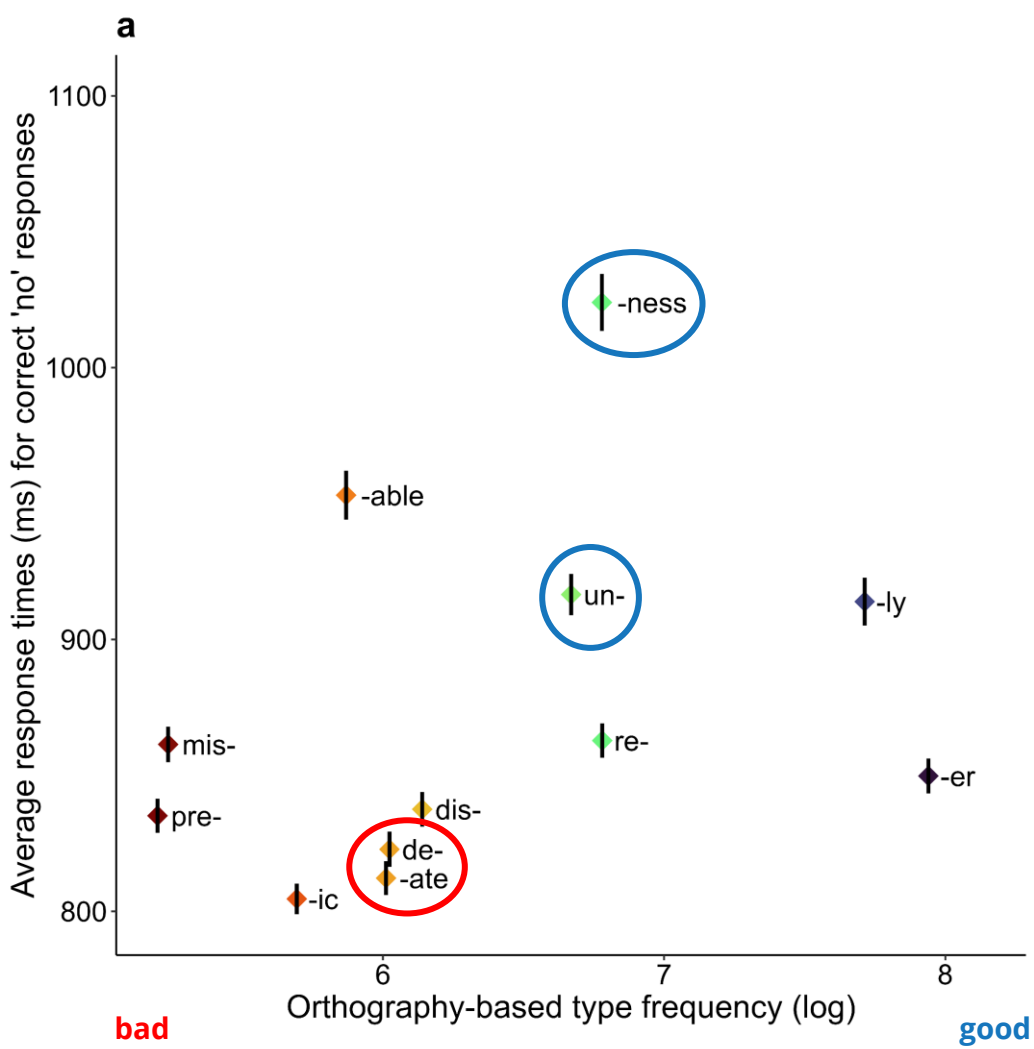
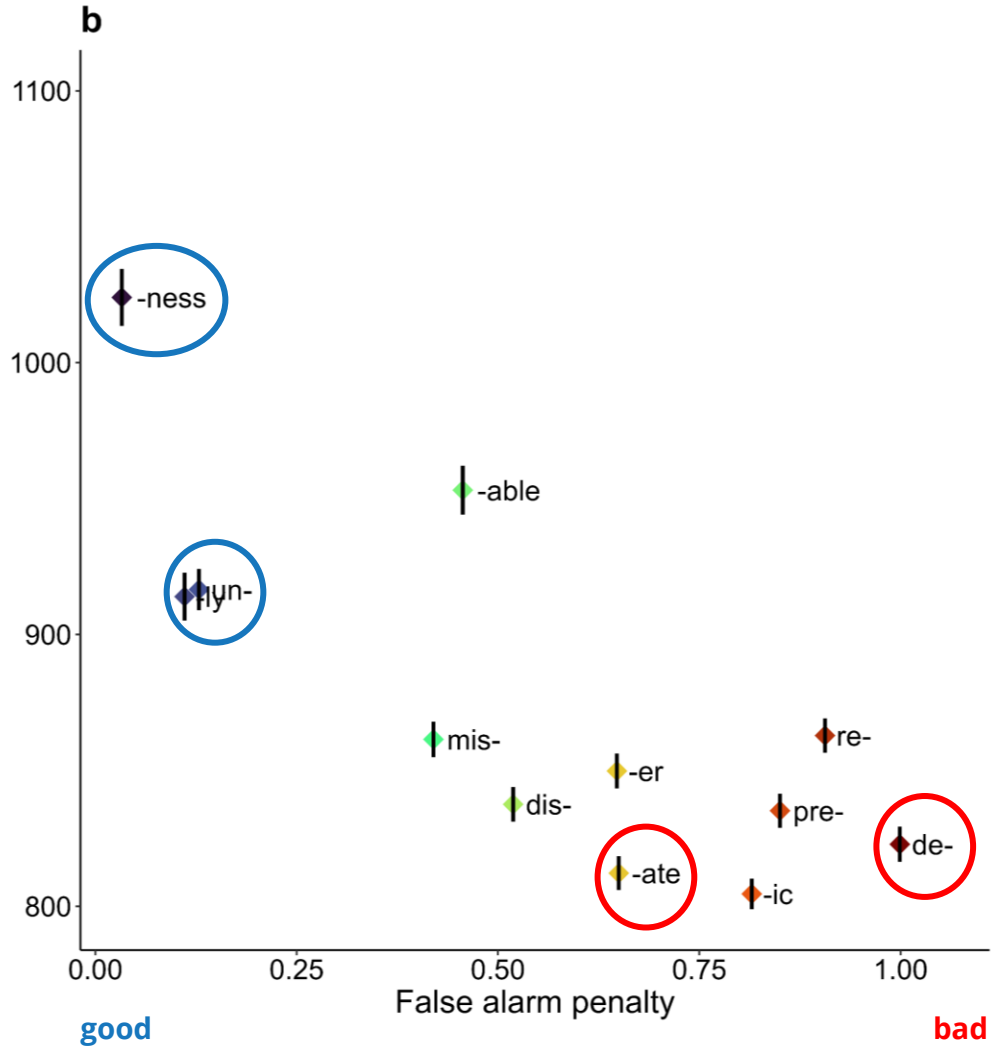
Nonwords with “good” affixes are hard to reject…



… and these rejections take time





Conclusions

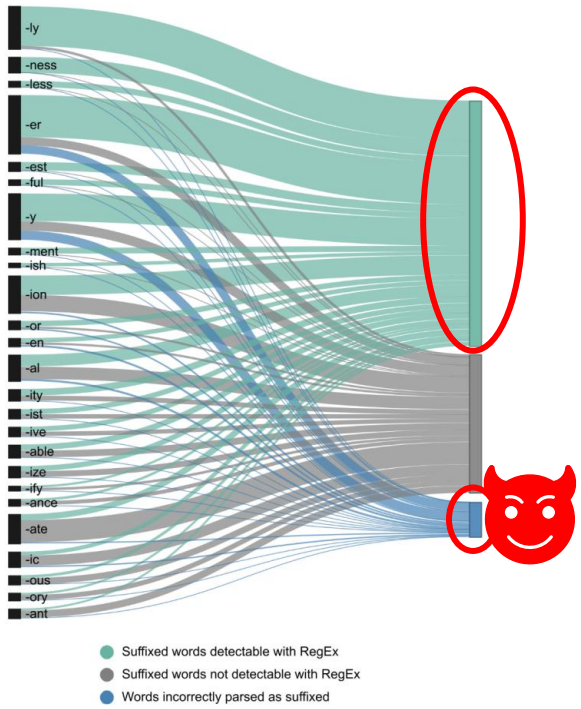
Quantified morpheme **experience** in print

↓

Proposed a new definition of morpheme experience

↓

Tested this definition against human data



- Critical step toward a **psychologically valid theory** of morpheme learning
- The field needs to **go beyond** approaches based on experience proxies detached from the *individual's actual experience*

Further reading

Article | Open access | Published: 05 May 2025

Morphology in children's books, and what it means for learning

Maria Korochkina & Kathleen Rastle

npj Science of Learning **10**, Article number: 22 (2025) | Cite this article

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Morpheme knowledge is shaped by information available through orthography

Maria Korochkina[1], Holly Cooper[1], Marc Brysbaert[2], and Kathleen Rastle[1]

In press in *Psychon. Bul. Rev.*, pre-print at:

https://doi.org/10.31219/osf.io/ad3jh_v2

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Morphemes in the wild: Modelling affix learning from the noisy landscape of natural text

Maria Korochkina[1], Marco Marelli[2], and Kathleen Rastle[1]

Under review, pre-print at:

https://doi.org/10.31234/osf.io/yzcqm_v1

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Thank you!

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UKRI Economic and Social Research Council

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