Vocabulary and morphological complexity in books popular with British children

Maria Korochkina[1] | **Marco Marelli**[2] | **Marc Brysbaert**[3] | **Kathy Rastle**[1]

[1]Department of Psychology, Royal Holloway University of London, UK

[2]Department of Psychology, University of Milano-Bicocca, Italy

[3]Department of Experimental Psychology, Ghent University, Belgium

FRiLL meeting

University of Reading

11 December 2023

The CYP-LEX project

The CYP-LEX project

- Large body of scientific knowledge on

The CYP-LEX project

- Large body of scientific knowledge on
  - how children learn to read & how they should be taught [1]

The CYP-LEX project

- Large body of scientific knowledge on
  - how children learn to read & how they should be taught [1]
  - the prerequisites for becoming an expert reader [2–6]

The CYP-LEX project

- Large body of scientific knowledge on
  - how children learn to read & how they should be taught [1]
  - the prerequisites for becoming an expert reader [2–6]
- The speed with which children gain reading expertise depends on the *nature of language* they are exposed to

The CYP-LEX project

- Large body of scientific knowledge on
  - how children learn to read & how they should be taught [1]
  - the prerequisites for becoming an expert reader [2–6]
- The speed with which children gain reading expertise depends on the *nature of language* they are exposed to
- Yet, presently, we know very little about *what* children and young people are reading

Corpus development

National reading surveys, publisher data, & book sales statistics from Amazon UK, BookTrust, Goodreads, LoveReading4Kids, etc.

Corpus development

National reading surveys, publisher data, & book sales statistics from Amazon UK, BookTrust, Goodreads, LoveReading4Kids, etc.

1,200 popular fiction & non-fiction e-books
400 books per age band

National reading surveys, publisher data, & book sales statistics from Amazon UK, BookTrust, Goodreads, LoveReading4Kids, etc.

⇓

1,200 popular fiction & non-fiction e-books
400 books per age band

7–9

10–12

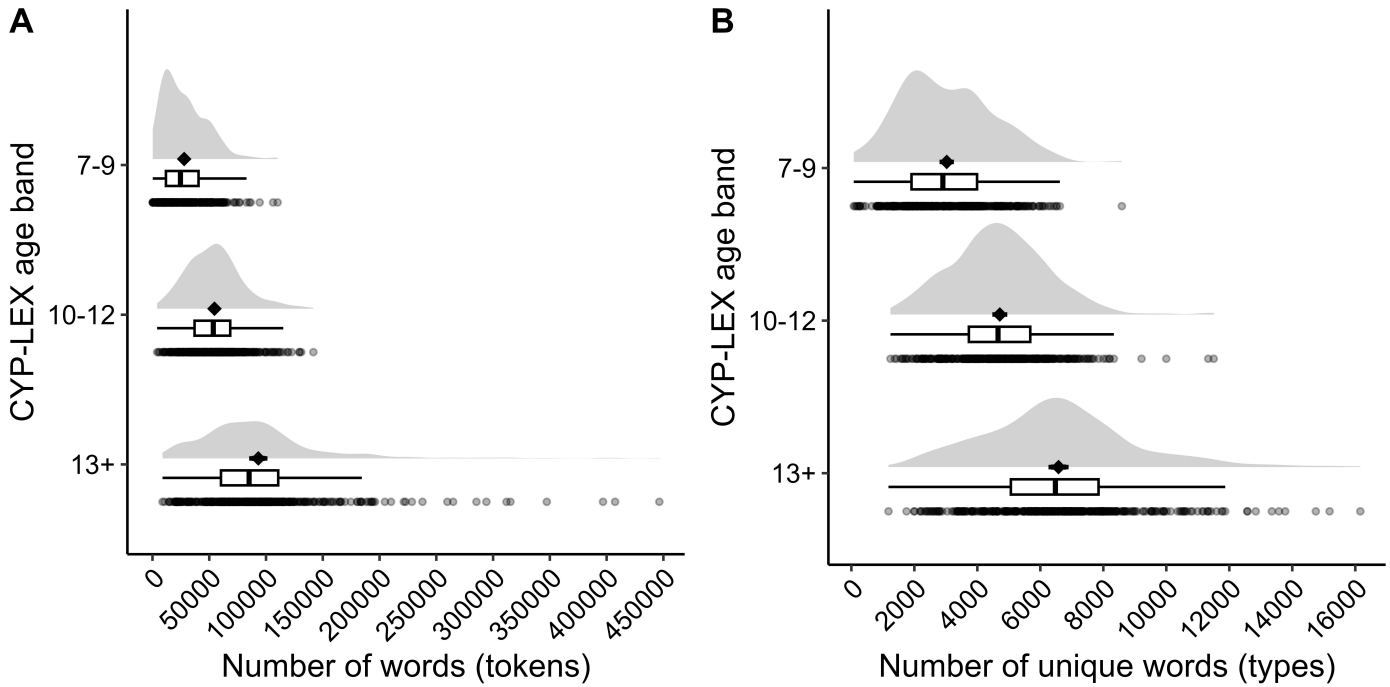
13+

The CYP-LEX corpus

70,287,217 tokens & 105,694 types

The CYP-LEX corpus

70,287,217 tokens & 105,694 types



	7–9	10–12	13+
N words	11,162,653	21,837,794	37,286,770
Average *N* (σ) words per book	27,907 (19,212)	54,594 (24,012)	93,217 (57,718)
N unique words	52,851	70,945	90,980
Average *N* (σ) unique words per book	3,028 (1,452)	4,713 (1,550)	6,447 (2,366)

Children may encounter many unfamiliar words in books

Children may encounter many unfamiliar words in books

Percentage of CYP-LEX words that children DO NOT encounter on TV

	Cbeebies *0–6 years*	CBBC *6–12 years*	SUBTLEX-UK *adults*
7–9 age band	40%	30%	
10–12 age band		60%	14%
13+ age band		48%	21%

Children may encounter many unfamiliar words in books

Percentage of CYP-LEX words that children DO NOT encounter on TV

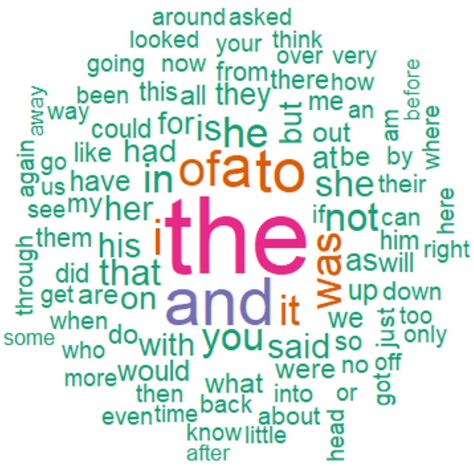
	Cbeebies *0–6 years*	CBBC *6–12 years*	SUBTLEX-UK *adults*
7–9 age band	40%	30%	
10–12 age band		60%	14%
13+ age band		48%	21%

From the earliest years of independent reading, children may be encountering a large proportion of words in books that are not in their spoken vocabulary

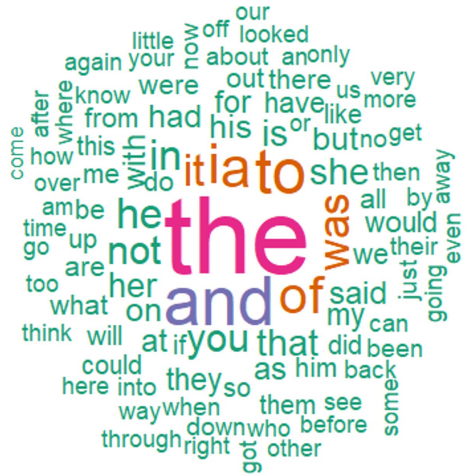
Few words used in books are encountered frequently

Few words used in books are encountered frequently

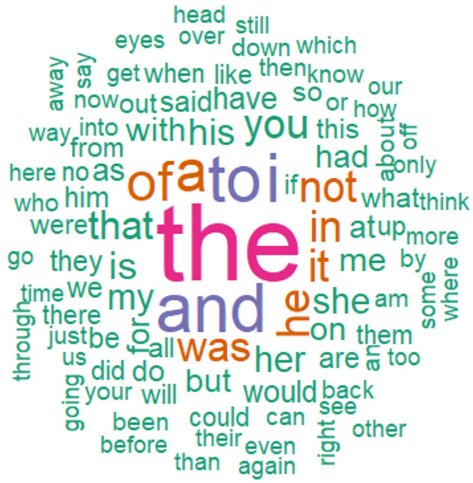
A 7-9 age band



B 10-12 age band

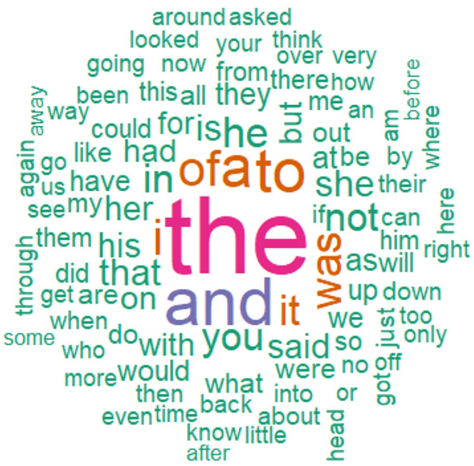


C 13+ age band

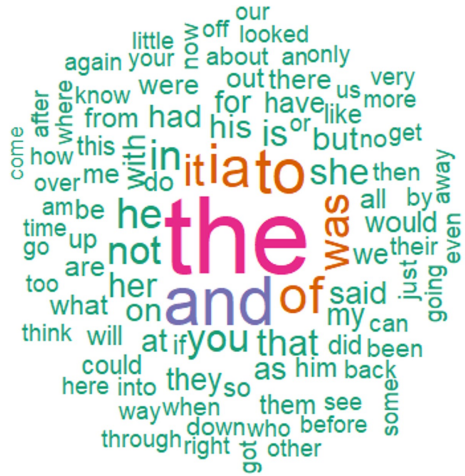


Few words used in books are encountered frequently

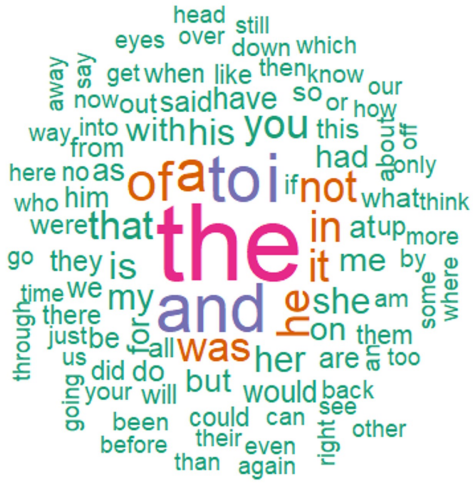
A 7-9 age band



B 10-12 age band



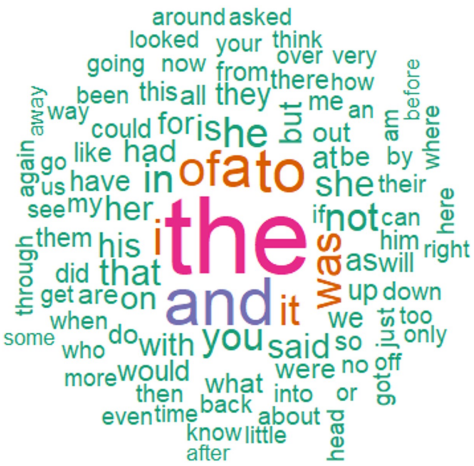
C 13+ age band



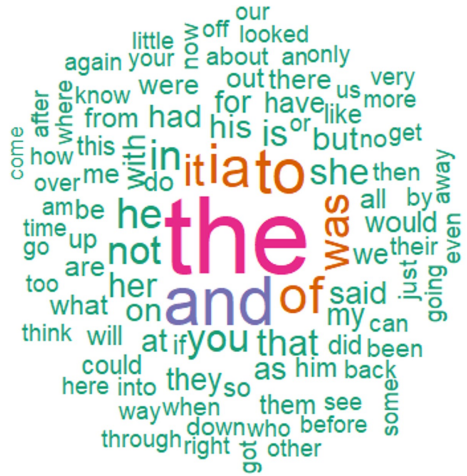
- The top-100 words amount to half of each age band

Few words used in books are encountered frequently

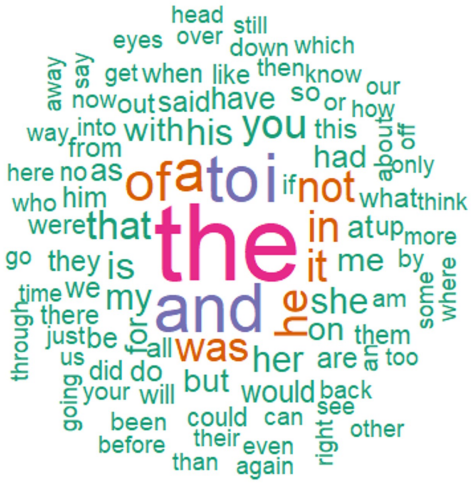
A 7-9 age band



B 10-12 age band



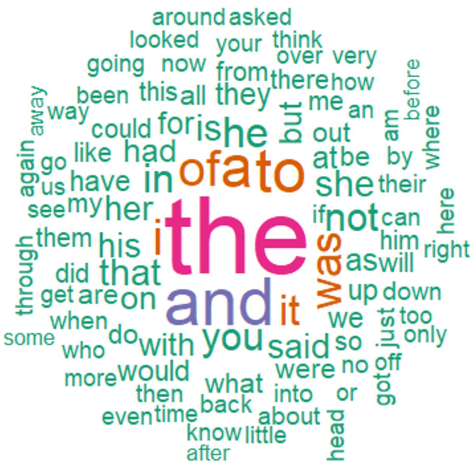
C 13+ age band



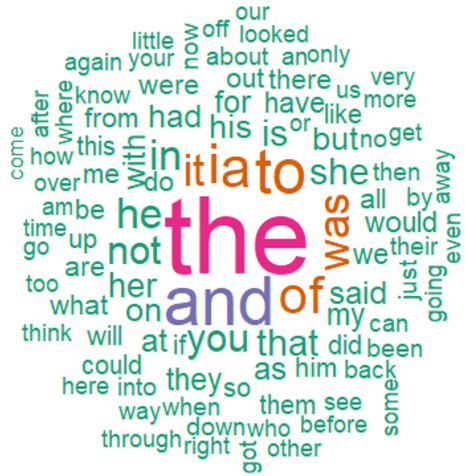
- The top-100 words amount to half of each age band
- Max 11% of words in each age band with *fpmw* > 10

Few words used in books are encountered frequently

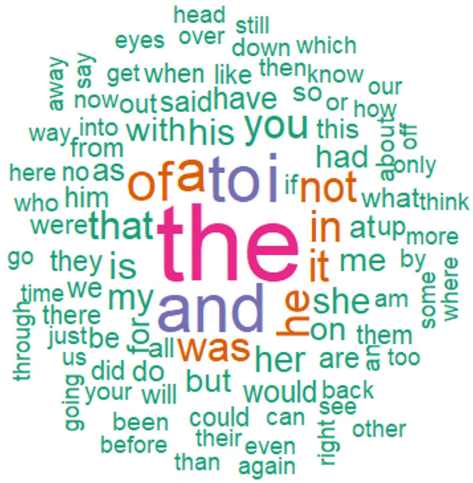
A 7-9 age band



B 10-12 age band



C 13+ age band



- The top-100 words amount to half of each age band
- Max 11% of words in each age band with *fpmw* > 10

$\Downarrow$

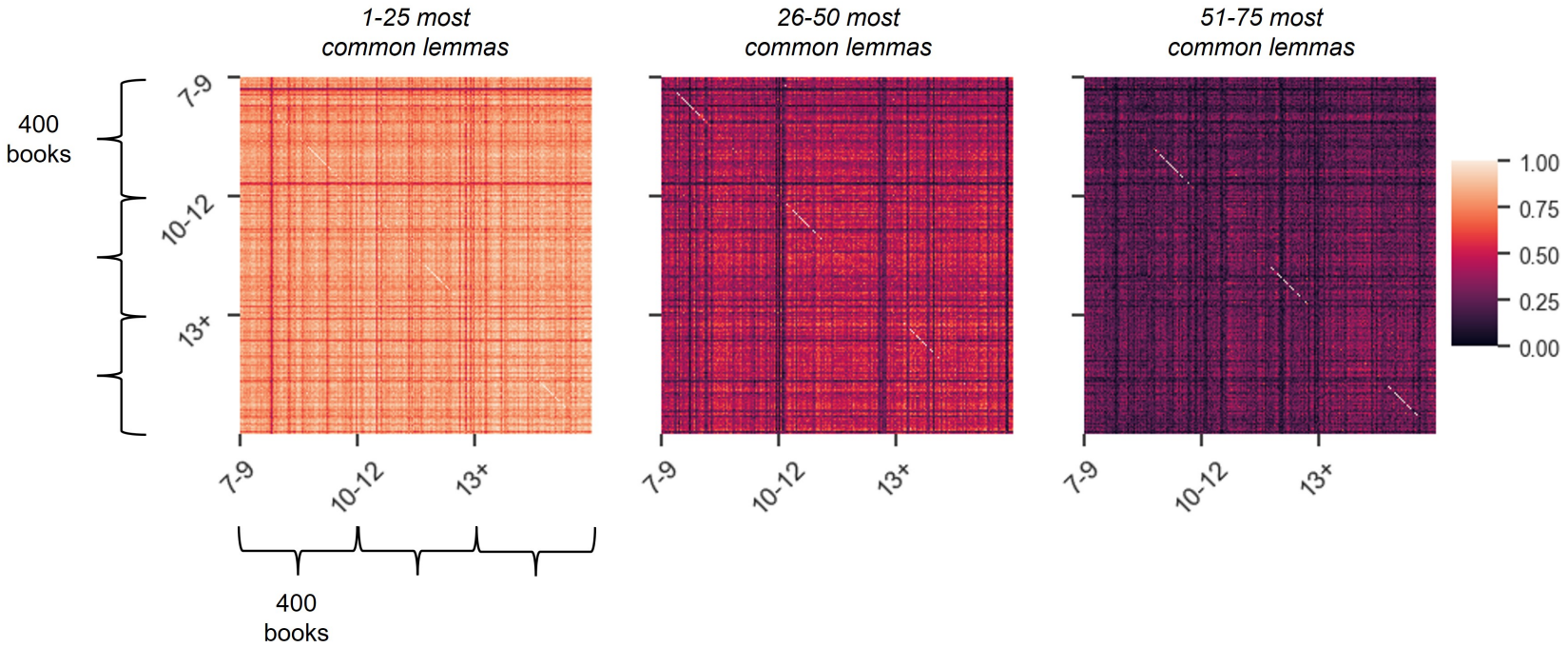
Only a small subset of words may be learned to the degree that they are recognised automatically and effortlessly

Most words are infrequent and used in few books

75 most common *lemmas* in sets of 25

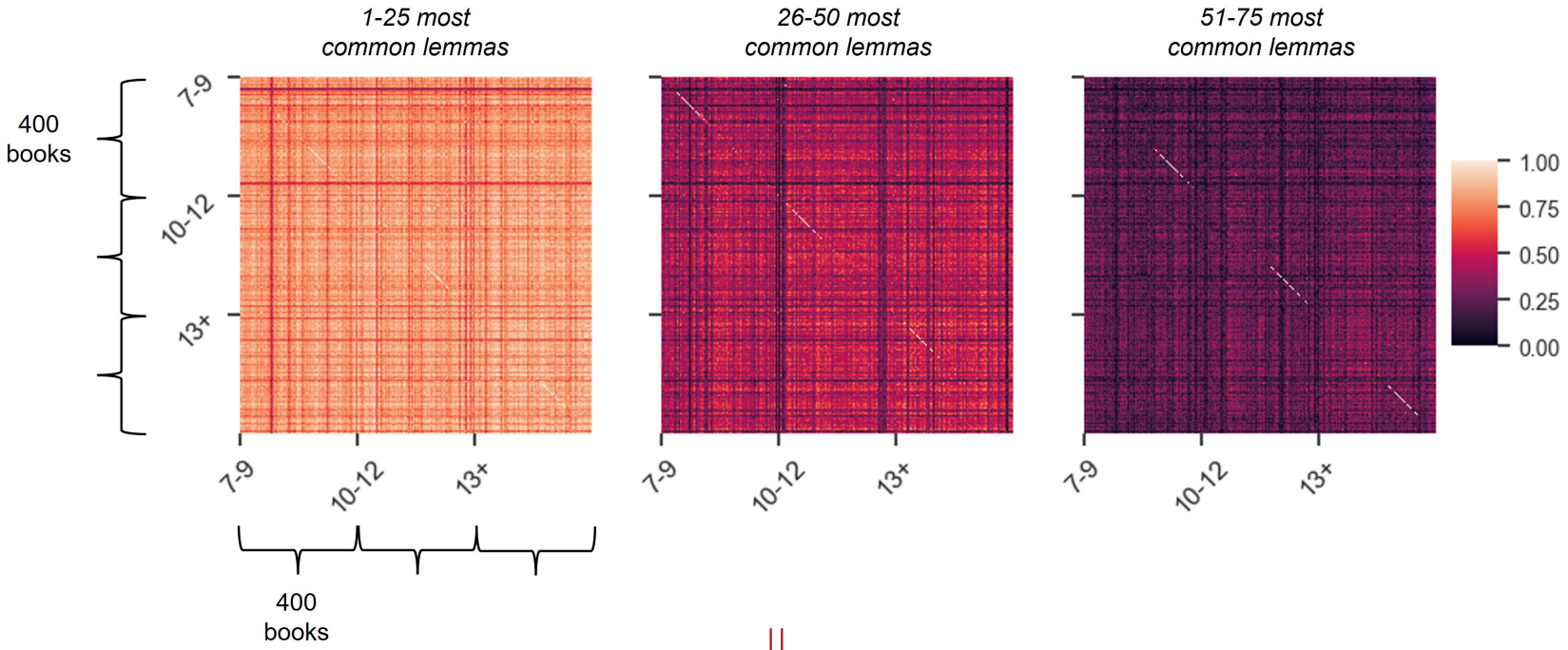
Most words are infrequent and used in few books

75 most common *lemmas* in sets of 25



Most words are infrequent and used in few books

75 most common *lemmas* in sets of 25



⇓

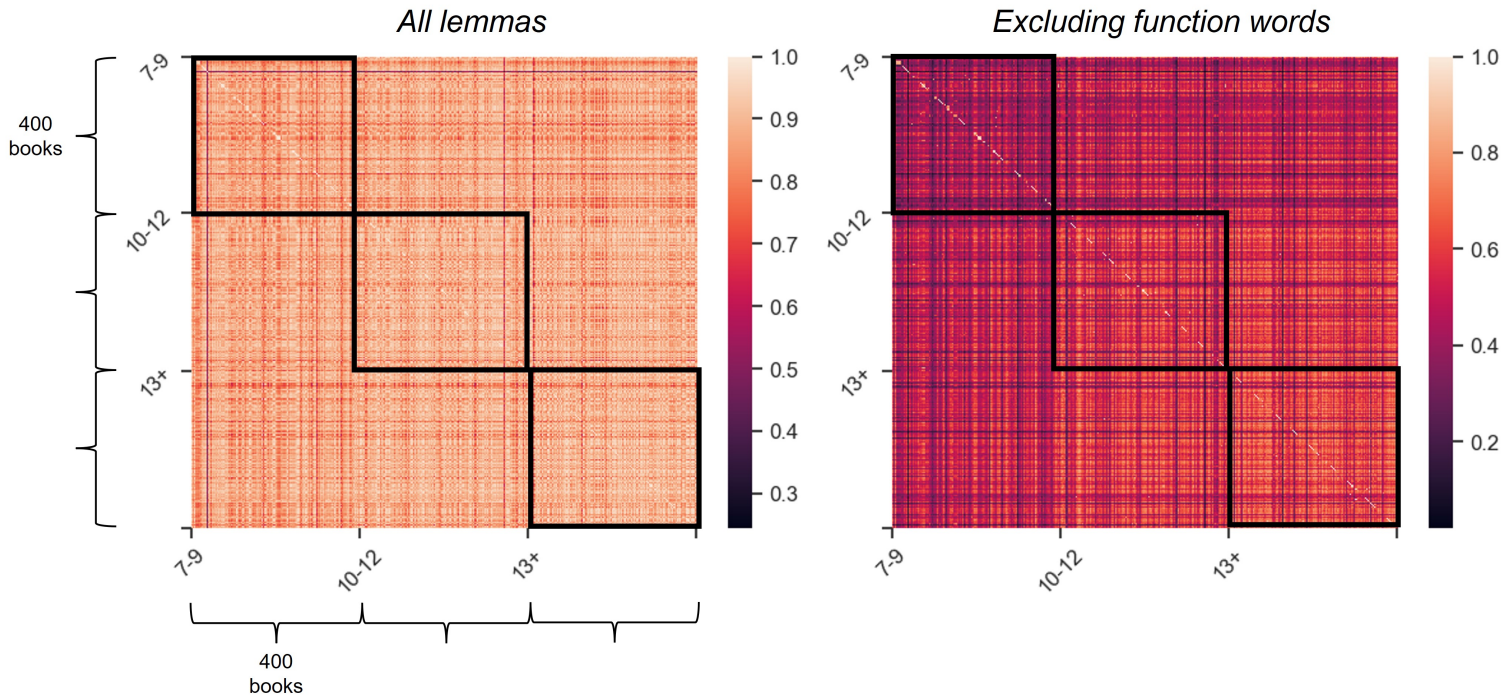
Books similar regarding most common lemmas but rapidly diverge

Most words are infrequent and used in few books

All lemmas & all lemmas excluding function words

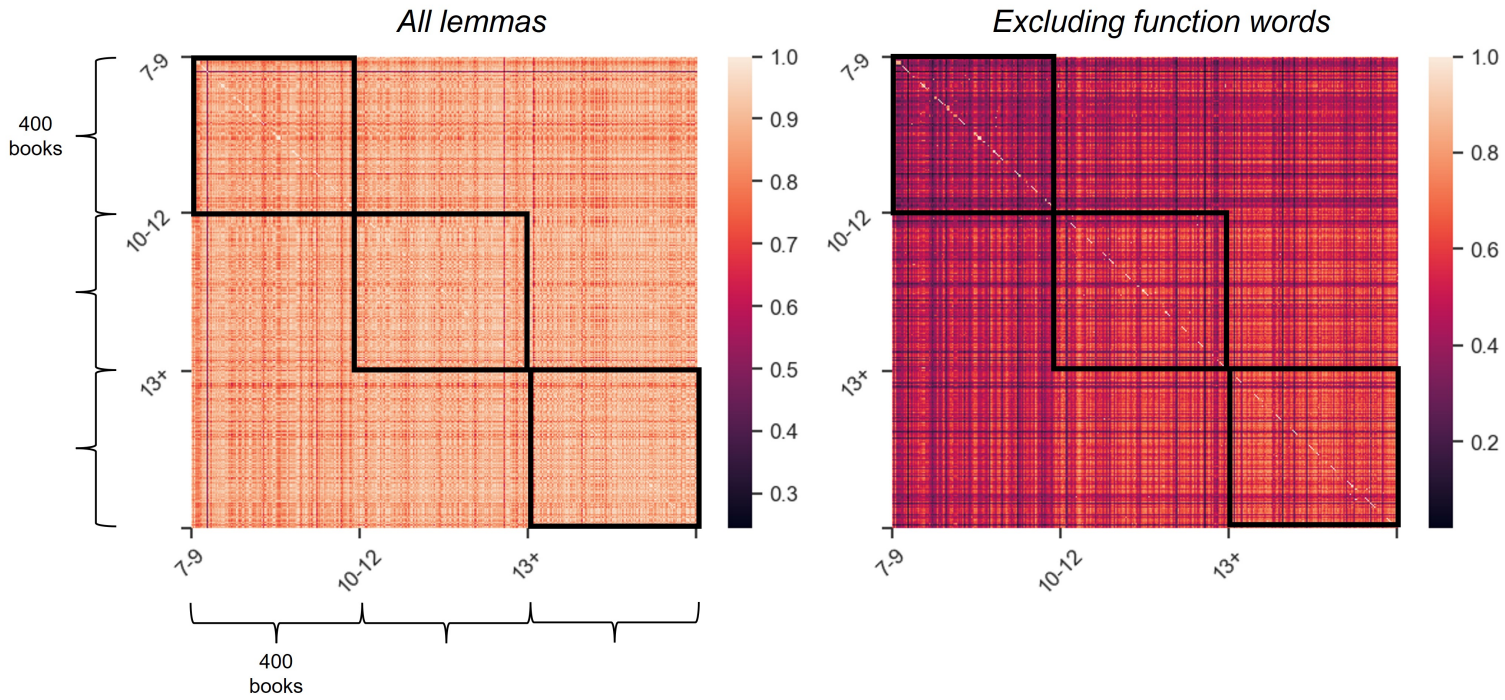
Most words are infrequent and used in few books

All lemmas & all lemmas excluding function words



Most words are infrequent and used in few books

All lemmas & all lemmas excluding function words



⇓

Books in the 7–9 age band are less similar to one another than those in the other age bands are to one another

Many new words in each age band

About 25,000-31,000 words

Many new words in each age band

About 25,000-31,000 words

10-12 vs. 7-9:
73% encountered $\leq$ 3 times

Many new words in each age band

About 25,000-31,000 words

10-12 vs. 7-9:
73% encountered $\leq$ 3 times

Many new words in each age band

About 25,000-31,000 words

10-12 vs. 7-9:
73% encountered $\leq$ 3 times

13+ vs. 10-12:
74% encountered $\leq$ 3 times

Many new words in each age band

About 25,000-31,000 words

10-12 vs. 7-9:
73% encountered $\leq$ 3 times

13+ vs. 10-12:
74% encountered $\leq$ 3 times

The importance of morphology

The importance of morphology

- Morphological knowledge is an important heuristic for vocabulary growth and is thus crucial for the development of reading expertise

The importance of morphology

- Morphological knowledge is an important heuristic for vocabulary growth and is thus crucial for the development of reading expertise
- Children's morphological knowledge is shaped through their experience with written text

The importance of morphology

- Morphological knowledge is an important heuristic for vocabulary growth and is thus crucial for the development of reading expertise
- Children's morphological knowledge is shaped through their experience with written text

Understanding the nature of text experience is critical for understanding what children can learn about individual morphemes and how

Etymological approach: MorphoLex

Etymological approach: MorphoLex

MorphoLex size: 68,624 words
ELP complete list: 79,672 words

57,133 words (54%)
in MorhoLex
48,560 words are not

CYP-LEX size: 70,287,217 tokens & 105,693 types

	7–9	10–12	13+
N words	11,162,653	21,837,794	37,286,770
Average N (σ) words per book	27,907 (19,212)	54,594 (24,012)	93,217 (57,718)
N unique words	52,851	70,945	90,980
Average N (σ) unique words per book	3,028 (1,452)	4,713 (1,550)	6,447 (2,366)

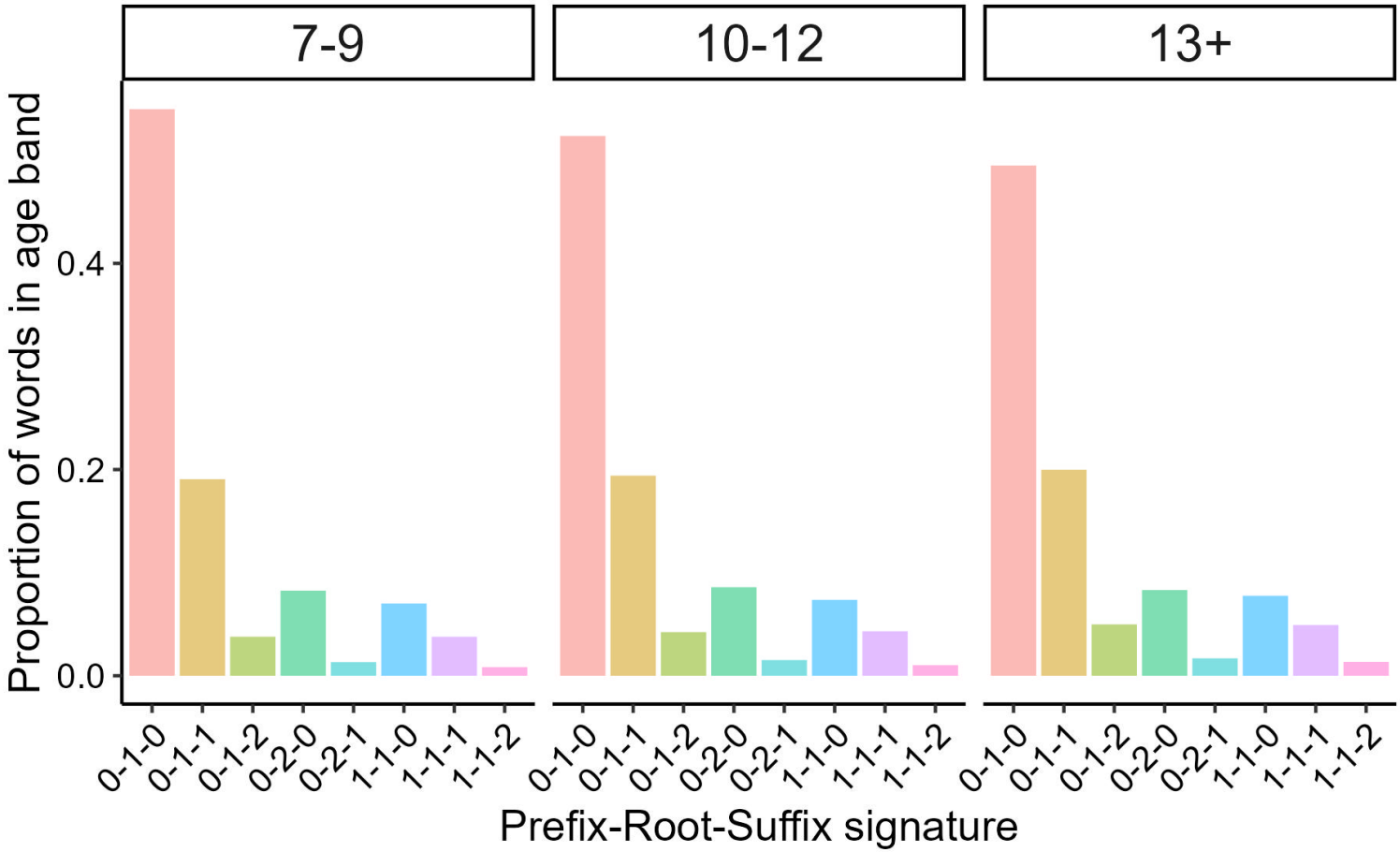
39,149 words (74%)
in MorhoLex
13,702 words are not

47,363 words (67%)
in MorhoLex
23,582 words are not

54,557 words (60%)
in MorhoLex
36,423 words are not

At least half of words are multimorphemic

At least half of words are multimorphemic



Properties of multimorphemic words

Properties of multimorphemic words

Multimorphemic words...

Properties of multimorphemic words

Multimorphemic words...

- are less common than monomorphemic words, but their frequency increases with book target age

Properties of multimorphemic words

Multimorphemic words...

- are less common than monomorphemic words, but their frequency increases with book target age
- appear in fewer books than monomorphemic words, but their CD increases with book target age

Properties of multimorphemic words

Multimorphemic words...

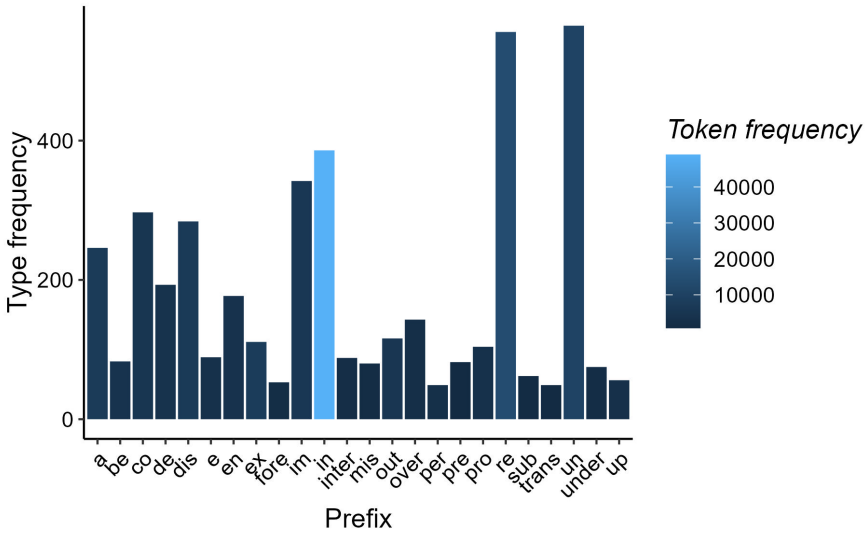
- are less common than monomorphemic words, but their frequency increases with book target age
- appear in fewer books than monomorphemic words, but their CD increases with book target age
- constitute the majority of words missing in SUBTLEX-UK or younger age bands, with the number and frequency of these words increasing with book target age

Prefix frequency and contextual diversity

7–9 age band

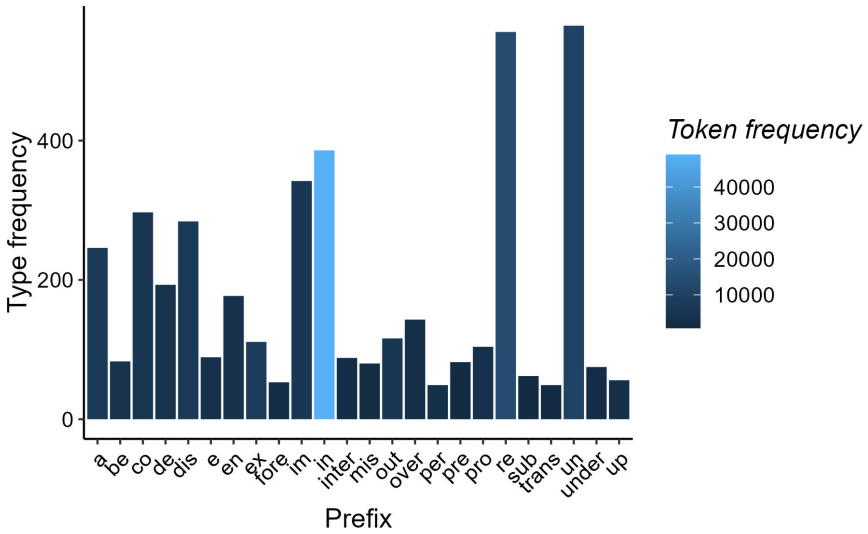
Prefix frequency and contextual diversity

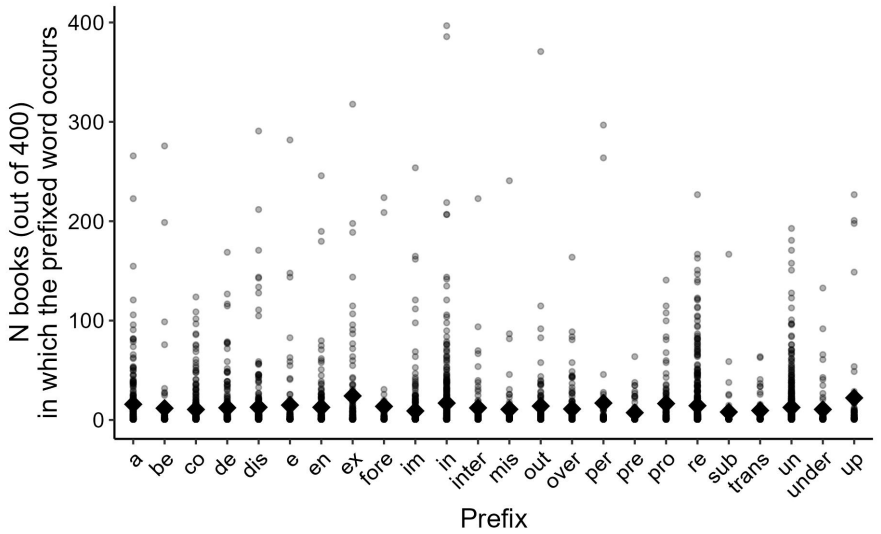
7–9 age band



Prefix frequency and contextual diversity

7–9 age band



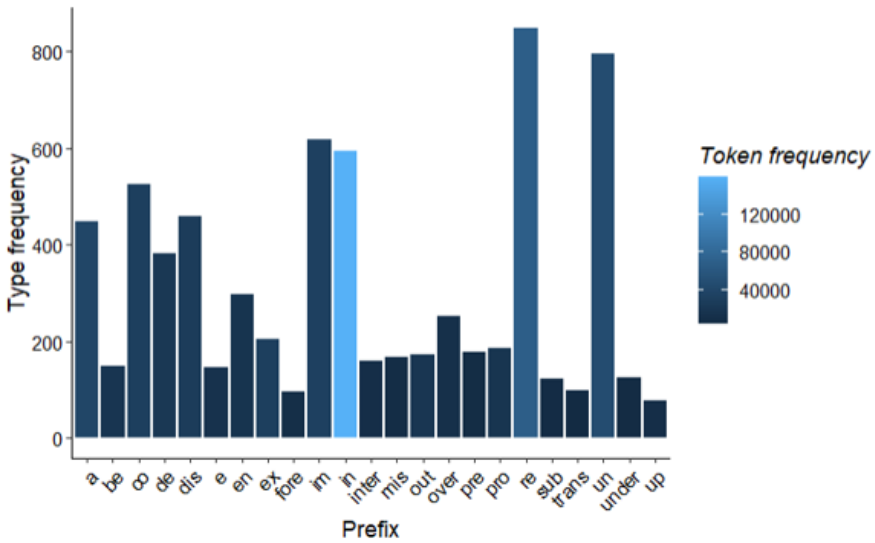


Prefix frequency and CD increase with book target age

13+ age band

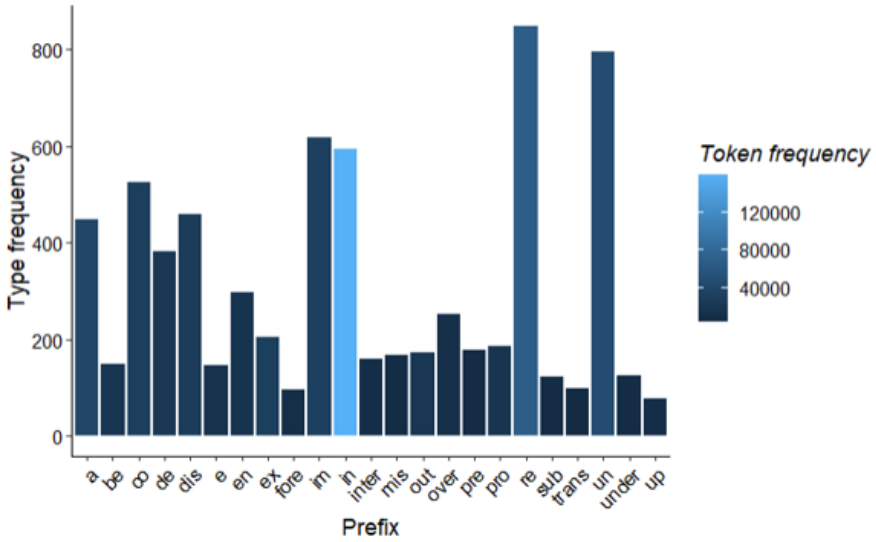
Prefix frequency and CD increase with book target age

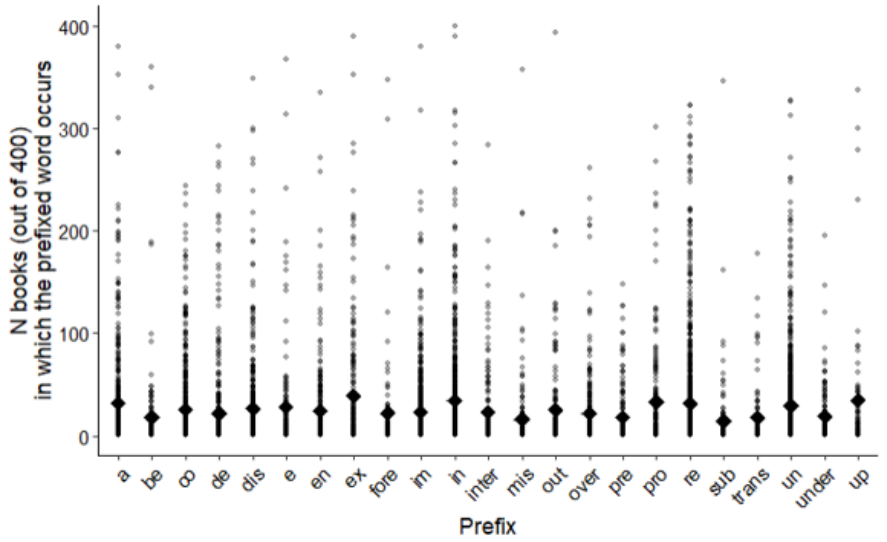
13+ age band



Prefix frequency and CD increase with book target age

13+ age band



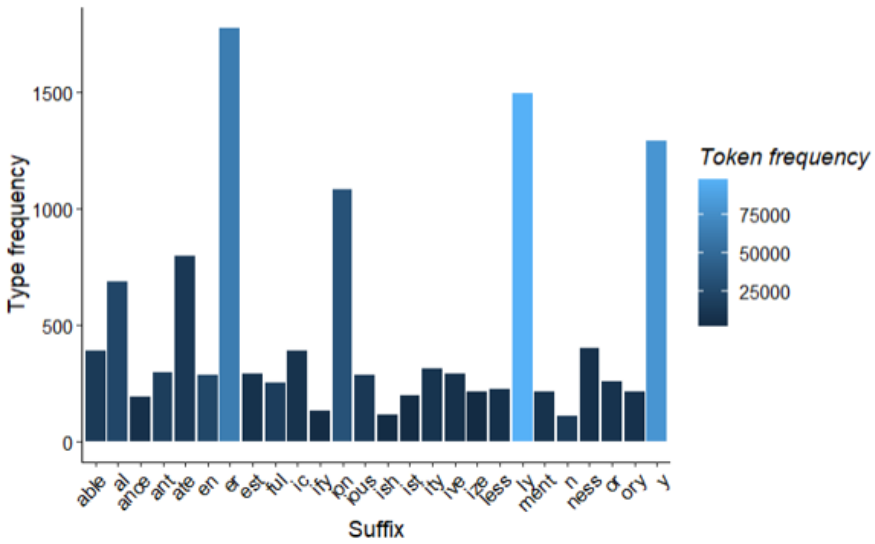


Suffix frequency and contextual diversity

7–9 age band

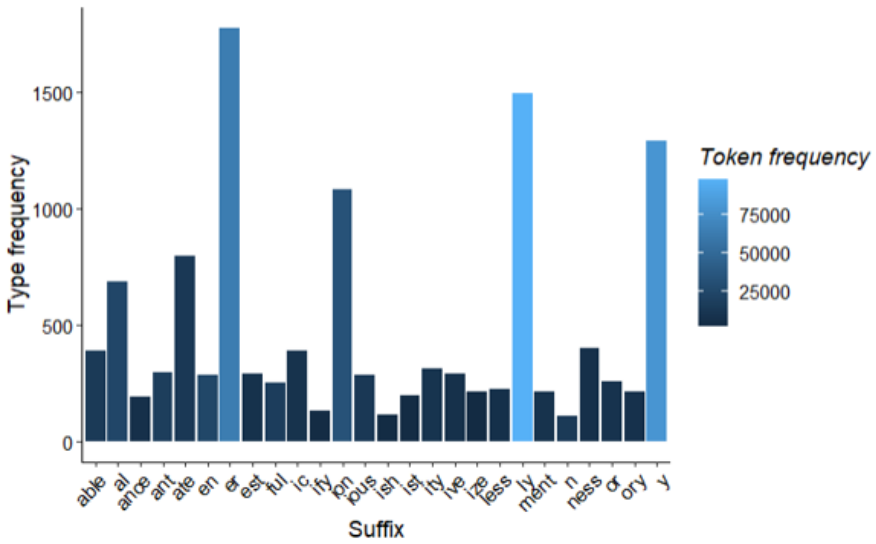
Suffix frequency and contextual diversity

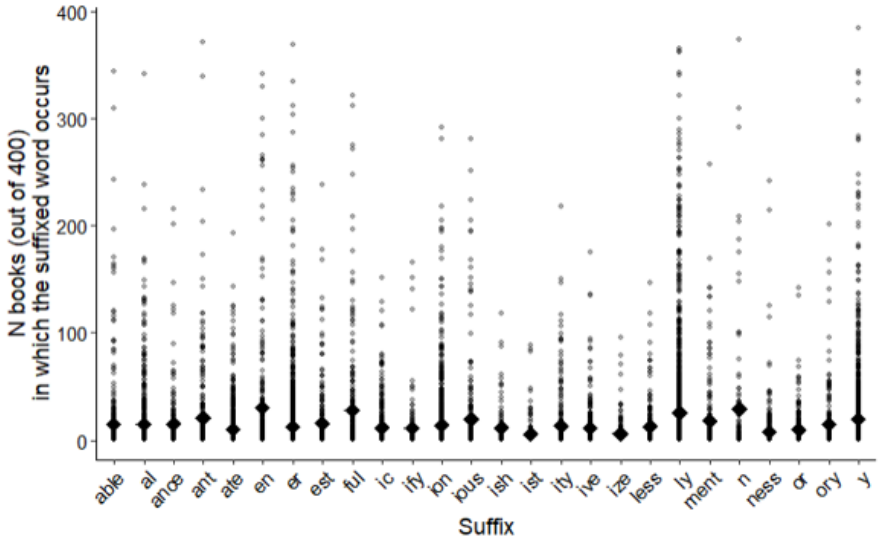
7–9 age band



Suffix frequency and contextual diversity

7–9 age band



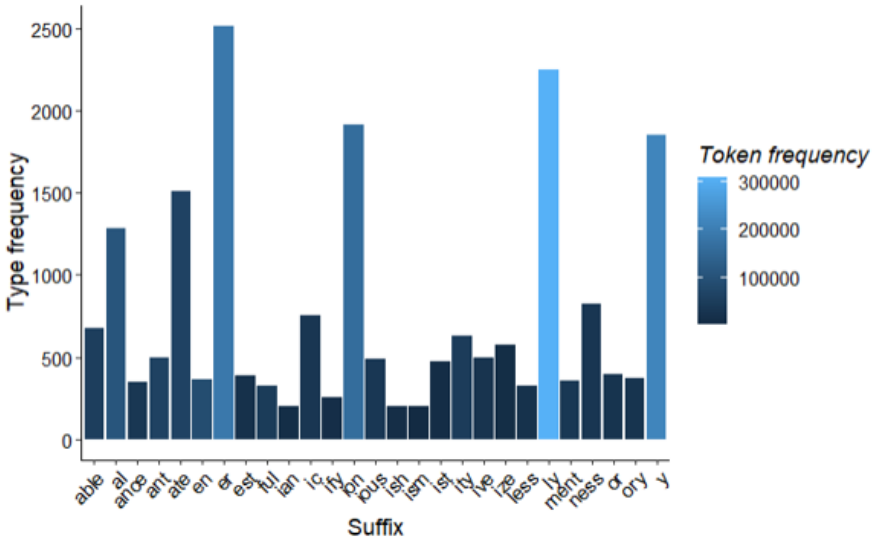


Suffix frequency and CD increase with book target age

13+ age band

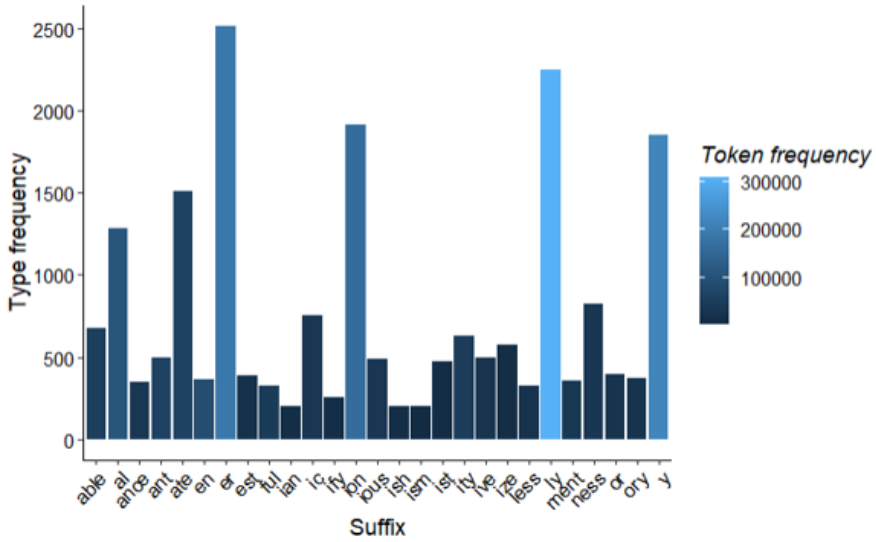
Suffix frequency and CD increase with book target age

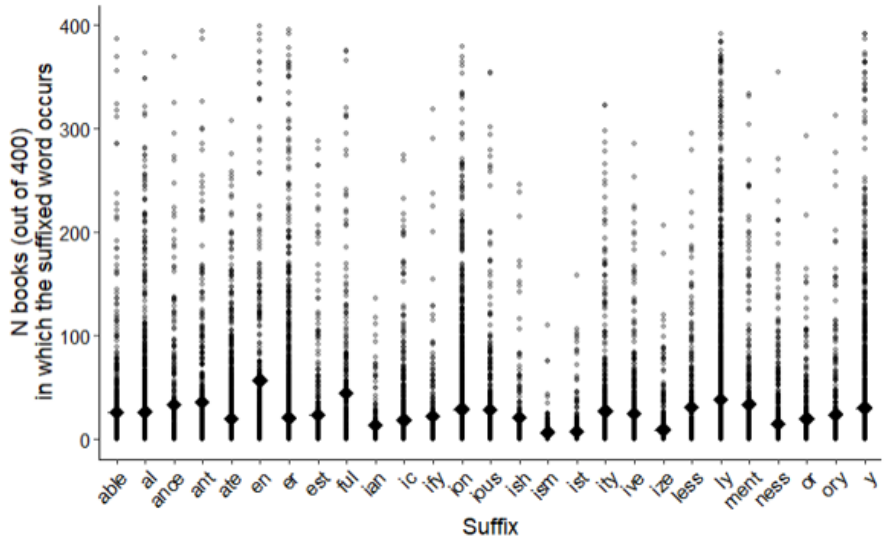
13+ age band



Suffix frequency and CD increase with book target age

13+ age band





Limitations of current approach & future directions

Limitations of current approach & future directions

- Information available only for half of the CYP-LEX types

Limitations of current approach & future directions

- Information available only for half of the CYP-LEX types
- Children have limited linguistic knowledge & operate on the orthographic principle ('sustain' vs. 'corner')

Limitations of current approach & future directions

- Information available only for half of the CYP-LEX types
- Children have limited linguistic knowledge & operate on the orthographic principle ('sustain' vs. 'corner')
- Affixes differ in terms of semantic consistency ('-less' vs. '-ist')

Limitations of current approach & future directions

- Information available only for half of the CYP-LEX types
- Children have limited linguistic knowledge & operate on the orthographic principle ('sustain' vs. 'corner')
- Affixes differ in terms of semantic consistency ('-less' vs. '-ist')

Use distributional semantic modelling to build affix meaning representations

Limitations of current approach & future directions

- Information available only for half of the CYP-LEX types
- Children have limited linguistic knowledge & operate on the orthographic principle ('sustain' vs. 'corner')
- Affixes differ in terms of semantic consistency ('-less' vs. '-ist')

⇓

Use distributional semantic modelling to build affix meaning representations

⇓

Develop theoretically-driven metrics that capture the complexity of derivational regularities encountered in children's books

Want to know more?

Korochkina, M., Marelli, M., Brysbaert, M., & Rastle, K. (2023). The Children and Young People's Books Lexicon (CYP-LEX): A large-scale lexical database of books read by children and young people in the United Kingdom. *Pre-print*. https://doi.org/10.31234/osf.io/nha8t

Thank you!

References I

[1] A. Castles, K. Rastle, and K. Nation, "Ending the Reading Wars: Reading acquisition from novice to expert," *Psychological Science*, vol. 19, no. 1, pp. 5–51, 2018. DOI: https://doi.org/10.1177/1529100618772271.

[2] A. Castles, C. Davis, P. Cavalot, and K. Forster, "Tracking the acquisition of orthographic skills in developing readers: Masked priming effects," *Journal of Experimental Child Psychology*, vol. 97, pp. 165–182, 2007. DOI: https://doi.org/10.1016/j.jecp.2007.01.006.

[3] S. E. Mol and A. G. Bus, "To read or not to read: A metaanalysis of print exposure from infancy to early adulthood," *Psychological Bulletin*, vol. 137, pp. 267–296, 2017. DOI: https://doi.org/10.1037/a0021890.

[4] K. Nation, "Nurturing a lexical legacy: Reading experience is critical for the development of word reading skill," *npj Science of Learning*, vol. 2, pp. 1–4, 2017. DOI: https://doi.org/10.1038/s41539-017-0004-7.

[5] K. Rastle, "The place of morphology in learning to read in english," *Cortex*, vol. 116, pp. 45–54, 2019. DOI: https://doi.org/10.1016/j.cortex.2018.02.008.

[6] C. A. Perfetti and L. Hart, "The lexical quality hypothesis," in *Precursors of Functional Literacy*, L. Verhoeven, C. Elbr, and P. Reitsma, Eds., John Benjamins, 2002, pp. 189–212. DOI: https://doi.org/10.1037/a0021890.