DRAIC WORKSHOP · 11 NOVEMBER 2026

Beyond Reading Speed: What Can Eye Movements Tell Us About L2 Readers' Morphosyntactic Proficiency?

Evidence from the MECO L2 corpus, and future directions

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Why look at grammar for L2 readers?

MOTIVATION

L2 readers learn fewer words from reading

Reynolds & Ding (2024)

- L1-English and EFL readers read the same novel.
- L1 readers learned more new words.
- Faster reading meant more learning in both groups.

The question

Is the L2 disadvantage only speed, or does grammatical processing play a part?

MOTIVATION

ESL readers seem to gain more from reading

Rusk & Paradis (2025)

- Adolescent ESL learners (Canada) and EFL immersion learners (Taiwan), both schooled in English for over eight years.
- Similar weekly English reading in both groups.
- Reading hours predicted vocabulary size **only for the ESL learners**, who were also more accurate on a grammaticality judgement task.

MOTIVATION

Syntax helps children learn words

> ***"The sentence frame can therefore serve as a 'word-meaning frame' that narrows the scope of possible meanings of an unknown word."***
>
> Babineau et al. (2024)

Syntactic bootstrapping

- 'a *bamoule*' → a noun
- 'they *bamoule*' → a verb
- 'they *bamoule* us' → a transitive verb

For L2 readers

A weaker frame gives less from each encounter with a new word.

MOTIVATION

L2 readers may process syntax less deeply

Hopp (2022)

L2 readers can rely less on the syntactic parse, and more on word meanings, context and familiar word orders, than L1 readers do.

One example

The Shallow Structure Hypothesis (Clahsen & Felser, 2006, 2018).

- Claims that L2 learners build less detailed hierarchical structure during comprehension.

A matter of degree?

'Shallow' processing is not absolute. L1-like syntactic processing has been found in some highly proficient L2 readers (Hopp, 2022).

Function words and content words

Content words: open class

Class	Example
Noun	*birds*
Verb	*spend*
Adjective	*excessive*
Adverb	*quickly*

Function words: closed class

Class	Example
Determiner	*their*
Preposition	*on*
Pronoun	*it*
Auxiliary	*is*
Conjunction	*and*, *because*
Particle	*to* (*to read*)

Captive birds spend hours on excessive preening, pulling out their feathers.

MOTIVATION

Where I started

Readers with better structural knowledge should **anticipate function words**: skip them more often, or fixate them more briefly.

Skipping is ambiguous

- **(a)** a fluent reader with good structural knowledge
- **(b)** a reader who reads for meaning and passes over function words

Individual L2 readers may be either.

First fixation duration

A shorter first fixation on function words may be a better indicator, but only with **word length and frequency held constant**: function words are short and frequent.

MECO: the same texts, different screens

What is MECO?

The **Multilingual Eye-Movement Corpus**:

- an open database of eye movements recorded while people read short texts
- collected by labs around the world with one shared procedure.

1,204

Readers of **English as an L2**, in two waves.

19

First languages, from Dutch and Hebrew to Hindi and Mandarin.

12

English texts, the same for every reader.

Kuperman, V., et al. (2023). Text reading in English as a second language: Evidence from the Multilingual Eye-Movements Corpus. *Studies in Second Language Acquisition*, *45*(1), 3–37.

Kuperman, V., et al. (2025). New data on text reading in English as a second language: The Wave 2 expansion of the Multilingual Eye-Movement Corpus (MECO). *Studies in Second Language Acquisition*, 1–19.

What each reader did

Reading

- 12 short, encyclopedia-style English texts, one per screen, read silently.
- Two comprehension questions after each.
- EyeLink trackers; the same experiment at every site - **though not the same display**.

English skill tests

- Spelling (spelling recognition)
- Vocabulary
- LexTALE (vocabulary-based lexical decision proxy for proficiency)
- **No grammar test**

What MECO has found

Samples differ

Large differences between samples, with no clear linguistic factor behind them.

Fluency, not comprehension

L1 and L2 readers differ far more in fluency than in comprehension.

Skills show in the eyes

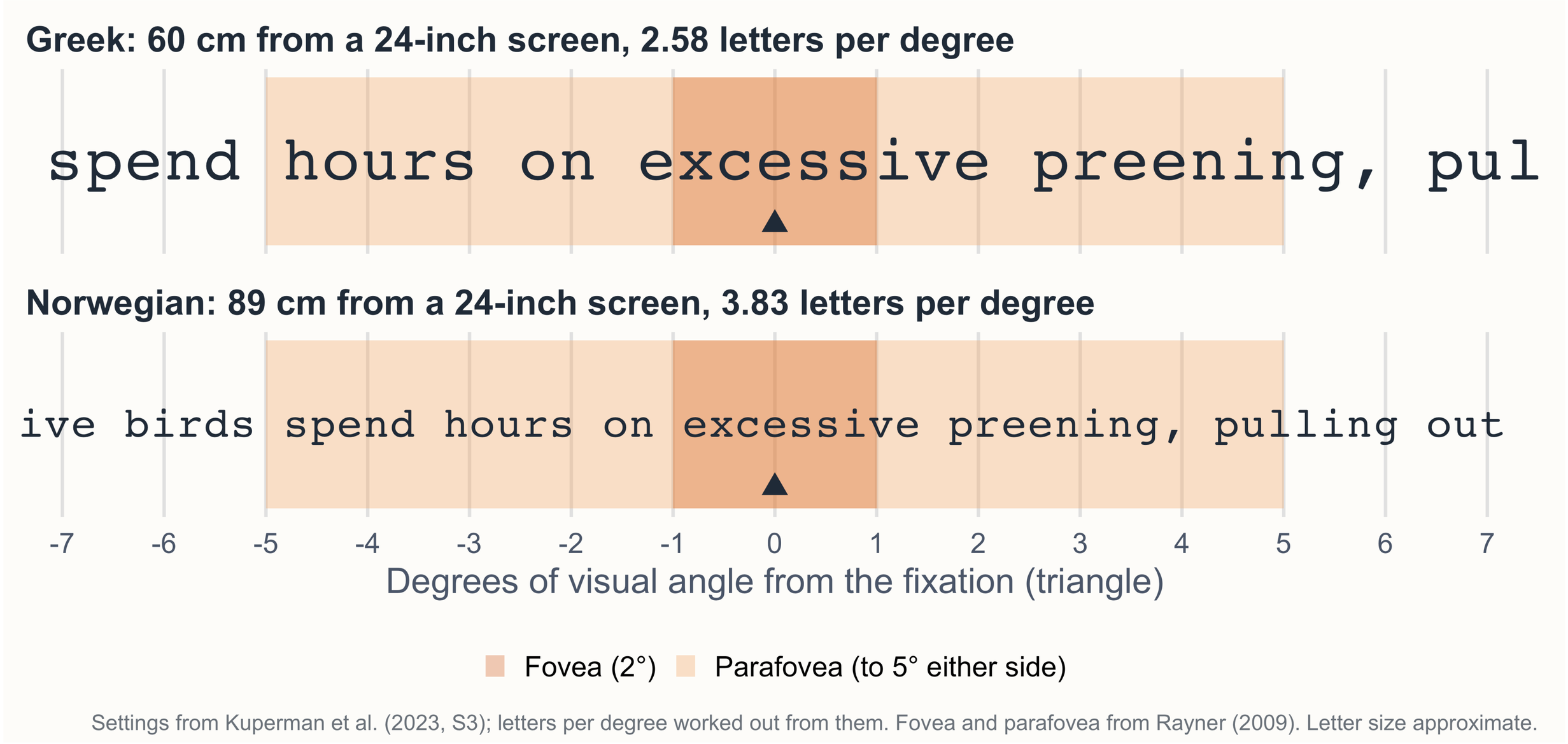
Better English skills go with more skips and fewer, shorter fixations.

Kuperman, V., et al. (2025). New data on text reading in English as a second language: The Wave 2 expansion of the Multilingual Eye-Movement Corpus (MECO). *Studies in Second Language Acquisition*, 1–19.

Each lab chose its own display

Sample	Distance from screen	Font	Screen	Letters per degree (worked out)
Greek	60 cm	20 pt	1920 × 1080, 24 in	2.58
Norwegian	89 cm	20 pt	1920 × 1080, 24 in	3.83

The same line, drawn to scale for both setups



Settings from Kuperman et al. (2023, S3); letters per degree worked out from them. Fovea and parafovea from Rayner (2009). Letter size approximate.

So every test is run within a sample

The samples

- **26 L2 samples**: each lab's readers form one sample.
- **2 L1-English samples** for comparison.

Every test

Fitted within each sample; then I count the samples: "21 of 26" point the same way (sign test).

Parafoveal preview of upcoming words is unknown, and differs between samples.

MECO: function words vs content words

No function-word advantage once length and frequency are held constant

Function words

their, *on*, *is*

vs

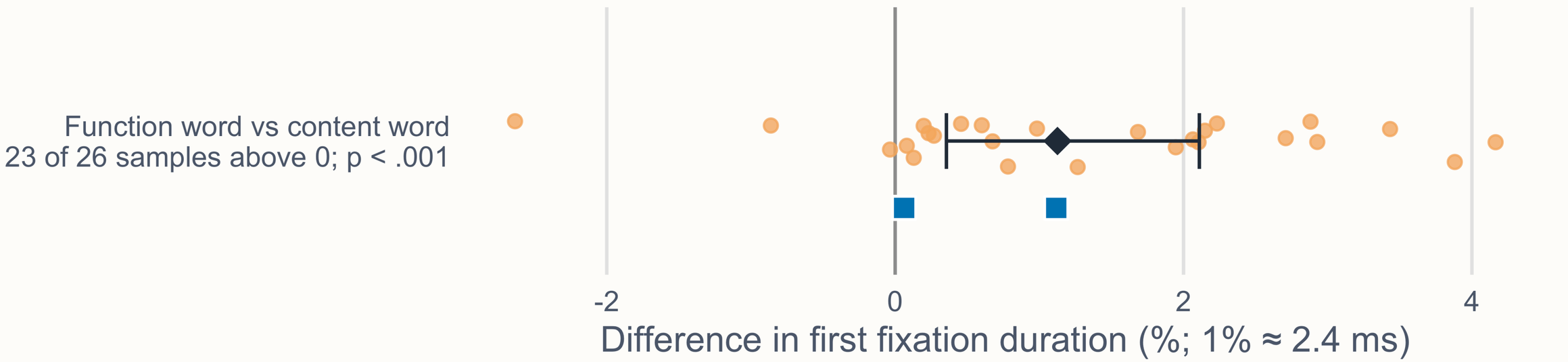
Content words

birds, *spend*, *hours*

→

In the model, not matched

Length and frequency



Points: one L2 sample each. Diamond and bar: median across samples with a bootstrap 95% interval.
Blue squares (just below each row): the two L1-English samples.
Mixed model per sample: log first fixation ~ word class + length + frequency + landing position, random intercepts for readers and words.

MECO: regressions and grammatical structure

Two automatic parsers: udpipe and spaCy

Dependency parse (what the parsers give)

Each word points to one **head**; there are no phrase nodes.

an → *couple* · *Italian* → *couple* · *couple* → *designed*

Constituency parse

Words are grouped into **nested phrases**.

[S [NP an Italian couple] [VP designed [NP the modern encased pencil]]]

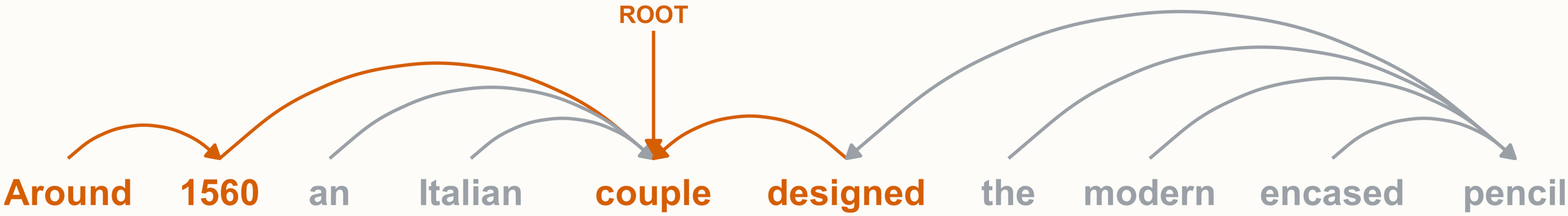
‘Shallow’ processing is about how much hierarchical structure readers build. Dependency parses show that hierarchy as head–dependent links rather than phrases; I use them as a **convenience**, to tease apart some structural relations between words in every MECO sentence.

Srinivasa-Desikan, B. (2018). *Natural language processing and computational linguistics*. Packt.

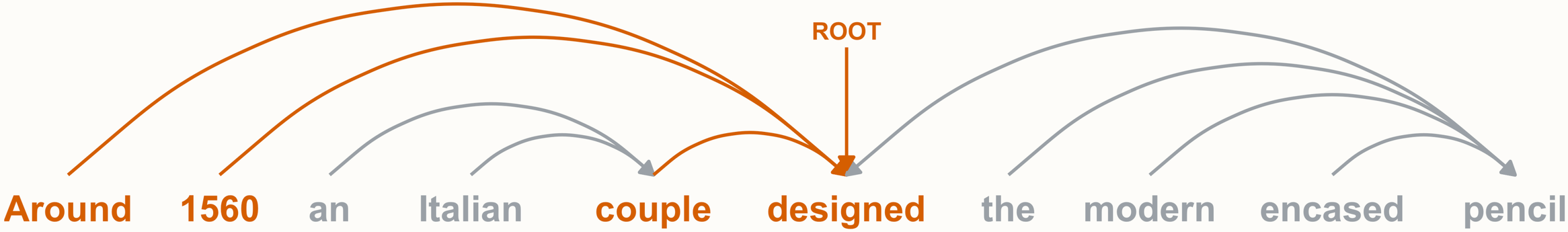
Straka, M., & Straková, J. (2017). Tokenizing, POS tagging, lemmatizing and parsing UD 2.0 with UDPipe. *Proceedings of the CoNLL 2017 Shared Task*, 88–99.

udpipe and spaCy disagree on a MECO sentence

udpipe: couple is the root, and designed modifies it



spaCy: designed is the root, and couple is its subject



Passage 11, sentence 2. Arrows point from each word to its head. Orange: the head differs between the parsers.
Relations as used in the analysis (spaCy's heads aligned with udpipe's conventions); spaCy attaches the preposition Around to the verb.

Two relations

Linked

One word is the other's head: *excessive* → *preening*.

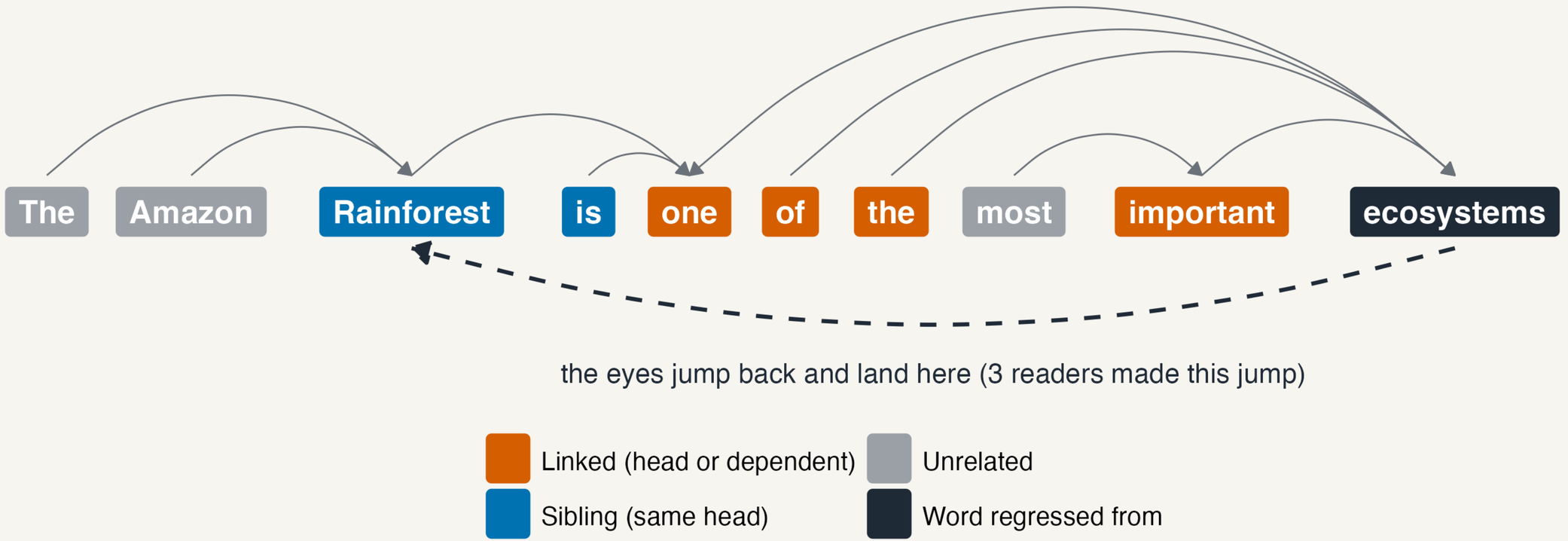
Sibling

Same head: *excessive* and *on* both depend on *preening*.

The test

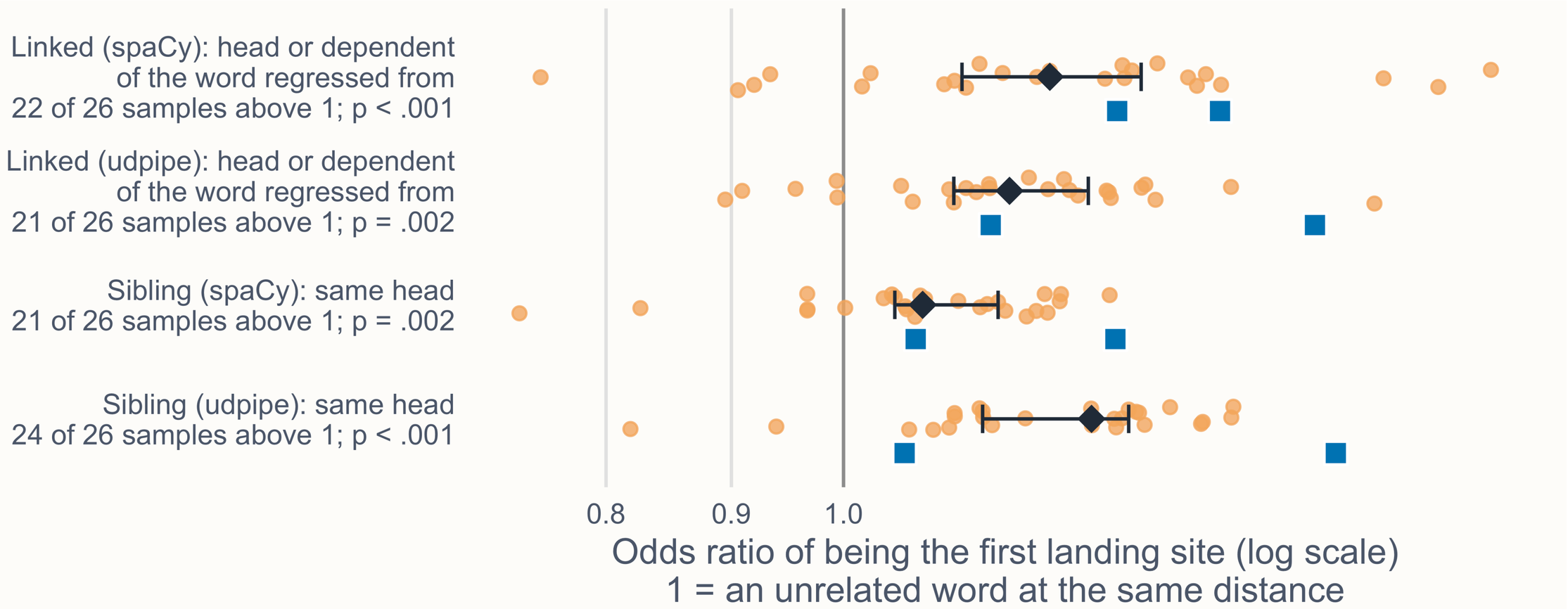
For each of **54,459** regressions: which of the words 1 to 10 back in the sentence was the first landing site? Conditional logit, per sample.

A regression from MECO



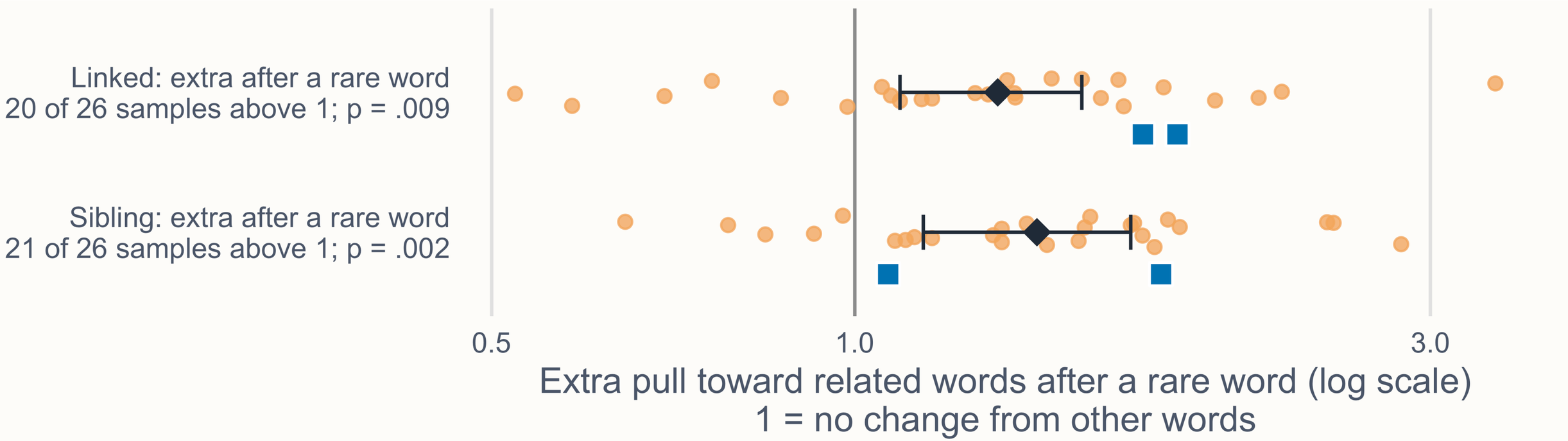
Arcs: each word points to its head (udpipe). Dashed arrow: the regression. | File: F_example_regression_1.png | Script: DRAIC3_meco_regression_targets.R

Regressions favour related words over unrelated ones, with either parser



Points: one L2 sample each. Diamond and bar: median across samples with a bootstrap 95% interval.
Blue squares (just below each row): the two L1-English samples.
Compared with the unrelated words 1 to 10 back in the same sentence; distance back, length, frequency and class held constant; 54,459 regressions.
udpipe and spaCy (en_core_web_trf, heads aligned with udpipe's conventions) are independent parsers; they agree on about two thirds of linked pairs.

From a rare word, regressions go to syntactically related words even more



Points: one L2 sample each. Diamond and bar: median across samples with a bootstrap 95% interval.
Blue squares (just below each row): the two L1-English samples.
udpipe relations. Distance back, length, frequency and class held constant.

Compatible with readers consulting the sentence frame around an unfamiliar word.

A future direction

NEXT

Where do regressions from an unknown word land?

Design

- L2 readers, one lab, one display.
- New words (pseudowords) placed in sentences, so every reader meets the same unknown words.
- Each regression from a new word: does it land on a word syntactically related to it, or on an unrelated word?

What it could show

- Whether readers who go back to the related words learn the new word better.
- Whether this goes with grammar knowledge, beyond vocabulary and reading speed.

NEXT

What obvious confound am I missing?

Regressions from a **rare word** land on its **syntactically related words** more than on matched unrelated words.

What else, besides the reader using the sentence structure, could produce that?

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Thank you

Comments and questions welcome.

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