

# Lessons Learned Developing a Personalized Language Learning System

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EASEAI, Aug 23, 2021

Roughly **1.2 billion** people worldwide are currently learning a foreign language.

<https://techcrunch.com/2017/03/05/3-habits-of-successful-language-learners/>

**And your's truly is one of them :)**

In fact I have been one for the last 20 years



# One of the best tools for learning? **Extensive Reading.**

Willy A. Renandya. **The Power of Extensive Reading.**

Timothy Bell. **Extensive Reading: Why? and How?** *The Internet TESL Journal* 4

C McCarthy. **Reading theory as a microcosm of the four skills.** *The Internet TESL Journal* 5

## As We May Study: Towards the Web as a Personalized Language Textbook

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### ABSTRACT

We present a system designed to enable learners of a foreign language to read materials that are personally interesting to them from the web and practice vocabulary with interactive exercises based on their past readings. We report on the results of deploying the system for one month with three classes of Dutch highschool students learning French. The students and their teacher were positive about the system and in particular about the personalization aspects that the system enables.

### ACM Classification Keywords

H.5.2. Information Interfaces and Presentation (e.g. HCI): User Interfaces

### Author Keywords

language learning; personalization; education

### INTRODUCTION

At any given moment, numerous people are learning new languages. English, estimates the British Council, will be learned by two billion people by 2020. Although a plethora of tools and techniques exist for beginners, few exist to support the intermediates and advanced learners, for whom one of the best possible activities is extensive reading [8, 3, 24].

However, when reading in a foreign language, most of the intermediate learners still require language textbooks. Such textbooks are designed by experts who make sure that the texts are simple enough for the desired language level of a broad audience and that exercises that allow the readers to practice newly learned concepts accompany the texts. In spite of becoming more colorful, being sold with complementary audio or video lessons, their main limitation remains unchanged since the last century: by being designed for any average learner they are not exciting for any individual learner [18]. A student interested in sports might not be motivated to read about *Maria who is a babysitter in Spain*. The lack of motivation, a well known problem, especially with young learners [18, 33], might be solved if learners could read materials that are

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ISBN 978-1-4503-5620-6/18/04...\$15.00  
DOI: <https://doi.org/10.1145/3173574.3173912>

personally interesting. If they would spend more time reading, their capabilities would increase, and enjoyment would result in further reading, in a virtuous circle [4, 16].

Given the vast amounts of multi-language content available and added daily on the Internet (e.g. blogs, news articles, eBooks) it is likely that every student can find materials that are *personally interesting* for them in almost any language they are learning. This would fit a general trend where old systems designed for the average user are being replaced with personalized attention across domains: in medicine<sup>1</sup>, computer security, web design [32], or mathematical education [30].

Although individual components have been proposed before for free reading (e.g. browser extensions) and interactive exercises (e.g. Duolingo), a system that integrates free reading with personalized exercises into a *personalized textbook* has not been evaluated. The first contribution of this paper is describing the architecture and user experience of a system which combines:

1. **Reading comprehension support on both desktop and mobile devices for texts that are interesting to the user.** If ideal comprehension support should work “*without requiring even a single click*” [31], the next best thing is one-click (or one-touch) support. This is combined with a system for estimating text difficulty that allows the learner to choose articles that are within their capabilities<sup>2</sup>.
2. **Integration between vocabulary practice and reading history.** Instead of manually adding words to an external vocabulary practice system, the most relevant unknown words encountered in the readings are automatically scheduled for practice, when possible in the context of the original text, since learning a word in context is more effective [26].

The second contribution is the evaluation of the usefulness and usability of such a system by deploying it with three classes of French learning highschool students for one month. We analyze their usage of the system, their feedback, and the feedback of their teacher to understand when and how such a system fits the modern language classroom.

<sup>1</sup>The nascent discipline of *personalized medicine* suggests that analysis of the genetic makeup of an individual may guide health care decisions far more precisely than big group studies do

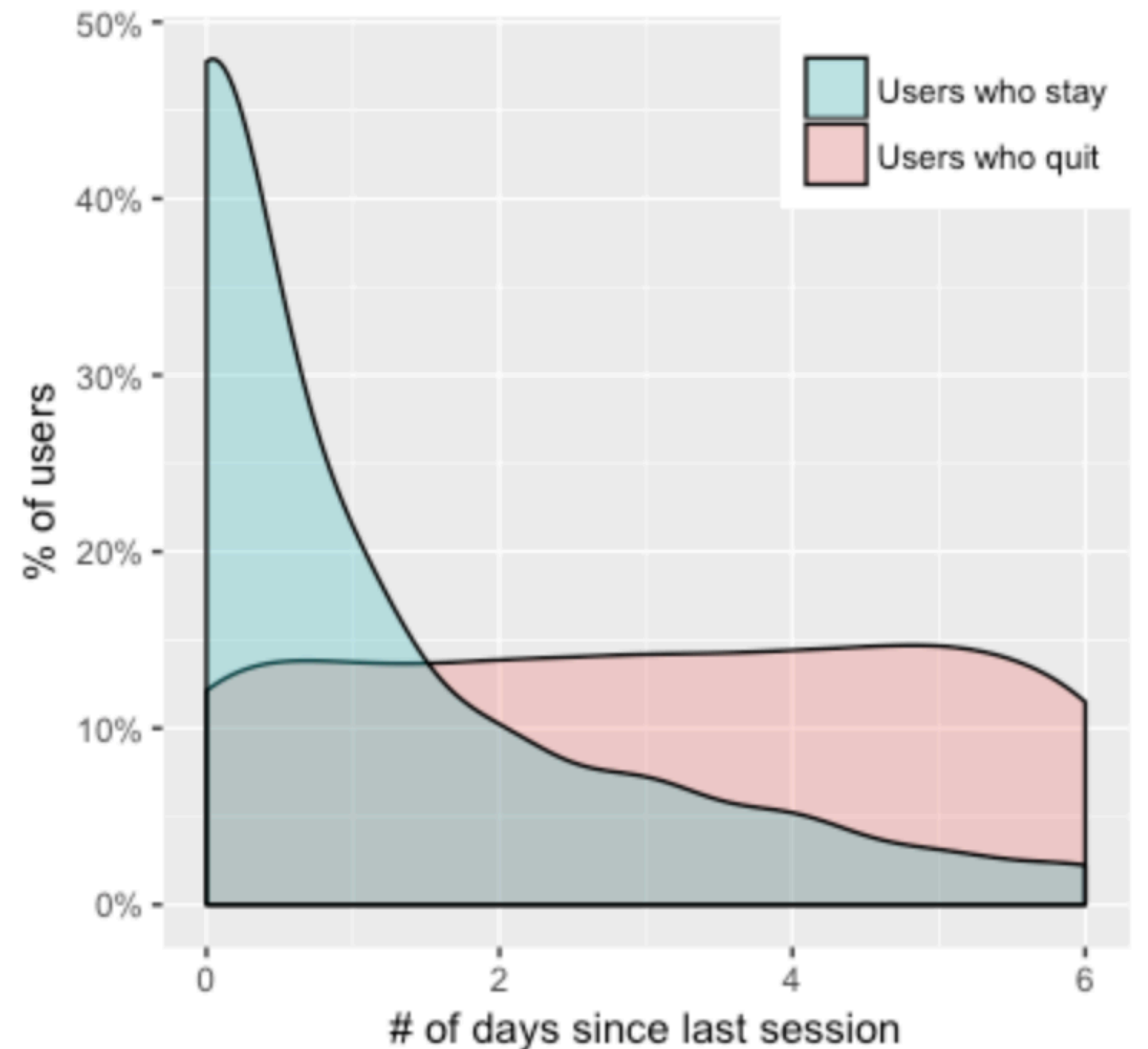
<sup>2</sup>This to address the problem of a learner choosing an article randomly from a website and discovering that it is too difficult and giving up.

more details in the CHI paper...

# Best predictor of language learning? Motivation.

Suzanne Hidi and Judith M Harackiewicz.  
**Motivating the academically unmotivated:** A critical issue for the 21st century. *Review of educational research* 70, 2 (2000), 151–179.

William G Brozo, Gerry Shiel, and Keith Topping. **Engagement in reading: Lessons learned from three PISA countries.** *Journal of Adolescent & Adult Literacy*



**Blauzungekrankheit!**

Designed for the *average learner*



**Quickly become boring**

**No Freedom =>  
Demotivation**

**There is no  
such thing as  
the average  
person**

## When U.S. air force discovered the flaw of averages

TR

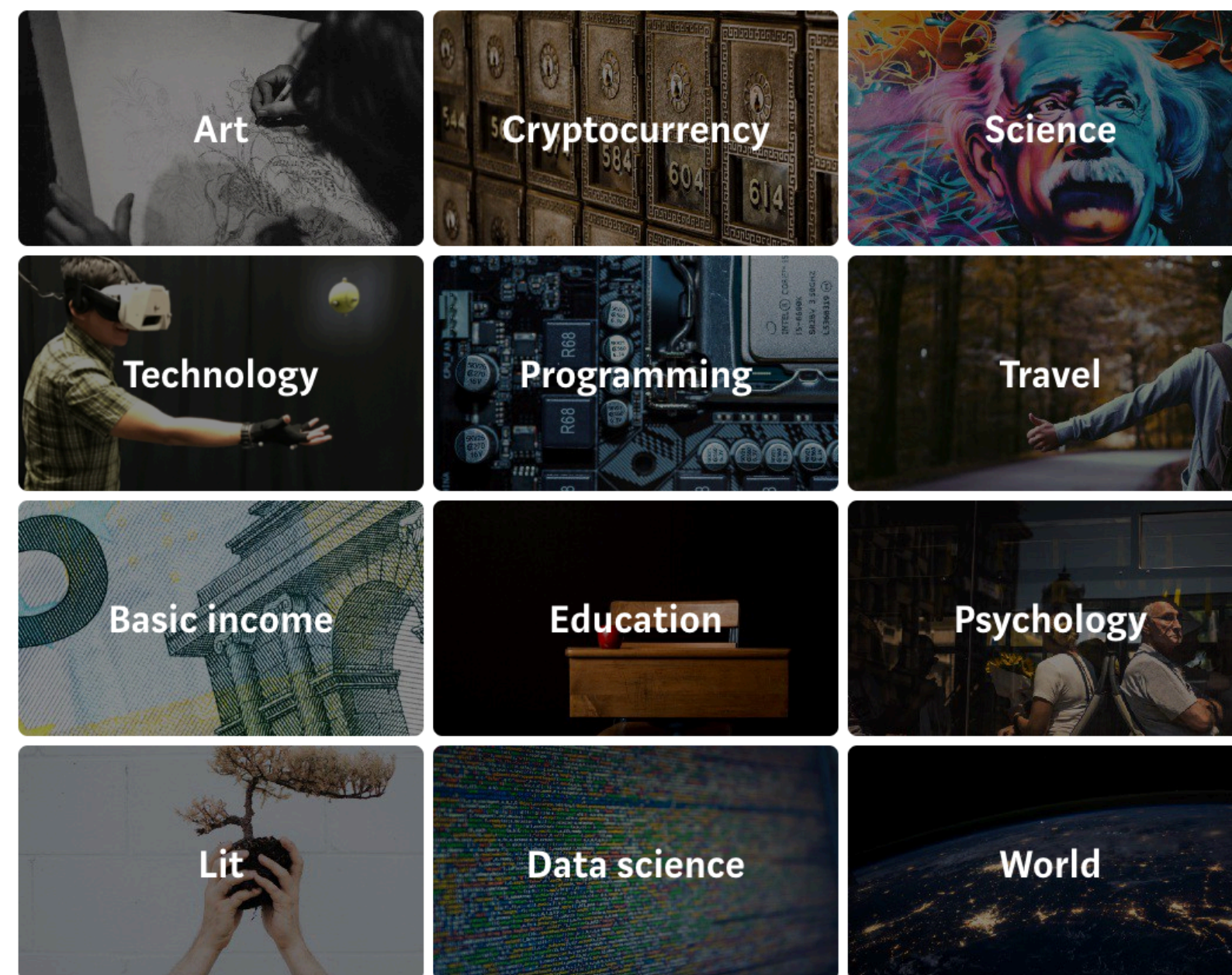
By Todd Rose

▲ Sat., Jan. 16, 2016 | 11 min. read



<https://www.thestar.com/news/insight/2016/01/16/when-us-air-force-discovered-the-flaw-of-averages.html>

# Interesting texts exist on the net for everybody but they're often too difficult



No Competence =>  
Demoralization

# Two Problems

When learning a foreign language as an intermediate

1. **Demotivation:** Textbooks are not interesting because are not adapted to an individual's **interest**
2. **Demoralization:** The web is bound to have interesting material but is not adapted to the **capability** of the reader

RQ: Can we use the web as a  
**Personalized Textbook** for the  
intermediates?

# **Apropos of personalization...**

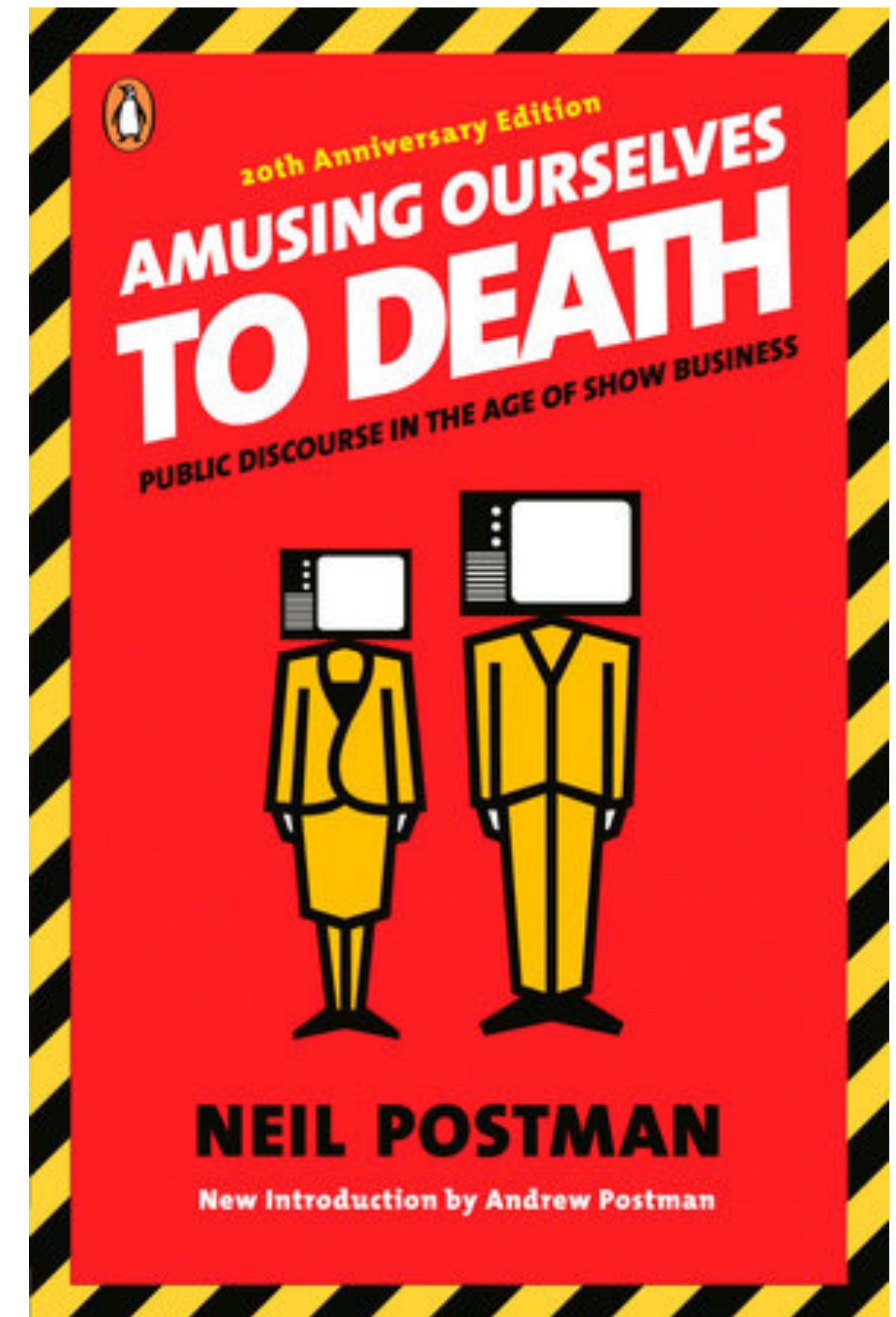
You know who uses it very well, right?

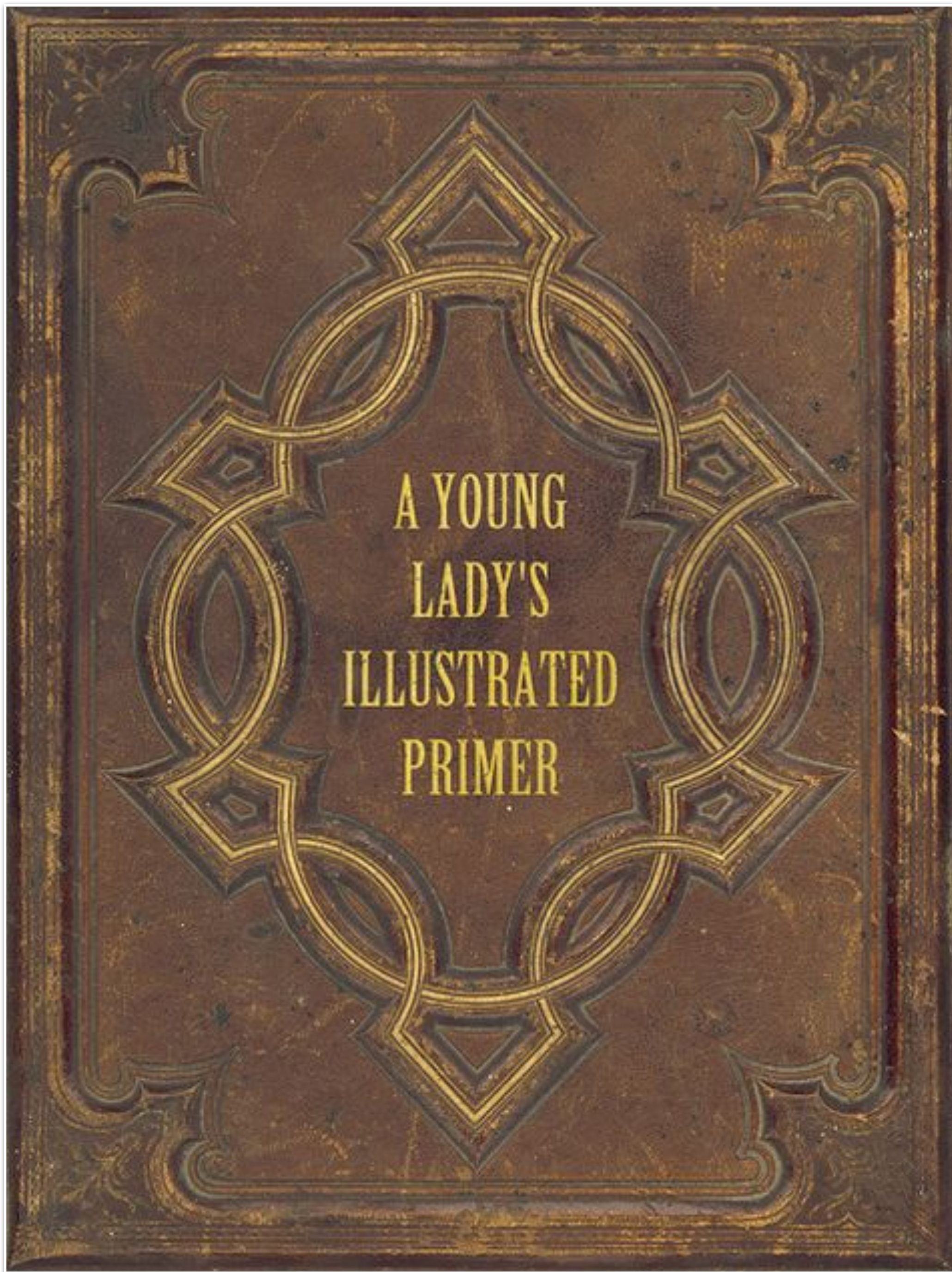


**FAANG use personalization  
... to motivate us to  
buy stuff!**

Or to entertain us and sell our data later.

Fantastic book:





**fully interactive, able to teach reading, science, history and martial arts (among other things) while adapting to the current need of the reader.**

**Neal Stephenson**



**zeequu.org**

**An MVP for a**  
***PERSONALIZED***  
**Language**  
**Textbook**

Note: following are some of our solutions of solving these previously identified challenges; many are still work in progress.our solution is more of an MVP at the moment; each challenge is addressed as basic as possible so we can start testing and learning more.

# A **PERSONALIZED** Language Textbook Should

1. Enable Learners to **Read What They Like, Easily**



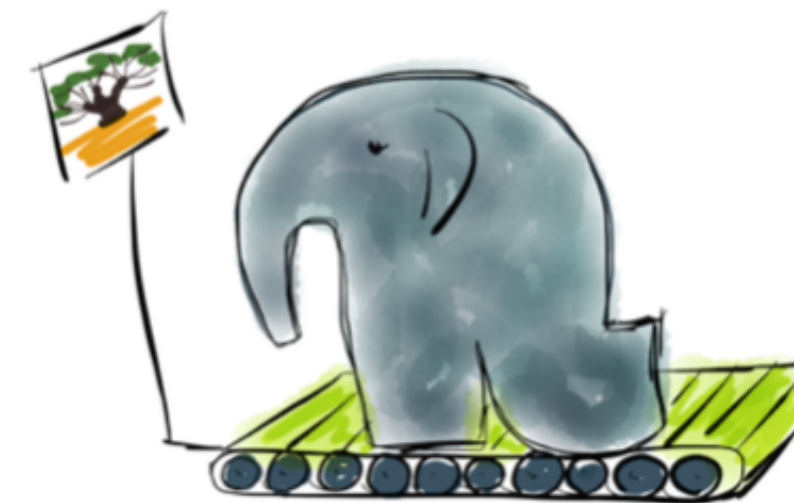
HCI Challenge

2. **Generate Exercises Based on Past Readings**



Algorithmic Challenge

3. Provide **Insights Into Activity and Progress**



HCI & Algorithmic Challenge

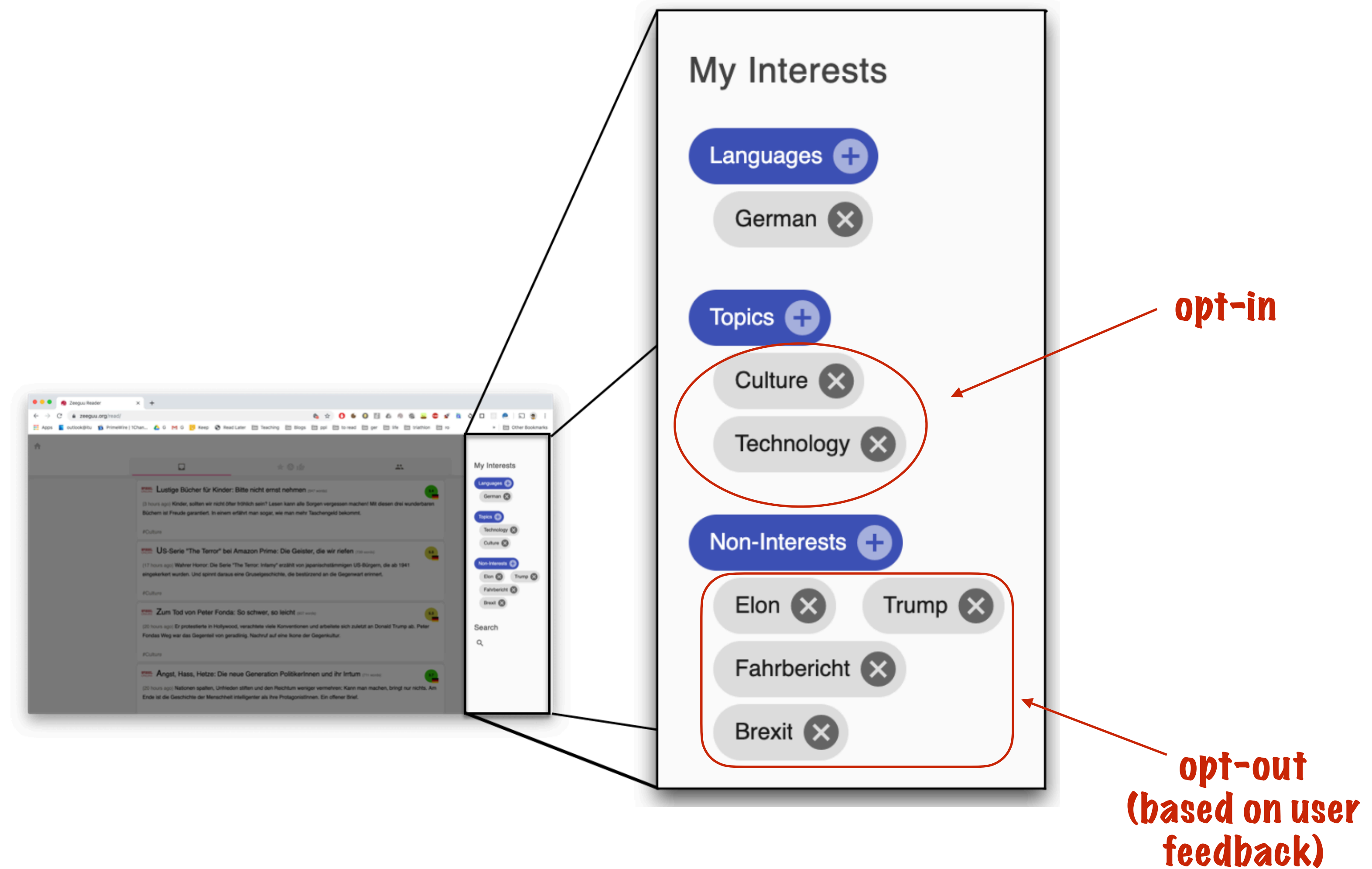
# 1. Enable Learners to **Read** **What They Like, Easily**

- a. Support individual topic preferences
- b. Provide difficulty estimation
- c. Offer easy in-text translations



Read **What They Like**, Easily

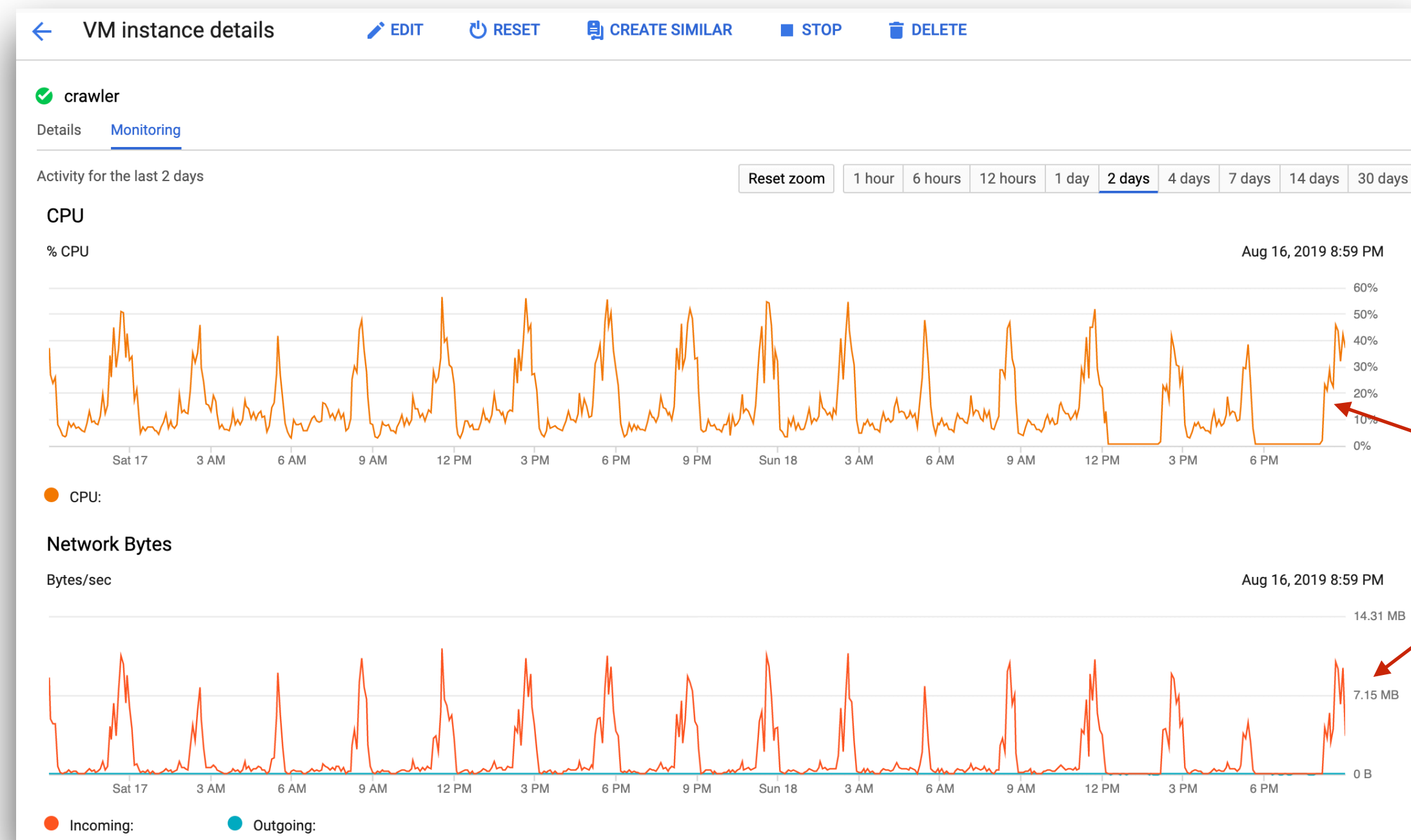
# Support individual topic preferences



Read **What They Like**, Easily

# Support individual topic preferences

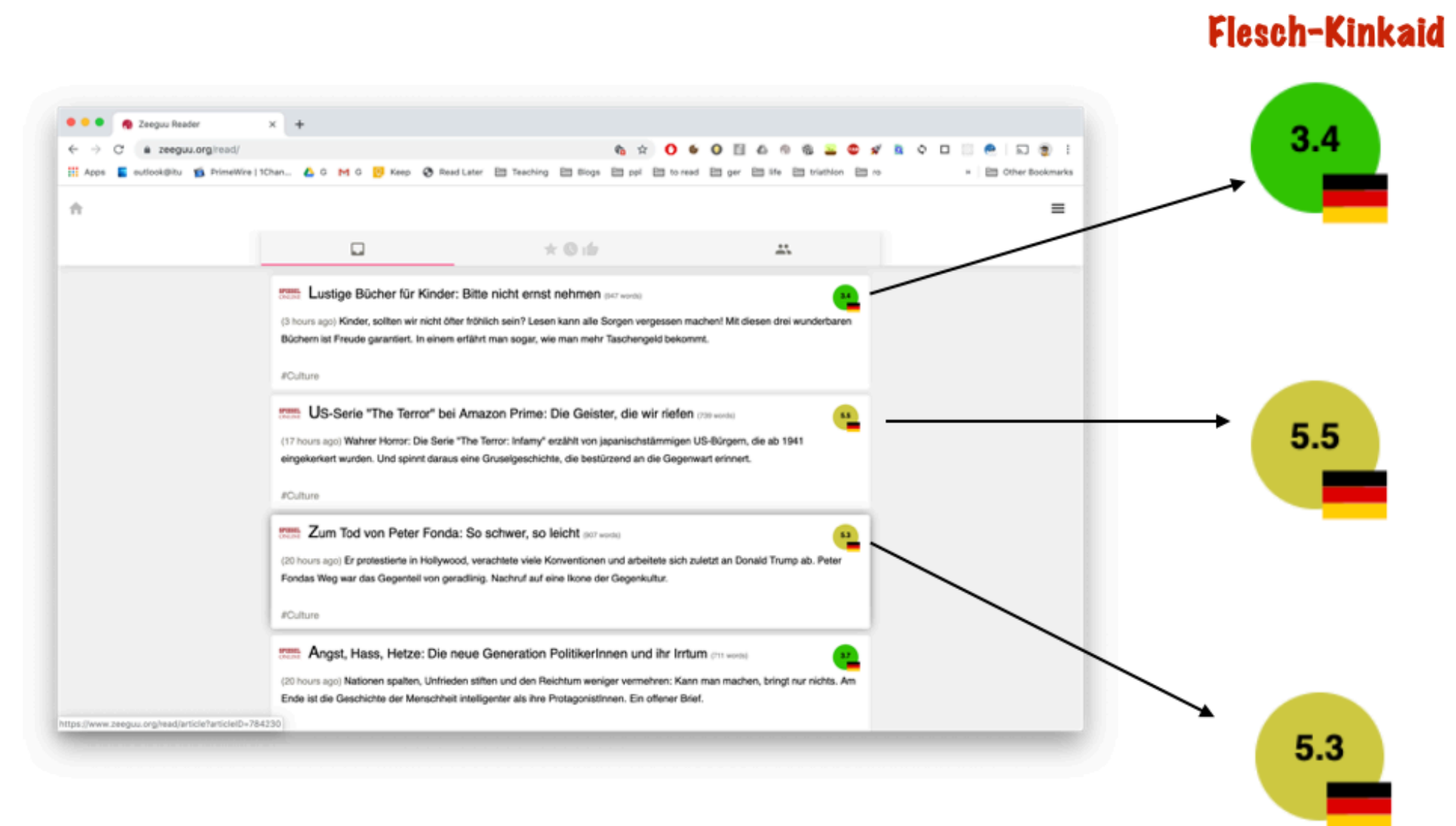
**Under the Hood**



**Regular Web Crawls for  
New Material**

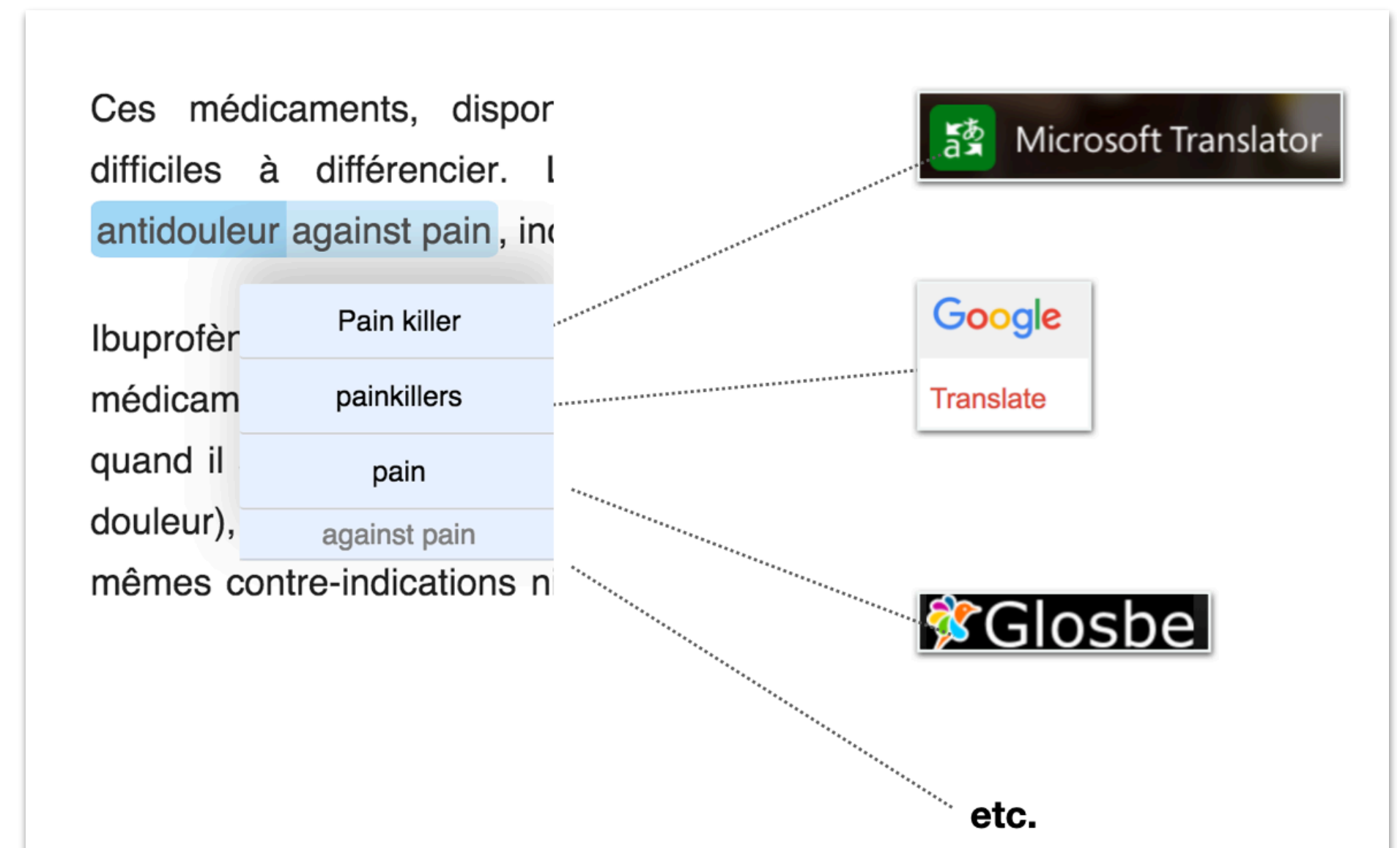
# Provide difficulty estimation

- Because if something is too difficult learners will just give up
- If it's too easy, they won't learn
- However, the learners can put up with difficult texts if they like the topic!



# Offer easy in-text translations

- Translation is a difficult problem: outsource it to others (GOOG, MSFT)
- HCI trade-off:
  - 1-click insert translation but might not be the best
  - 2-click: show alternatives but one extra click



the teacher who was *happy that translations are not perfect*

## 2. **Generate** <sup>vocabulary</sup> Exercises Based on Past Readings

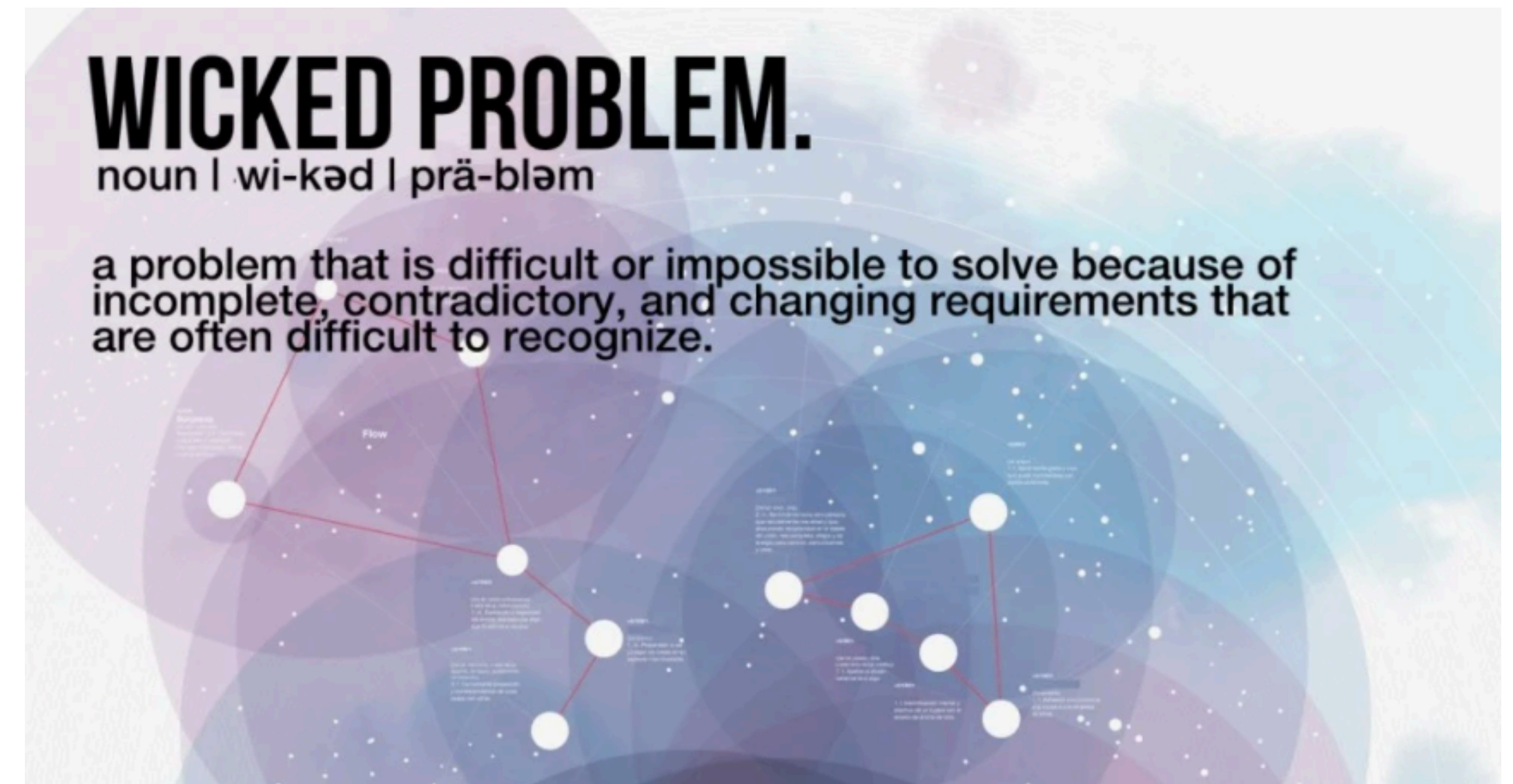
- a. **Decide which words to prioritize**
- b. **Consider multiple exercise types**



# Decide which words to prioritize

Factors to consider

- frequency
- already in learning
- recently looked up
- the allocated time
- spaced-repetition requirements
- user provided priority
- reaction times



# Multiple exercise types

- Users want multiple exercise types so they are not bored
- Different exercise types have different difficulties
- Some contexts are too long: don't practice them... problem with teachers who don't understand!

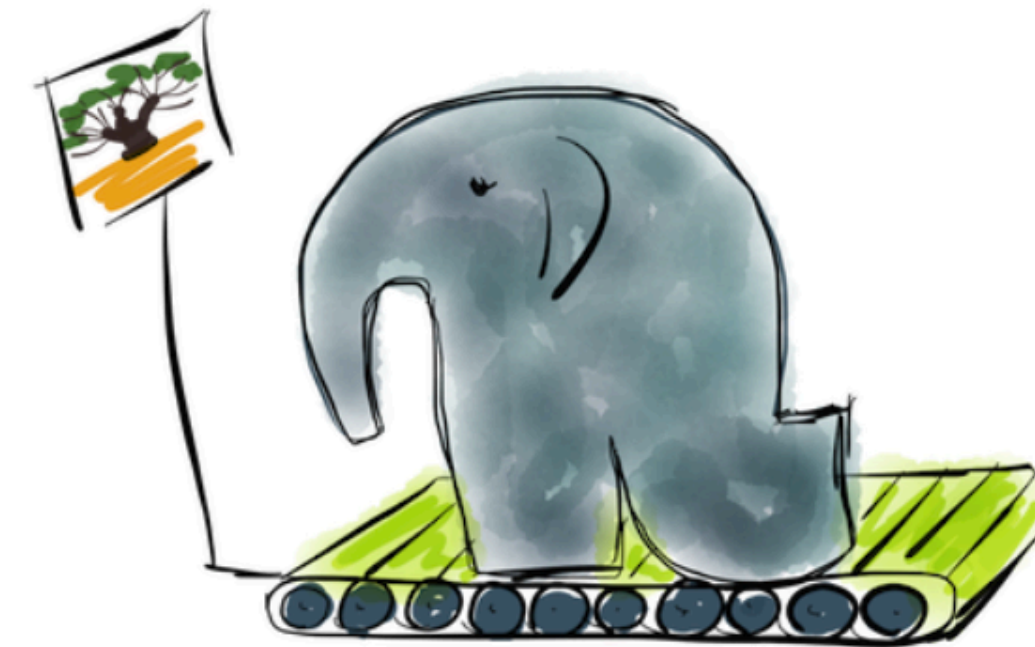
The screenshot shows a 'Triple Choice' exercise. At the top, a yellow header contains the text 'Triple Choice'. Below the header, a text block reads: 'Ich habe den Eindruck, das hat damit zu tun, dass wir eher einer Realpolitik als einer Symbolpolitik \_\_\_\_\_ .'. At the bottom, three buttons are visible: 'angehen', 'Fürstel', and 'verpflichtet sind'.

The screenshot shows a 'Match' exercise. At the top, a green header contains the text 'Match'. Below the header, there are two columns of buttons. The left column contains 'umgestellt würde' and 'verpflichtet sind'. The right column contains 'grouchy', 'Would be reversed', and 'Are required'. At the bottom, a grey bar contains a question mark icon.

The screenshot shows a 'Recognize & Type' exercise. At the top, an orange header contains the text 'Recognize & Type'. Below the header, a text block reads: 'Die beiden anderen grossen Temporärunternehmen, Manpower und Kelly Services, planen dagegen gegenwärtig keine vergleichbaren Angebote.'. At the bottom, there is a grey bar with a question mark icon, a text input field with the placeholder 'Type or click a word', and a green 'Check' button.

# 3. Provide Insights Into Activity & Progress

- a. Feedback to Learner
- b. Insights for Teacher



# Feedback for Learner

## Dashboard

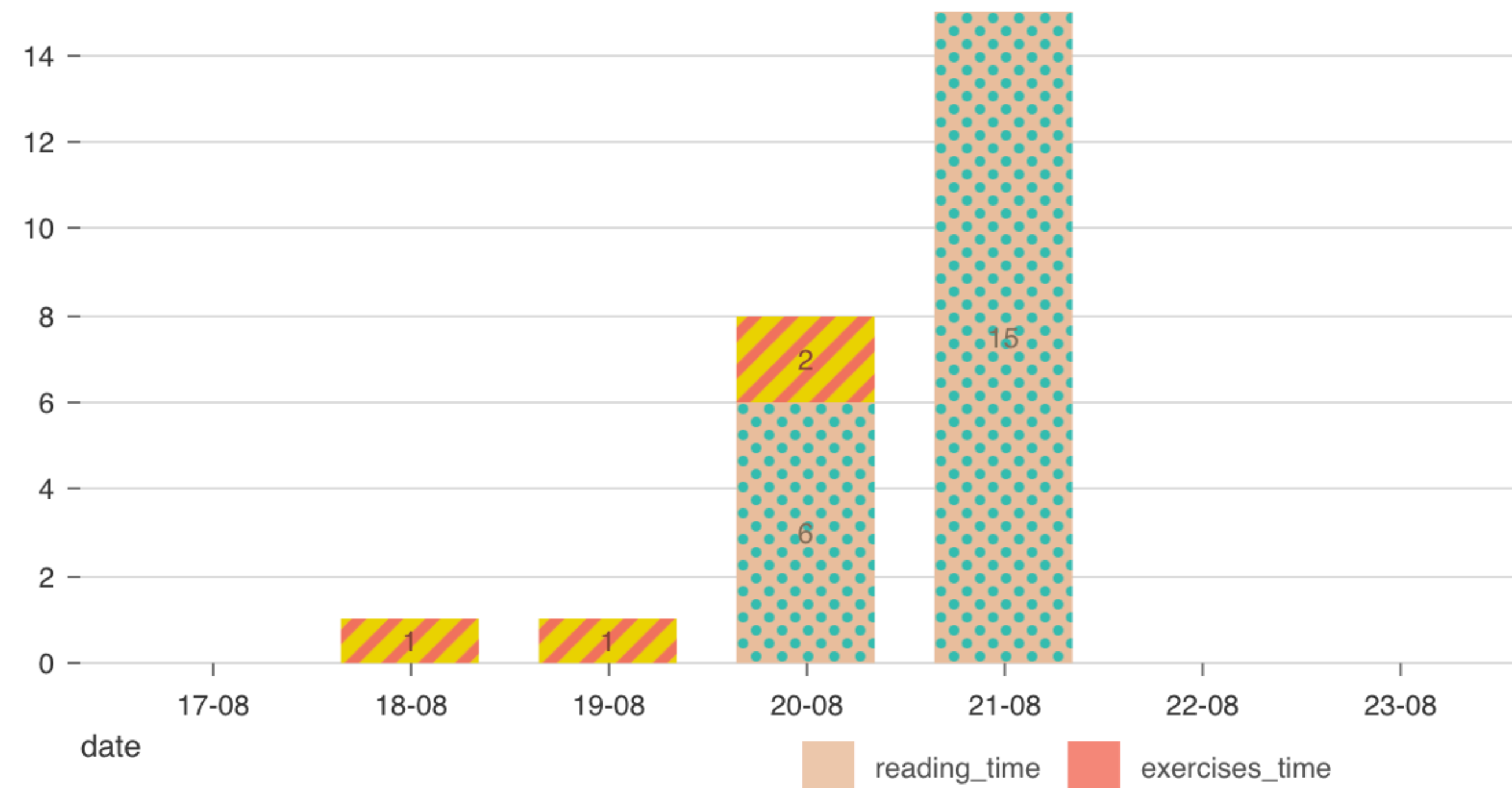
Activity

Words

Your activity data for **Last 7 days**

Time count shown in **minutes**

Do you have some feedback for us?







# Insights for Teacher

**OD23A2+** Dutch

Invite code: OD23A2+

MANAGE ARTICLES

EDIT CLASS

NAME	TIME SPENT ↓	CLASS NAME	ACTIVITY <span>Reading / Exercises</span>
Aron	147h 19m	OD23A2+	
Maria	3h 25m	OD23A2+	
Erin	1h 24m	OD23A2+	
Vasile	1h 5m	OD23A2+	
Justin	0h 30m	OD23A2+	
Thijs	0h 15m	OD23A2+	
Anna-Maria	0h 10m	OD23A2+	

# Demo...



[zeequu.org](http://zeequu.org)

# Lessons

**Or at least: Some Lessons**

# Learners benefit from personalization of content

## 3 Weeks & 60 French Students

(bilingual Dutch-English)



### The Teacher's Perspective

Presentation by Wim Gombert

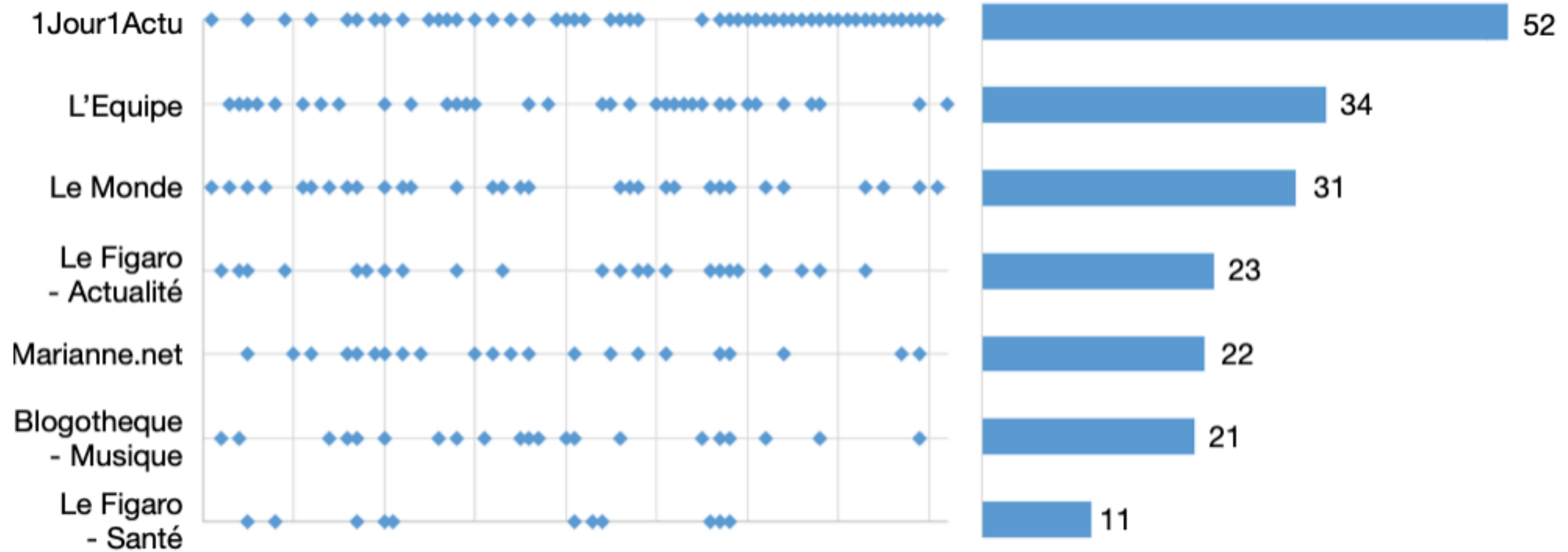
### Telemetry

How do learners use the system?

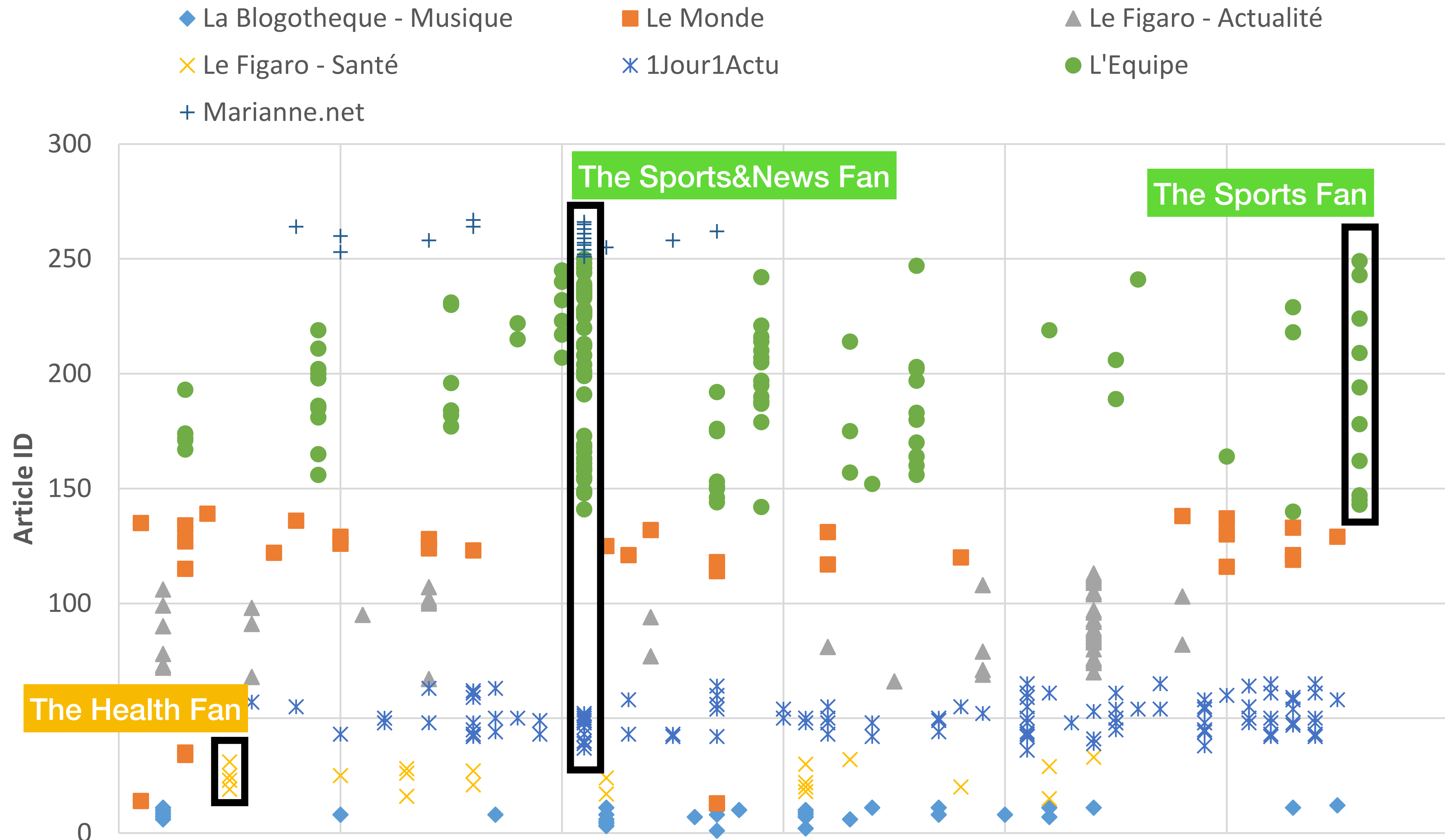
### Student Feedback

My vocabulary truly is improving, but you do have to use it more than a few times. A very nice website, easy to use and with nice topics

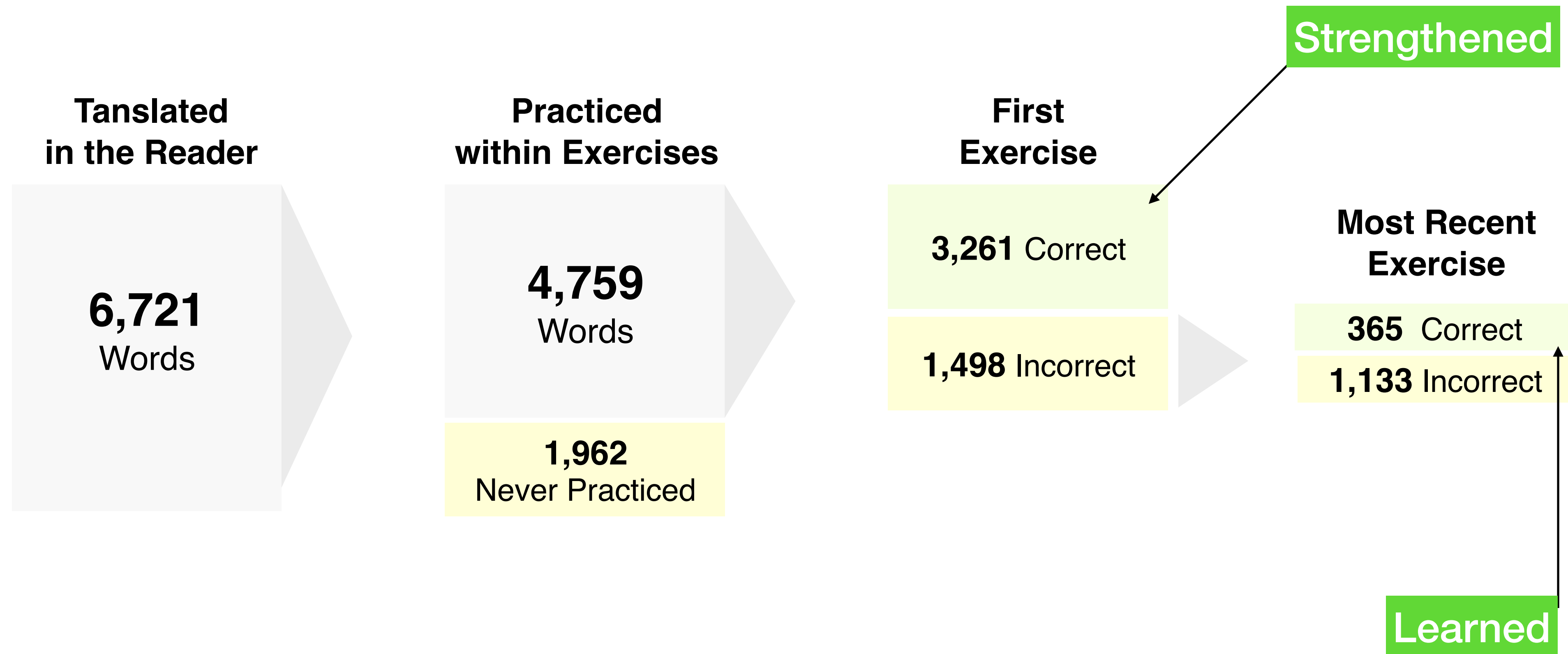
# Source Subscriptions



# Reader Types



# Word Interactions In the Exercises

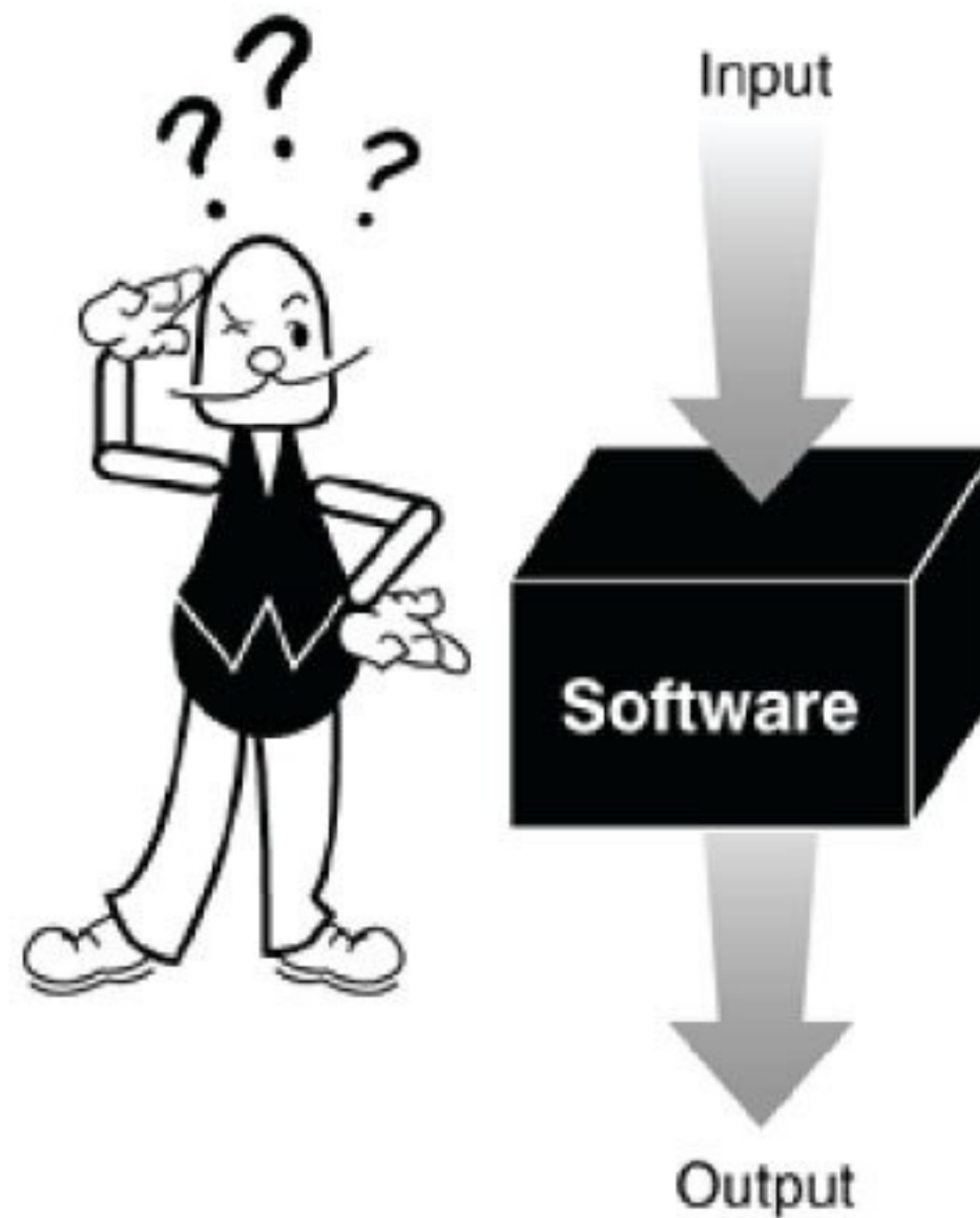


# Teachers want visibility into (some) algorithms

“Why are there some words that the students don’t see in exercises?”

“What is the definition of learned words?”

“How is reading time computed?”



NB: teachers don’t care about the algorithm for assigning categories...

# Progress is not easy to quantify

## Activity

- Easier to measure (still surprises learners!)
- Can be also combined with gamification

## Knowledge

- Not so easy (“what is a learned word”?)
- Teachers seem to be happy with simple definitions

The screenshot shows a developer's profile on Stack Overflow. At the top, there are navigation tabs for 'Profile', 'Activity', 'Developer Story', and 'Settings'. The 'Activity' tab is selected. Below the navigation, the 'REPUTATION' section displays a score of 6,346 with a green '+790' badge, indicating a recent increase. A line graph shows the reputation growth from 2018 to 2021, starting at 1.7k and reaching 6.3k. The profile is ranked 'top 6% overall'. The 'Top tag' is 'python' with a '+270' badge. The 'Next privilege' is '10,000 Rep.' with a gear icon, and a button labeled 'Access moderator tools' is visible. Below this, the 'Job Recommendations' section is shown, based on experience, interests, and preferences. Two job listings are visible: 'Sr. Software Engineer (Full stack) - Growing SaaS Container Shipping Start-up' at Portchain in Copenhagen, Denmark, and 'Full-Stack Engineer (Python Javascript)' at Neo4j in Malmö, Sweden. The bottom of the screenshot shows a navigation bar with 'Summary', 'Answers', 'Questions', 'Tags', 'Badges', and 'Bookmarks'. The 'Questions' tab is selected, showing a list of questions with their respective vote counts and titles.

Vote Count	Question Title
110	Why did pip upgrade from version 10 to version 18?
102	Installing node with brew fails on Mac OS Sierra
37	Randomly change the prompt in the Python interpreter
35	drop_all() freezes in Flask with SQLAlchemy

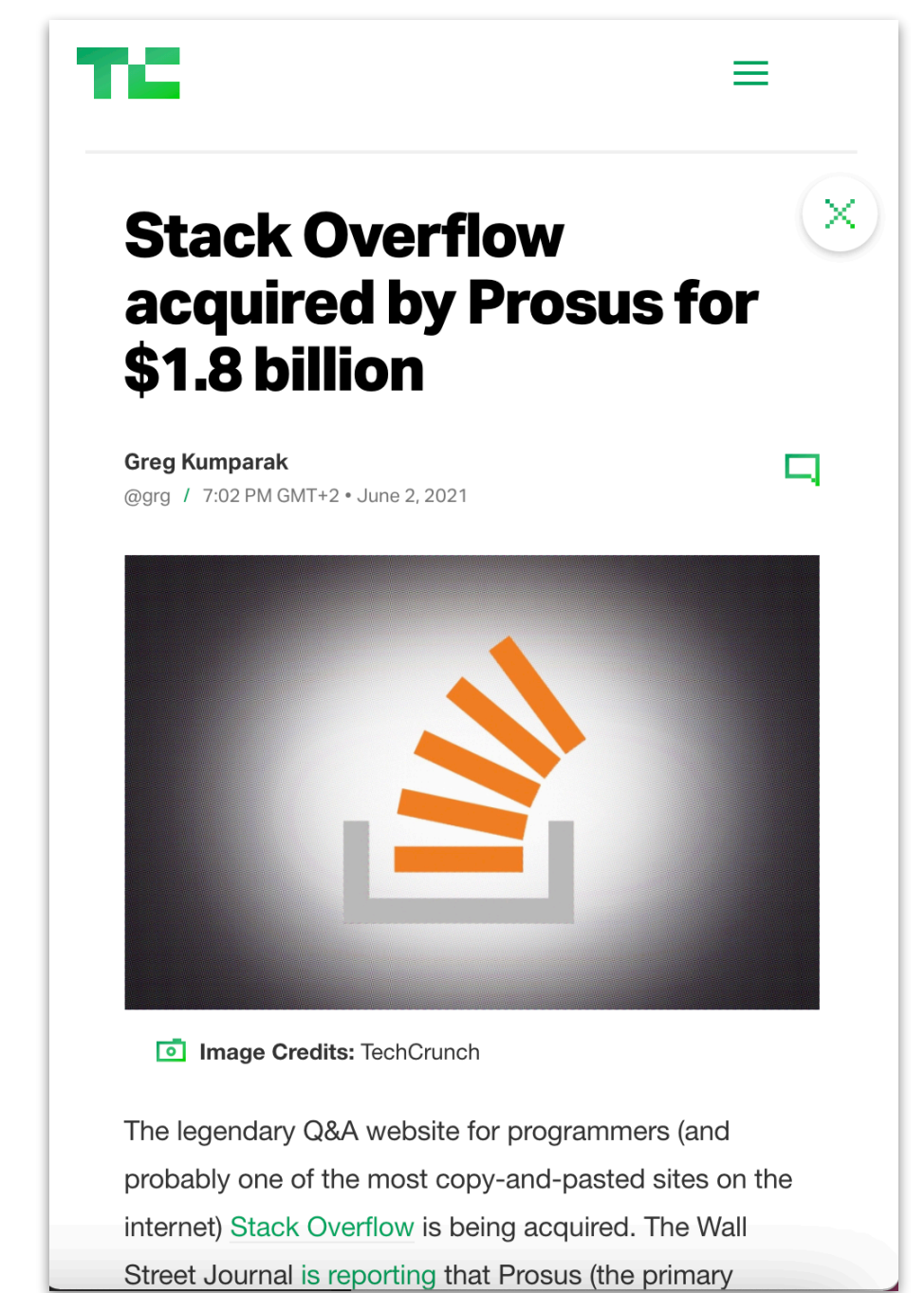
# Curating net content is a challenge

A bit like eating at McDonalds vs local when traveling...

Student: "I do not want to read about accidents and death!"

## Possible Approaches

- Semi-automatic (Apple News)
- Crowdsourcing (StackOverflow)



# (Personalized or not), It's (still) a tool

- True Stories
  - The user that keeps reading two years later :)
  - Teachers who fail to use the tool in the classroom :(
  - Student showing the teacher “how many words they translated” >-)



# Recap of the Lessons

- Learners benefit from personalization
- Teachers need algorithmic visibility
- Progress is not easy to quantify
- Curating net content is a challenge
- It's still a tool

And last but not least: it's promising :)

# Future Directions

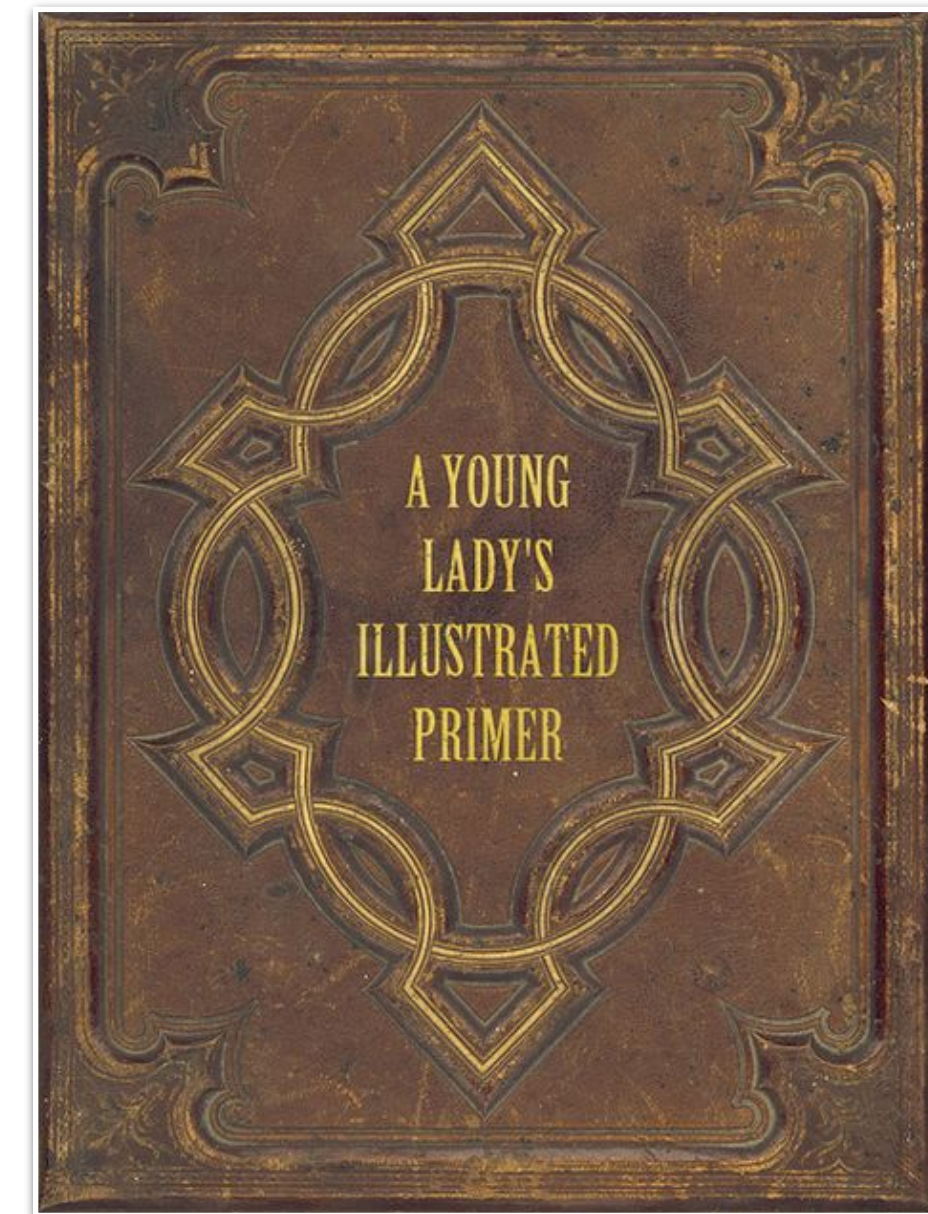
## Short Term: **Improve**

- Difficulty estimation
- Knowledge modeling
- Progress feedback

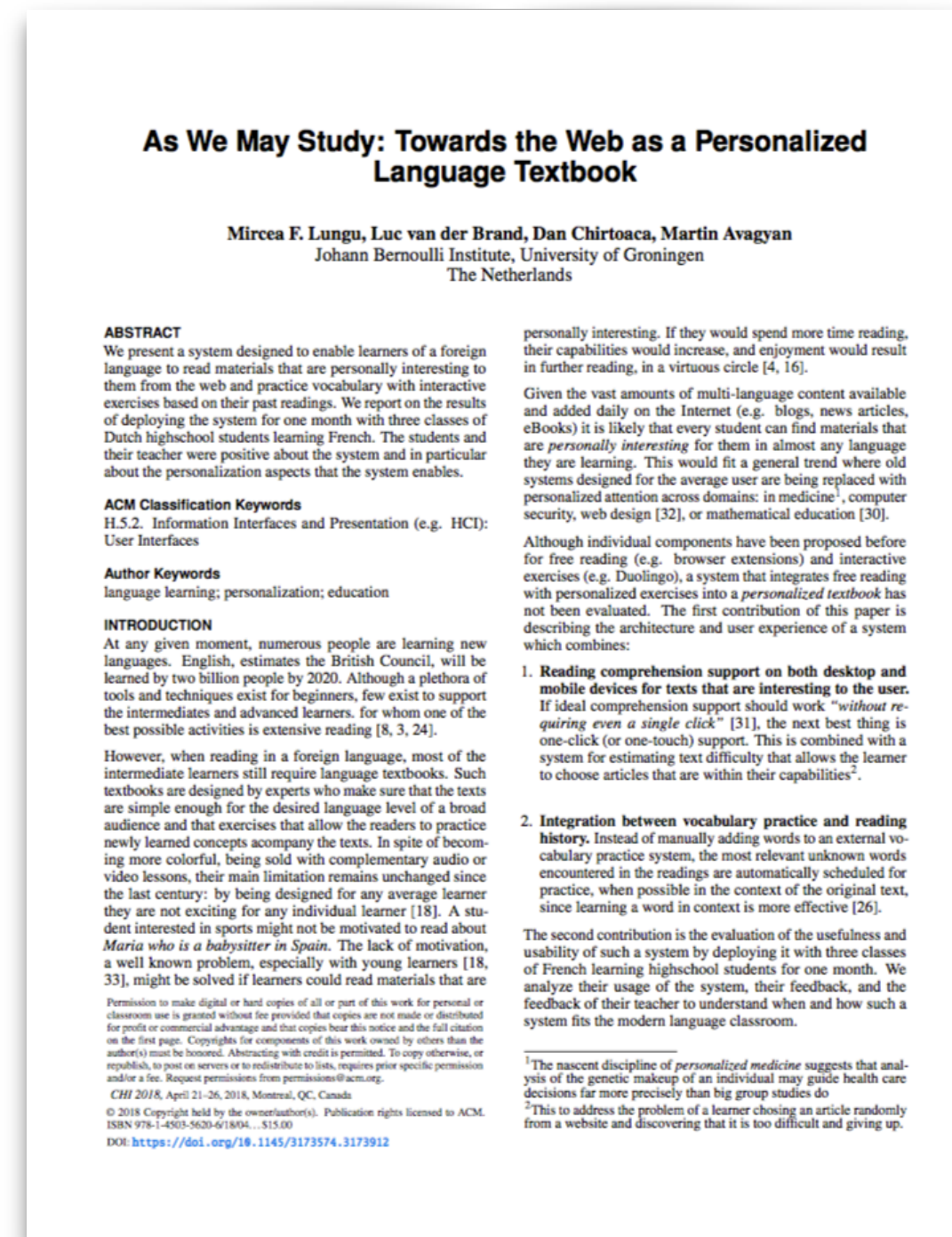
## Long Term: **Support**

- Grammar
- Other knowledge domains

## Very Long Term: **Develop ... :)**



# Read CHI Paper UX data analysis student feedback teacher feedback



Try out the system  
Invite Code: **easeai21**  
<https://zeeguu.org>



Get In Contact  
[mlun@itu.dk](mailto:mlun@itu.dk)  
Twitter: @mircealungu

“Such a system is **critical for language education in schools**, since the possibility of choosing their topics of interest is motivating” (French Language Teacher)

“My vocabulary truly is improving but you have to use it more than a few times. **Easy to use and with nice topics**”. (Student)