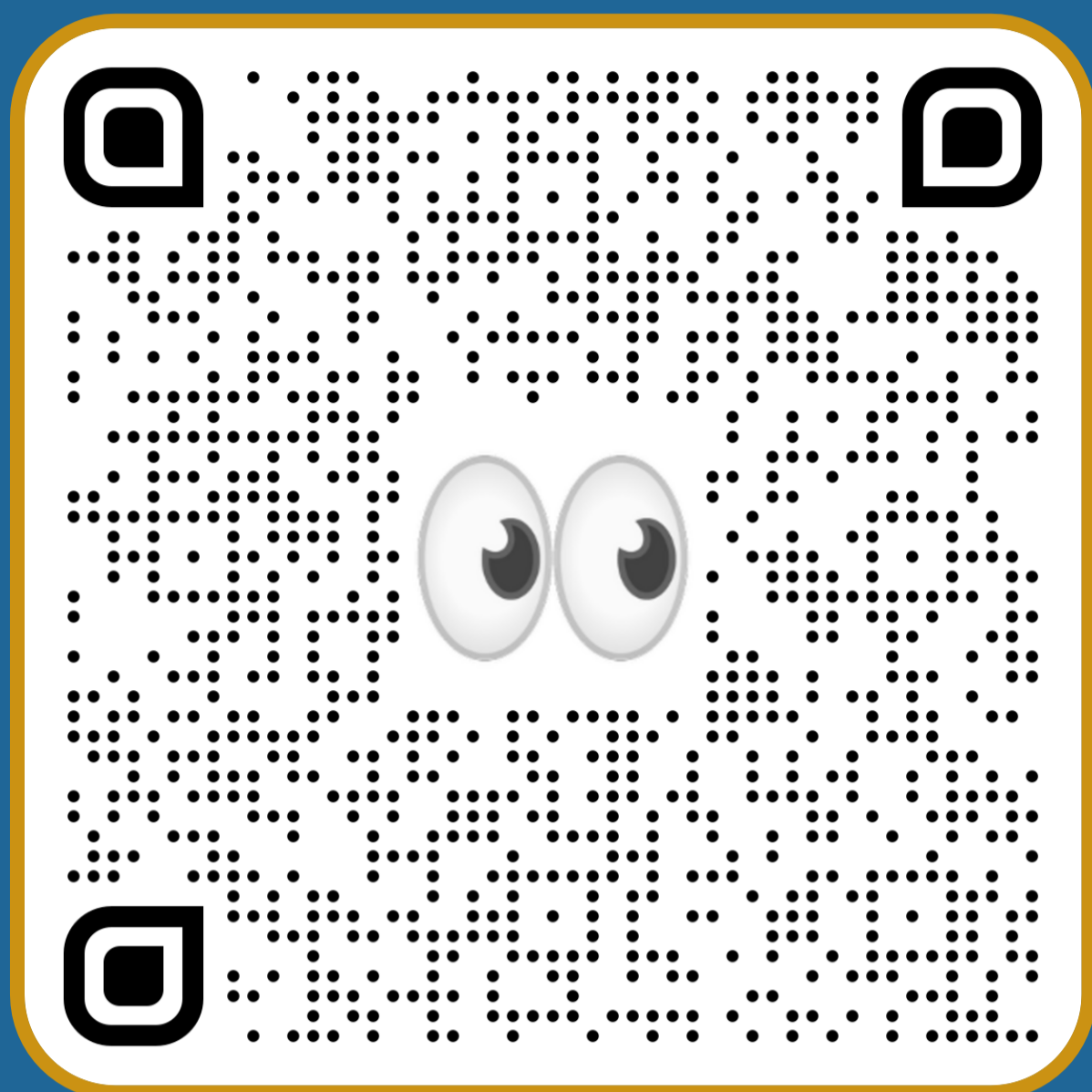


We can predict in **2 seconds** whether you're looking for specific information in this poster only from your **eye movements!**



Decoding Reading Goals from Eye Movements

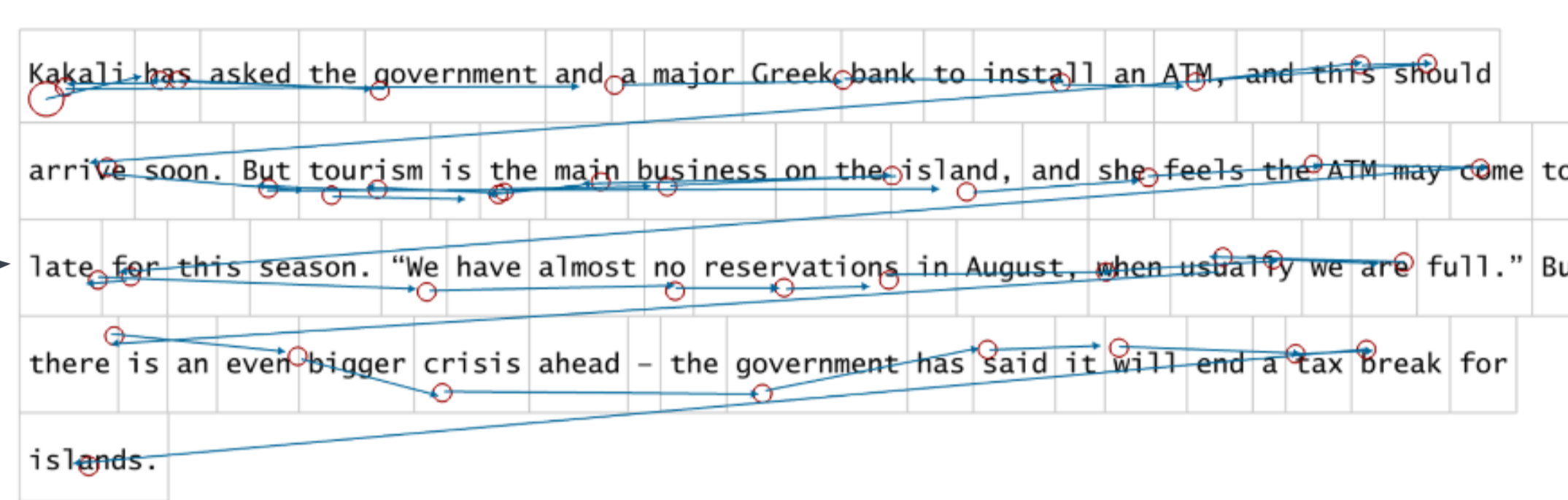
Omer Shubi*, Cfir Hadar* and Yevgeni Berzak



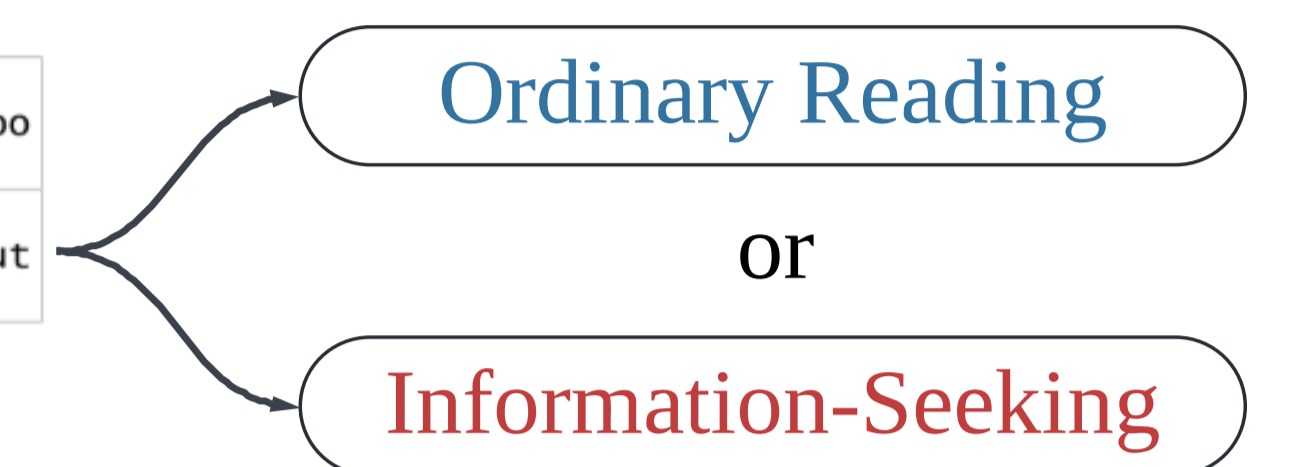
Single-Passage Single-Participant Reading Goal Decoding



Single Participant S



Eye movement recording for a single passage P



Participant's Reading Goal

Experimental Setup

OneStop Eye Movements

(Berzak, Malmaud and Levy 2020 ; Berzak et al, 2025)

360 X 54

English L1 Participants

Passages from the Guardian

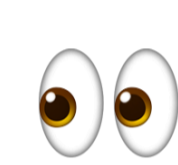


Two between-subjects conditions:

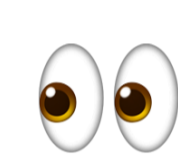
~10k **Ordinary Reading** Trials

~10k **Information Seeking** Trials

Ordinary Reading

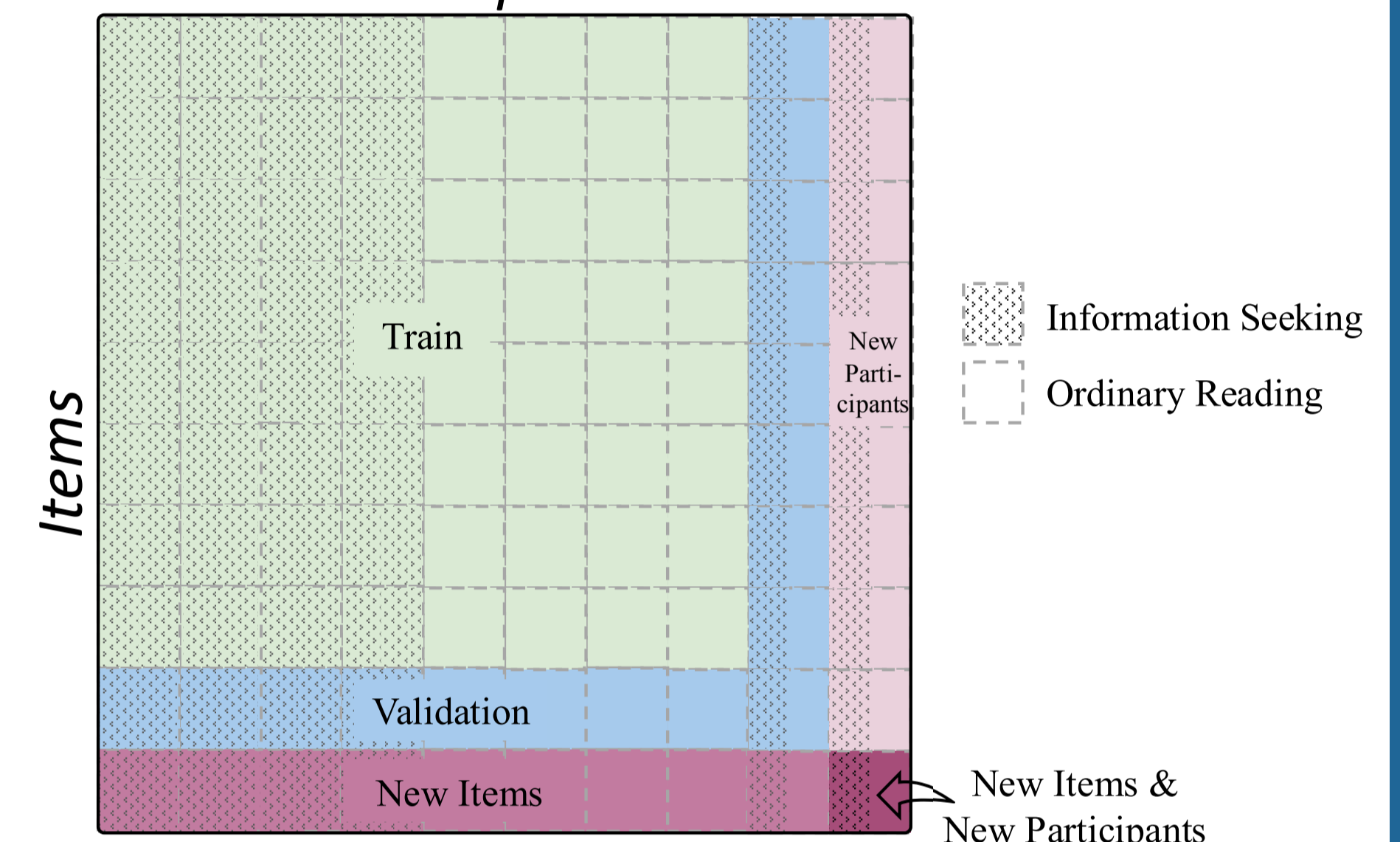


• **Information Seeking**



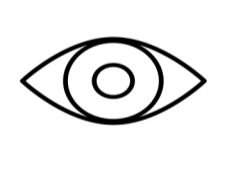
Train, Validation and Three Test Regimes

Participants



Eye Movements and Text Representation

CNN wants to change viewers' habits.

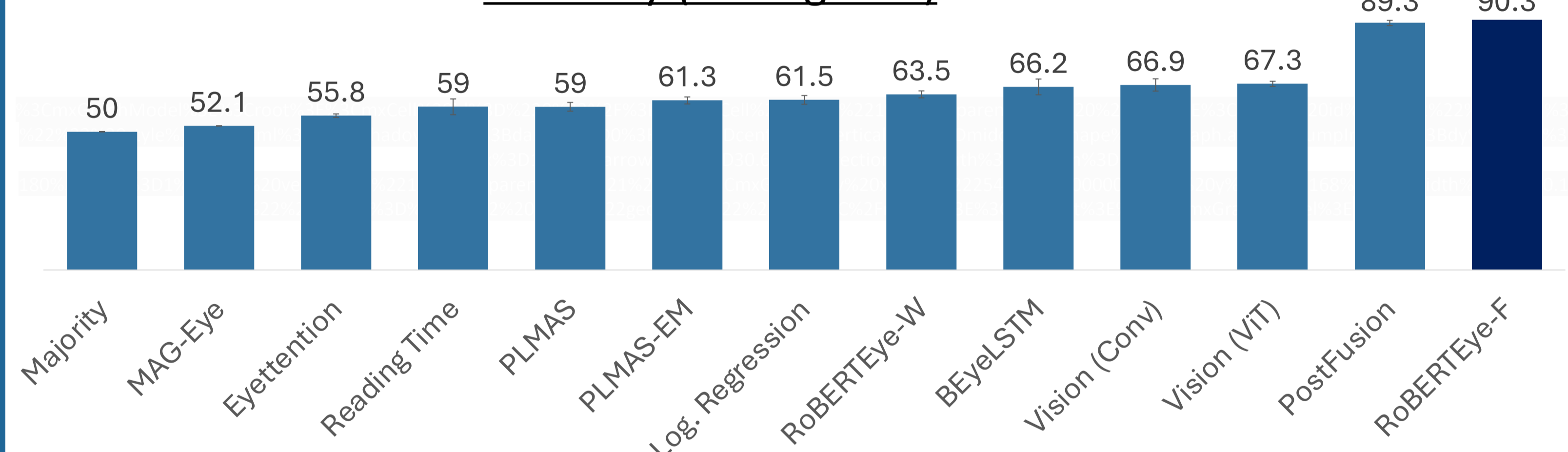


- Global e.g. average total FD
- Word-level e.g. total FD
- Fixation-level e.g. fixation duration (FD)
- Raw Data e.g. millisecond-level XY coordinates

- Embedding e.g. language model
- Properties e.g. Frequency, surprisal, word length...
- None

Results

Accuracy (All Regimes)



Analyses

Cohen's Kappa Model Predictions

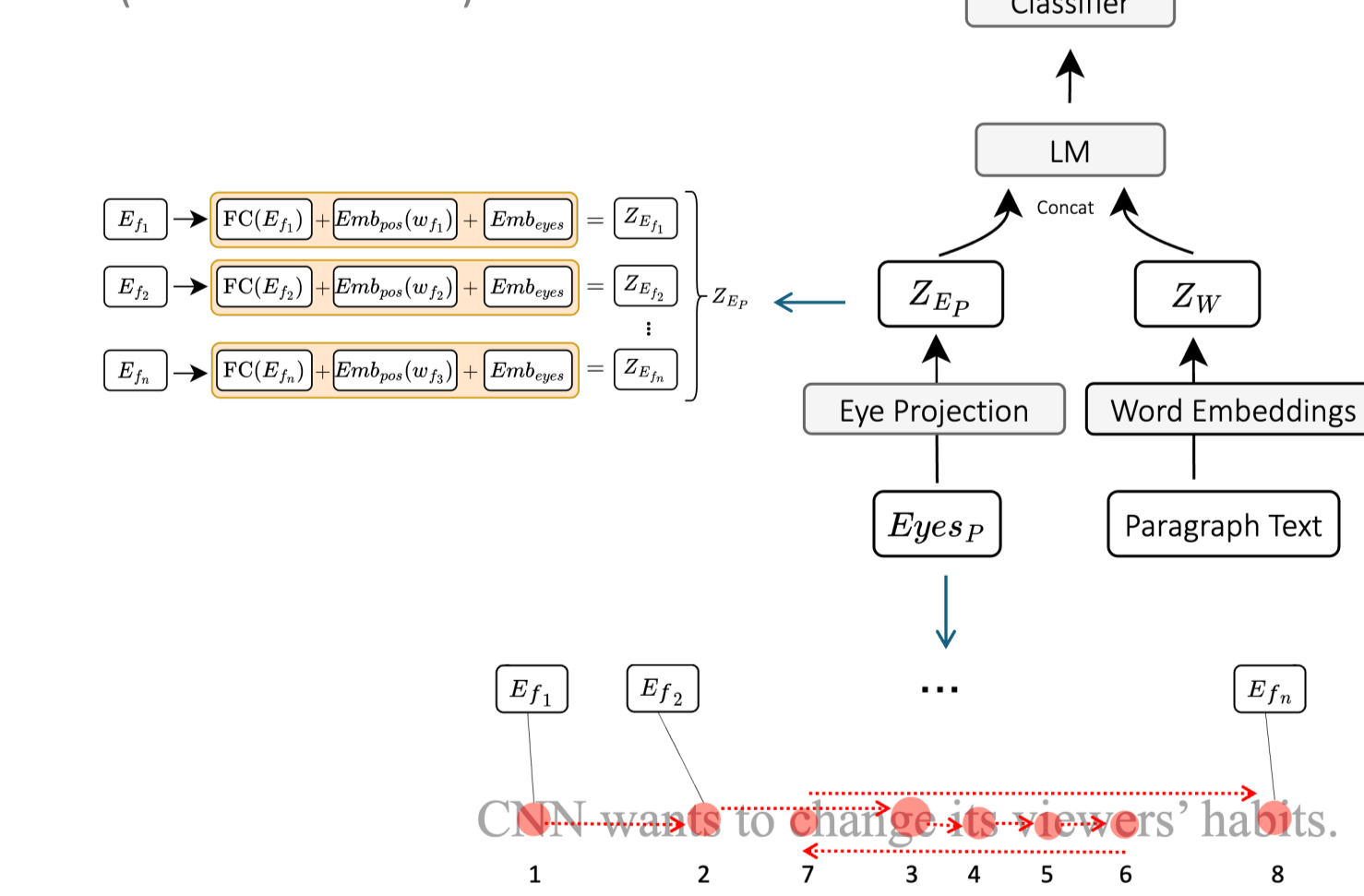


+1.1% Improvement

Logistic Ensemble

ROBERTEye - Fixations

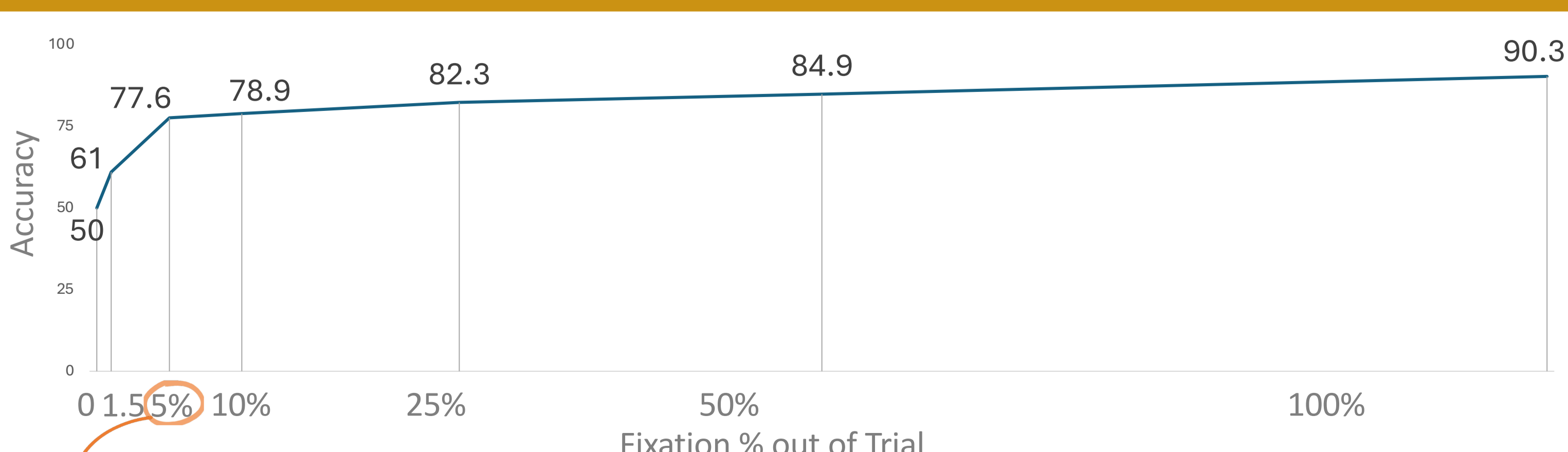
(Shubi et al 2024)



What Contributes to Prediction Difficulty?

- Question: Question Difficulty (X), Critical Span Length (✓)
 - Text: Paragraph Length (✓), Paragraph Difficulty (X)
 - Interaction: Position in the Experiment (✓), Reading Time Inside/Outside the Critical Span (✓), Answered Question Correctly (X)
- $P(\text{Correct}) \sim \text{Metadata} + (1|\text{item}) + (1|\text{participant})$

How Fast Can We Make Accurate Predictions?



1.5 Seconds to classify ordinary reading versus information seeking

Take-Aways & Conclusions

- Decoding reading goals -- **ordinary reading** versus **information seeking** -- from eye movements is possible! Even in real time.
- Models that represent both text & eye movements as fixations are best.
- Insights into prediction difficulty by experiment metadata.