How Does Text in Real-World Scenes Attract Attention?

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- Are **texts** more attractive than **non-text objects** or **control regions**?
  - Texts: signs, banners, license plates, …



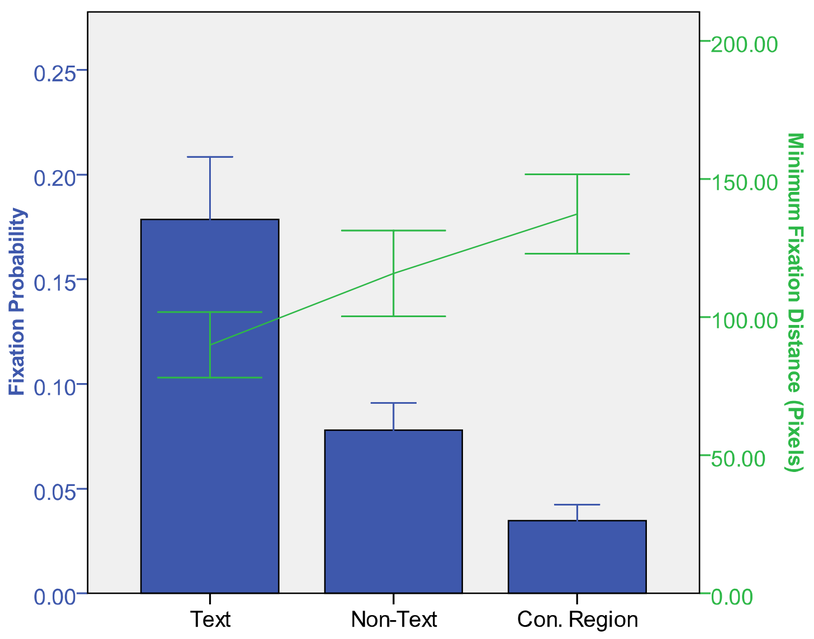
  - Non-text objects: people, cars, monitors, printers, …




  - Control Regions: Regions of similar features paired with texts.

- What **factors** affect the allocation of attention?
  - Size? Eccentricity (Ecc.)?
  - Saliency (Sal.; Itti & Koch, 1998)?
  - Luminance Contrast (LumC.)?
  - Contextual Guidance (i. e., expected location; Torralba et al., 2006)?
  - Informativeness?
- Eye movement **measures** of attraction
  - Fixation Probability
  - Minimum Fixation Distance: minimum distance between an object and any fixation during a trial.

Experiment 1: Reanalysis of Previous Data – **Attractiveness of Texts**

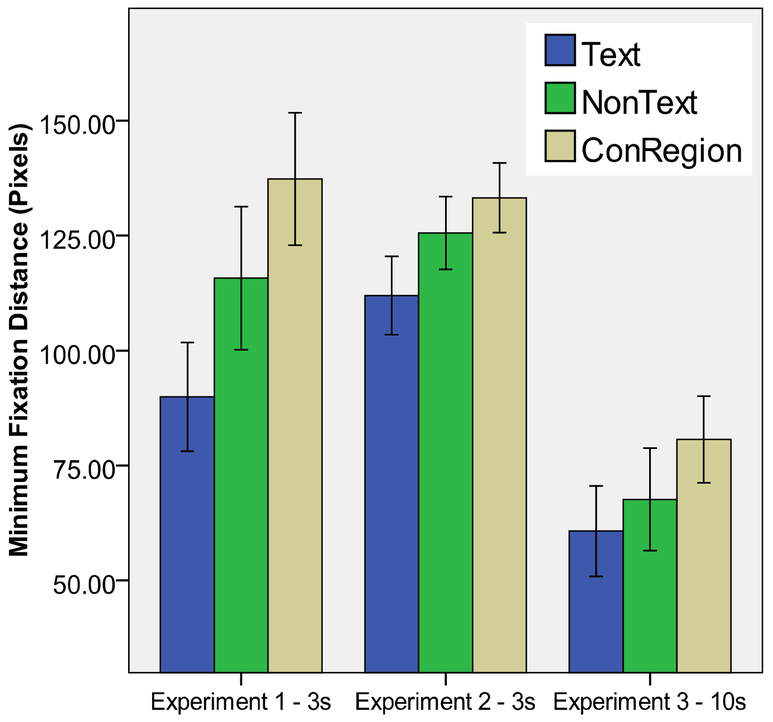


Reanalyze eye-movement database by Judd et al. (2009)

The effects might be caused by
1) Typical saliency (Itti & Koch)
2) high level features (e. g., expected locations), or
3) unique visual features of texts

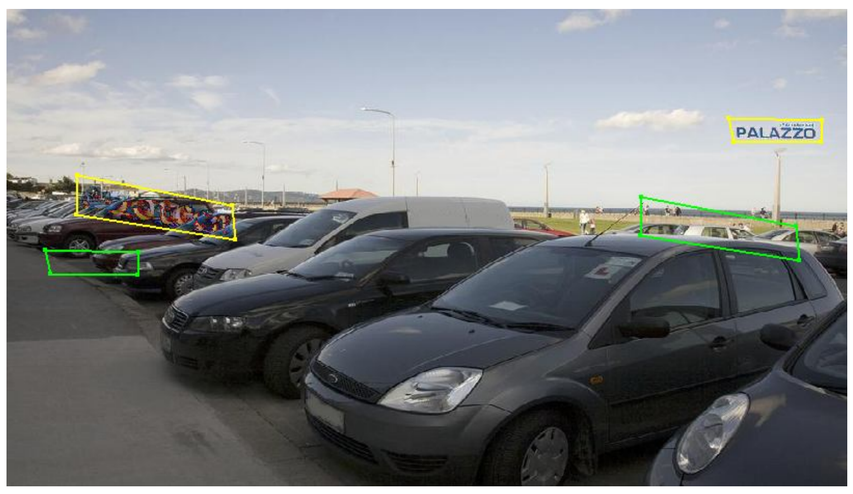
The selected controls ruled out the first hypothesis.

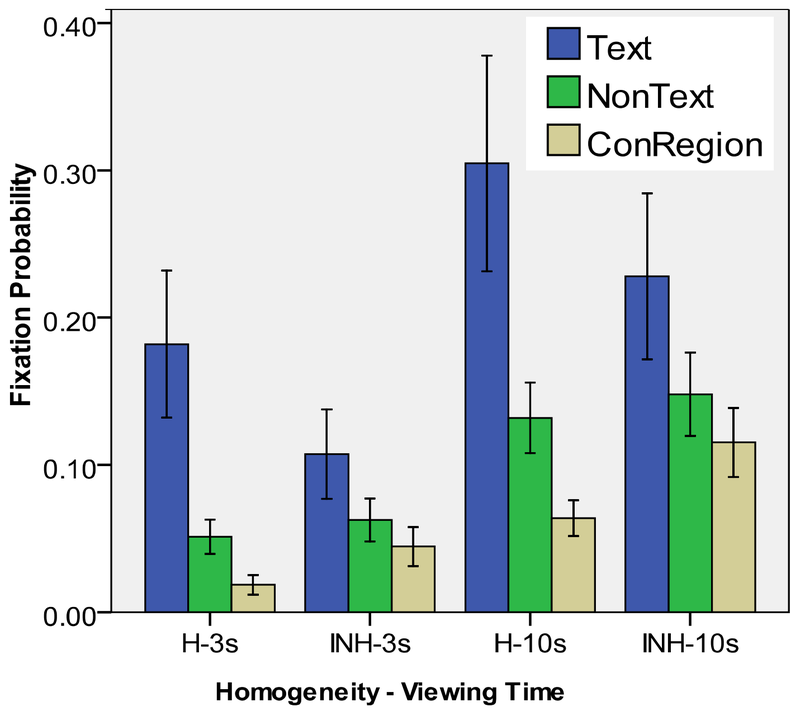
Experiment 2: Erased Text – Effect of **Expected Locations**



- Remove text from objects by filling surface with background color
- The typical locations of text still matter even when they do not contain any text.
- This result indicates that part of the attractiveness of texts derives from their expected locations.

Experiment 3: Unconstrained Text – Effect of the **Unique Visual Features of Texts**

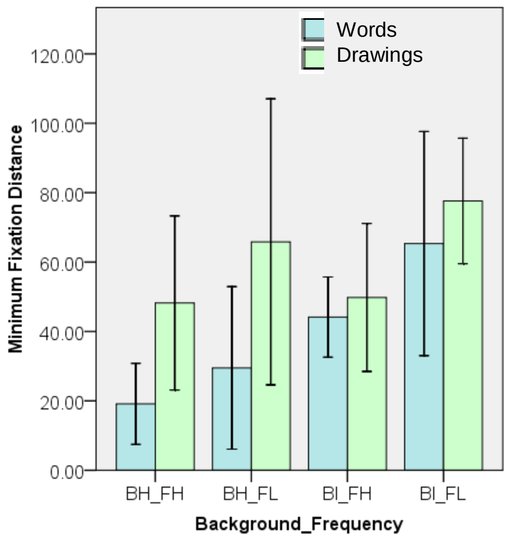


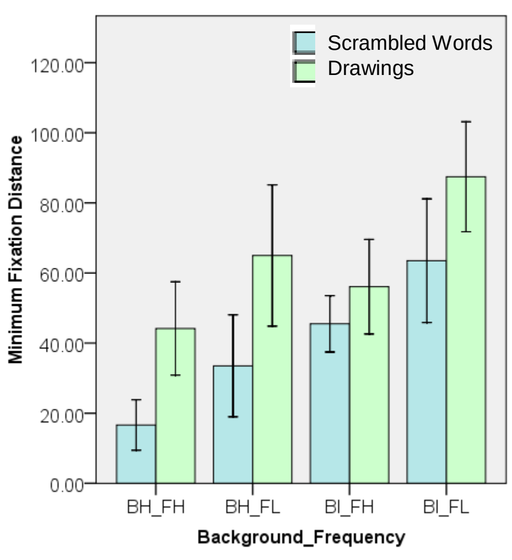


- Place text on **h**omogeneous (UncText H, fully visible) or **inh**omogeneous (UncText INH, degraded variants) backgrounds.
- For UncText INH, the fixation probability was still significantly higher, but the difference was not as large as for UncText H.

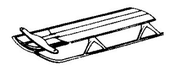
Are Chinese Texts Attractive to Non-Chinese Speakers? Does informativeness Influence Text Attraction?

Experiment 4: **Unconstrained Texts and Drawings**



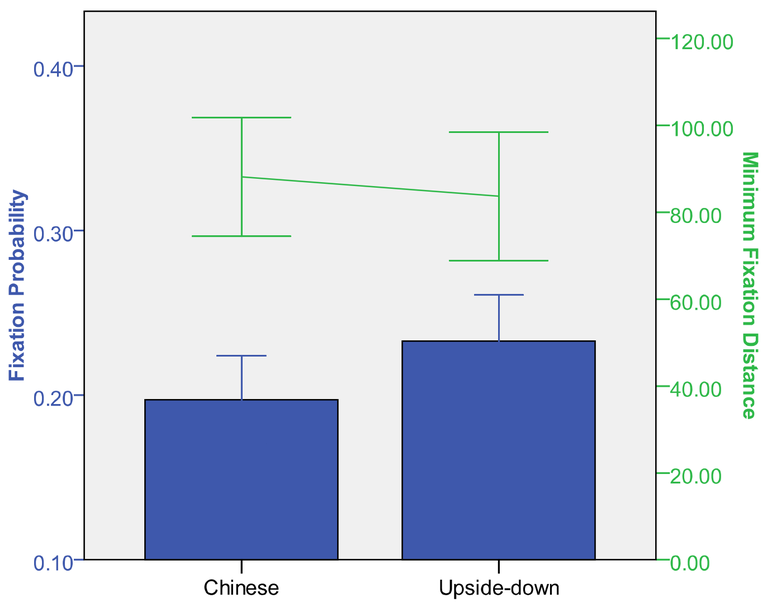


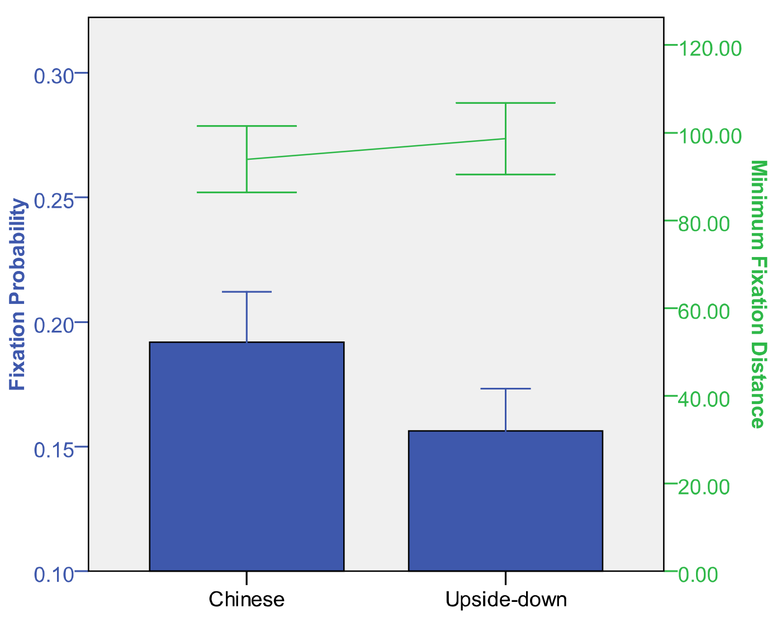
- Texts
  - Regular Words
    - High Frequency (car)
    - Low Frequency (sled)
  - Scrambled Words
    - High Frequency (acr)
    - Low Frequency (dsle)
- Object Drawings
  - High/ Low Frequency



- Background
  - Homogeneous
  - Inhomogeneous
- Regular words are more attractive than drawings for HB_HF and HB_LF, and scrambled words are more attractive than drawings for HB_HF and IB_LF.

Experiment 5: **Upside-down and Chinese Text**





- Texts in Experiment 1 were either rotated to **upside-down** or replaced by **Chinese** texts.
- The stimuli were presented to **non-Chinese English** speakers and **Chinese** speakers.
- For English speakers, fixation probability of upside-down texts was higher than Chinese texts, $Fs(1; 14) > 34.98$, $ps < 0.001$. For Chinese speakers, the result is reversed compared to English speakers.
- The results suggest that viewers might have developed stronger text detectors for their native language during everyday life so that their attention is biased.

Discussion and Conclusions

- In Experiment 1, text objects were found more attractive but the effects were **not caused by typical saliency**.
- Experiment 2 suggested that **expected locations matter** and supports the factor of “contextual guidance” found by Torralba et al. (2006) even during scene viewing.
- Experiment 3 indicated that **the unique visual features of texts dominated** the attention allocation over high-level features.
- Experiment 4 resolved the possible confound of oddness of unconstrained texts and indicated that **texts are more attractive than drawings**.
- Experiment 5 found that **familiarity** influences attention allocation.

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