An Information Search Model Integrating Visual, Semantic and Memory Processes
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Model
Simulation of Scanpaths
3 processes: visual, semantic and memory. Each one generates a map.

\[ M_{\text{gen}} = \alpha_V M_{\text{vis}} + \alpha_S M_{\text{sem}} + \alpha_M M_{\text{mem}}, \]
\[ \alpha_V + \alpha_S + \alpha_M = 1 \]

\(\alpha_V, \alpha_S\) and \(\alpha_M\) are experimentally set.

Experimental Data Collection
40 words, semantically spread on the display.
Spatially close = semantically close.
18 different user’s search goals.
Example: Find the biggest animal.
2 experiments:
Visual features = size  Visual features = color
Linear from 13 to 19  Bimodal: red or black
43 participants  29 participants
SR research EyeLink II eye tracker.

Examples: Find the small musical instrument (left) Find the biggest animal (right)

Visual Part
Tend to prefer local or highly salient regions.
- Visual Acuity:
  Maximal resolution near current fixation.
  Resolution decreasing with eccentricity.
- Pseudo Saliency Map:
  Saillant features: color or large font size.

Semantic Part
Tend to prefer current region if fixated word if relevant wrt goal.
Tend to avoid current region otherwise.
Semantic similarity based on LSA [2].

Memory Part
Tend to avoid regions already seen.
Variable Memory Model [1]:
2 parameters:
- \(\theta\) probability of encoding
- \(\phi\) probability of recovering information

When an item is attended, the location of that item could be encoded by the model, or not, depending of the encoding probability \(\theta\).
The second parameter, \(\phi\), simulates a forgetting mechanism.

Comparisons between Model and Human Scanpaths
We compared the last 6 maps seen by the participants, once they were well aware of the task and the semantic organization of words on the display with the model.

Example of a model simulation: Find the biggest animal.

Estimation of parameters with variables: number of words before the target and rate of progressive saccades.
The most important component is the memory part.
With these values we have a good fit on the following distributions for both experimental dataset color and size.

Visual features = size  Visual features = color

References