Alpscarf

Augmenting Scarf Plots for Exploring Temporal Gaze Patterns

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Motivation

In eye tracking studies, researchers may be interested in how gaze moves among different regions of the stimuli. These regions are called Area of Interest (AOI). A reading study, as shown on the right, may define one AOI for each paragraph in the reading text.

Researchers might be interested in finding temporal patterns of AOI visits:

- What are the reading strategies? Do study participants read the text sequentially or jump to different sections out of sequence?
- How do participants read and re-read individual sections?

Visit patterns are visualized as scarf plots or transition matrices. However, when there are more than 10 AOIs, these visualizations become ineffective.
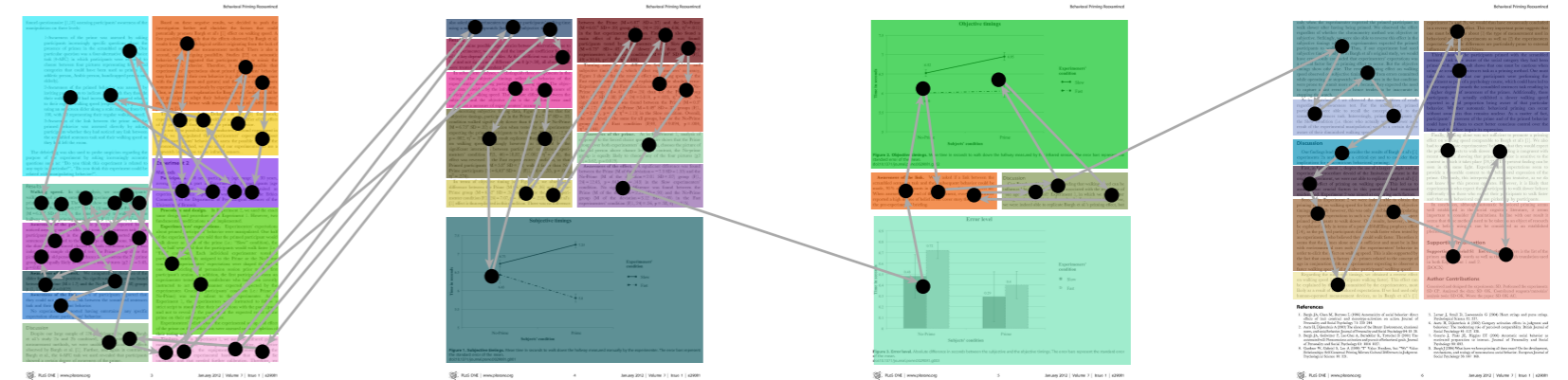
Four pages of the article used in a reading study. Each paragraph is an AOI. Gaze transitions across paragraphs are shown as arrows and dots.

A scarf plot shows the gaze transitions among AOIs (denoted by a distinct color). It is difficult to discern temporal patterns of AOI visits.

Visualization

We visualize temporal patterns by augmenting scarf plots with mountains and valleys.

Mountains visualize if AOI visits conform to an expected order (e.g., the order of section appearance in an article). Mountains are symmetrical; the peak indicates the middle of such sequence-conformity behavior.

Color schemes indicate hierarchical structures of the AOIs. Paragraph AOIs of the same section are shown as shades of same color, with the luminance ordered by paragraph appearance.
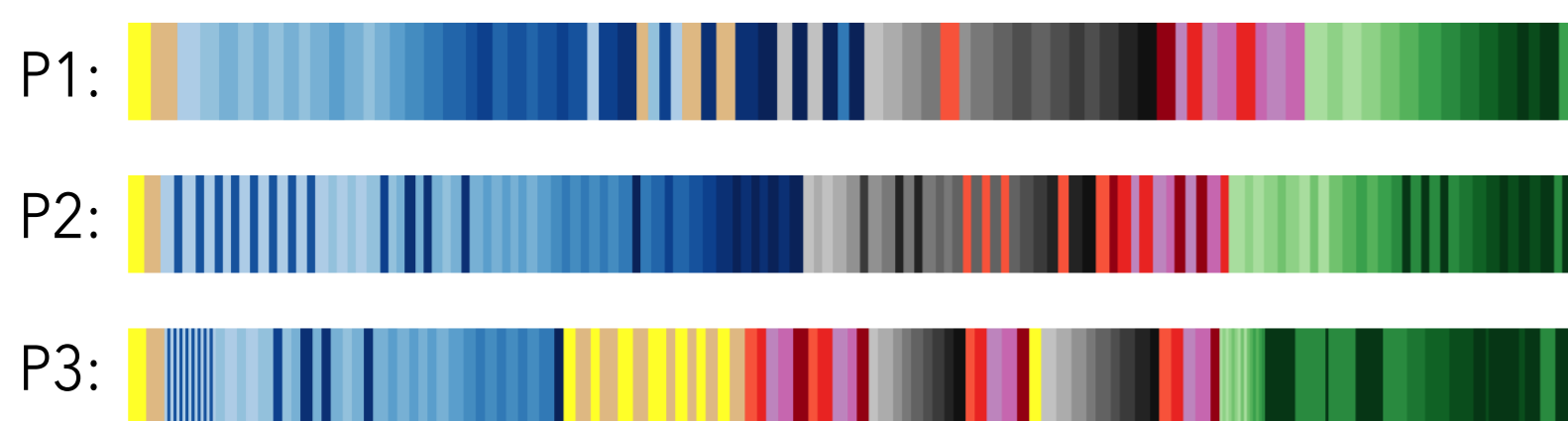
Valleys indicate the occurrence of visiting patterns; for instance, reading paragraph A, B, and A again. The horizontal length of the valley corresponds to the duration of such re-visiting behavior.
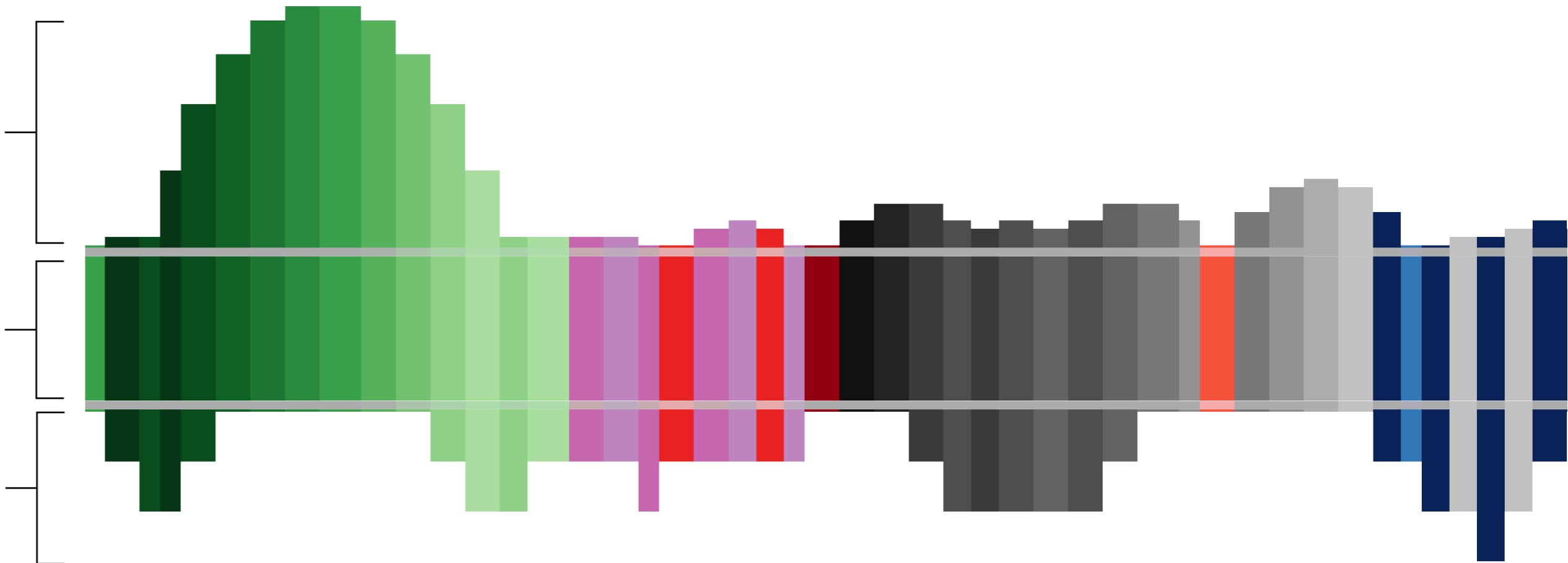
Example

We analyze reading patterns for three participants.

Scarf plots:

P1:

P2:

P3:

❶ P1 and P2 seem to have similar reading pattern: yellow → blue → gray → red → green
At a glance, the green region of P1 and P2 looks somewhat similar in terms of color gradation: P1:   P2:

❷ Some paragraphs seem to be re-read, shown by the alternating colors such as   .

Alpscarfs:

❶ While P1 and P2 seem to share similar reading order, P2 reads less sequential and exhibits more re-reading behaviors than P1.

P1:

P2:
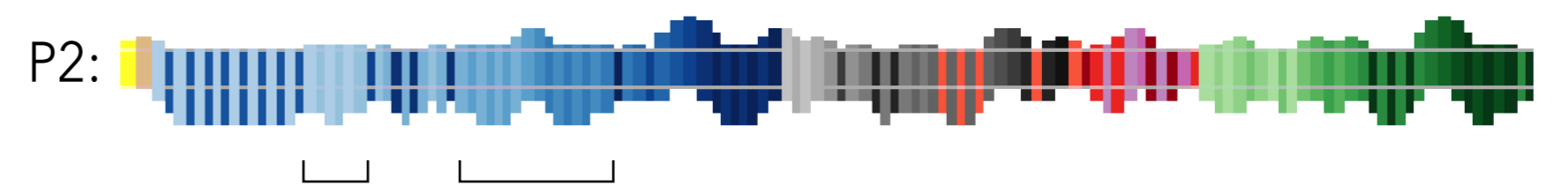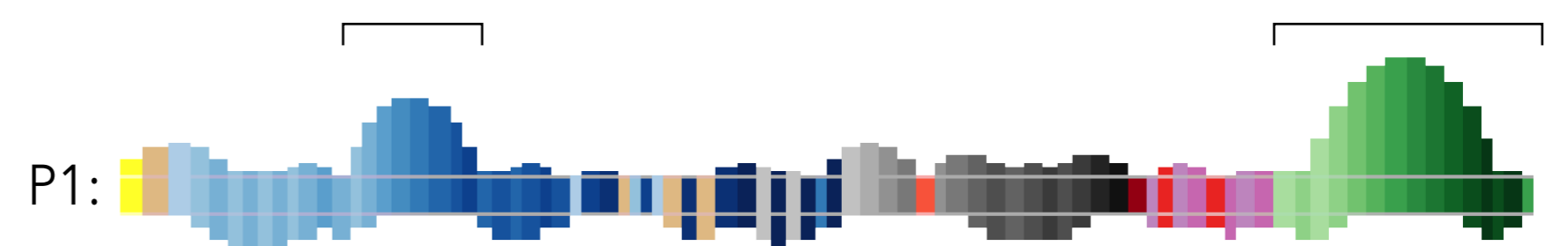
❷ Re-reading in the AOIs with similar colors can be easily spotted with valleys.

Mountains reveal sequential reading patterns that were unapparent before.

P3:

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