The Effect of Visual Long-Term Memory on Eye Movements over Time
Lisa F. Schwetlick, Hans A. Trukenbrod & Ralf Engbert

Introduction

- Familiarity with an image can affect eye movement measures:
  - in visual search: speed and performance benefit
  - in free viewing: fixation duration increases and saccade amplitudes decreases
- Capacity and persistence of visual long-term memory (VLTM) is robust: images stay “familiar” over long periods
- The effects of VLTM on eye movement have only been investigated on short time scales (seconds or minutes; repeated presentation within the same session)
- Do these image familiarity effects on eye movement transfer to longer time scales?

Method

- We present a series of 3 experiments which varied the time between repetitions:
  - Experiment 1: 32 participants viewed images in 3 sessions with several days between sessions
  - Experiment 2: 30 participants viewed images in 3 sessions with session 1 and 2 on the same day and session 3 on the next day
  - Experiment 3: 32 participants viewed images in 1 session
- Data were recorded with an Eyelink 1000 Eyetracker (SR Research)
- Images could be unfamiliar, familiar or semantically familiar
- We generated a new image set of 188 pairs of similar images
- Session 3 in Experiment 1 and 2 employed a gaze contingent viewing paradigm (periphery appears scrollable) to investigate memory-driven behavior in the absence of peripheral information

Results: Regular Viewing

- Fixation Duration: Statistically we were not able to replicate the prolongation of fixation durations for the second viewing.
- Saccade Amplitude: Statistically we were not able to replicate the reduction of saccade amplitudes for the second viewing.
- Distance to Center: Observers showed a stronger tendency to fixate the center during the second viewing of an image.

Results: Gaze Contingent Viewing

- Fixation Duration: In the absence of peripheral information fixation duration increases slightly, but not significantly.
- Saccade Amplitude: We found no significant change to saccade amplitudes depending on image familiarity.
- Distance to Center: The tendency to fixate near the image center becomes less the more familiar the image.

Results: Recognition

- Participation showed the expected proficiency in recognizing images.
- The absence or reduction of the expected effect is therefore not due to a participant’s failure to recognize the images.

Conclusions

- Scene exploration is primarily driven by the current visual input and only weakly modulated by VLTM from previous days, or even VLTM from hours and minutes ago.
- Even in the absence of peripheral image information we find evidence for only very limited influence of VLTM on eye movement measures.
- Possible caveats are the new image material and the introduction of the “similar” condition into the experimental design.
- Take Home Message: The previously reported effect of familiarity on eye movement seems to be either smaller or more volatile than we expected.

References & Acknowledgements

Conclusions.

Acknowledgments:
- This work was supported by grants from Deutsche Forschungsgemeinschaft to the collaborative research center SFB 1294 project B05.

Appendix A.
- Table of statistical analyses and results.

Appendix B.
- Additional figures and tables.