Scan patterns when viewing natural scenes: Emotion, complexity, and repetition

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Introduction

Experiment 1

Experiment 2

General Discussion

Goal

- To provide a qualitative and quantitative description of scanning behavior.
- Elucidate how perceptual and memorial factors affect eye movements when viewing affective pictures.

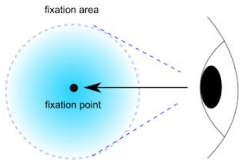
Eye Movement

Measurements

Eye Movements

- Periods of repose (Fixations)
  Visual fixation is the maintaining of the visual gaze on a single location.

- Rapid movement (Saccades)
  When participants were asked to see natural scenes, there were found to have **longer fixation** durations as well as **greater saccade lengths**.



Fixation Point

Saccades

References: https://medium.com/swlh/a-framework-for-speed-reading-6c9a999df226

Measurements

- **Number of discrete fixations**
- **The total scan path**

  - These two indices characterize the amount and breadth of information intake from a visual array.

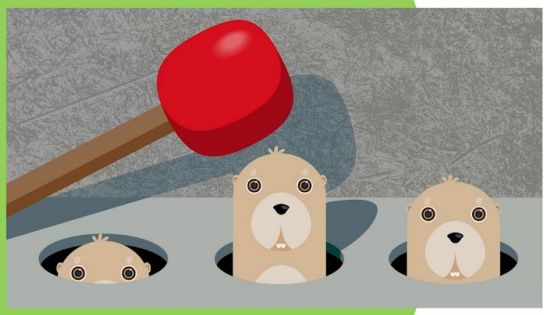
  - Emotional pictures would prompt a greater number of fixations than neutral pictures.

Neutral Picture

Emotional Picture

Example

whack-a-mole



https://www.robleon.com/blog/2018/12/10/whack-a-mole-tech

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Emotional Picture

https://www.telegraph.co.uk/world-cup/2018/07/15/france-vs-croatia-world-cup-final-2018-live-score-latest-updates/

Neutral Picture

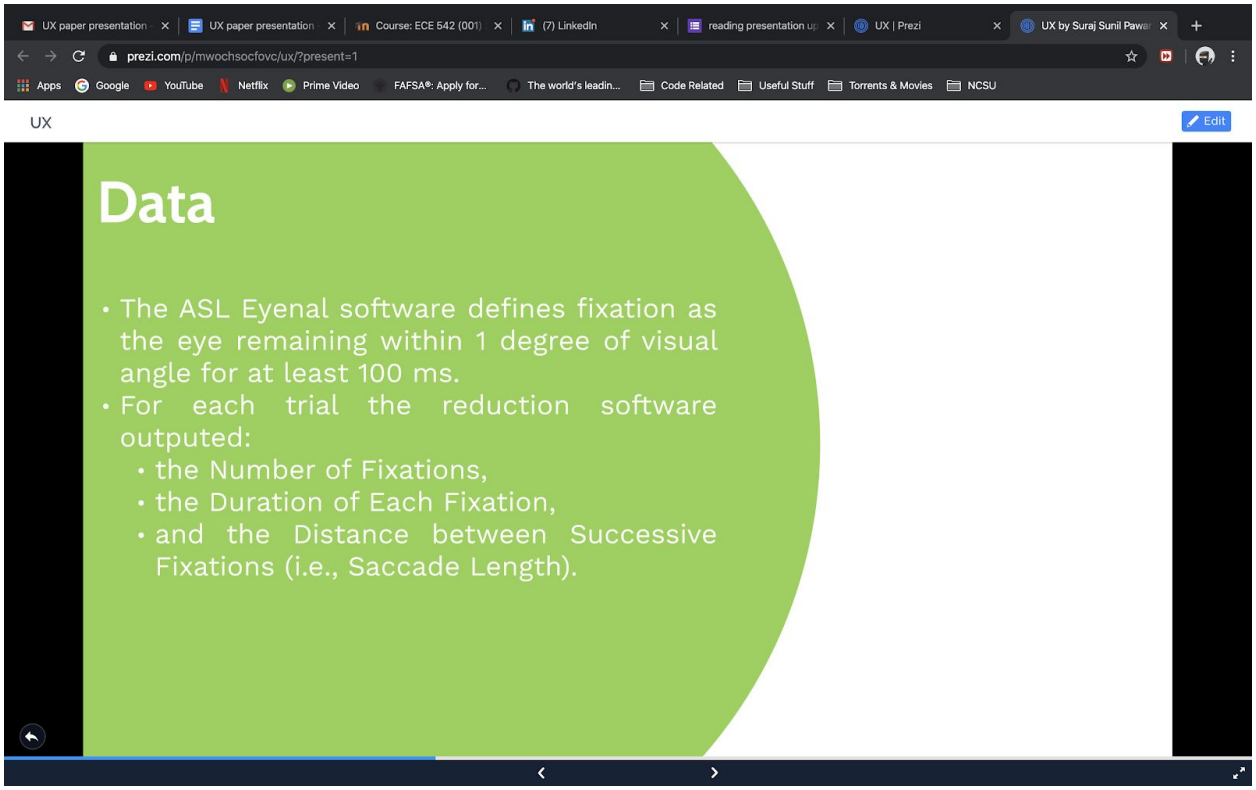
https://en.wikipedia.org/wiki/Mona_Lisa

Method

- There were 13 male and 11 female participants.
- The stimuli were 192 color photos: 64 pleasant, 64 neutral and 64 unpleasant.
- Half of them were simple figure-ground compositions and half depicted more complex scenes.
- Each trial consisted of a 6-s picture viewing period, and a 2.5-s inter-picture interval.
- Eye movements were recorded using an eye-tracker system, which consists of video camera and infrared light source.

Data

Results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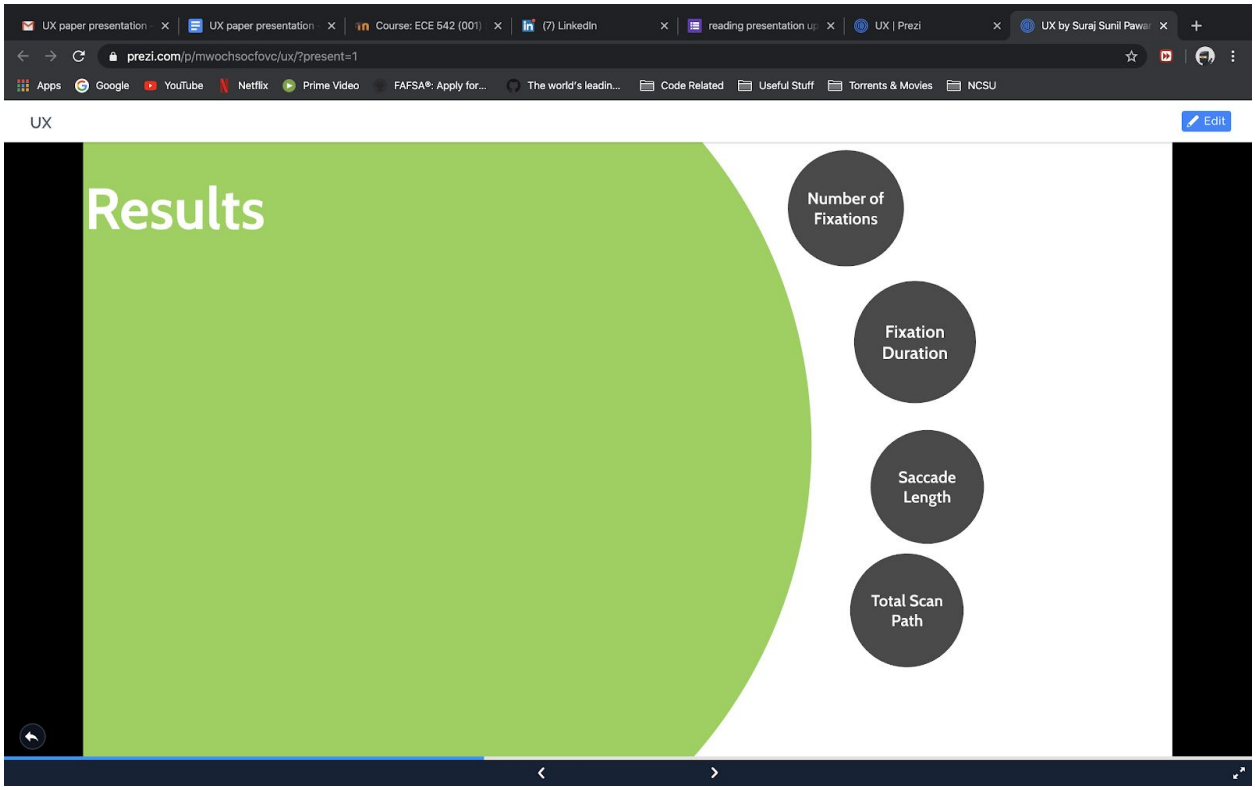
Data
• The ASL Eyenal software defines fixation as the eye remaining within 1 degree of visual angle for at least 100 ms.
• For each trial the reduction software outputed:
• the Number of Fixations,
• the Duration of Each Fixation,
• and the Distance between Successive Fixations (i.e., Saccade Length).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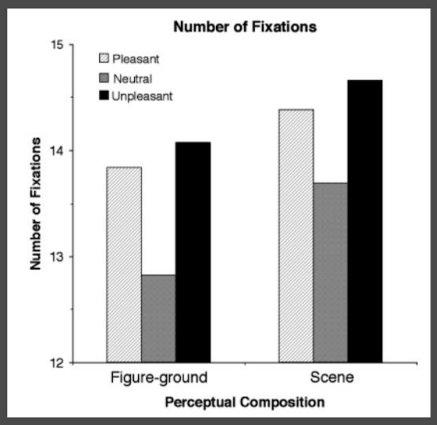
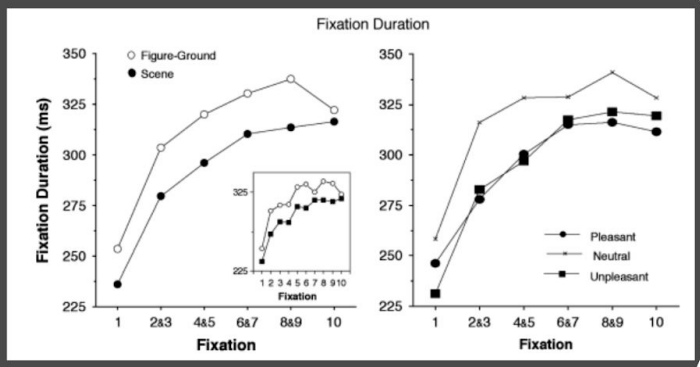
Results
Number of Fixations
Fixation Duration
Saccade Length
Total Scan Path

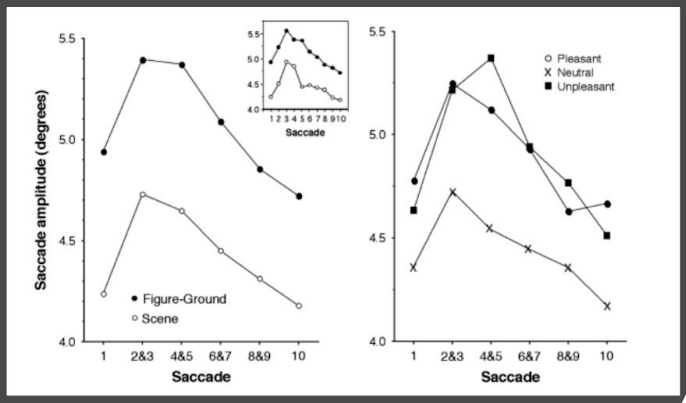
Number of Fixations



Fixation Duration



Saccade Length



Total Scan Path

	Hedonic content			
	Pleasant	Neutral	Unpleasant	Mean
Figure-ground	59.6 (2.3)	47.5 (2.9)	61.7 (2.0)	56.2 (2.3)
Scene	67.9 (2.3)	62.9 (2.3)	69.5 (2.2)	66.8 (2.1)
Mean	63.7 (2.2)	55.2 (2.5)	65.6 (2.0)	

Note. Standard errors are in parentheses.

Method

- There were 27 male and 37 female participants.
- The stimuli were 72 color photos: 36 emotional (18 pleasant,18 unpleasant) and 36 neutral.
- Half of them were simple figure-ground compositions and half depicted more complex scenes.
- Of the 18 pictures of each content, 6 were presented once (novel), 6 were presented 4 times in a row (massed repetition), and 6 were presented 4 times distributed across the study (distributed repetition), resulting in 108 total trials.
- Each trial consisted of a 6-s picture viewing period, and a 10–15 s inter-picture interval.
- Eye movements was recorded as in Experiment 1.

Results

Results

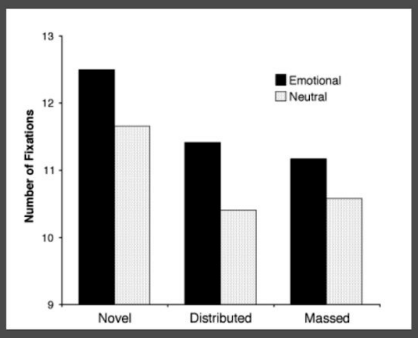
Number of Fixation

Fixation Duration

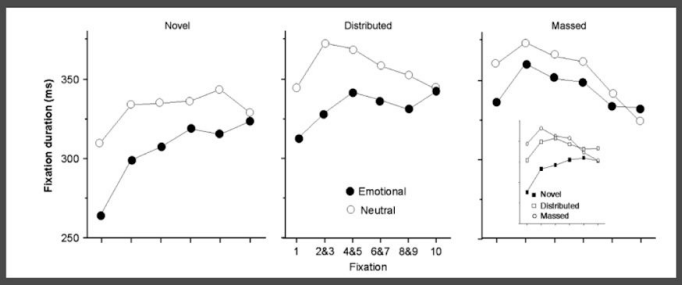
Saccade Length

Total Scan Path

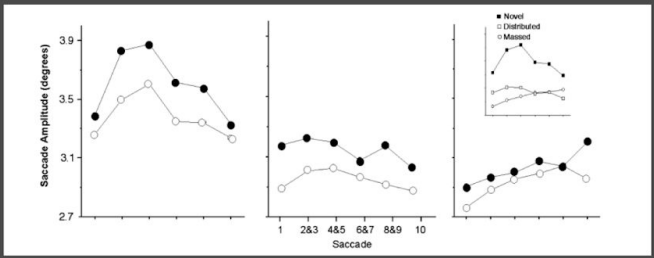
Number of Fixations

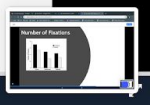


Fixation Duration



Saccade Length





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Total Scan Path

Table 2. *Total Scan Path (in Degrees) for Pictures Viewed in Experiment 2*

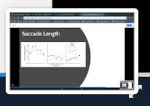
	Emotional	Neutral	Mean
Novel	41.3 (1.0)	36.3 (1.0)	38.9 (0.9)
Distributed repetition	32.0 (0.9)	28.0 (0.9)	30.3 (0.8)
Massed repetition	30.6 (0.8)	28.2 (0.9)	29.5 (0.8)
Mean	34.9 (0.8)	30.9 (0.9)	

Note. Standard errors are in parentheses.

General Discussion

- Emotional pictures prompted a greater number of discrete fixations (of briefer duration) and a longer total scan path of a visual array.
- Saccade length increases as picture size increases especially with images with more informative content which requires longer visual array.
- In **Experiment 2**, novel picture viewing elicited a greater number of fixations and longer scan paths than when viewing repeated pictures.
- For repeated pictures, initial fixation durations were generally long and saccade lengths short, compared to when viewing novel pictures.
- Eye movements and scan patterns reflect differences in emotionality, complexity, and memory when perceiving natural scenes, and therefore comprise an important tool in the study of emotional visual perception.

Reading Reactions



Reading Reactions

Josh Bhupendra Dhakad ▸ UX Class @ NCSU

#readingreactions #attention

Bradley, Margaret M., et al. "Scan patterns when viewing natural scenes: Emotion, complexity, and repetition." Psychophysiology 48.11 (2011): 1544-1553.

The paper discusses how eye movement is affected by the type of visual stimulus as well as by its semantic relevance. The author talks about the results of two experiments conducted, and how emotion plays a major role in influencing fixations and scan patterns. I felt most of the insights extracted from data towards the study of emotional visual perception as highlighted by the paper was quite obvious. Such as emotional pictures yield disparate but longer fixation when compared with neutral pictures. I found the experiment quite interesting. Although I was not aware of some of the psychophysiological terms, I enjoyed the reading. Also,the mathematical conclusions were a little hard to understand, but overall, it was an excellent read!

Jeel Ghanshyam Sukhadiya ▸ Readings

#ReadingReaction #Attention

Bradley, Margaret M., et al. "Scan patterns when viewing natural scenes: Emotion, complexity, and repetition." Psychophysiology 48.11 (2011): 1544-1553.
This paper is a good read, it has two experiments in which the eye movements are assessed and effects of hedonic content, perceptual composition, and repetitions on these movements are also assessed.
In the first experiment,people were shown emotional and neutral images for a 6 second viewing period. The emotional images consisted of both emotionally pleasant/unpleasant or complex images and the neutral images were something like figure-ground compositions images. The paper points out that when users were exposed to emotional/complex images they provide more fixations and high attention in simple words. Complex images with some emotion always attributes to high attention as there are things which are meaningful and to be understood as compared to neutral images and hence more attention is required.
In the second experiment, the people are provided with both novel and repeated images , again it was found out that novel images grabbed more attention as compared to the repeated ones, as the repeated ones are already in the memory somewhere.
But i had one doubt and which was difficult to understand was that what if the novel pictures in the second experiment were neutral images, will the result obtained above will be still applicable to the neutral novel images as compared to repeated images.

Thank You

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