

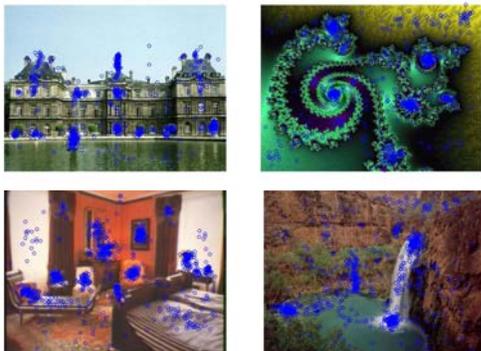
Interesting Locations in Natural Scenes Draw Eye Movements

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Introduction

Parkhurst and Niebur (2003) found a high degree of consistency in participants' selections of the 5 most interesting points in various scenes.



We tracked a different group of participants eye movements as they free viewed the same images. Then, we determined the correlation between interest points, fixation locations and image saliency, which was determined by a computation model of stimulus-driven attention (Itti, Koch & Niebur, 1998).

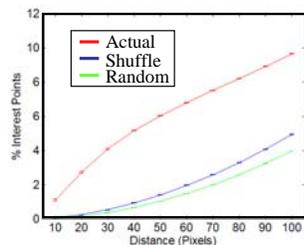
Method

Eye movements were recorded from 21 Iowa State University undergraduates. Each participant viewed 100 images in a random order. Images were displayed for 5 seconds and subtended 30.4° x 24.2° visual angle.

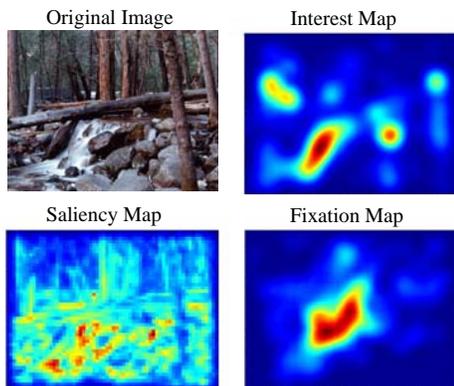
802 different individuals selected the 5 points in each of 15 – 75 scenes, from the same set, that they found most interesting. They participated via the internet.

Results

Clustering of Interest Points. The distance of each interest point to all other interest points in the same image. Shuffle: Each point compared to all points on a different image. Random: Each point compared to a randomly selected location.



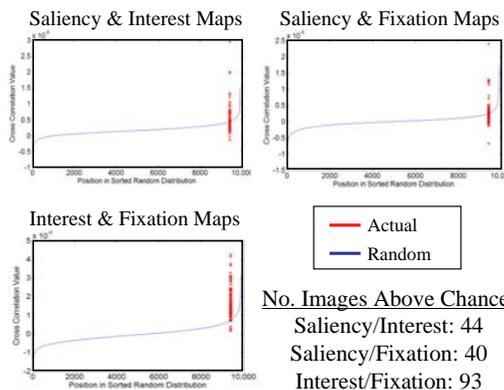
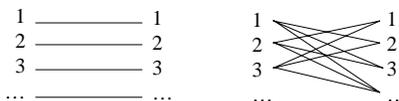
Creation of Saliency, Interest and Fixation Maps. Saliency maps: Model developed by Itti et al. (1998). Interest and saliency maps: A Gaussian blob was placed around each interest point and fixation location, respectively.



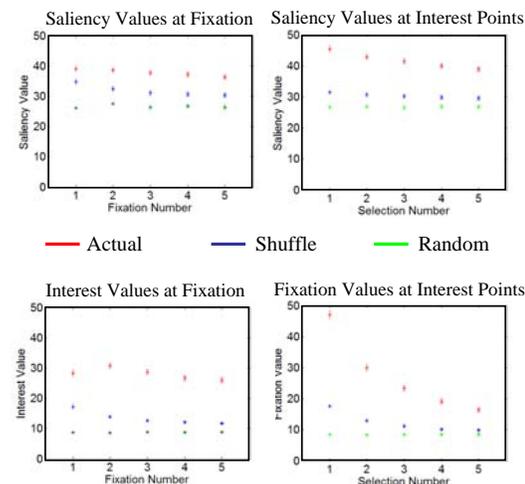
Convolution of Saliency, Interest and Fixation maps.

Corresponding pixels between two images were multiplied, and these values were summed. Actual values were compared to the 95% value of the random distribution to determine significance.

Actual Comparison Random Distribution



Saliency & Interest Point Values. Values of interest, saliency and fixation maps extracted at the x,y coordinates of the first five fixation, and all interest point, locations. Shuffle: Map values from each other image at the location of fixations or interest points of comparison image. Random: Map values from random x,y coordinates of comparison image.



Discussion

Participants fixated on salient regions above chance, replicating previous studies (e.g., Parkhurst, Law, & Niebur, 2002). Fixations were also highly correlated with regions labeled as interesting by our internet participants, even at very early fixations. Moreover, for some images, the interest map appeared to correlate better with participants' fixations than its saliency map. Overall, interest point selections between participants are not idiosyncratic, salient regions tend to be labeled as interesting, and subjectively defined interesting locations provide a very robust measure of where people fixate in natural scenes.

References

Itti, L., Koch, C., & Niebur, E. (1998). A model of saliency-based visual attention for rapid scene analysis. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 20, 1254-1259.
Parkhurst, D., Law, K., & Niebur, E. (2002). Modeling the role of visual saliency in the allocation of visual attention. *Vision Research*, 42, 107-123.
Parkhurst, D., & Niebur, E. (2003). *What could over 1000 internet users tell us about visual attention in natural scenes?* Talk presented at Vision Science Society, Sarasota, FL.