

Gender Differences in Visual Attention as Measured By Neuromorphic Saliency: What Women and Men Watch

Introduction

• Stimulus-driven models of visual attention have two well-known limitations: 1. Task demands redefine what parts of the stimulus are informative.

2. Models assume that individuals are identical in attention selection mechanisms.

• Complex tasks have revealed differences in patterns of eye movements among gender (Mueller, 2008).

• Here we quantify these differences using a listening task in complex natural scenes based on low-level visual features, using the Itti saliency model (Itti, 2004).

• We predict that saccades from men will more often hit salient targets than those from women, based on gender studies of eye contact and spatial ability (Baron-Cohen, 2002)

Experimental Design

• Full-HD videos were taken in outdoor settings of personal interviews with volunteers. Clips were selected with the intent to maximize the number of natural distractors.



• Videos (84 clips, 33 min. total) were presented 98 cm from the subject with a field of view of 54.8° x 32.7°.

• 34 subjects (15 male, 19 female) were instructed to "listen and watch the videos" and "answer questions based on the information in each video". They were also told they are not being eye tracked during the videos.

• The questions after each trial have a two-fold purpose: to confirm that the subject correctly performs the listening task and to motivate the eye-tracking procedure to the subject.

 Calibrations were done every 15 trials. The accuracy of tracking was confirmed post-experiment to 1°.

 What is she talking about?
 Distractor
 Distractor

 Distractor
 Distractor
 Distractor

 Distractor
 Distractor
 Distractor

Correct Answer Distractor Distractor Distractor Distractor Distractor Distractor Distractor

¹Neuroscience Graduate Program, ²Computer Science Department; University of Southern California

Annotations

• We manually annotated each video with the CSAIL VideoLabelMe toolbox to outline the speaker's face, as well as any other interesting objects.



• For the purpose of this analysis, we defined the region around the speaker's face as the *task-relevant area* (F) and outside areas as *task-irelevant* (NF).



Conclusions

A region-of-interest based analysis reveals significant gender differences related to face processing for a listening task.

Shen, John¹; Itti, Laurent^{1,2} partment; University of Southern California



The Itti saliency model is scored over the saccade targets of eye-traces (green, red circles).
 Other models, such as individual feature channels, saliency channels with faces (Cerf, 2009), and control models, are also compared.



Normalised saliency of saccade targets from male subjects vs. female subjects and a subjects and a subjects Female subjects Female subjects Random locations Relative saliency value ROC curves AUC scores AUC scores and a female

> Low-level feature models reveal significant differences in saccadic eye movements between men and women that may be explained by enhanced spatial processing. These differences apply only to saccades which are not task-relevant, suggesting that task constraints may hide individual variation in attentional selection.

An AUC score measures model correlation with saccade targets above correlations that occur from random locations (blue circles).
Significance for AUC difference is tested by a

permutation test; each permutation shuffles the gender of each subject and evaluates the difference in AUC scores between shuffled genders.

- The rank of the true difference among the shuffled differences gives the significance level.













Citations:

L. Itti. IEEE Transactions on Image Processing.13,10,1304-1318, (2004) S.C. Mueller,C.P.T. Jackson, R.W.Skelton. Behavioural Brain Research. 193,2,209-215,

S. Baron-Cohen. Trends in Cognitive Sciences. 6, 6, 248-254, (2002) S. Vassallo, S.L. Cooper, J.M. Douglas. Journal of Vision. 9, 3, 11, (2009) M. Cerf, E.P. Frady, C. Koch. Journal of Vision, 9, 12, 10, (2009)