

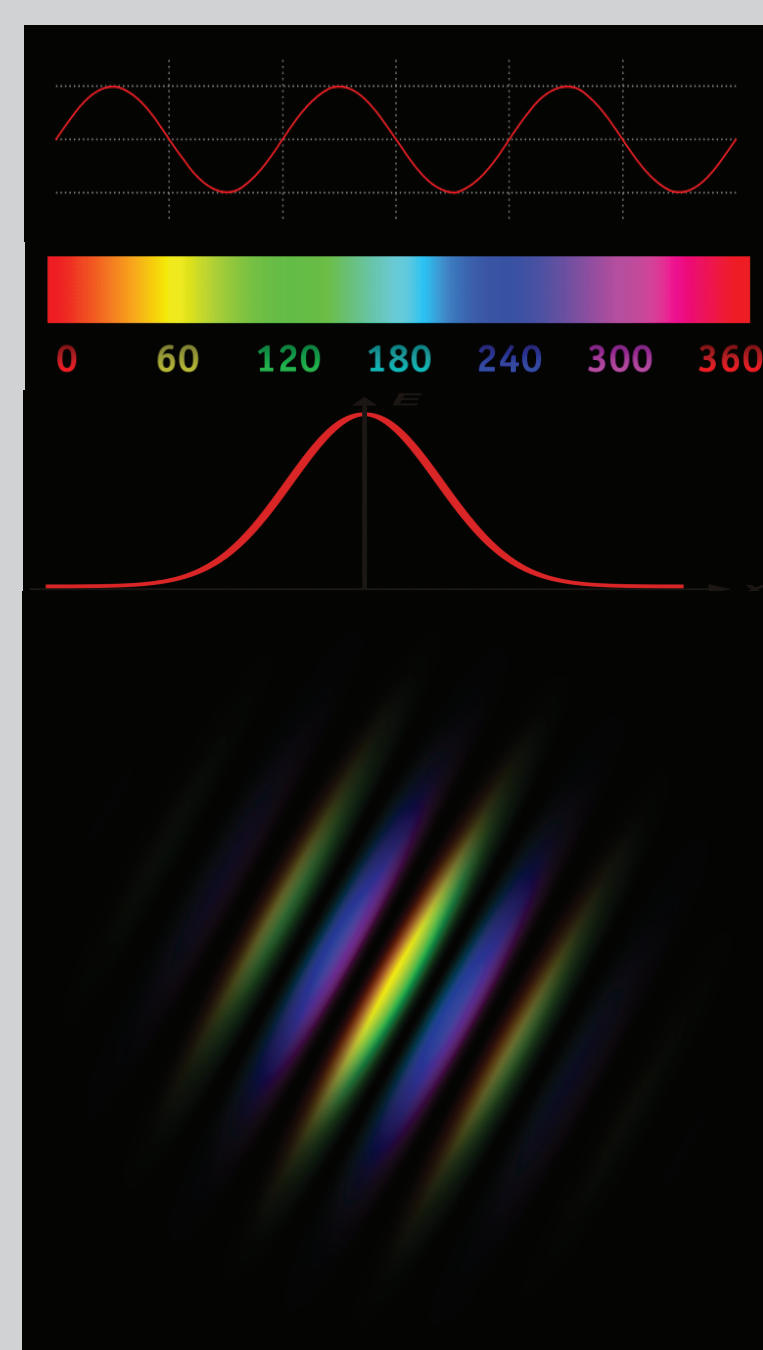
## 1. Introduction/Motivations

Several studies (Schoups, A. et al. 2001, Seitz, A. et al 2005) have shown that repeated exposure to visual stimuli can improve discrimination skills of observers.

What is a possible account for this acquisition of expertise? We address this question from a deployment of attention point of view. A demanding visual search paradigm was designed and administered to 5 subjects to look for improvement after 10 sessions.

We analyze the eye movements of the subjects to extract statistics that would elucidate the mechanisms that enable the development of expertise on the task.

## 2. Stimulus/Paradigm

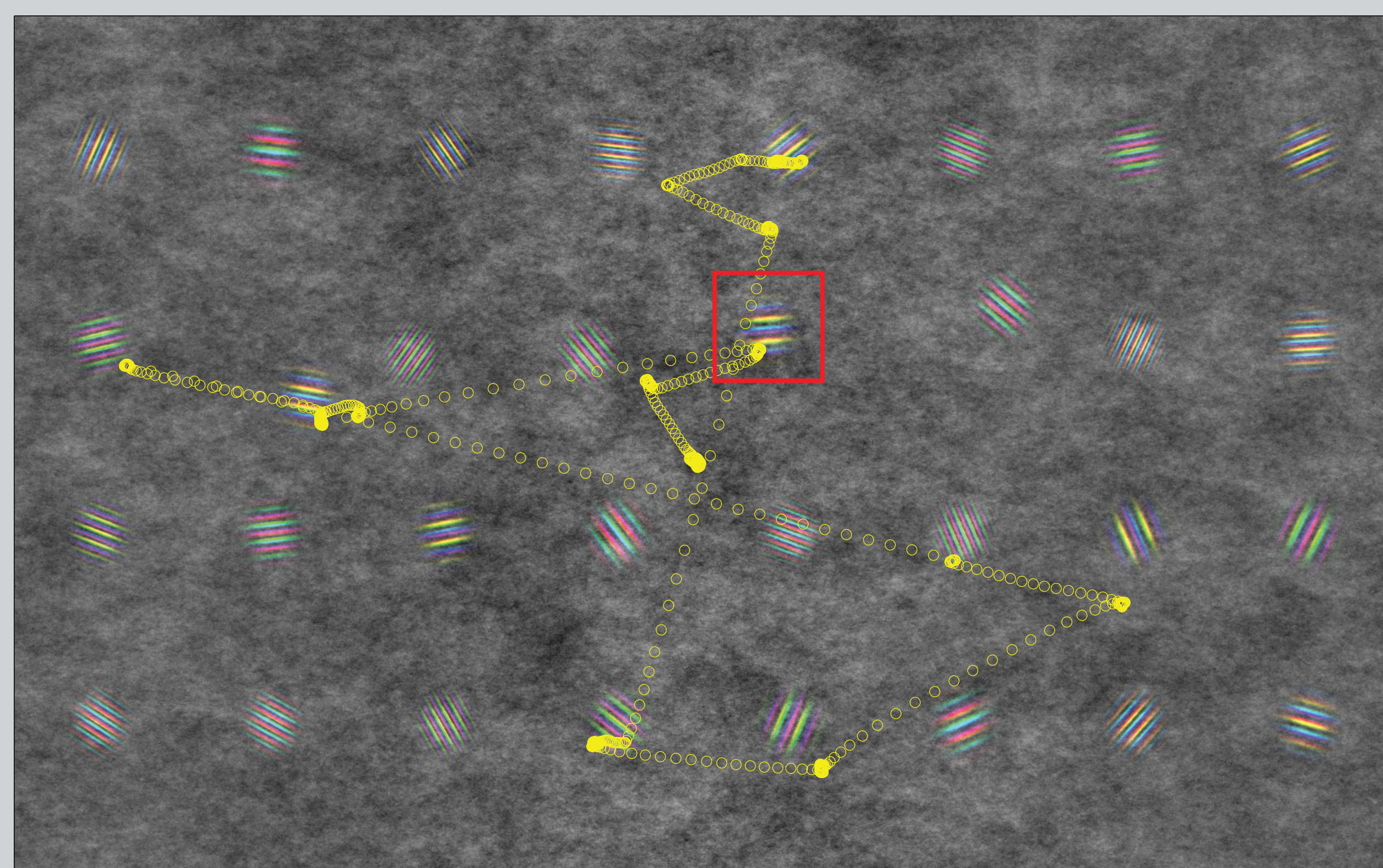


**-Stimuli-**  
Color Gabor patches were designed where the hues in HSV space are modulated by the sinusoid. The final gabor modulates the V values in HSV space to yield a color gabor patch. This stimuli is uniquely identified by a triple conjunction of frequency, orientation and hues.

**-Task-**  
Subjects perform 100 trials per session for 10 session. In each trial the target is shown for 2s followed by a search array consisting of 32 patches embedded in 1/f noise.

Subjects must find the target as quickly as possible and hit a key. The key press causes a number display to show up for 200ms followed by a user prompt to input the number corresponding to the location of the target.

## 3. Methods

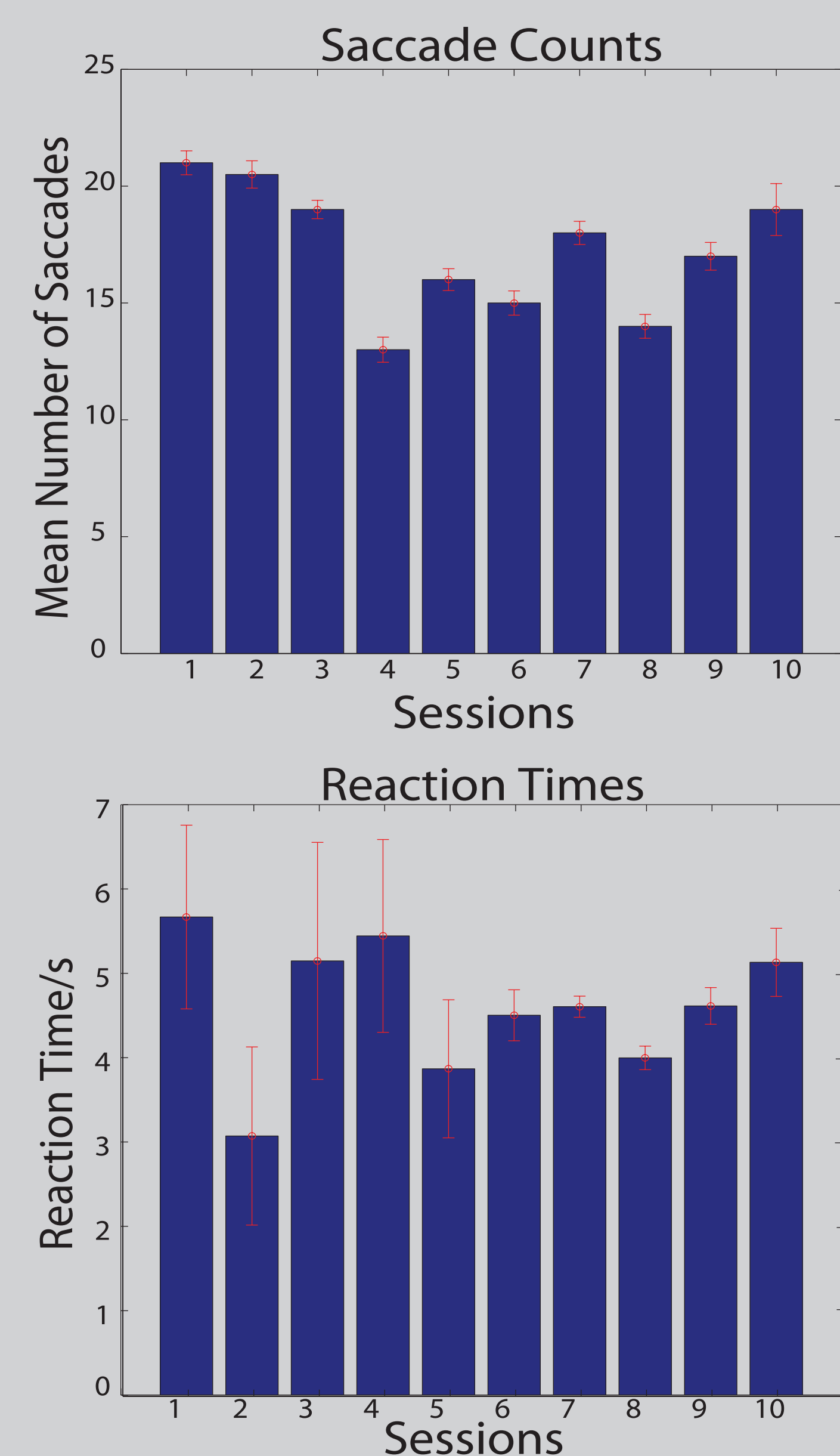


-Stimulus was displayed on a large 1920x1080 display

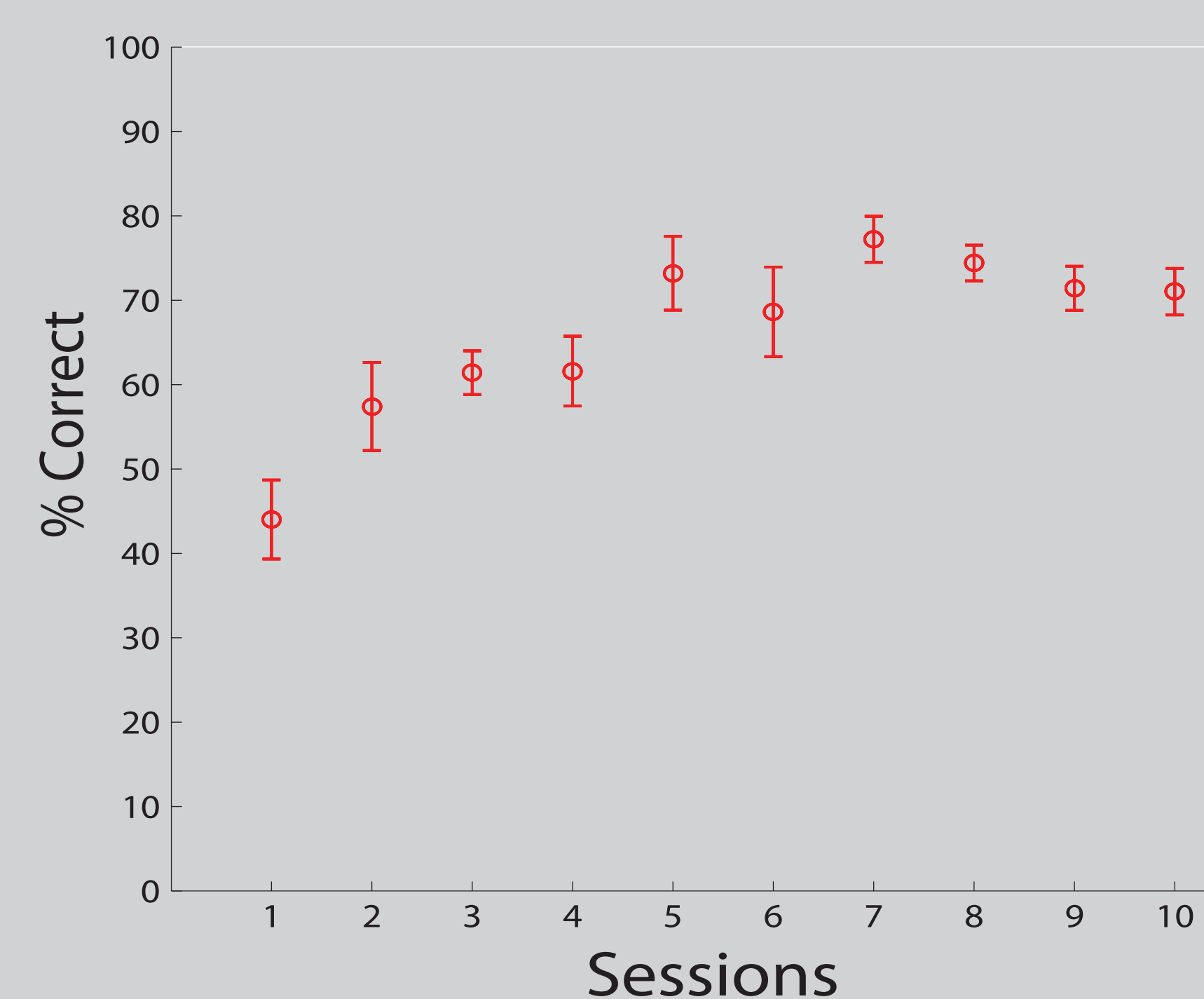
-5 subjects performed 10 sessions of 100 trials each on 10 consecutive days.

-ISCAN eyetracker was used to sample the eye positions of the subjects at 240 Hz.

## 4. Reaction time and Saccade counts



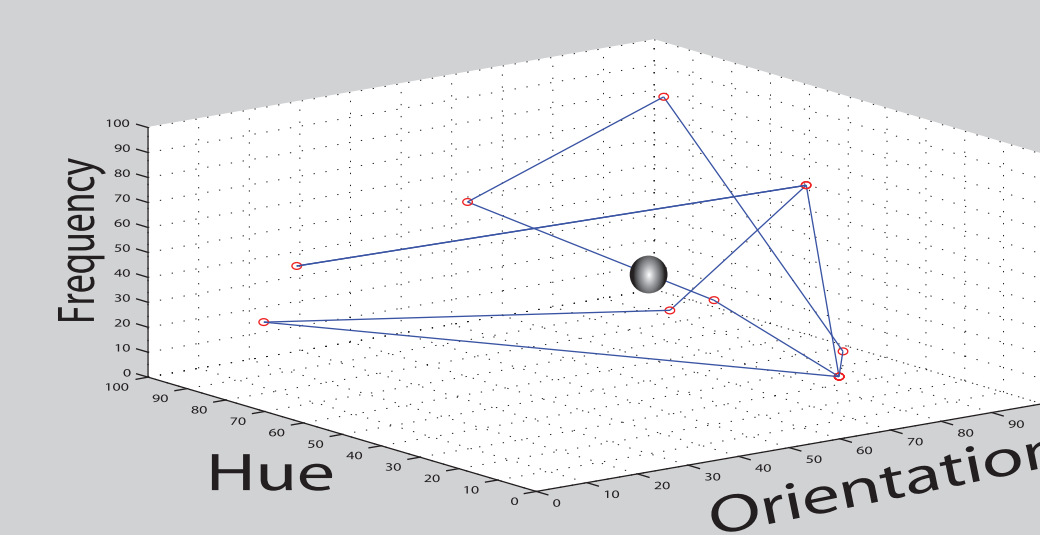
## 5. Performance Results



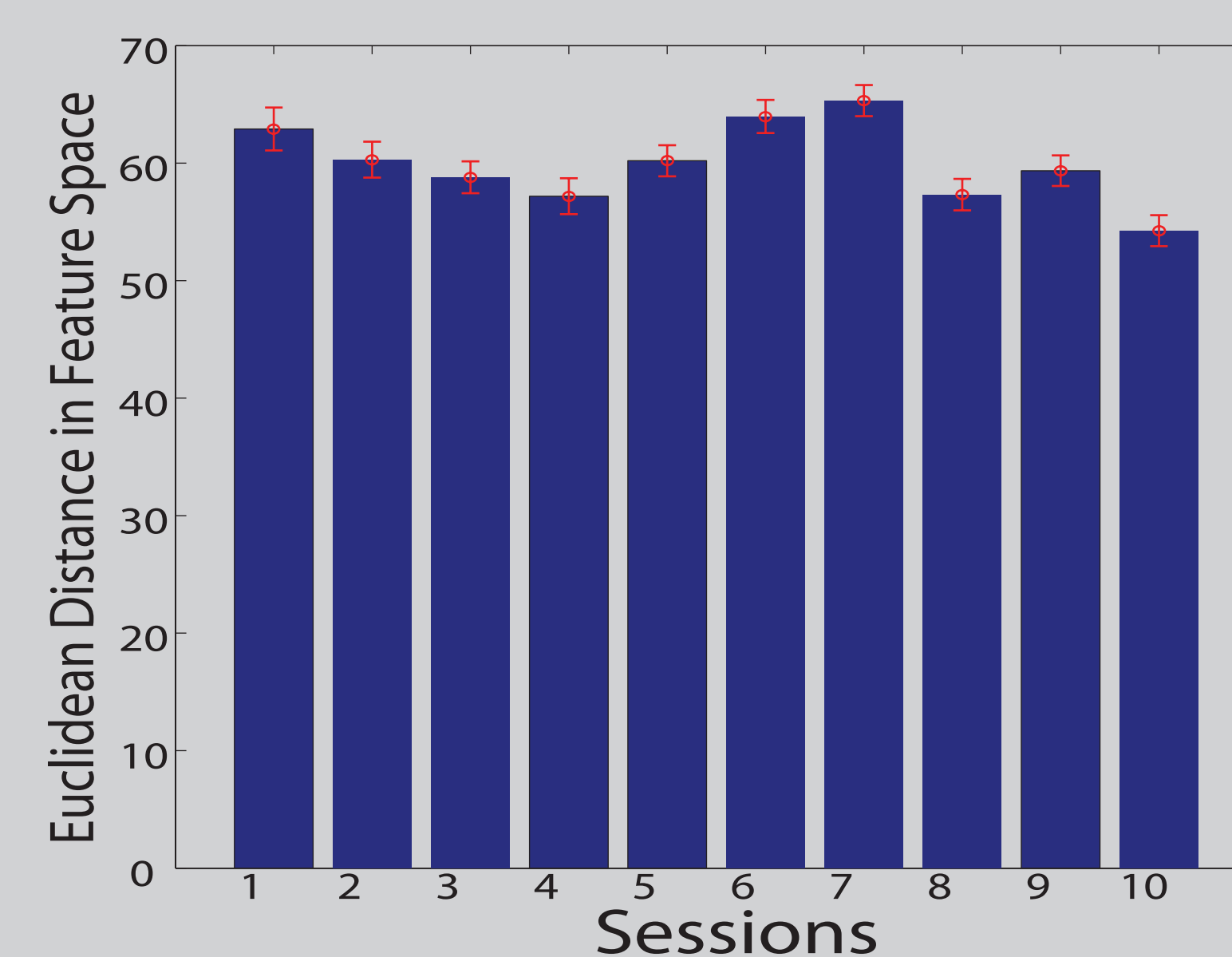
-All subjects showed significant improvement in identification of targets from one session to the next (one way ANOVA  $p < 10^{-5}$ )

-Therefore the task improved discrimination on this demanding conjunction search task where the target changed on each trial.

## 6. First Saccade Analysis

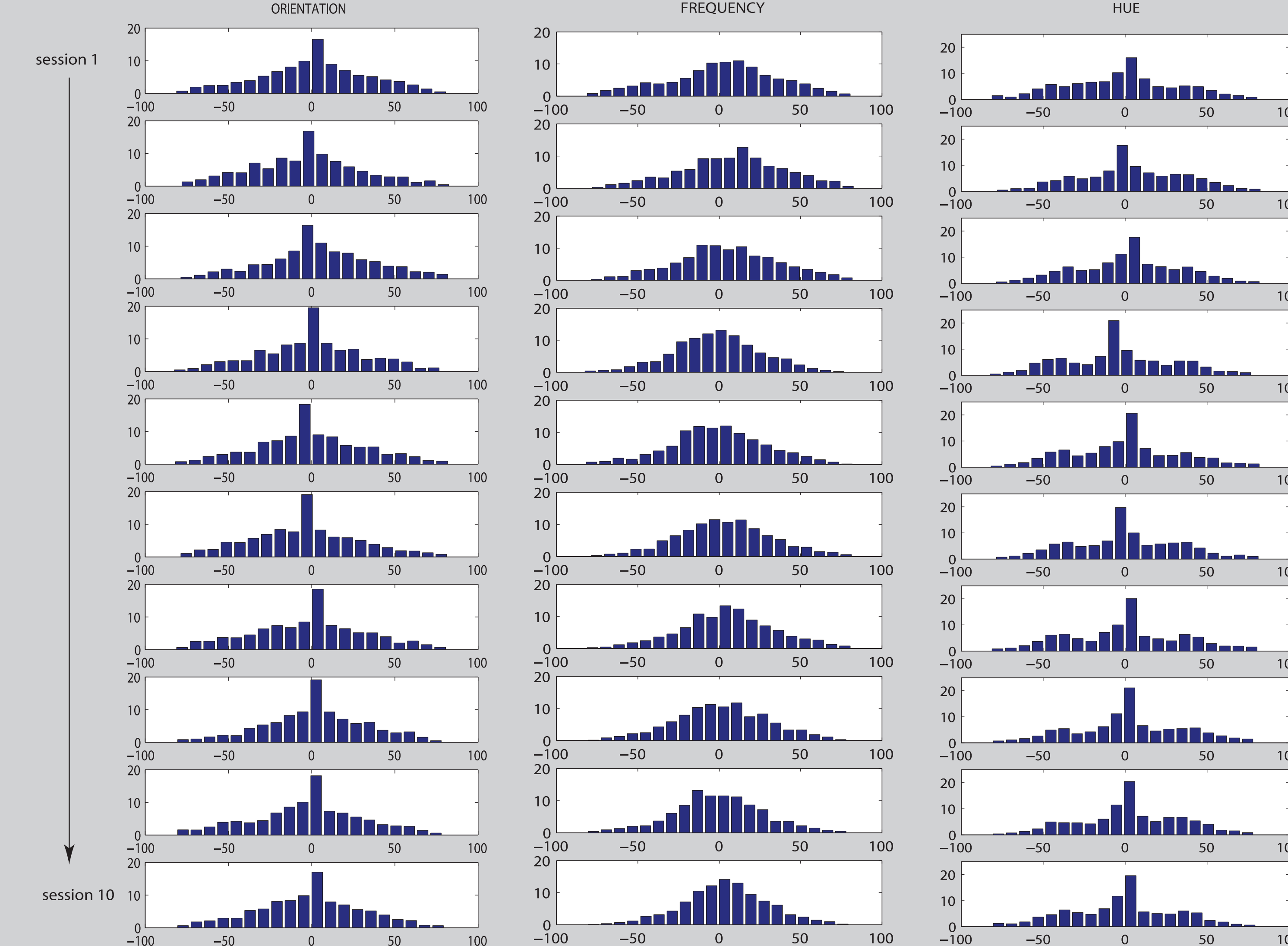


-Euclidean distances of the first saccade target from search target, in 3 dimensional feature space, were computed.



-A significant decrease in euclidean distance was observed from session 1 to session 10 ( $p < 0.05$ ) however a steady decrease from one session to the next was not observed.

## 7. Saccade distributions



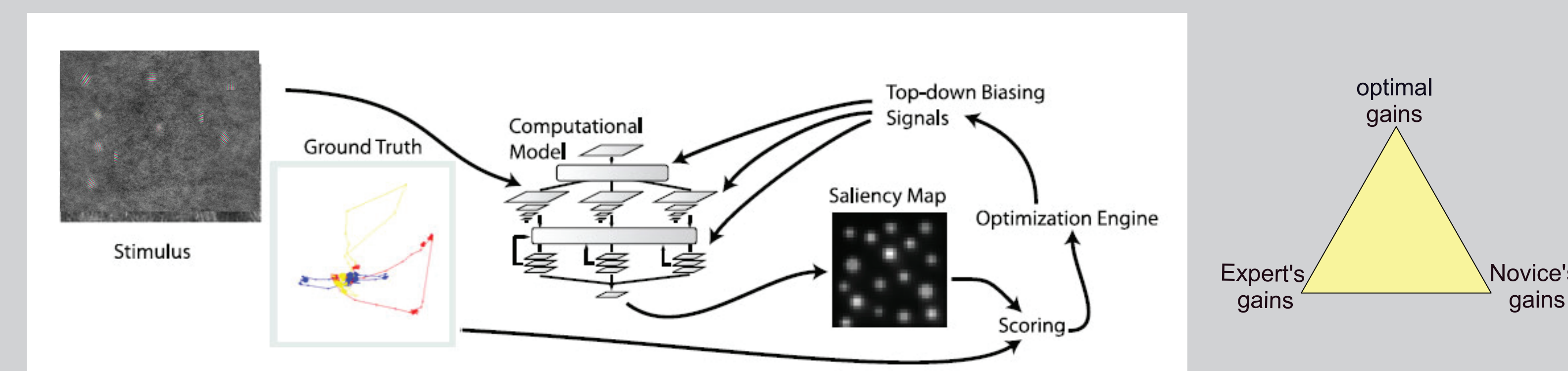
- Saccade distributions are plotted in feature dimension shown as a deviation from the target. A small sharpening effect around the target is seen for the frequency and orientation dimension.

## 7. Conclusions and Further work

-Subjects performing several trials on a novel conjunction search task show improvement in performance over 10 consecutive sessions

-Saccade distribution show a small sharpening in tuning and this is more pronounced for frequency and orientation

-The first saccade target is closer in feature space to the search target from session 1 to 10 but this drop is not consistent from session to session



-Further work involves the use of eye movements of novice and expert observers as ground truth to bias a computational model of attention (Itti & Koch 2001).

-Comparison of novice, expert and optimal gains (Navalpakkam & Itti 2007) would enable us to ascertain whether the acquisition of expertise is achieved through setting of appropriate gains.