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Inferring task based on eye movements: The living classifier

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Inferring task based on eye movements

Several studies, including Yarbus (1967), have found that various task instructions for viewing images influence visual behavior. This holds true for both experimenter driven and participant driven tasks.

Research has also shown that classifier technology is capable of determining the task that was being performed based on the individual's eye movements.

Typically classifier technology is designed to perform tasks humans are known to be cable of performing. However, little research has been done on the human ability, or lack thereof, to determine task based on eye movements.

Purpose

To determine to what extent humans are able to classify task performed when task was consistent (E1) and when task was switched (E2) based on recorded eye movements in the form of fixations, scanpaths, and dynamic videos.

Task:

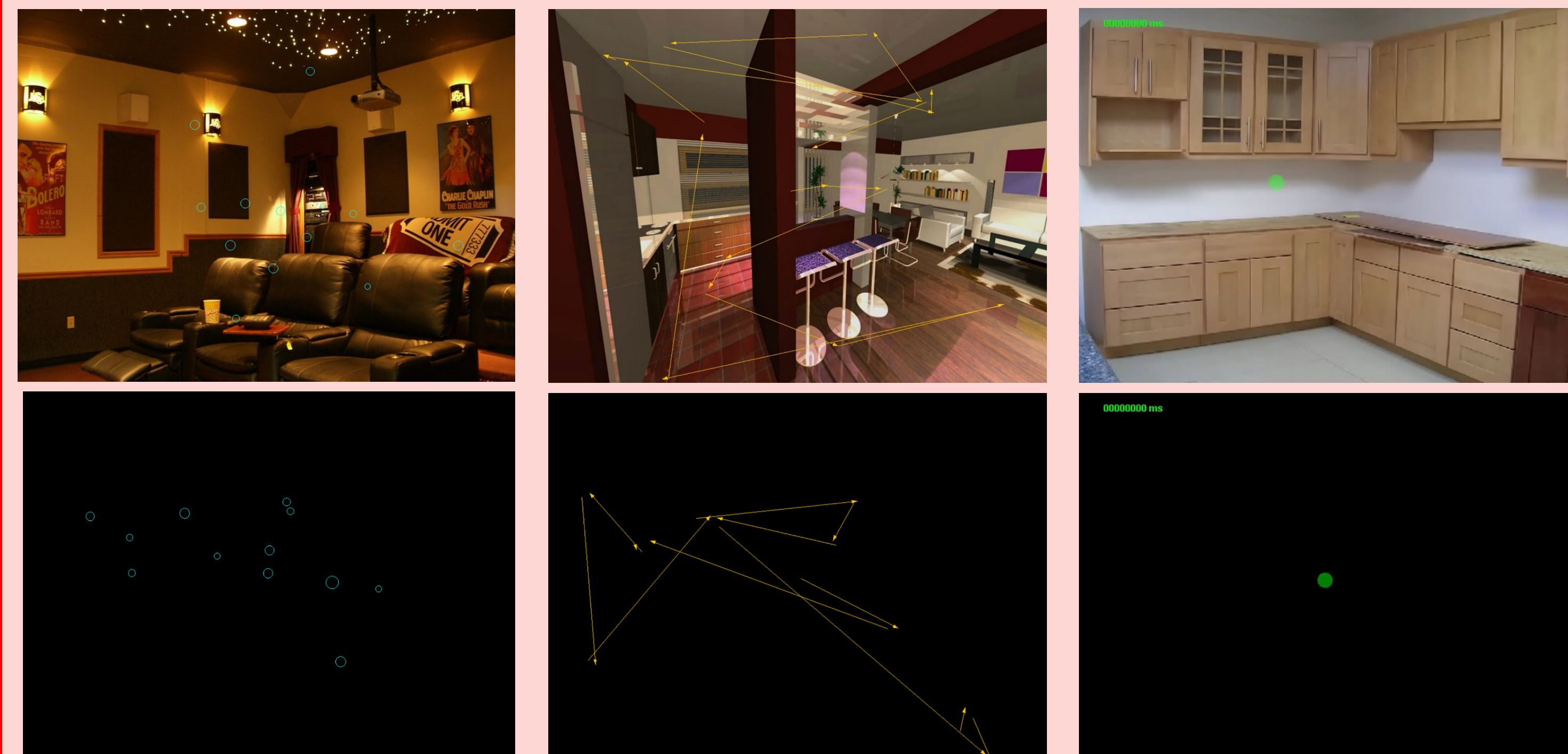
Each participant completed 60 trials per condition. All participants completed three conditions, fixation, scanpath, and dynamic video. Fixations and scanpaths were displayed for 8 seconds. Dynamic videos were displayed for 4 seconds. Eye movement data was varied between being transposed over the original image or a black background. Participants discriminated between searching, memorization, and rating tasks.

Experiment 1: Task Consistent

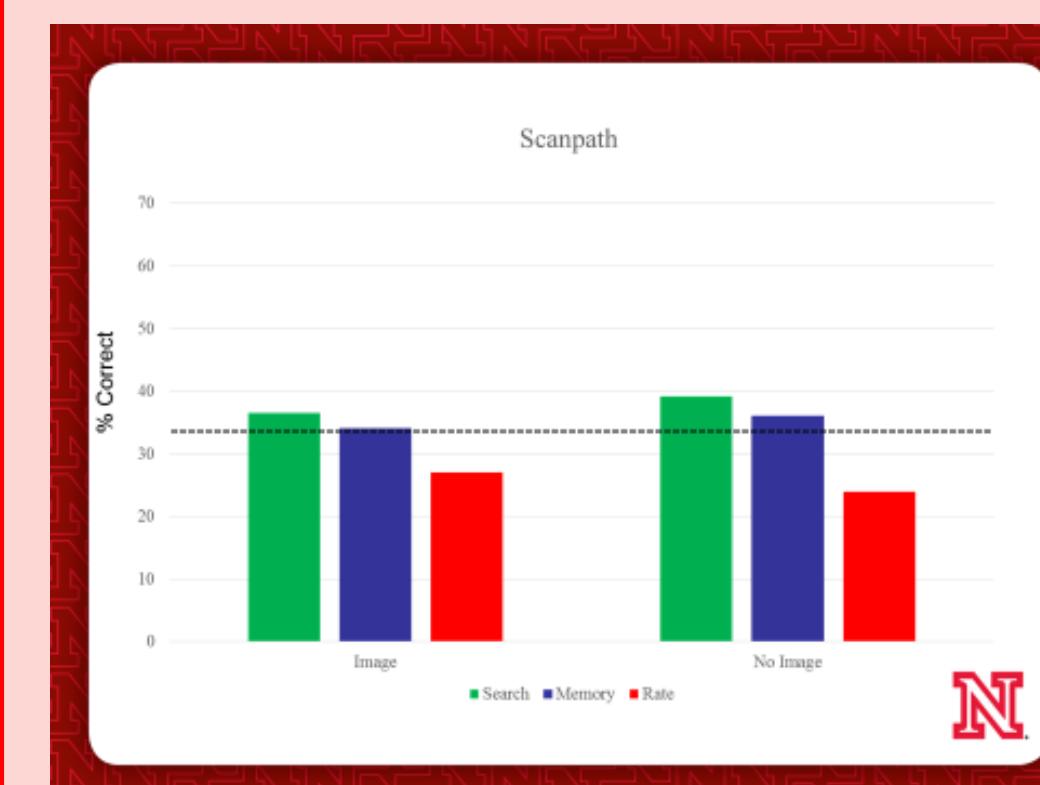
The eye movement data utilized in the present study was collected from individuals performing only one task (search, memory, or rating) repeatedly.

Experiment 2: Task Switching

The eye movement data utilized in the present study was collected from individuals performing the search, memory, and rating tasks intermixed. However, sometimes the same task was repeated at least once.

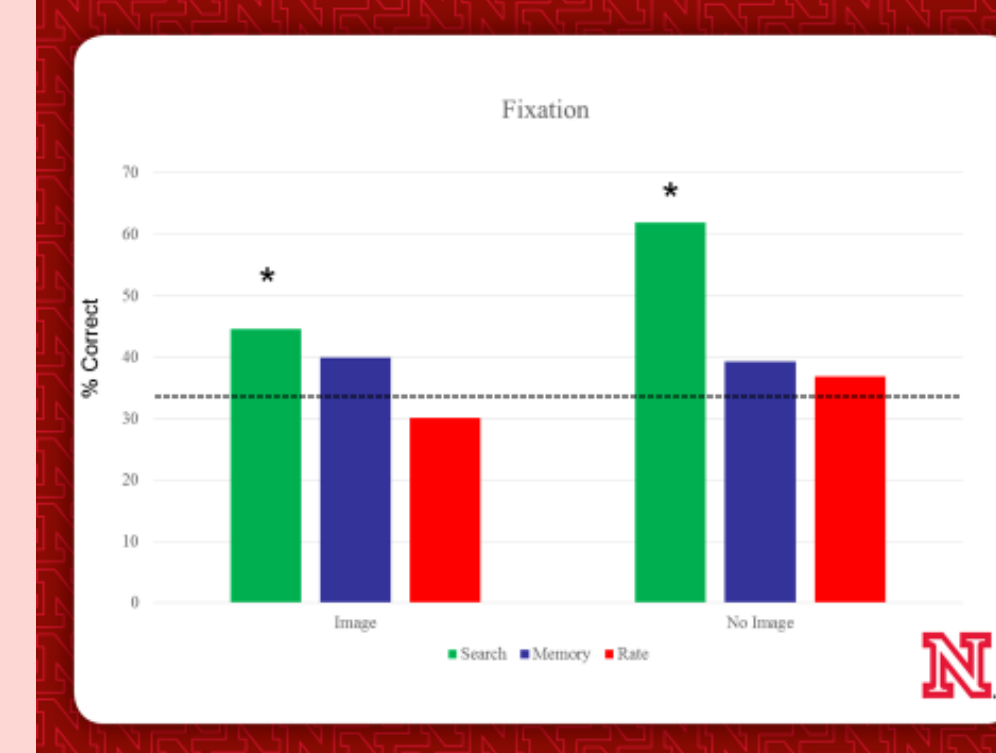


From Left to Right: Fixation, Scanpath, Dynamic Video Top: Scene Condition Bottom: No Scene Condition



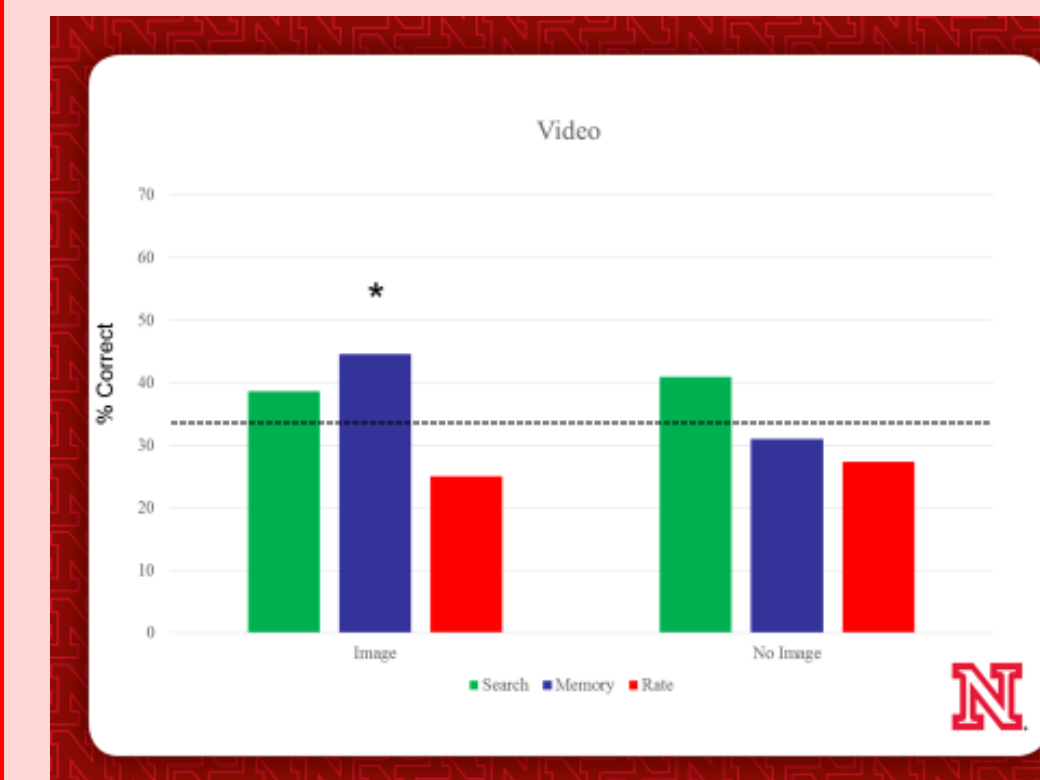
E1: Scanpath

Participants were unable to identify any task type (search, memory, rate) at a rate significantly above chance in the scanpath condition regardless of if the eye movements were transposed over the original image or a black background.



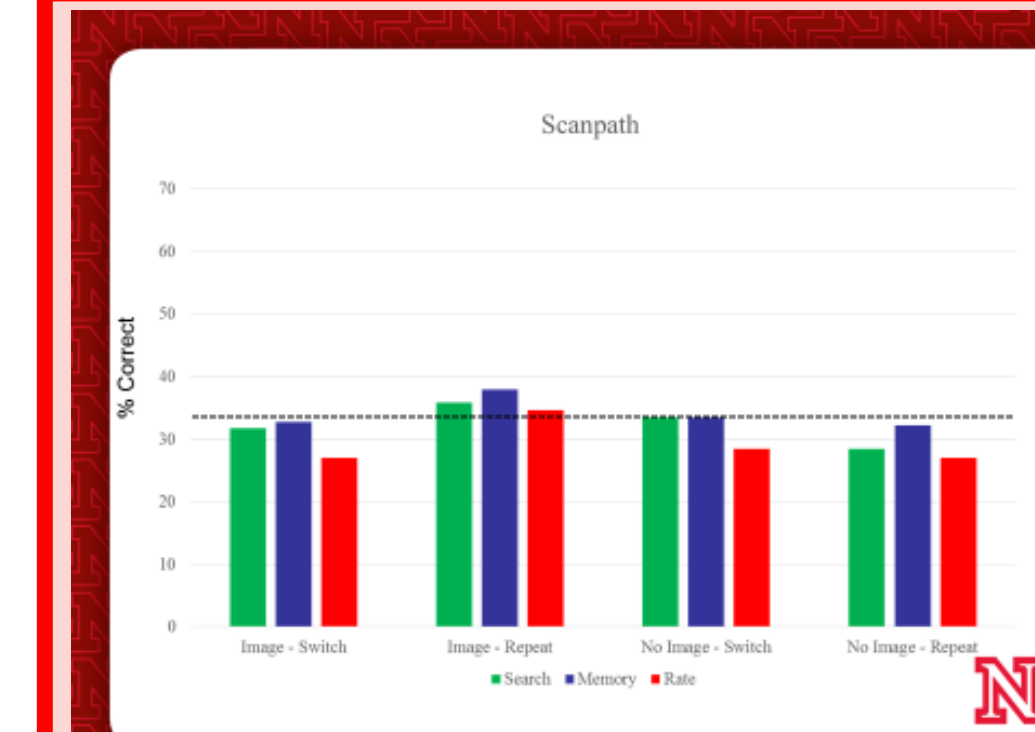
E1: Fixation

Participants were able to identify the search task at a rate significantly above chance in the fixation condition regardless of if the eye movements were transposed over the original image or a black background. However, participants were far more successful at identifying the search task when the eye movements were transposed over a black background than the original image.



E1: Dynamic Video

Participants were able to identify the memory task at a rate significantly above chance in the video, but only when the eye movements were transposed over the original image.



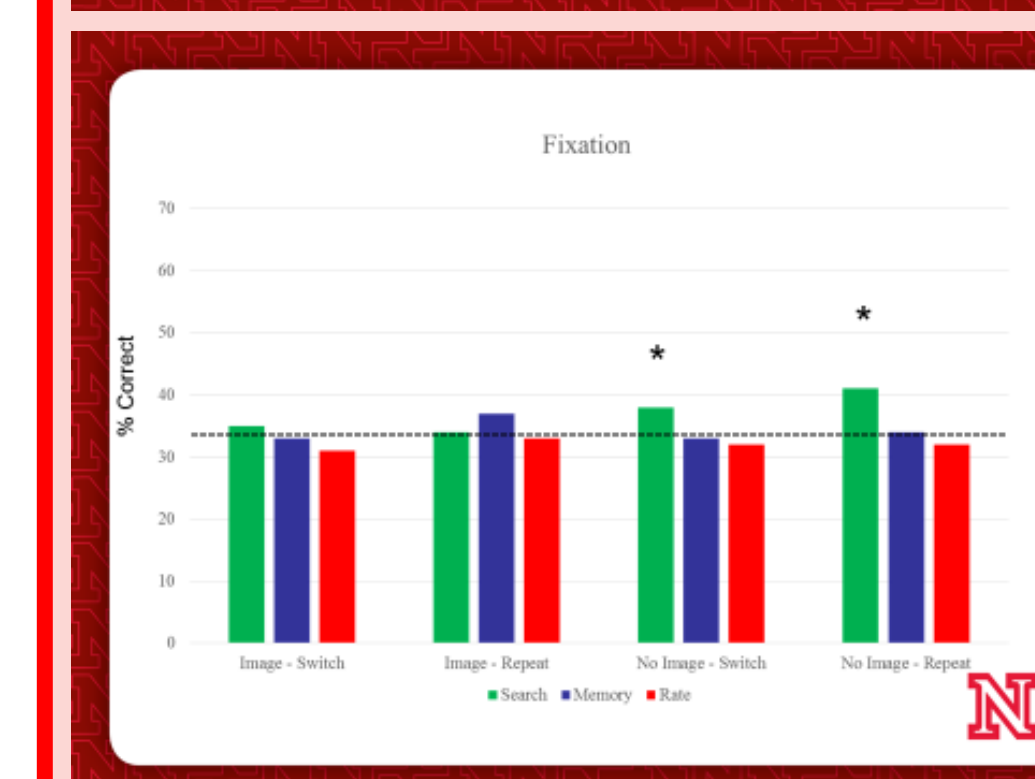
E2: Scanpath

Participants were unable to identify any task type (search, memory, rate) at a rate significantly above chance in the scanpath condition regardless of if the eye movements were transposed over the original image or a black background, and regardless of whether or not the task was repeated.



E2: Video

Participants were able to identify the memory task at a rate significantly above chance in the video condition, but only when the task was repeated and the eye movements were transposed over the original image.



E2: Fixation

Participants were able to identify the search task at a rate significantly above chance in the fixation condition regardless of if the task was repeated, but only if the eye movements were transposed over a black background.

Discussion

Humans appear to be able to identify certain types of tasks, but only under specific conditions. If the task is switched, this ability seems to decrease. It has been suggested that the requirement to switch tasks leads individuals to adopt a single "general" task set which would make our three tasks look very similar. Search was by far the best identified task, particularly when the original image was not displayed. Participants reported that they identified search tasks by their larger amount of fixations and shorter fixation durations. For identifying the memory task, on the other hand, it appears that viewing the original image is necessary.