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# The Effects of Caffeine on Visual Attention in Caffeine-naïve Participants

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## Introduction

Controversy exists concerning the effects of caffeine on cognitive function. One of the greatest challenges in resolving this controversy stems from the fact that caffeine is the most widely used drug in the United States, consumed daily by a majority of the population. The frequent and widespread use of caffeine means that most research participants are already using it regularly. When this is the case, effects attributed to caffeine in studies can just as easily be explained by relief from withdrawals. What seems to be an improvement in cognitive function in participants who are given caffeine may simply be a return to baseline.

This experiment aimed to observe the effects of caffeine independent of withdrawals by testing participants who were willing to abstain from caffeine for at least seven days prior.

This study is also novel in that visual attention was tested using naturalistic tasks. The types of tests used were comparable to experiences people have daily, such as searching for a specific object and reading. These tasks allow conclusions to be drawn concerning how caffeine affects visual attention in everyday circumstances.

## Methodology

Participants were asked to abstain from caffeine for one week prior to each session to eliminate the effects of caffeine withdrawals. Upon arriving at the lab, each participant completed an alertness survey which used a sliding scale to subjectively self-report alertness.

Each participant was given a drink which contained one of three doses of caffeine or a placebo. The doses were either 0.5, 1, or 2 mg of caffeine per kilogram of body mass, which approximate the amount of caffeine in a soda, coffee, or energy drink, respectively. In this double-blind experiment, neither the participants nor the experimenters knew which drink was administered and the solution was mixed with Crystal Light drink mix to mask flavor. Each participant returned to the lab once a week for four weeks and received each dose and the placebo in a randomized order.

Thirty minutes after drinking the caffeinated drink or placebo, the participants were presented with a series of visual tasks on a computer. An eye tracker was used to record their eye movements, called saccades, as they completed each task. The first task was a pro/antisaccade task, which involved looking at or away from a square that appeared on either the left or right side of the screen. The second task was a visual search task in which the participants looked for various objects as quickly as they could in forty different scenes. The last task was a reading task with twenty short passages, each followed by a comprehension question. New material was used in the visual search task and reading task as each participant returned for various sessions.

## Results

The results of this study showed no difference between participants who had consumed various doses of caffeine and the placebo. Speed and accuracy did not significantly differ between participants in visual search or reading comprehension, even when controlling for alertness. There is no evidence that caffeine affects eye movements.

## Discussion

As expected, caffeine did not improve performance in complex, naturalistic tasks involving visual attention. Part of these results were surprising. It was expected that caffeine would improve simple measures such as response time and saccade velocity, which was not observed. The results are in line with the second half of the hypothesis, which was that caffeine would not improve higher-level cognitive function.

Other studies which do show a difference between groups may observe such differences due to the confounding variable of withdrawals. Participants who consume caffeine after having abstained for a short period of time, such as only twenty-four hours, may simply be experiencing relief from withdrawals. Participants who abstain for a short amount of time and are given a placebo will still be experiencing the negative effects of withdrawals. Thus, in such studies, results attributed to caffeine may only appear to exist because measurements are compared against groups experiencing symptoms of withdrawal.

This study is unique in that it shows the effect of caffeine dosages or the absence of caffeine in participants who have abstained for seven days prior to testing, eliminating symptoms of withdrawal. The results show that in those who are not regularly consuming caffeine, no benefits or deficits in visual attention tasks can be attributed to caffeine.

## Conclusion

According to this study, caffeine does not provide the supposed benefits to attention for which it is commonly used. For those who do not regularly drink caffeine, consuming caffeine neither improves nor hinders visual attention in complex naturalistic tasks, such as visual search and reading comprehension.

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