**Mental Rotation Task**

PSY310 Lab in Psychology

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**GitHub Link:**

**Abstract**

This study investigated the following research question: Does logo familiarity affect accuracy and reaction times during mental rotation tasks? It looked at how logo familiarity affected performance in a mental rotation test. Five Ahmedabad University volunteers, ages 18 to 20, finished a PsychoPy-based exercise that included both unknown logos made by the researcher and well-known company logos. Participants were asked to determine if each of the seven logo orientations—0°, 20°, 40°, 60°, 80°, 100°, and 120°—was mirrored or in the proper orientation. It was predicted that when participants saw known logos, they would react more quickly and accurately than when they saw unfamiliar ones.

Faster results would be observed using known logos (mean RT = 1.76 seconds) with the known logos compared to unknown logos (mean RT = 2.20 seconds), thereby supporting the hypothesis. On average, participants did better on the trials with known logos, with accuracies from 62.22% to 76.67%. The findings indicate that increased accuracy and faster responses in mental rotation tasks were improved by familiarity with logos. Thus the study highlights prior experience as essential for visual recognition and cognitive performance in tasks such as brand logos and other recognizable stimuli. Further investigation of the familiarity and mental rotation efficiency correlation needs to be done using a larger sample size.

**Introduction**

There are, without any doubt, spatial abilities that enable cognitive skills used in many daily activities; these may include learning about the environment and pursuing academic goals. One of the more common problems in the study of visual perception relates to how one can prove that figure objects have the same shape despite differences in size or orientation. That is the piecemeal technique as a method by which subjects visually observe discrete portions of a stimulus and internalize the parts. When asked about the cognitive system creating a mental image of a visual stimulus, this would be the most often recognized hypothesis. With the piecemeal method, the stimulus figure is broken down into many pieces-for example; one part would rotate mentally with respect to a comparative figure while recognizing that the other parts will then be mentally rotated as well to check for parity. Perceptual encoding of the stimulus identification and orientation of the stimulus mental rotation of the stimulus, parity evaluation, response, and execution are five sequential steps thought to comprise the mental rotation tasks (Jiguo Xue, 2017).

Mental rotation tasks are commonly used in research on spatial cognition because they direct participants to rotate objects in memory so that they match other orientations. Knowledge of what the rotated items are, such as business logos, might affect how well the task is performed, that is, making it easier to recognize and requiring fewer cognitive resources.

Therefore, the research purpose strives to provide a condition for the following research question: Will knowing corporate logos influence the accuracy and reaction times of mental rotation tasks? In total, it is predicted that familiar logos will generate quicker and more accurate responses than unfamiliar ones. Familiarity will facilitate the performance of the task as less cognitive effort will be required for mental rotation and perceptual encoding.

Thus, the hypothesis that familiarity creates cognitive efficiency in spatial tasks is verified further with the expected outcomes indicating that more recognizable logos would be both more accurate and yield faster reaction times. This study aims to unveil how familiarity informs mental rotation and spatial cognition through the study of these variables.

**Method**

Five Ahmedabad University students, ages 18 to 20, took part in the study. To reduce distractions, they used PsychoPy software to complete the mental rotation activity while seated in front of a computer in a calm setting.  
  
There were five trials in the experiment. A 500 ms fixation cross was shown in the middle of the screen at the start of each trial, and then a company logo was shown for one second. The logos were either unfamiliar (made by the researcher, especially for the experiment) or famous (from well-known companies like Google, Facebook, Instagram, Cartoon Network, Twitter, Twitch, and Adidas).

Ten rotation angles—0°, 20°, 40°, 60°, 80°, 100°, 120°, 140°, 90°, and 10°—were used to display the logos. The participants had to determine if the logo was mirrored or in its proper orientation (normal). The left arrow key was used to denote "normal" orientation and the right arrow key was used to denote "mirrored."  
  
Each trial's logo presentation order was randomized to minimize sequence effects. Throughout the trials, every logo was shown in all ten rotation situations, giving each logo a total of ten distinct orientations. The overall number of trials was determined by the number of logos utilized and the rotation angles displayed.

The two important metrics were accuracy or the right scores among participants in doing the task and reaction time or the duration of time spent between a participant in giving his/her response and seeing the logo. Since participating in such an experiment entails reward, participants were commended and debriefed at the end of conducting the experiment. The above experiment data will want to understand the influence of rotation angle and familiarity with a logo on these resulting factors of accuracies and reaction times.

**Result**

In total, the overall reaction time of *Participant 1* was 2.02 seconds while the accuracy rate was up to 75.56 percent. Reaction times for logos were measured to be 1.88 seconds for familiar logos and 2.52 seconds for unknown logos. This shows that, through familiar logos, better performance is possible in mental rotation tasks and confirms the hypothesis whereby subjects react much faster to logos they know than new ones.

*Figure 1.*

*Participant 2's* total reaction time stood at 1.83 seconds versus a percentage accuracy of 65.56. The familiar logos produced a reaction time of 1.68 seconds and the unfamiliar logos, a time of 2.36 seconds. These results further provide evidence for the notion that familiarity with logos increases performance in a mental rotation task, which suggests that known logos produce faster reaction times.

*Figure 2.*

*Participant 3* has a mean reaction time of 1.67 seconds, and their accuracy percentage is 62.22%. For familiar and unfamiliar logos, the respective reaction times were 1.62 and 1.83 seconds. Although accuracy was somewhat lower than that of the other participants, these results would support the hypothesis that familiar logos produce faster reaction times, indicating that familiarity helps improve performance in the mental rotation task.

*Figure 3.*

*Participant 4* achieved an accuracy percentage of 74.44% with an overall reaction time of 1.91 seconds. Reaction times for familiar logos and unfamiliar logos were 1.78 seconds and 2.35 seconds respectively. These results suggest that an increase in familiarity results in improvement in performance in the mental rotation task and adds further evidence in support of the theory stating that common logos elicit faster reaction times.

*Figure 4.*

*Participant 5* achieved an accuracy of 76.67% and had a mean reaction time of 1.82 seconds, with 1.79s and 1.91s recorded for familiar and unfamiliar logos respectively. This suggests that familiar logos would, indeed, give shorter reaction times, indicating that familiarity facilitates performance in the mental rotation tasks. This high accuracy rate corresponds well with the overall trend seen with other participants.

*Figure 5.*

The five participants had accuracy rates ranging between 62.22% and 76.67%, with Participant 4 showing the lowest accuracy scores. With familiar logos averaging 1.68 to 1.79 seconds while unfamiliar logos were averaging 1.83 to 2.52 seconds, their response times for familiar logos were always quicker than unfamiliar logos. Hence, faster overall viewing and response times for recognized logos add further credence to the theory that logo familiarity improves performance on the mental rotation task.

**Discussion**

As shown in the findings of the study, the participants who were accustomed to the logos performed better in mental rotation tasks as they will always show quick reaction times and more precise responses when familiar logos were used compared to an unfamiliar one. The findings theoretically support the dual-coding theory and other cognitive models that familiarity activates preexisting mental templates and thus lessens cognitive effort and increases efficiency. This has supported the area of research on mental rotation because it demonstrates the significant influence of familiarity on visual identification, mostly complex stimuli as in corporate logos. These results have implications for branding and advertising, focusing on the importance of exposure to logos amongst audiences to boost engagement and recognition. In such competitive worlds, it will be familiar logos that are fast-solving processing and improved accuracy. Using these observations in training and educational settings can also bring those under-the-spotlight preparations for task activity and learning. The effects associated with it can then be understood in a better manner as well as broadened health applications through future studies that include larger sample sizes using a wider range of stimuli and varying degrees of experience.

# References

Jiguo Xue, C. L. (2017). Uncovering the cognitive processes underlying mental rotation: an eye-movement study. *Scientific Reports*.