RESEARCH NOTE

**Your Name goes here**

**Mental rotation: A reaction time comparison of normal vs. backward letters at different angles of rotation**

Abstract Your summary goes here. It should include one background sentence introducing the topic of mental rotation, one sentence describing the participants, one sentence describing the task, and two sentences describing the main results. The Abstract should be typed as one paragraph.

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# Introduction

You should begin by introducing the topic of *mental rotation.* What is it, and why is it important? Cite your textbook and the original research (Shepard & Metzler, 1971) as references.

Next, describe how any object (such as a normal or reversed letter of the alphabet) can be physically rotated to different orientations or angles and then mentally rotated back to an upright orientation. Refer to the examples in Figure 1. (Include Figure 1 as it is now.)

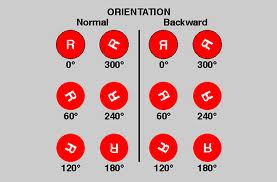


Figure 1. Examples of normal letters and backward letters on a mental rotation task.

Then describe the purpose of our experiment—as a replication of the original research finding that response speed slowed down as the angular rotation of the object increased. Clearly state the two main hypotheses in this experiment about the effect of rotation angle on reaction time and the effect of letter type (normal vs. backward) on reaction time. Then state the secondary hypothesis about a gender difference on this task. Cite the article by Shepard and Metzler (1971) and your textbook as references for your hypotheses.

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# Method

*Participants.* Describe the participants in this study (number, age group, gender).

Then explain how they were recruited and whether they received any compensation for participating.

*Design.* Every experiment involves at least one independent variable (that gets manipulated) and at least one dependent variable (that gets measured). Name and describe the two independent variables and the two dependent variables in this experiment. *(Hint: look at your data sheet.)*

*Apparatus and procedure.* Using the Shepard and Metzler article as a model, describe how the stimulus materials were presented, including the sequence of events in each trial. You may need to take another look at the practice trials in the actual experiment.

Then describe how the participants responded. Describe the specific procedures this experiment used to collect the behavioral responses from the participants. You may need to review the practice trials of the actual experiment.

Finally, describe the number of practice trials and the number of test trials, and state the approximate length of the testing session.

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# Results

*Before you begin writing this section, plot your own RT results in the middle section of your data sheet (line graph for Normal and Backward). Then plot the pooled RT results for all the students who participated in this experiment at the bottom of your data sheet.*

Begin the Results section by reminding the reader about the two dependent variables that were measured in this experiment. Using information from the pooled results, describe the statistical analyses that were performed on the RT data from the participants, and refer the reader to Table 1, which reports the mean and standard deviation for each cell of the design.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Normal** | | **Backward** | |
| Degree | Mean | StDev | Mean | StDev |
| **0** |  |  |  |  |
| **60** |  |  |  |  |
| **120** |  |  |  |  |
| **180** |  |  |  |  |
| **240** |  |  |  |  |
| **300** |  |  |  |  |
| Overall |  |  |  |  |

Table 1. Mean RT and standard deviation for each cell of the experimental design.

*Letter Type.*

Next, construct and include a simple bar/column graph (replacing Figure 2) that displays the pooled results comparing RT for normal and backward letters overall. Use the “overall” values from the pooled data (the last column in the table above). Describe the pattern of pooled RT results for the effect of Letter Type. Include the t-value, degrees of freedom, and p-value for the statistical test, and indicate whether the difference was statistically significant.

A screenshot of a cell phone

Description automatically generated

Figure 2. Effect of Letter Type on Mean RT.

Refer the reader to Figure 2, and state whether the results supported the major hypothesis about the effect of Letter Type.

*Rotation Angle.*

Then construct and include a simple bar/column graph (replacing Figure 3) that displays the pooled results comparing the first 4 angles of rotation for Normal letters only. Describe the pattern of pooled RT results for the effect of Rotation Angle. Include the t-value, degrees of freedom, and p-value for each statistical test, and indicate whether the difference was statistically significant.

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Figure 3. Effect of Rotation Angle on Mean RT.

Refer the reader to Figure 3, and state whether the results supported the major hypothesis about the effect of Rotation Angle.

*Gender.*

Then construct and include a simple bar/column graph (replacing Figure 4) that displays the pooled results comparing males and females on overall RT for Normal letters only. Describe the pattern of pooled RT results for the effect of Gender. Include the t-value, degrees of freedom, and p-value for the statistical test, and indicate whether the difference was statistically significant.

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Figure 4. Gender comparison for overall Mean RT for Normal Letters only.

Refer the reader to Figure 4, and state whether the results supported the secondary hypothesis about a gender difference.

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# Discussion

*Overall findings.* Remind the reader of the difference between “normal letters” and “backward letters” on a mental rotation task. Briefly describe the general pattern of results from earlier mental rotation studies and cite the Shepard and Metzler (1971) article again.

Next, summarize the results from our participants in this mental rotation task *(no statistics here, please)*. Did our results support the hypotheses derived from the earlier studies?

Finally, describe the implications of our mental rotation results for how people process information without words (nonverbal information). Is the way we manipulate mental images in our minds similar to the way that we manipulate real objects with our hands?

*Individual variability.* Write one or two sentences explaining why the average results from a group of participants are more reliable than the results from any one participant.

Construct and include a simple line graph (replacing Figure 5) that displays your own results on this mental rotation task. Include two lines on your graph—one for each type of letter at each angle of rotation.

A close up of a map

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Figure 5. Letter Type and Rotation Angle for a single participant.

Then, as an example of individual variability, compare your own individual results to the pooled results, and refer the reader to Figure 5. Describe how the overall pattern of your results is similar to or different from the pooled results. Be sure to submit your Data Sheet / Graph Page to your instructor as documentation of the accuracy of this graph!

Conclude with a short paragraph suggesting future studies that could be performed to follow up on these results.

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# References

Myers, D. G., & DeWall, C. N. (2018). Thinking in images. In *Psychology: Twelfth edition in modules,* 356–357. New York: Worth Publishers.

Myers, D. G., & DeWall, C. N. (2018). Gender similarities and differences. In *Psychology: Twelfth edition in modules*, 381–382. New York: Worth Publishers.

Shepard, R. N., & Metzler, J. (1971). Mental rotation of three-dimensional objects. *Science,* 171, 701–703.

Acknowledgments I wish to thank Dr. Thomas Ludwig for providing the computer software used for data collection.