Study on the Effect of Type of Environment on Recalling Capacity of a Student

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GROUP - 8

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Introduction

In an era where educational environments are increasingly being scrutinized for their impact on student performance, understanding how different environmental factors affect cognitive functions has become essential. This report outlines a study aimed at exploring how variations in lighting and noise levels influence students' recalling capacity and hesitation during recall. The study seeks to provide insights into designing optimal learning environments to enhance memory recall and reduce cognitive hesitation.

Problem Statement

The study aims to investigate how different environmental conditions, specifically lighting conditions (dim versus bright) and noise levels (quiet versus loud), influence:

1) Recalling Capacity: Measured on a scale of 1 to 10 based on the ability to recall random images.
2) Number of Pauses: A count of hesitation during the recall task.

Additionally, the study incorporates gender differences to examine potential variability in responses across these environments.

Motivation

Recent studies have highlighted that environmental factors like lighting and noise significantly affect cognitive performance, such as memory recall and hesitation. However, the combined influence of these factors in controlled academic settings remains underexplored. By examining recalling capacity and number of pauses, this research addresses a critical gap, offering valuable insights for educators and facility planners to design conducive learning environments that enhance both performance and confidence.

RESEARCH DESIGN

Objective

To assess the impact of room lighting (dim versus bright), noise levels (quiet versus loud), and gender (male versus female) on:
1. Recalling Capacity: A measure of memory recall.
2. Number of Pauses: A measure of hesitation during recall.

Variables

- Independent Variables:
  Lighting of Room: Dim versus Bright
  Noise Level of Locality: Quiet versus Loud
  Gender of Student: Male versus Female
- Dependent Variables:
  Recalling Capacity: Measured on a scale from 1 to 10.
  Number of Pauses: Total count of hesitations during recall.
- Control Variable:
  Time of the Day: Ensures consistency in environmental conditions.

Sample

Approximately 300 students participated in the study. They were divided into 8 groups based on the combinations of lighting, noise, and gender, ensuring equal representation.

METHODOLOGY

Preparation

1

Set up 8 distinct environments based on combinations of lighting, noise levels, and gender:
1. Dim lighting with Quiet noise (Male)
2. Dim lighting with Quiet noise (Female)
3. Dim lighting with Loud noise (Male)
4. Dim lighting with Loud noise (Female)
5. Bright lighting with Quiet noise (Male)
6. Bright lighting with Quiet noise (Female)
7. Bright lighting with Loud noise (Male)
8. Bright lighting with Loud noise (Female)

Each environment was designed to simulate realistic study conditions while maintaining consistency across groups.

Exposure

2

Each student was exposed to a PowerPoint presentation containing random images

The images were selected to ensure variety and randomness, reducing the influence of familiarity on recall.

Testing

3

After the exposure period:
1. Students were asked to recall as many images as possible.
2. The number of images recalled was scored on a scale of 1 to 10.
3. The number of pauses (hesitations) during the recall process was also recorded.

Data Collection and Analysis

4

A total of 300 data points were collected and analyzed using statistical methods, including Three-Way ANOVA, to identify significant effects and interactions.

DATA

Summary of the data

```
summary(data)
```

```
   BITS_ID              Name           Light_Intensity    Sound_Intensity
 Length:308         Length:308         Length:308         Length:308
 Class :character   Class :character   Class :character   Class :character
 Mode  :character   Mode  :character   Mode  :character   Mode  :character



    Gender              Score         No_of_Pause
 Length:308         Min.   : 4.000   Min.   :1.000
 Class :character   1st Qu.: 6.000   1st Qu.:1.000
 Mode  :character   Median : 7.000   Median :2.000
                    Mean   : 6.792   Mean   :1.925
                    3rd Qu.: 8.000   3rd Qu.:3.000
                    Max.   :10.000   Max.   :4.000
```

```
# View the result
print(combination_counts)
```

```
# A tibble: 8 × 4
  Light_Intensity Sound_Intensity Gender Count
  <chr>           <chr>           <chr>  <int>
1 Bright          Loud            F         30
2 Bright          Loud            M         40
3 Bright          Silent          F         34
4 Bright          Silent          M         36
5 Dim             Loud            F         35
6 Dim             Loud            M         45
7 Dim             Silent          F         37
8 Dim             Silent          M         51
```

THREE WAY ANOVA – SCORE (RECALLING CAPACITY)

```
model_score <- aov(Score ~ Light_Intensity * Sound_Intensity * Gender, data = data)
summary(model_score)
```

Output

```
model_score <- aov(Score ~ Light_Intensity * Sound_Intensity * Gender, data =
data)
summary(model_score)

                                 Df Sum Sq Mean Sq F value  Pr(>F)
Light_Intensity                   1    7.5    7.49   6.304 0.01257 *
Sound_Intensity                   1  113.1  113.10  95.239 < 2e-16 ***
Gender                            1    9.9    9.88   8.324 0.00420 **
Light_Intensity:Sound_Intensity   1    7.0    7.00   5.893 0.01579 *
Light_Intensity:Gender            1    2.6    2.60   2.191 0.13989
Sound_Intensity:Gender            1    0.3    0.26   0.216 0.64272
Light_Intensity:Sound_Intensity:Gender  1    8.1    8.12   6.839 0.00937 **
Residuals                       300  356.3    1.19
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Interpretation

1) Significant Effects:

- **Light Intensity:** F = 6.304 , p = 0.01257

Light intensity significantly impacts recalling capacity. This indicates that the level of lighting can influence students' recall performance.

- **Sound Intensity:** F = 95.239 , p \< 2e\^{-16}

Sound intensity has a highly significant effect on recalling capacity, confir ming that high noise levels negatively impact recall ability.

- **Gender:** F = 8.324 , p = 0.00420

Gender significantly affects recalling capacity, implying gender-related co gnitive differences under the given environmental conditions.

- **Interaction Effects:**
- Light Intensity × Sound Intensity: F = 5.893 , p = 0.01579

A significant interaction suggests that the combined effect of light and so und intensity on recalling capacity is more substantial than their individu al effects.

- **Light Intensity × Sound Intensity × Gender:** F = 6.839 , p = 0.00937

A significant three-way interaction reveals that the combined influence o f light intensity, sound intensity, and gender strongly impacts recall.

2) Non-Significant Effects:

- Light Intensity × Gender and Sound Intensity × Gender interactions are not statistically significant (p \> 0.05).

THREE WAY ANOVA – NO. OF PAUSES

```
model_pause <- aov(No_of_Pause ~ Light_Intensity * Sound_Intensity * Gender, data = data)
summary(model_pause)
```

Output

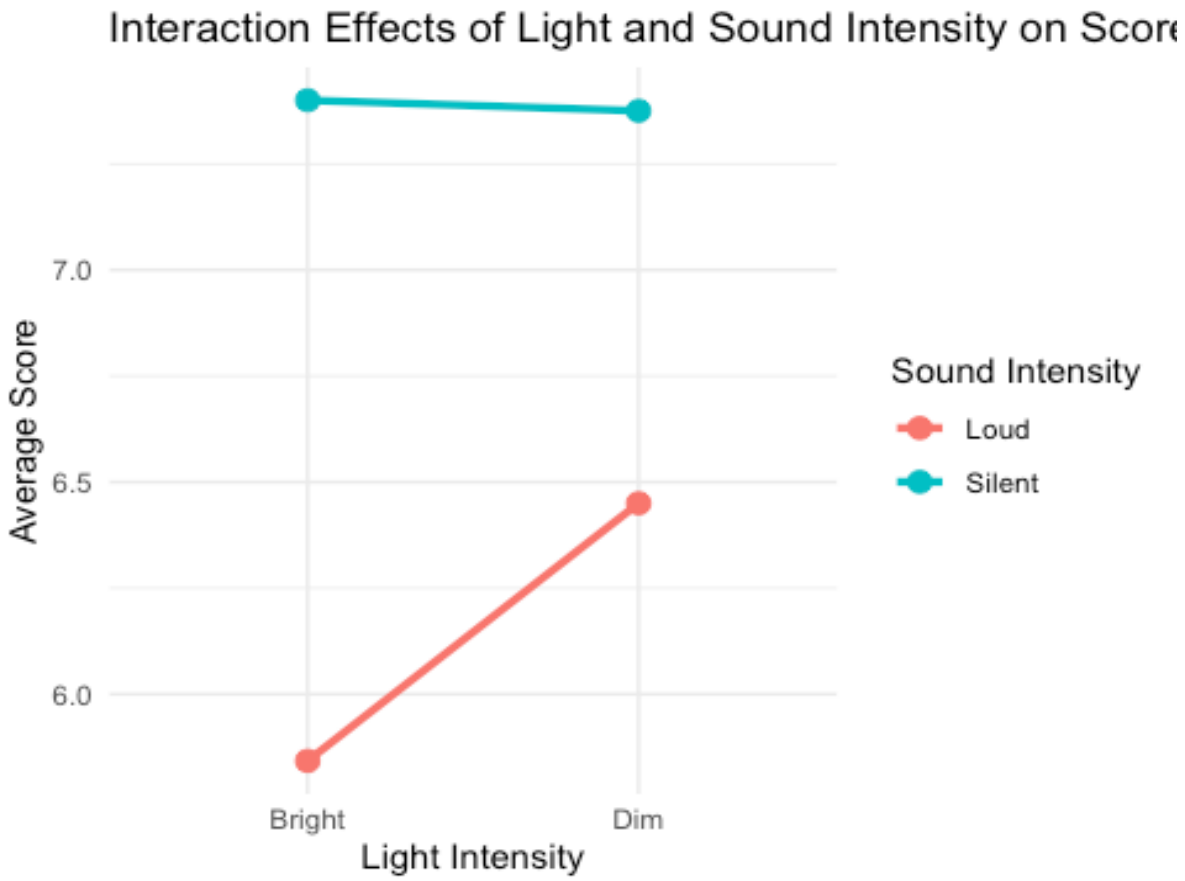
```
model_pause <- aov(No_of_Pause ~ Light_Intensity * Sound_Intensity * Gender,
data = data)
summary(model_pause)

                                 Df Sum Sq Mean Sq F value Pr(>F)
Light_Intensity                   1   0.08  0.0848   0.135  0.714
Sound_Intensity                   1   0.99  0.9928   1.575  0.210
Gender                            1   0.11  0.1122   0.178  0.673
Light_Intensity:Sound_Intensity   1   0.31  0.3081   0.489  0.485
Light_Intensity:Gender            1   0.81  0.8062   1.279  0.259
Sound_Intensity:Gender            1   0.50  0.4986   0.791  0.374
Light_Intensity:Sound_Intensity:Gender  1   1.41  1.4058   2.231  0.136
Residuals                       300 189.07  0.6302
```

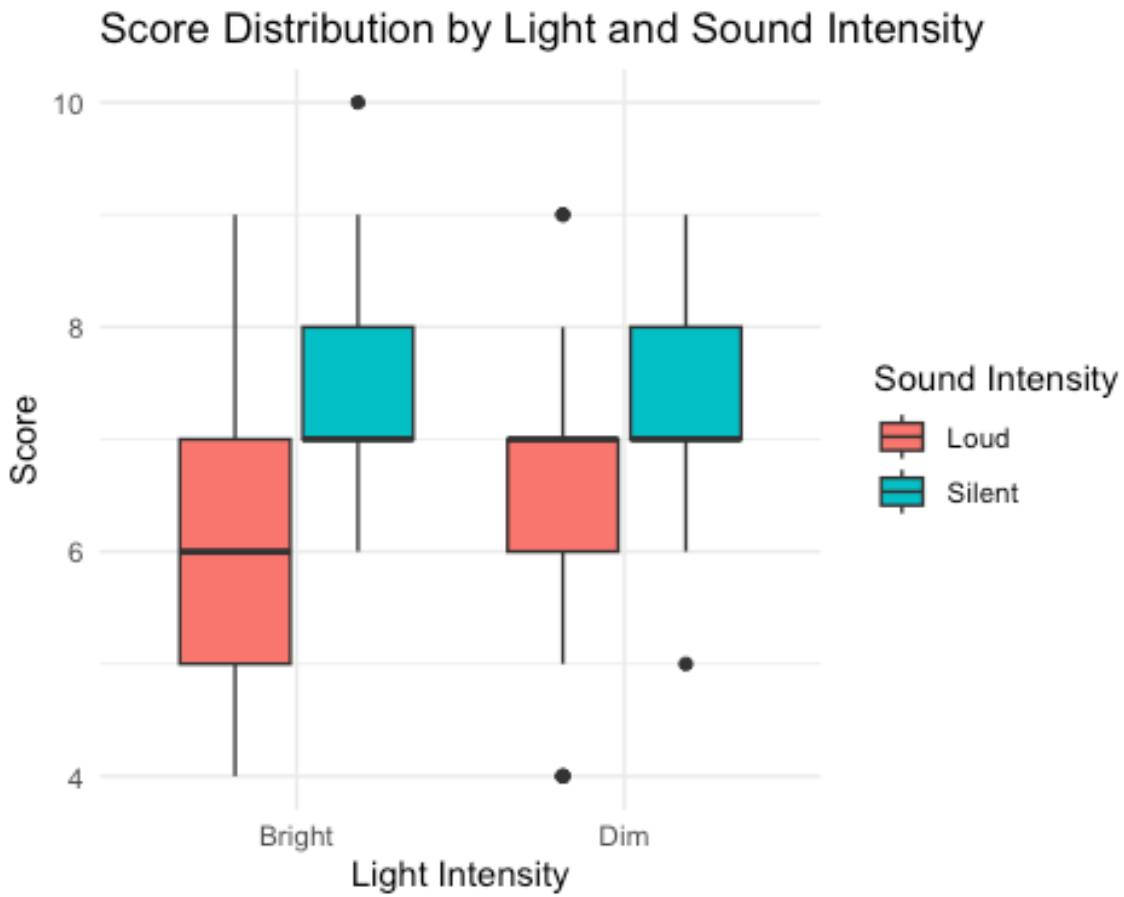
Interpretation

1) Non-Significant Effects:
All main effects (Light Intensity, Sound Intensity, Gender) and interactions have $p > 0.05$, indicating no statistically significant relationship between these factors and the number of pauses students take during the test.

2) Implications:
The number of pauses during the test is unaffected by the tested environmental factors or gender.

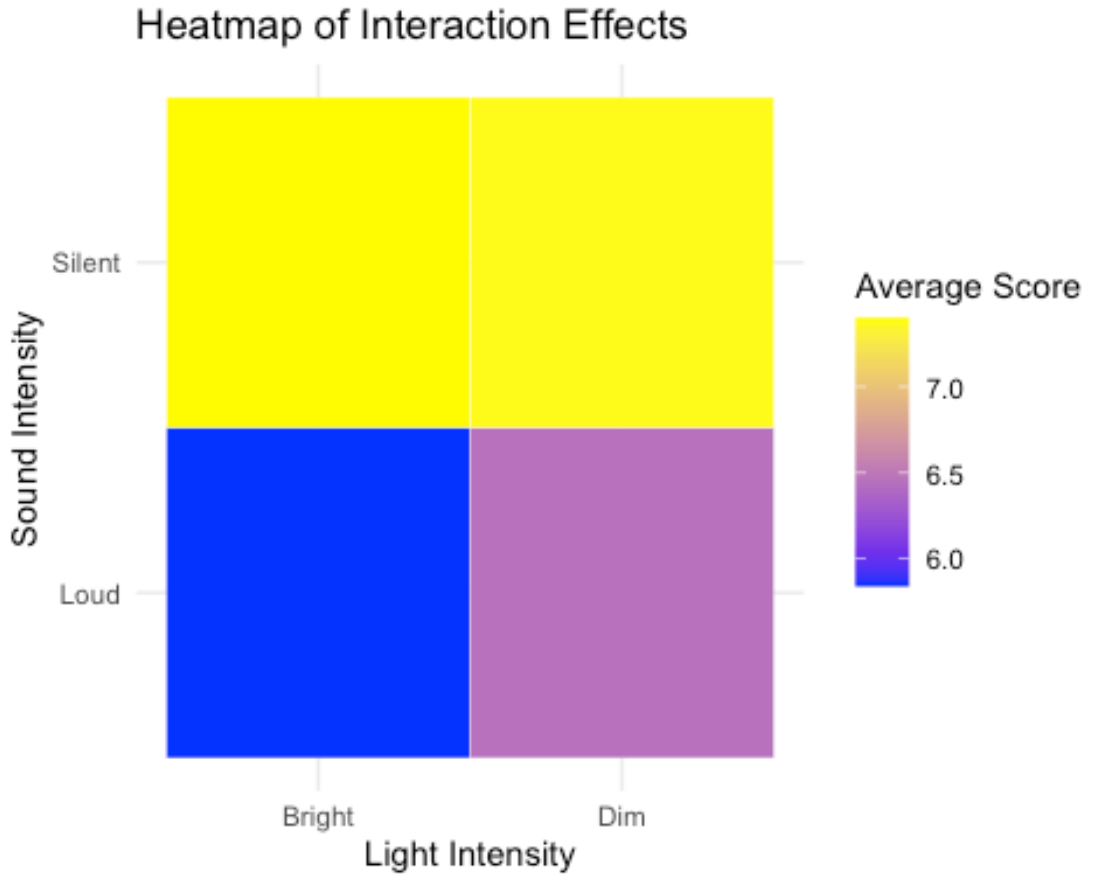
PLOTS


Interaction Effects of Light and Sound Intensity on Score
Average Score
7.0
6.5
6.0
Bright
Dim
Light Intensity
Sound Intensity
Loud
Silent


Score Distribution by Light and Sound Intensity
Score
10
8
6
4
Bright
Dim
Light Intensity
Sound Intensity
Loud
Silent

PLOTS


Score Distribution by Gender
10
8
6
4
Score
F
M
Gender
Gender
F
M


Heatmap of Interaction Effects
Silent
Loud
Sound Intensity
Bright
Dim
Light Intensity
Average Score
7.0
6.5
6.0

Thank You

Q&A