Measuring User Biases

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Abstract

This study attempted to investigate the relationship between response times and user biases towards various statements, based on the Hick-Hyman Law. Six participants from diverse ethnic and educational backgrounds were presented with opinion statements and asked to categorize them as "good," "bad," or "neutral." After the response times were measured, linear regression analysis revealed a negative correlation between response times and statement-response mappings (Hs), supporting the Hick-Hyman Law. The findings underscore the usefulness of response time measures for inferring user biases, having implications for user interface design.

Introduction

User biases can influence human-computer interactions and impact the effectiveness of user interfaces (Wickens, Hollands, Parasuraman, & Banbury, 2012). The Hick-Hyman Law, which says that describes the time it takes for a person to make a decision as a result of the possible choices: increasing the number of choices will increase the decision time logarithmically Wikipedia. (2024, January 16). Retrieved from <https://en.wikipedia.org/wiki/Hick%27s_law> By presenting users with statements and measuring response times for categorizing those statements, underlying biases can be inferred.

Purpose of the Study

The purpose of this study was to investigate the relationship between user biases and response times when categorizing opinion statements and to evaluate the applicability of the Hick-Hyman Law in this context. It was hypothesized that response times would increase as a function of the number of statement-response mappings, reflecting user biases.

Method

*Participants*

Six participants (3 females, 3 males) were recruited for this study. They ranged in age from 18 to 62 years old (M = 33.83, SD = 15.87). Participants came from diverse ethnic backgrounds, with most indicating that English was not their first language. Education levels varied from high school to bachelor's degree.

Apparatus

The experiment was conducted using a custom Python script that presented statements, recorded user responses and response times, and output results to a CSV file. Participants wore headphones to minimize external distractions.

Independent Variables

The independent variable was the number of possible statement-response mappings (Hs), operationalized as the reciprocal of response time (1/RT).

Dependent Variables

The dependent variable was response time, measured in seconds, for participants to categorize presented statements as "good," "bad," or "neutral."

Design

A correlational design was used, with Hs values calculated for each statement response. Linear regression was performed to assess the relationship between Hs and response times.

Procedure

Participants, wearing headphones, were presented with a series of opinion statements (e.g., "The sky is blue"). For each, they categorized the statement as "good," "bad," or "neutral" using the keyboard. The script recorded the responses and response times. After finishing all statements, debriefing was provided.

Results

Participant response data was output to a CSV file, which was then analyzed in Python. Hs values were calculated and plotted against response times. Linear regression revealed a significant negative relationship between Hs and response times (Response Time = -0.89 \* Hs + 2.19; R^2 = 0.80).

The scatter plot showed response times generally decreasing as Hs values increased, though some variability was evident. a. Mean Response Time: Calculating the mean response time across all participants and statements: Mean Response Time = 1.2488 seconds This indicates that, on average, participants took 1.2488 seconds to respond to the given statements. b. Distribution of Responses: Counting the number of each type of response: Good: 24 Bad: 21 Neutral: 14 This shows that participants responded with "good" and "bad" more frequently than "neutral".

Discussion

The results support the hypothesis, demonstrating an inverse relationship between the number of statement-response mappings and response times. This aligns with the Hick-Hyman Law's prediction that response times increase with the number of stimulus-response alternatives. The findings suggest that response times can provide insight into user biases when categorizing statements.

Examining the scatter plot, the data points mostly clustered around the regression line, indicating a moderately strong linear relationship. However, individual differences were apparent, likely reflecting variations in reading speed, English proficiency, and prior biases. Gathering data from a larger sample could help to better represent the population.

Conclusion

This study demonstrates the utility of the Hick-Hyman Law for measuring user biases through response times. The inverse relationship between statement-response mappings and response latency suggests that the law can be applied to the domain of categorizing opinion statements, providing a tool for inferring biases.

These findings have implications for user interface design. By understanding user biases, interfaces can be optimized to align with user expectations and minimize cognitive load. Future research should explore how response time-inferred biases compare to explicit measures, as well as how biases impact actual interface interactions.

References

Wickens, C. D., Hollands, J. G., Parasuraman, R., & Banbury, S. (2012). Engineering Psychology and Human Performance (4th ed.). Pearson.

Wikipedia. (2024, January 16). Hick's law. Retrieved from <https://en.wikipedia.org/wiki/Hick%27s_law>