

Reports for “*Subjective and Objective Cognition*” and “*Mechanisms of Visual Search*”

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Executive Summary

This report presents an overview and analysis of two experiments: "Subjective and Objective Cognition" and "Mechanisms of Visual Search." Both experiments were conducted online and aimed to explore different aspects of cognitive performance and user interaction. The first experiment examined the relationship between subjective self-assessments and objective cognitive performance through various cognitive tasks and self-reported cognitive failures. The second experiment focused on understanding the mechanisms of visual search, particularly the accuracy of detecting low-prevalence targets.

In the "Subjective and Objective Cognition" experiment, participants completed tasks that assessed their cognitive abilities, such as memory recall and attentional focus, while also reporting on everyday cognitive failures. This experiment combined subjective and objective measures to provide a comprehensive understanding of cognitive performance.

The "Mechanisms of Visual Search" experiment involved a visual search task where participants identified the presence of a specific target in an array of letters and digits. This experiment aimed to investigate how often missed targets in low-prevalence situations can be influenced by contextual and individual factors.

The report compares the two experiments, highlighting their similarities and differences, and provides a detailed analysis of the personal experiences and methodologies involved. The relevance of these user-participation experiments to web design and development is also discussed, emphasizing the importance of user evaluation in creating effective and user-friendly interfaces.

Introduction

This report explores two distinct experiments focusing on different aspects of cognitive performance and user interaction. The first experiment, "Subjective and Objective Cognition," aimed to understand the relationship between subjective self-assessments and objective cognitive tasks, involving memory, attention, and mental arithmetic, along with reporting on everyday cognitive failures.

The second experiment, "Mechanisms of Visual Search," investigated the accuracy of visual search tasks for low-prevalence targets. Participants identified the presence of a target letter in an array, aiming to understand how contextual and individual factors influence search accuracy.

The report begins with a summary of each experiment, describing their purposes, methodologies, and findings. It then provides a personal account of the participation experience, discussing specific tasks, challenges, and overall engagement. The strengths and weaknesses of each experiment are analyzed, considering their effectiveness and data reliability.

The report compares the two experiments, highlighting similarities and differences in their approaches and findings. Finally, it reflects on the relevance of these user-participation experiments to web design and development, discussing how insights from these studies can inform and enhance the creation of user-centered web interfaces.

First Experiment: Subjective and Objective Cognition

Summary of the Experiment

The purpose of this experiment was to explore the relationship between subjective and objective assessments of cognitive performance. Subjective assessments involve personal perceptions, while objective assessments involve measurable outcomes like accuracy and speed in cognitive tasks. The study aimed to see if the Cognitive Failures Questionnaire (CFQ) could better explain variations in objective cognitive performance.

Participants completed the experiment online, answering questions about cognitive failures and demographic information. They also performed cognitive tasks, such as visual stimulus response, memory recall, and mental arithmetic, using "Millisecond" software.

Personal Experience

Participating was straightforward and engaging. I first answered a cognitive questionnaire and then installed the Millisecond software for the tasks. The instructions were clear, although the "Press No Key" instruction was initially confusing.

The cognitive tasks, especially pressing the spacebar for numbers except 3, required high attention and quick reflexes. Despite some challenges, I understood the instructions and felt confident.

My Comments on the Experiment

The experiment effectively combined subjective and objective measures, providing a comprehensive view of cognitive performance. Clear instructions and well-structured tasks made participation easy and engaging. The "Attention test" in the questionnaire ensured meaningful responses.

However, reliance on self-reported data could introduce bias. The small, mostly student sample might limit the findings' generalizability. Some tasks could be stressful, and clearer instructions were needed for "Press No Key."

Overall, the experiment effectively explored cognitive assessments. The data seemed reliable, but further studies with larger, more diverse samples are needed.

Second Experiment: Mechanisms of Visual Search

Summary of the Experiment

The purpose of this experiment was to investigate the mechanisms of visual search for low-prevalence targets. The study aimed to understand how contextual and individual factors could improve accuracy in visual searches where the target appears infrequently. Participants completed visual search tasks, identifying the presence or absence of a target letter (e.g., the number 7) in a 3x3 matrix. Additionally, demographic information and questions about everyday attentional, memory, and motor mistakes were collected.

The experiment was conducted online. Participants began by calibrating their screens using a standard-sized object, such as a credit card, to ensure accurate presentation of visual elements. After calibration, they answered questions about minor cognitive mistakes and provided basic demographic information. The visual search tasks required pressing specific keys based on whether the target (the number 7) was present in the array, repeated multiple times over about 10 minutes.

Personal Experience

Participating in this experiment was engaging and informative. The initial calibration was straightforward, ensuring correct display of visual elements. Answering questions about everyday cognitive mistakes was reflective, prompting me to consider my attentional lapses and memory errors.

The main visual search task was challenging and stimulating. I had to stay vigilant and quickly determine the presence or absence of the number 7 in various arrays. Most arrays did not contain the target, making sustained attention crucial. The instructions were clear, and the practice trials provided a good understanding of the task. However, I personally found it challenging to consistently focus and capture the number 7 in the arrays.

Overall, the experiment was clear and easy to follow, though it required sustained concentration. The task of identifying the target letter was engaging, and completing the experiment online was convenient and efficient.

My Comments on the Experiment

This experiment had notable strengths. It combined demographic and cognitive self-assessment data with objective performance measures, allowing for a thorough analysis of how various factors influenced visual search performance. The online platform made participation accessible and convenient, broadening the potential participant pool.

However, there were some weaknesses. Identifying a low-prevalence target required sustained attention, which might be challenging for some participants and could lead to fatigue, affecting performance. The sample, mostly university students, might limit the generalizability of the results.

Despite these limitations, the experiment was well-conducted and successfully investigated visual search mechanisms for low-prevalence targets. The clear instructions and structured tasks ensured participant understanding, and the data appeared reliable. Further studies with a more diverse participant pool and additional contextual factors could provide deeper insights.

Comparison of the Two Experiments

Similarities:

1. **Online Format:** Both experiments were conducted online, allowing participants to complete tasks conveniently in their chosen locations.
2. **Cognitive Assessment:** Each experiment involved tasks assessing cognitive performance. The first focused on subjective self-assessment and objective cognitive tasks, while the second focused on visual search accuracy.
3. **Demographic Data Collection:** Both studies collected basic demographic information to analyze the impact of individual differences on cognitive performance.

Differences:

1. **Focus Areas:** The first experiment aimed to understand the relationship between subjective and objective cognitive assessments, including memory recall and mental arithmetic. The second focused on visual search mechanisms and target prevalence accuracy.
2. **Task Nature:** The first experiment involved questions about cognitive failures and various cognitive tasks using downloaded software. The second involved identifying a target letter in an

array directly in a web browser.

3. Software Requirements: The first experiment required Millisecond software installation, while the second used a calibration procedure and was fully web-based.

Personal Experience Comparison:

Both experiments were engaging and informative. The first experiment's variety of tasks was stimulating but required managing multiple activities and software. The second experiment's focused visual search task was straightforward but demanded sustained attention. Both were well-organized with clear instructions, though the first experiment's installation step added complexity.

Experiment Conduct Comparison:

The first experiment was well-structured but involved a more complex setup due to software download. The second experiment had a smoother start with simple calibration and direct web-based tasks. Both experiments effectively gathered relevant data, though the first required more initial effort from participants.

Conclusion Reflecting the Relevance of User-Participation Experiments to Web Design and Development

User-participation experiments are vital for informing web design and development in Human-Computer Interaction (HCI). They provide insights into user behavior, preferences, and cognitive processes, essential for creating user-centered web interfaces.

Relevance to Web Design and Application in HCI:

1. Understanding User Behavior: These experiments reveal how users process information and make decisions, helping designers create interfaces that align with users' cognitive abilities and limitations, enhancing usability.
2. User-Centered Design: Direct user feedback during testing ensures the final product meets user needs and expectations, leading to more effective web experiences.
3. Improving Accessibility: Insights from cognitive and visual search experiments guide the creation of accessible web interfaces for users with varying cognitive abilities.

HCI emphasizes user evaluation in the design process. Effective user interface design involves principles such as visibility, feedback, and error prevention, refined through user-participation studies [1]. These experiments identify usability issues and gather data on user performance, informing design decisions.

As web technologies evolve, continuous user-participation experiments drive innovation and ensure intuitive, efficient web interfaces. Incorporating findings from user studies helps developers create web environments that meet and exceed user expectations.

References

- [1] Shneiderman, B., & Plaisant, C. (1998). Designing the user interface strategies for effective human-computer interaction. SIGB.