

INFORMED CONSENT DOCUMENT

Title of Study: Tackling the ‘right’ problem: Investigating cognitive strategies used in understanding engineering problems

Investigators: Seda Yilmaz, PhD
Jaryn Studer, Research Assistant

This is a research study. Please take your time in deciding if you would like to participate. Please feel free to ask questions at any time.

INTRODUCTION

The purpose of the study is to investigate problem exploration heuristics – strategies used to identify and refine problem definitions (also called problem finding or framing). You are being invited to participate in this study because you contacted us about your willingness in taking part in this research, where we explore cognitive heuristics used in defining design problems. You should not participate if you are under 18.

DESCRIPTION OF PROCEDURES

If you agree to participate, you will be given a problem statement describing a problem and its context in a written format, and asked to work on it for 25 minutes. The problem statement will be developed based on existing problems in engineering, inspired by the Grand Challenges. No interventions will be employed. After the problem statement is provided, you will be asked to reshape that problem into other potential problems, which may be more important or feasible to solve. We will, then, ask you to describe your thoughts as you form ideas for problems, and to explain why you think the defined problem is important. This task will then be repeated using a different problem statement.

After each 25 minute task, we will follow up with an interview addressing the types of design problems faced in practice, how problems change throughout the life of the project, what heuristics are used in framing problems and identifying new solution opportunities, and how problem space influences the solution space. These retrospective interviews will take about 10 minutes each to understand how you describe your own decision-making processes. These interviews will be audio-recorded and transcribed later for analysis.

The entire study will take about one hour and 30 minutes and you will not be asked to spend time on studies in addition to what you will be asked.

RISKS

While participating in this study you may experience the following risks: Minor psychological discomfort; however, we will provide a short think-aloud exercise at the beginning to minimize the discomfort of talking aloud while working on the task.

BENEFITS

If you decide to participate in this study there is no direct benefit to you. However, a possible benefit is that you will become more aware of your approach to problem exploration as we will ask specific questions about your behavior in how you think the design problem changed over time, during meetings and while you are working alone.

COSTS AND COMPENSATION

You will be compensated with \$30 for participating in this study. This amount will be provided to you at the end of the session.

This information allows the University to fulfill government reporting requirements. Confidentiality measures are in place to keep this information secure. You may forego receipt of payment(s) and continue in the research study if you do not wish to provide your social security number and address. Information regarding documentation required for participant compensation may be obtained from the Controller's Department; 294-2555 or <http://www.controller.iastate.edu>.

PARTICIPANT RIGHTS

Your participation in this study is completely voluntary and you may refuse to participate or leave the study at any time. If you decided to not participate in the study or leave the study early, it will not result in any penalty or loss of benefits to which you are otherwise entitled. You can skip any questions that you do not wish to answer.

CONFIDENTIALITY

Records identifying participants will be kept confidential to the extent permitted by applicable laws and regulations and will not be made publicly available. However, federal government regulatory agencies, auditing departments of Iowa State University, and the Institutional Review Board (a committee that reviews and approves human subject research studies) may inspect and/or copy your records for quality assurance and data analysis. These records may contain private information.

To ensure confidentiality to the extent permitted by law, the following measures will be taken: the coding of the data will be done by the researchers who will be blind to the project. Participants' information will be removed and replaced by ID codes. These ID codes will be matched by participants, but will only be available to the PI. No identifiers will be provided to researchers for data analysis. The identifiers will be kept in PI's office, in a locked cabinet. The data will also be kept there, and will be taken out when the researchers analyze them.

If the results are published, your identity will remain confidential.

QUESTIONS OR PROBLEMS

You are encouraged to ask questions at any time during this study.

- For further information about the study contact Dr. Seda Yilmaz at 515.294.716.
- If you have any questions about the rights of research subjects or research-related injury, please contact the IRB Administrator, (515) 294-4566, IRB@iastate.edu, or Director, (515) 294-3115, Office for Responsible Research, Iowa State University, Ames, Iowa, 50011.

.....

PARTICIPANT SIGNATURE

Your signature indicates that you voluntarily agree to participate in this study, that the study has been explained to you, that you have been given the time to read the document, and that your questions have been satisfactorily answered. You will receive a copy of the written informed consent prior to your participation in the study.

Participant's Name (printed) _____

(Participant's Signature)

(Date)

Problem Number: _____ Participant Number: _____

EXPLORING THE PROBLEM PROTOCOL STUDY

ABOUT YOU

1

GENDER:

MALE

FEMALE

OTHER

FIELD: *check all that apply*

ENGINEERING

DESIGN

YEARS OF EXPERIENCE:

0 – 3 YEARS

7 – 9 YEARS

4 – 6 YEARS

10+ YEARS

BRIEF DESCRIPTION OF EXPERIENCE:

HOW COMFORTABLE DO YOU FEEL:

(1 = not comfortable at all, 7 = very comfortable)

1. ANALYZING A PROBLEM

1

2

3

4

5

6

7

2. EXPLORING MULTIPLE APPROACHES TO A PROBLEM

1

2

3

4

5

6

7

3. DEFINING A SPECIFIC PROBLEM TO SOLVE

1

2

3

4

5

6

7

Problem Number: _____ Participant Number: _____

EXPLORING THE PROBLEM PROTOCOL STUDY

PROBLEM STATEMENT

2

Read the given problem statement below and ensure your understanding of the task. Feel free to use this sheet of paper for any annotations or notes.

On the provided sheets of paper, sketch and describe as many solutions to the problem as you can think of in the time allotted [25 minutes]. If you finish before the time is up or you've exhausted the number of solutions you can think of, please notify the researcher to move on to the next task.

Please **think aloud** as you complete this task.

Disaster Relief

In areas recently stricken by natural disasters (tsunamis, earthquakes, hurricanes, floods, tornadoes, etc.), large populations are suddenly made homeless and lose access to electricity. Disaster relief efforts focus on rescue, and supplying food and shelter to victims, often meaning that electrical power can be inaccessible for a very long time. Your task is to design a deployable device(s) that can be used at the site of a disaster relief effort. They should be suitable for quick deployment and set-up, and should be operable by everyday citizens, including victims of disaster.

Problem Number: _____ Participant Number: _____

EXPLORING THE PROBLEM PROTOCOL STUDY

PROBLEM STATEMENT

2

Read the given problem statement below and ensure your understanding of the task. Feel free to use this sheet of paper for any annotations or notes.

On the provided sheets of paper, sketch and describe as many solutions to the problem as you can think of in the time allotted [25 minutes]. If you finish before the time is up or you've exhausted the number of solutions you can think of, please notify the researcher to move on to the next task.

Please **think aloud** as you complete this task.

Playground

A city resident has recently donated a corner lot for a playground. You are an engineer who lives in the neighborhood and you have been asked by the city to help with the project. Your task is to design playground equipment for the lot using locally sourced materials that are able to withstand outdoor conditions all year long.

Problem Number: _____ Participant Number: _____

EXPLORING THE PROBLEM PROTOCOL STUDY

GENERATE SOLUTIONS

3

CONCEPT			
DESCRIPTION			
	1	2	3

Reminder: Please think aloud as you generate these solutions

Problem Number: _____ Participant Number: _____

EXPLORING THE PROBLEM PROTOCOL STUDY

GENERATE SOLUTIONS

3

CONCEPT			
DESCRIPTION			
	4	5	6

Reminder: Please think aloud as you generate these solutions

Problem Number: _____ Participant Number: _____

EXPLORING THE PROBLEM PROTOCOL STUDY

GENERATE SOLUTIONS

3

CONCEPT			
DESCRIPTION			
	7	8	9

Reminder: Please think aloud as you generate these solutions

Problem Number: _____ Participant Number: _____

EXPLORING THE PROBLEM PROTOCOL STUDY

ANALYZE SOLUTIONS

4

For each of the solutions you generated, write a problem statement that would allow other students to come up with the same solution you developed.

Please **think aloud** as you complete this task.

1

2

3

4

5

Reminder: Please think aloud as you generate these solutions

Problem Number: _____ Participant Number: _____

EXPLORING THE PROBLEM PROTOCOL STUDY

ANALYZE SOLUTIONS

4

7

8

9

10

11

12

Reminder: Please think aloud as you generate these solutions