CS4249 Assignment 1 Part 1

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# **Experiment Design**

1. **Define the research question**

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| 1.1: Start with a general question | *How does marking menu compare with radial menu in terms of performance?* |
| 1.2:Define the target population | *Computer users* |
| 1.3:Define task(s) | *Select items from menu with different menu depths.* |
| 1.4: Define measure(s) | *Speed, accuracy, number of attempts* |
| 1.5: Define other factor(s) | *Different menu depth, different computers, different familiarity of using computers, different input devices used (mouse vs touchpad)* |

1. **Determine variables**

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| 2.1: Techniques, Task Types, & Other Factors → Independent variables | *Independent variables:*   * *Technique (2 levels: Marking Menu, Radial Menu)* * *Menu depths (3 levels: 1,2,3)* * *Menu breadths (2 levels: 4, 8)* * *Input devices (2 levels: Mouse, Touchpad)* * *Task type, usage scenario (single-task vs multi-tasking), menu breadth (3 levels: 4, 6, 8) . By differentiate we mean that there will be a statistical signiﬁcance when analyzing the dependent variables based on this independent variable. Hint: This can come from both task types, or other factors. In the slides from the class, a few factors have been mentioned, you can use one of the factors mentioned there. Note that we don't recommend between-subject factors such as gender or age group. Please choose a within-subject factor and implement it in the experimental environment. However, you can still include the above factors as the fourth independent variable if you are interested in investigating their effects.*   ***Extra credit****: if you can identify another factor that's not mentioned in the lecture slides which can also help to differentiate the techniques.* |
| 2.2: Measures → Dependent variables | *Dependent variables:*   * *Completion time (seconds)* * *Error rate (%)* * *Attempts (count number).* |
| 2.3: Everything else → Control/Random Variables | *Control variables:*   * *Same computer, same instruction*   *(same experiment time, same instruction)*   * *E.g. Time of day, device, same instruction, etc.*   *Random variables:*   * *Age, gender, occupation, background of using computers* * *E.g. Participants’ age, gender, occupation, etc.* |

1. **Arrange conditions**

|  |  |
| --- | --- |
| 3.1: List all independent variables and their levels | * *Technique (2 levels Marking Menu, Radial Menu) → Fully counter-balanced* * *Menu Depth (3 levels: 1,2,3) →*   *No counter-balance, sequential, because there should be a learning effect if users go to depth 3 menu prior to other depth menus*   * *Menu Breadth (2 levels: 4,8) → Fully counter-balanced* * *Input Device (2 levels: mouse, touchpad) → Fully counter-balanced* |
| 3.2: Decide counter-balancing strategy for each variable |
| 3.3: Determine the minimum No. of participants | *2!\*1\*2!\*2! = 8* |
| 3.4: Arrange the overall design | *Please fill in this part. You might wish to include it as a separate section below this table.* |
| 3.5: Determine detailed arrangement for each participant | *Please fill in this part. You might wish to include it as a separate section below this table.* |

1. **Decide trials**

|  |  |
| --- | --- |
| 4.1: Estimate time for each trial (typically >= 3 trials per condition) | *Estimate time for each trial: 10 seconds*  *Number of trials for each condition: 3*  *Total number of trials: 3 trials/condition x 24 conditions = 72*  *Total time: 72 x 10 sec = 12 minutes*  *It is recommended that the experiment will be finished within 45 minutes, excluding the pre and post questionnaires. This is because this allows you to quickly test with more participants since each participant only need to spend less than 45 minutes for your experiment. However, if you have good reasons to extend the experiment beyond 45 minutes, it’s also fine with us.* |
| 4.2: Decide number of trials so that the main experiment is within 45 minutes |
| 4.3: Combine trials with the condition arrangement |

1. **Set instruction and procedures**

|  |  |
| --- | --- |
| 5.1: Recruit participants (determine target users and randomize) | *Please fill in the minimum number of participants to recruit. However, make sure it is equal to or more than 6 participants* |
| 5.2: Consent form and pre-experiment questionnaire | *Please include the pre-questionnaire as a separate document.*  *Please come up with a basic questionnaire to help you gather participant information. The purpose of this questionnaire is to report the participant data and convince readers that you have picked an appropriate target user group and the result has certain generalizability.*  *Hint: typically, you want to collect the age, gender, information, educational background, prior experience with the computers and test techniques.*  *e.g.: Name: \_\_\_\_\_, Age: \_\_\_\_\_\_\_, Occupation: \_\_\_\_\_\_, etc.* |
| 5.3: Instructions | *Provide clear and consistent instructions to participants. Please fill in this part in a separate document.* |
| 5.4: Practice trials | *Make sure people start with each technique with roughly the same experience. You may decide to include or not include any practice trials for one or more of your testing conditions. We leave this for you to decide.* |
| 5.5: Main experiment with breaks | *Ask participants to take breaks* |
| 5.6: Post-experiment questionnaire and interview | *Please design a basic post-experimental questionnaire (no more than 10 questions in a separate document) to help you to provide more in-depth information about the trade-offs between the tested techniques. After the experiment, you want to collect more qualitative and quantitative feedback about the tested techniques. Some of the typical questions include, personal preferences, any difficulties participants experienced in the experiment, and areas of improvement.*  *e.g.: Which technique do you like better?*  *Rate the ease of use of Technique A on a 5 point Likert scale.*  *Rate the ease of use of Technique B in a 5 point Likert scale.* |
| 5.7: Debriefing | *Answer any questions, thank the participants, etc.* |

# **Arrangements**

## 3.4 Overall Design Arrangement

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Ordering | IV1: Technique | | IV2: Menu Depth | | | IV3: Menu Breadth | | IV4: Input Device | |
| 1 | Marking | Radial | 1 | 2 | 3 | 4 | 8 | Mouse | Touchpad |
| 2 | Marking | Radial | 1 | 2 | 3 | 8 | 4 | Mouse | Touchpad |
| 3 | Marking | Radial | 1 | 2 | 3 | 4 | 8 | Touchpad | Mouse |
| 4 | Marking | Radial | 1 | 2 | 3 | 8 | 4 | Touchpad | Mouse |
| 5 | Radial | Marking | 1 | 2 | 3 | 4 | 8 | Mouse | Touchpad |
| 6 | Radial | Marking | 1 | 2 | 3 | 8 | 4 | Mouse | Touchpad |
| 7 | Radial | Marking | 1 | 2 | 3 | 4 | 8 | Touchpad | Mouse |
| 8 | Radial | Marking | 1 | 2 | 3 | 8 | 4 | Touchpad | Mouse |

Total number of orderings: 2! x 1 x 2! x 2 = 8

## 3.5 Detailed Arrangement for each Participant

For ordering 1:

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Cond | Ordering | IV1: Technique | | IV2: Menu Depth | | | IV3: Menu Breadth | | IV4: Input Device | |
| 1 | 1 | Marking |  | 1 |  |  | 4 |  | Mouse |  |
| 2 | 1 | Marking |  |  | 2 |  | 4 |  | Mouse |  |
| 3 | 1 | Marking |  |  |  | 3 | 4 |  | Mouse |  |
| 4 | 1 | Marking |  | 1 |  |  |  | 8 | Mouse |  |
| 5 | 1 | Marking |  |  | 2 |  |  | 8 | Mouse |  |
| 6 | 1 | Marking |  |  |  | 3 |  | 8 | Mouse |  |
| 7 | 1 | Marking |  | 1 |  |  | 4 |  |  | Touchpad |
| 8 | 1 | Marking |  |  | 2 |  | 4 |  |  | Touchpad |
| 9 | 1 | Marking |  |  |  | 3 | 4 |  |  | Touchpad |
| 10 | 1 | Marking |  | 1 |  |  |  | 8 |  | Touchpad |
| 11 | 1 | Marking |  |  | 2 |  |  | 8 |  | Touchpad |
| 12 | 1 | Marking |  |  |  | 3 |  | 8 |  | Touchpad |
| 13 | 1 |  | Radial | 1 |  |  | 4 |  | Mouse |  |
| 14 | 1 |  | Radial |  | 2 |  | 4 |  | Mouse |  |
| 15 | 1 |  | Radial |  |  | 3 | 4 |  | Mouse |  |
| 16 | 1 |  | Radial | 1 |  |  |  | 8 | Mouse |  |
| 17 | 1 |  | Radial |  | 2 |  |  | 8 | Mouse |  |
| 18 | 1 |  | Radial |  |  | 3 |  | 8 | Mouse |  |
| 19 | 1 |  | Radial | 1 |  |  | 4 |  |  | Touchpad |
| 20 | 1 |  | Radial |  | 2 |  | 4 |  |  | Touchpad |
| 21 | 1 |  | Radial |  |  | 3 | 4 |  |  | Touchpad |
| 22 | 1 |  | Radial | 1 |  |  |  | 8 |  | Touchpad |
| 23 | 1 |  | Radial |  | 2 |  |  | 8 |  | Touchpad |
| 24 | 1 |  | Radial |  |  | 3 |  | 8 |  | Touchpad |

Total number of conditions for each ordering: 2 x 3 x 2 x 2 = 24

For ordering 2:

## 4.3 Combine Trials with the Condition Arrangement

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Cond | Ordering | IV1: Technique | | IV2: Menu Depth | | | IV3: Menu Breadth | | IV4: Input Device | | Trial |
| 1 | 1 | Marking |  | 1 |  |  | 4 |  | Mouse |  | 1 |
| 1 | 1 | Marking |  | 1 |  |  | 4 |  | Mouse |  | 2 |
| 1 | 1 | Marking |  | 1 |  |  | 4 |  | Mouse |  | 3 |
| 2 | 1 | Marking |  |  | 2 |  | 4 |  | Mouse |  | 1 |
| 2 | 1 | Marking |  |  | 2 |  | 4 |  | Mouse |  | 3 |
| 2 | 1 | Marking |  |  | 2 |  | 4 |  | Mouse |  | 2 |
| 3 | 1 | Marking |  |  |  | 3 | 4 |  | Mouse |  | 2 |
| 3 | 1 | Marking |  |  |  | 3 | 4 |  | Mouse |  | 1 |
| 3 | 1 | Marking |  |  |  | 3 | 4 |  | Mouse |  | 3 |
| 4 | 1 | Marking |  | 1 |  |  |  | 8 | Mouse |  | 2 |
| 4 | 1 | Marking |  | 1 |  |  |  | 8 | Mouse |  | 3 |
| 4 | 1 | Marking |  | 1 |  |  |  | 8 | Mouse |  | 1 |
| 5 | 1 | Marking |  |  | 2 |  |  | 8 | Mouse |  | 3 |
| 5 | 1 | Marking |  |  | 2 |  |  | 8 | Mouse |  | 1 |
| 5 | 1 | Marking |  |  | 2 |  |  | 8 | Mouse |  | 2 |
| 6 | 1 | Marking |  |  |  | 3 |  | 8 | Mouse |  | 3 |
| 6 | 1 | Marking |  |  |  | 3 |  | 8 | Mouse |  | 2 |
| 6 | 1 | Marking |  |  |  | 3 |  | 8 | Mouse |  | 1 |
| … |  |  |  |  |  |  |  |  |  |  |  |

Total number of trials for each participant: 3 trials/condition x 24 conditions = 72