Current Topics in Media Computing and HCI
L02 Experimental Research: Writing a Protocol

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http://hci.rwth-aachen.de/cthci
Expected Until Now

- Received the “Welcome to CTHCI SS 18” email via L2P
- Read Research contributions in human-computer interaction
- Watched all videos on iTunes Podcasts (RSS) (total 8)
  - HCI contribution types
  - Contribution and benefits statement
  - Experimental approaches
  - Experimental research
- Formed a team for assignments
# Assignment Teams

<table>
<thead>
<tr>
<th>Last Name</th>
<th>First Name</th>
<th>Team</th>
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<tbody>
<tr>
<td>Shanmuga Sundaram</td>
<td>Harish Balaji</td>
<td>1</td>
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<tr>
<td>Arsenij</td>
<td>Anton</td>
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<td>Pelinescu</td>
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<td>M?nguez Garrigues</td>
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<td>Isaenko</td>
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<td>Ahnvik</td>
<td>Louise</td>
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<td>Messerschmidt</td>
<td>Moritz Alexander</td>
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<td>Olbrich</td>
<td>Joshua</td>
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<td>Röttgen</td>
<td>Michel Maximilian</td>
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<td>Belova</td>
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<td>Benscheid</td>
<td>Jan</td>
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<td>Bayer</td>
<td>Patrick</td>
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<td>Slupczynski</td>
<td>Michal Piotr</td>
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<td>Golinski</td>
<td>Tanja</td>
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<td>Offermanns</td>
<td>Tobias</td>
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<td>Bayer</td>
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<td>Peskovic</td>
<td>Mirela</td>
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<td>Wronska</td>
<td>Ada Magdalena</td>
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<td>Junga</td>
<td>Marten</td>
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<tr>
<td>Lagare</td>
<td>Rakesh Mahaveer</td>
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<td>Snizhko</td>
<td>Oleksandr</td>
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<td>Kücükyareli</td>
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<td>Menon</td>
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<td>Hupri</td>
<td>Devendra Bharates</td>
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<td>Tavarekere Ramamoorthy</td>
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<td>Hupmann</td>
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<td>Schäfer</td>
<td>René</td>
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<td>Comanns</td>
<td>Fabian</td>
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This list is no longer valid!
Basic Elements of Experimental Study

- **Manipulate**
  - A
  - B

- **Measure**
  - Controls
  - Extraneous variables

- **Compare**
- **Validity:**
  - Internal
  - External

- **Scales:**
  - Nominal
  - Categorical
  - Interval
  - Ratio

- **Hold constant**
- **Matching**
- **Random assignment**

- **Confounding variables**
Hypothesis

• Hypothesis

• A hypothesis is an educated prediction about the relationship between two or more variables. It is a specific, testable prediction about what you expect to happen in a study.

• Example: “Young participants will have significantly better memories than older participants”

• How could we study this?

• Variables?

https://explorable.com/operationalization
Operationalization

• Operationalization

  • “Operationalization is the process of strictly defining variables into measurable factors. The process defines fuzzy concepts and allows them to be measured, empirically and quantitatively.”

• Example: “Young participants will have significantly better memories than older participants”

  • Young participants: aged between 16 - 30
  • better memories: recall more nouns from a list of twenty
  • older participants: aged between 55 - 70

• Final hypothesis “Participants aged between 16 - 30 will recall significantly more nouns from a list of twenty than participants aged between 55 - 70”
User Study Protocol

• A document that explicitly states why a research project is being conducted and how

• Purpose:
  • Clearly state the research question and hypotheses
  • Plan the research procedure in details
  • A guide for all involved personal
  • Monitor research progress
  • Reproducibility

*(O’Brien and Wright, 2002) How to write a protocol
Title - “Evaluating the performance of a new keyboard layout”

Research problem - “We intend to find if our new keyboard layout performs faster and with less errors than the QWERTY keyboard. The new layout would lead to smaller form factors.”

Context - “There have been many new layouts that appear to perform faster than QWERTY but lead to fatigue [X, Y, Z]”

Aim (derived from context)

Hypotheses - “There is no difference in typing speed between the new layout and QWERTY”
Protocol Structure: The Research Method 1/2

• Independent variables & dependent variables (levels, operational definition, measurement scale and unit)

• Task - “The user will perform a composition task using statements from MacKenzie et al. (CHI 2003). The participant will do the following activities to complete the task…”

• Subjects/Participants (number, gender, age distribution, main characteristics, criteria to include or exclude them)

• Experimental design (within or between groups and how the conditions will be assigned)
Protocol Structure: The Research Method 2/2

- **Experiment setup and/or apparatus** (such as hardware or special features in the testing space)
- **Experiment procedure** (what the experimenter will do to setup the testing space)
- **Data analysis methods**
- **References**
- Include images or sketches if informative
- Write this section in future tense
A01: Reverse Engineering User Studies

• Split each team to two smaller teams
• Read the paper’s introduction and experiment sections
• Reconstruct the experiment protocol
• How did the paper attempt to establish internal and external validity?
• Peers will evaluate the protocol using a checklist
Validation

• The difference between a claim and a result is validation.

• Internal validity: the extent to which you can say that no other variables expect the ones you are studios caused the measure result.

• External validity: the extent to which the results of one experiment can be generalized to the world at large.
Protocol Evaluation Check List

• Is the research question stated clearly?
• Is there any alternative interpretation of the question?
• Suppose you can accept the stated hypotheses, does it contribute to the understanding of the research question?
• Are variables defined clearly on the operational level?
• Is there more than one possible interpretation for the variables?

• Is the experimental design chosen carefully with consideration of the trade-offs?
• Are the statistical methods specified?
• Are the resources needed to conduct the experiment stated?
• Is the duration of the experiment appropriate?
• Ultimate question: If you had no idea about the experiment before, could you pick up this protocol, set up, and conduct the experiment? (Replicability)
What You Need To Do Now

• Finish and submit A01 via L2P
  • The assignment will also be available for you on L2P

• Required Read:
  • Methodology Matters – McGrath, 1995 (starting from STUDY DESIGN, COMPARISON TECHNIQUES, AND VALIDITY section)

• Recommended Read:
  • Developers ask reachability questions – LaToza, T. D., & Myers, B. A., ICSE 2010