Current Topics in Media Computing and HCI

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Media Computing Group
RWTH Aachen University
Summer Semester 2015
http://hci.rwth-aachen.de/cthci
Goals

• Understand ways to do research in HCI

• Practice how to retrieve and evaluate information from the literature
  ⇒ Preparation for thesis and future research work

• Learn about up-to-date developments in Human–Computer Interaction and interactive multimedia from new books and recent conference/journal articles
Topics for 2015

• Research literacy (3.5 weeks)
  • Understanding HCI research approaches
  • Experimental research and user study protocol (case study: text entry techniques)
  • Statistics in HCI research (case study: midair input techniques)
  • Publication and peer-review process

• Research topics (7.5 weeks)
  • Research in coding and IDEs
  • Touch and tangibles on large interactive surfaces
  • Augmented reality in HCI
  • Gestural and stroke input: from touch screens to midair
  • HCI design patterns
  • Interactive e-learning
  • Personal fabrication and personal design
Current Topics in Media Computing and HCI

• Audience
  • M.Sc. Computer Science
  • M.Sc. Media Informatics
  • M.Sc. Software Systems Engineering
  • B.Sc. Computer Science (extra credit / carry-over)
  • B.Sc. / M.A. Technical Communication (with focus on CS/HCI research)

• Prerequisite: DIS I
  • In our lectures, assignments, and exams we assume that you know DIS I
Literature Sources

- Recent (usually last 2 years) conference papers
  - CHI, UIST, ITS, DIS, Ubicomp,…
  - Older seminal papers included
- Recent journal articles
  - TOCHI,…
Literature Sources

- Recent books
  - Research Methods in HCI (Lazar et al., 2010)
    Recommended reading for more details about evaluation methods — especially if you are going to do your thesis at our chair!
  - Research Methods for the Behavioral Sciences (Gravetter and Forzano, 2012)
    Recommended reading for more details about experimental research methods
Administrative

• Format: 6 ECTS

• Lecture: Tuesday, 10:15–11:45
  • Presentation & discussion of research topics
  • Small group in-class exercises
  • Weekly reading assignments (individual)

• Lab: Thursday, 08:15–09:45
  • Practice skills learned from the lecture and discuss reading and written assignments
  • 3 written assignments (in groups)
  • 1 mini HCI research project (in groups)

• Extra supervision slots during mini project phase by appointment

Active attendance in both lecture and lab expected!
Final Grade

- 30% midterm (June 9)
- 15% 3 written assignments
- 10% mini HCI research project
- 45% final (July 28)
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<tr>
<td>07.04</td>
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| 14.04        | R1: Three approaches to HCI research | Jan | 16.04 | Paper reading and identifying contribution types | Nur | Required:  
• (Witbrock, 2014) Seven Research Contributions Types in Human-Computer Interaction  
• (Sinclair, n.d.) How to Read an Engineering Research Paper | A01: Categorizing research contributions and writing contribution statements | 16.04. |
| 21.04        | R2: Mechanics of experimental research and how to write a user study protocol (Case study: Text-entry techniques) | Nur | 23.04 | Literature searching and contributions & benefit statement | Nur | Required:  
• (MacKenzie, 2007) Evaluation of Text Entry Techniques  
Recommended: TBO | (A01 peer feedback) | 23.04. |
| 28.04        | T1: Research in coding and IDEs | Jan-Peter | 30.04 | Designing experimental user studies | Nur | Required: TBO  
Recommended: TBD | A02: Reverse-engineering user study protocol | 30.04. |
| 05.05        | (no lecture: Student Representative Council Meetings) | – | 07.05 | – | – | – | – | – |
| 12.05        | T2: Touch and Tangibles on Large Interactive Surfaces | Simon | 14.05 | (no lab: Ascension of Christ) | – | Required: TBO  
Recommended: TBD | A03: Writing a review: Interactive surfaces and tangibles | 14.05. |
| 19.05        | T3: Augmented reality HCI | Nur | 21.05 | • A02 discussion  
• Midterm exam preparation lab | Nur | Required: TBO  
Recommended: TBD | (A03 peer feedback) | 21.05. |
| 26.05        | (no lecture: Excursion week) | – | 28.05 | (no lab: Excursion week) | – | – | – | 28.05. |
| 02.06        | R3: Understanding statistics in HCI research (Case study: midterm input techniques) | Krishna | 04.06 | (no lab: Corpus Christi) | – | None (exam preparation week) | (Midterm exam preparation) | – |
| 08.06        | Midterm: R1–3, T1–2 (30%) | Nur | 11.06 | Midterm exam discussion (not review) | Nur | Required:  
• (Diakopoulos, 2014) Running an HCI Experiment in Multiple Parallel Universes  
• (Witbrock, 2011) Practical statistics for HCI | A04: Mini HCI research project: Midterm input techniques | 11.06. |
| 16.06        | T4: Gestural and stroke input: from touch screens to midair | Chat | 18.06 | • A03 discussion  
• Initial discussion for mini project | Nur | Required: TBO  
Recommended: TBD | (A04 continued) | 18.06. |
| 23.06        | R4: Peer-review process in HCI T5-1: Pattern language | Jan | 25.06 | Mini project interim presentation and feedback | Nur | Required:  
• (Dearden and Finlay, 2006) Pattern Languages in HCI: A Critical Review  
Recommended: TBD | (A04 peer feedback) | 25.06. |
| 30.06        | T5-2: Pattern language | Jan | 02.07 | Mini project interim presentation and feedback | Nur | Required: TBO  
Recommended: TBD | (A04 continued) | 02.07. |
| 07.07        | T6: Interactive e-learning  
• Topic evaluation  
• Course evaluation | Krishna | 09.07 | Mini project interim presentation and feedback  
A04 discussion | Nur | Required: TBO  
Recommended: TBD | (Final exam preparation) | 09.07. |
| 14.07        | T7: Personal fabrication and personal design  
• Course reflection | Jan | 16.07 | Final exam preparation lab | Nur | Required: TBO  
Recommended: TBD | (Final exam preparation) | – |
Learning Resources

- Public website with all general info: http://hci.rwth-aachen.de/cthci including links to:
  - L²P course room (slides, literature, assignments)
  - Lecture recordings on iTunes U
  - Research papers in the ACM Digital Library
    Free access from inside RWTH network
CTHCI Team

• Prof. Dr. Jan Borchers

• Nur Al-huda Hamdan, M.Sc.
  • hamdan@cs.rwth-aachen.de

• Topic presenters
Limited Seats

• 30 seats available

• Register in CAMPUS or email Nur for registration before Friday

• You will know if you’re in by next lecture (Tue)

• First assignment in the first lab (this Thu)
Plagiarism

Cite and quote instead of plagiarizing!

Consequences of Plagiarism in this Class

• Plagiarism will result in an immediate 5.0 for this class.

• Repeated plagiarism will also lead to banning from all other i10 classes.

• Sign the declaration of compliance and hand it in after the lab.
Three Approaches to HCI Research

Test
Empirical science

Look
Ethnography

Make
Engineering and design
Empirical Approach

Research question

Observation

Hypothesis
Initial Observation

• Begin with casual or informal observation

• Usually comes from personal experience that catches your attention or raises questions in your mind

• Example: “Cloth has an affordance of pinching. Could this be useful for interaction design?”
Research Question

• Identify variables and hypothesis that are associated with your observation

• **Variables:** characteristics or conditions that change or have different values for different individuals

• **Research question:** a statement that describes or explains a relationship between or among variables
  - A proposal to be tested

• Example: “For pinching cloth, different areas of the body would differ in preference and the way people pinch”
Hypothesis

- Concrete and testable statements derived from the research question
- Operational definition: a specific set of operations for measuring external, observable behavior
- In-class exercise: try giving an operational definition for the variables highlighted below
  - “There would be a difference in user’s preference among different areas on the body for pinching cloth.”
**Research Example: Pinstripe**

- **Karrer et al., CHI ’11**

- **Recall the prediction:**
  - “There would be a difference in user’s preference among different areas on the body for cloth pinching.”

- **Method:**
  - Identify 16 different body area
  - Ask the participants to perform the pinching gesture in these areas
  - Collect convenience rating in 5-point Likert scale

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**Figur 5.** We selected 16 areas from the front of the human body where textile UI elements could be placed. Some areas were left out deliberately. The two 'pocket' areas were added after the study to account for an observation we made during the experiment. The 'blobs' outline the parts of each area where study participants grabbed a fold. Each 'blob' is colored according to the average grade given to the respective area.

For each area, participants were asked to grade how conveniently they could perform the pinch-and-roll gesture. Grades were collected on a 5-point Likert scale (1 being 'very convenient' and 5 being 'very inconvenient'). The experimenter also recorded the position and angle of the fold by drawing a mark on a template sheet (similar to Figure 5) which was vectorized later, and he noted down the use of the dominant or non-dominant hand. After the trial, participants were asked to name the one single body area they would most prefer to use Pinstripe at. We also asked users for their preferred orientation of the control gesture, i.e. mapping an inwards motion of the thumb to an increase in the controlled value or a decrease. This information was only collected for the preferred body area the user had named.

**Observations**

We performed the study asking people on the campus of our university and around the city to participate. Of the 90 participants, 15 were female, 75 were male. 13 participants were left handed, the rest right handed. No ambidextrous person took part in this study. 8 persons wore tight fitting clothes, 9 wore loose clothing and the rest wore regular fitting clothes. Because we conducted the study during the summer, only 16 participants wore long sleeves.

Table 1 shows an overview of the tested areas. For each area, we calculated the median grade, lower and upper quartiles of the grade, and the standard deviation of the angle of the control gesture (Figures 5, 6). Five regions received a median grade of 2, six regions received a median grade of 3 and six regions received a grade of 4 or 5. The standard deviation of the angles reach from 11.7% at the sternum to 44.7% for the lower leg. The regions with the smallest spread in gesture angles are the sternum, the pockets, and the upper as well as the lower arms. These regions also show only one mode in the distribution of gesture angles. Most of the other areas show several modes, typically two, which correspond to different ways in which users held their hands when performing the gesture in these areas. Figure 7 shows the angular distribution of the middle waist area as an example where 23
Planned Observation

- Collect data to support, refute, or refine the original hypothesis
- Three strategies
  - **Descriptive research:** $X$ happens
    - Focus on the current state of each individual variable
  - **Relational research:** $X$ and $Y$ happen together
    - Measure two or more variables that exist naturally from each participant
  - **Experimental research:** $X$ causes $Y$
    - Manipulate one or more variables and observe their effects to other variables
Descriptive Research

- Describe a naturally-occurring phenomenon
- Measure and report individual variables \textit{without claiming relationships}
- Natural phenomena can occur when using a new technology as well
- Methods: observation, survey, case study
Research Example: Natural Troubles of Driving with GPS

- Brown (Sweden) and Laurier (Edinburgh), Best paper CHI ’12
- Goal: To understand users’ interaction with GPS navigation system in non-controlled setting
- 14 drivers, 2 video cameras, field notes
  - 9 hours of video \(\Rightarrow\) 75 clips \(\Rightarrow\) 37 detailed transcriptions
  - Analyzed the data to find common patterns/themes and construct theories that explain them
While the driver 'follows' what the GPS recommends the driver still needs skill to read what the GPS says and even to ignore GPS instructions.
Natural Troubles of Driving with GPS

• Contribution & benefits:
  • “Presents a video analysis study of driving using GPS navigation systems in natural settings. The paper argues for [understanding] driving with [a] GPS as an active process and not as ‘docile driving’.”

• Conclusion
  • Designer should take into account the “intelligent driver”
    E.g., less persistent instructions when the user decided to deviate from them
  • Normal natural trouble: “GPS is used in the way that was not foreseen. The driver must take instructions and the map and fit them with the situation.”
Relational Research

- Measure a set of variables for each participant
- Examine to identify patterns of relationship
  - Changes in one variable are consistently and predictably accompanied by changes in another variable
- Measure the strength of the relationship
Research Example: Social Network Activity and Social Well-Being

• Burke (CMU), Marlow, and Lento (Facebook), Best paper CHI ’10
  • “An empirical analysis of the relationship between direct and passive communication on Facebook and social well-being, including loneliness, bridging, and bonding social capital.”

• Survey in Likert scale (N=1193)

• Analyze the past two months of users’ Facebook activity data, e.g.,
  • Friend count (actual)
  • Directed communication: comments, likes
  • Passive consumption of broadcast items such as status updates
Patterns in the Relationship between Variables

Simulated data for instructional purpose, based on the result from [Burke et al., CHI ’10]
**Strength of the Relationship between Variables**

- **Directed communication score** vs **Social bonding score**

  - **Weak** relationships:
    - First graph: Directed communication score vs Social bonding score with a weak positive correlation.
    - Second graph: Directed communication score vs Social bonding score with a weak positive correlation.
  - **Strong** relationships:
    - Third graph: Directed communication score vs Social bonding score with a strong positive correlation.

Simulated data for instructional purpose
Limitations of Relational Research

- Correlation does not imply causation
  - E.g., loneliness ⇒ less direct communication?
  - or less direct communication ⇒ loneliness?
  - or third variable ⇒ direct communication and loneliness?

- Third variable problem: unidentified variable controls the correlated variables

- Shallow data from large number of people instead of deep data
  - Can be improved by follow-up interviews, follow-up surveys

- Participant sampling method limits the conclusion
  - Method: advertisement on Facebook
  - Participants: only English-speaking users, but compensated by many countries of origin
Next Week: Experimental Research

• How can we be sure that X causes Y? — Experimental methods
• How to measure that? — Measures and metrics
• How good is a piece of knowledge? — Validity and generalizability
• How to design a user study? — User study protocol
• Illustrated by a contemporary topic: Text entry UIs
What You Need To Do Now

• Sign up for this class in CAMPUS or email Nur by Friday!

• Read this paper today (definitely before the lab!):
  • Seven Research Contribution Types in Human–Computer Interaction
    — Jacob Wobbrock, 2014

• Come to the lab this Thu, April 16th!
  • Literature searching and reading techniques
  • Help with CAMPUS/L2P problems

• Read this paper before the next lecture:
  • How to Read an Engineering Research Paper — William G. Griswold

Links to articles: hci.rwth-aachen.de/cthci
S01 Refrenced Literatures


