HTI M.Sc. Thesis Introduction

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M.Sc. Programme in Human-Technology Interaction

University of Tampere, 9.5.2018
HTI Thesis

- Topics are often related to (a) the daily work of the students, (b) research topics of TAUCHI, (c) personal topics of students, and (d) continuation of course projects.

- Typically contains any combination of the following items: (i) Design, (ii) Implementation, and (iii), Evaluation of interactive systems or services.
  - However, rarely contains all of these in full extend, focus is usually one of these

- Methods range from constructive research (sometimes close to SE) to interviews, questionnaires, empirical experiments etc.

- Can be done in groups (pairs)
Typical HTI thesis structure

- Introduction (2-3 pages)
- Part I (“theory”):
  - Background (literature) 1 - 3 chapters
- Part II (“own work”):
  - Description of the main subject (e.g., an application, study)
  - Design
  - Implementation
  - Evaluation
  - Discussion
- Conclusions (2 - 3 pages)
HTI thesis process

- Familiarize yourself with the topic (e.g., this meeting)
- Write a brief (one page) abstract and submit it to head of the M.Sc. Programme (Markku Turunen)
- Your topic will be discussed among the supervisors; a supervisor candidate will be chosen according to the expertise and availability
- A discussion between you and your possible supervisor
- Signature of the supervision agreement
- Participate in the HTI M.Sc. Seminar
- Otherwise, follow the generic thesis guidelines
THESIS EXAMPLE: VILLE MÄKELÄ
Assistive techniques in gestural user interfaces
Avustavat tekniikat elekäyttöliittymissä

Research Question(s)

• Sticky Cursor vs. Normal Cursor
  - Do sticky cursors improve usability and efficiency in gesture interfaces?

• The Information Wall User Experience
Table of Contents

• Introduction ~ 2 pages
• Theory Section ~ 21 pages
• Information Wall Description ~ 16 pages
• User Studies - Finished ~ 11 pages
• Conclusion and Future Work ~ 4 pages

• Completed thesis at 61 pages + appendixes
The Evaluation

• All participants went through three sessions
• The task was to select the highlighted buttons in a sequence
• Selection was made by moving the cursor on the target and keeping it there until dwell time expired
• One session had a normal cursor, the other two had sticky cursors with varying volume (100px and 200px)
The Results

- Users were a lot faster and more consistent with sticky cursors
- Users also preferred sticky cursors over traditional cursors
The Writing Process

• I wrote a draft of the introduction section
  - This was to give myself an overview of what should be in the thesis, what I wanted to include and in which order

• I started searching for papers roughly related to my topic
  - Filtered the papers by reading their abstract/introduction and ditched the irrelevant ones

• I then started reading the papers and taking as much notes for the theory section as possible
  - While doing this I sometimes followed the ”trail” by checking the references of relevant papers to find even more relevant papers
The Writing Process

At the same time I would occasionally write the "easier" sections which didn’t require background studies, i.e. the technical description and the functionalities of the prototype

- This was to keep the writing process flowing and to prevent the writer’s block. I would then return to the theory section with a fresh point of view
- However, this was problematic as the requirements and functions of the prototype were constantly changing
The Writing Process

• After nearly finishing the first iterations of the theory section and the prototype description, I wrote a short evaluation design document
  - This document was used to confirm with my supervisor(s) that what I was planning for the evaluation was okay

• I then started to recruit people for the evaluation and integrated the evaluation component into the prototype
  - The evaluation was carried out in a laboratory at UTA over a period of 3 days
The Writing Process

• The writing of the evaluation section was pretty straightforward
  - What was actually studied
  - How the evaluation was carried out
  - Methods, setup
  - Analyzing the results

• Finally, I wrote the conclusion and finished all the other sections as well

• After getting some feedback from my supervisors, I spent an additional week polishing the thesis before returning the final version
Advices and Discoveries

• Make a clear research question in the beginning
  - Make sure you fully understand what the question means and what is needed to provide answers to it
  - It helps you focus and keep the thesis coherent

• Don’t start the actual writing too early
  - Take the effort to make an extensive background study
  - Take notes, organize them
    • Take notes in digital form as this way rearranging/rewriting them is easy
  - Try to pre-define a basic structure for the thesis
Advices and Discoveries

• Start the theory section with a general overview of the topic, then move on to the more detailed things

• Lots of pages does not necessarily mean quality
  - Have the courage to leave things out, even if you’ve already invested time in them
THESIS EXAMPLE: JOBIN JAMES
Information exchange with gestures
(continuation for Ville Mäkelä’s work)

Research Aim

To design and evaluate mid air gestural interactions for information exchange between large displays and personal devices in a semi public space.
Research Aim

To design and evaluate mid air gestural interactions for information exchange between large displays and personal devices in a semi public space.

Use of free hand movements to interact with a system.
Design considerations

- **Natural mapping**: A natural mapping between the interaction technique and the resultant action helps in reducing the cognitive load on the user to memorize the interaction technique.

- **Simple to perform**: As these gestures would be performed in a semi-public environment, keeping the gestures simple to perform would prevent the users from being discouraged and not using them at all.

- **Gesture modelling**: Human gestures are usually not very precise and chances are that we don’t have enough muscle control to perform very fine hand motions in mid-air. Therefore mid-air hand gestures should be modelled in such a way that it provides reliable output even if there is a degree of variance in the input.
Interaction techniques

2 interaction techniques were designed.

Both interaction techniques required the user to point at the target content of his choice on the public display to make the selection.

- **Grab & Pull**: User would perform a ‘grab’ gesture (make a fist) followed by a ‘pull’ gesture.
- **Grab & Drop**: User would perform a ‘grab’ gesture (make a fist) and then move his active hand to the designated drop zone and release the ‘grab’
Research Aim

To design and evaluate mid air gestural interactions for information exchange between large displays and personal devices in a semi public space.

What are the questions to be answered?
Research Question

Subjective property:
How would the user experience differ while performing these two interactions techniques?
Would the user have any subjective preference in terms of confidence, appeal (pleasantness), naturalness and fun element while using these interaction techniques?

Objective property:
Which of these techniques would be more effective for the user to perform? (Task completion times and Error rates)
Test Application

- An Interactive news application.
- Shows the latest and popular news in form of tiles.
- The task was to select the highlighted tile each of the earlier mentioned techniques.
- 2x10 repetition for each condition.
### Example results

<table>
<thead>
<tr>
<th>Naturalness</th>
<th>Grab-and-pull</th>
<th>Undecided</th>
<th>Grab-and-drop</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>9</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Confidence</th>
<th>Grab-and-pull</th>
<th>Undecided</th>
<th>Grab-and-drop</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4</td>
<td>5</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fun</th>
<th>Grab-and-pull</th>
<th>Undecided</th>
<th>Grab-and-drop</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pleasantness</th>
<th>Grab-and-pull</th>
<th>Undecided</th>
<th>Grab-and-drop</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Preference</th>
<th>Grab-and-pull</th>
<th>Undecided</th>
<th>Grab-and-drop</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

- Mid-air gestures are well suited for content retrieval scenarios and offer a unique and impressive user experience.

- A clear preference towards the grab-and-pull gesture in scenarios where content is transferred to the user.

- However, both gestures received positive feedback, and grab-and-drop was suggested to work well in other scenarios such as transferring content between two displays.
Note

• Both of the example M.Sc. thesis were published later on.
• In addition, there are part of Ville Mäkelä’s PhD dissertation “Design, Deployment, and Evaluation of Gesture-Controlled Displays in Ubiquitous Environments”.
THESIS SEMINAR
Course information

- Runs in practice continuously (two official seminars / semester)
- Part of the “M.Sc. package” (thesis + seminar: 45 cu)
- Meetings each month
- All participants presents their work and progress in each meeting when they are present
- Students need to participate and have full scale presentation at least three times (in the beginning, middle and end of their thesis process)
- All material in Moodle, Online participation possible
- Students participate in the seminar as long as they complete their thesis
Target audience

- Students who have completed most of their other courses
- Want to start their thesis work
- Aim to finish within a year
- No need to be specific topic or supervisor for the 1st meeting - however, a topic needs to be identified before the 2nd meeting.
Goal

To support the student's progress in the thesis work
PROGRESS MONITORING
Progress monitoring

- There is certain information which will be discussed in each meeting
- This information needs to be provided in advance
- This should be done in advance for the first meeting
<Thesis title>

<Author>

HTI M.Sc. Thesis Seminar 2017-2018

Meeting <#>: <DATE>

Present in the meeting: yes/no
Progress: 1/4

- Starting date:
- Expected ending date:
- Progress: %
- Cumulative work hours: h
- Supervisor:
- Last meeting with the supervisor:
Progress: 2/4

- Thesis abstract:
- Research question(s):
- Pages: / Words:
- Language:
Progress: 3/4

- Main items for the next meeting:
  - List of items to be addressed
Progress: 4/4

- Things to discuss during the meeting
  - List of items you like to discuss in the meeting

- Remarks
  - List of things you like to mention
Background

- <Background of the thesis, including motivation>
Research question(s)

• <research question(s), including why these should be studied>
Previous work

- <Previous work in the area>
Outline of the thesis

- <outline of the thesis: what elements the thesis will contain (e.g., empirical work, implementation, design), main chapters>
Work carried out

- <work carried out so far (including previous work in other courses, e.g.)>
Schedule and actions

- <overall schedule with main actions>
TOPICS
Evaluation of mid-air gestures for interaction with a walk-through fog screen

- **Supervisors:**
  Dr. Julia Kuosmanen Pinni B2088, (second supervisor Antti Sand)

- **Language:** EN / RU, (FI / EN)

- **Abstract:** to design experiment for Fitts’ law (ISO 9241-9 standard, see Fig.), run tests and analyze results

- **Timeline:** tests mid May–July 2018; results’ analysis & thesis writing depends on a student’s timeline

- **Skills:** Experiment design / user studies / UX

- **Other:** software & hardware is ready; thesis is a part of Academy of Finland project (# 308929)
Embodied active games for children with special needs

- Supervisors:
  Dr. Julia Kuosmanen Pinni B2088, (second supervisor Dr. Oleg Spakov)
- Language: EN / RU
- Abstract: to develop and/or evaluate games that are played by bodily motion with large and/or walk-through screens
- Timeline: tests can start as early as in summer-autumn 2018; otherwise the timeline is negotiable
- Skills: Design / experiments / UX / experience with Unity 3D & Kinect is desirable
- Other: some game software is ready for experiments; thesis is a part of Academy of Finland project (# 308929)
Gaze-based games for children with special needs

- Supervisor: Dr. Oleg Spakov Pinni B2021, (second supervisor Dr. Julia Kuosmanen)
- Language: EN / RU
- Abstract: to develop and/or evaluate gaze-based games
- Timeline: tests can start as early as in autumn-winter 2018; otherwise the timeline is negotiable
- Skills: Game design / experiments / UX / eye tracking / experience with Unity 3D is desirable
- Other: some game software is readily available; thesis is a part of Academy of Finland project (# 308929)
Multimodal Interaction for Human-robot interaction

- Supervisor: Markku Turunen / Jaakko Hakulinen
- Language: FI / EN
- Description: Human-robot interaction is not a new research area, but recently gained a lot of attention. This thesis studies truly multimodal natural interaction with social robots.
- Other information (e.g., required skills): -
Chatbot UX

- Supervisor: Markku Turunen / Jaakko Hakulinen
- Language: FI / EN
- Description: Chatbots are used in many fields today, and they will be one of the key interaction metaphors in the future. Still, we do not know much of their UX.
- Other information (e.g., required skills): tools such as IBM Watson available.
ICT4D

- Supervisor: Markku Turunen
- Language: FI / EN
- Description: ICT4D (or ICTD) is an emerging area. This project investigates recent techniques from the viewpoint of HCI4D. Field studies possible in India (e.g., City Compass - collaborative second language learning).
- Other information (e.g., required skills): a lot of software and background material available.
Sensors in HTI

- Supervisor: Markku Turunen / Jaakko Hakulinen
- Language: FI / EN
- Descriptions: Different sensors are heavily used in human-technology interaction. The thesis reviews the work done in area and proposes novel solutions for their usage.
- Other information (e.g., required skills): a lot of nice gadgets to play with 😊
Services for public transportation

- Supervisor: Markku Turunen
- Language: FI / EN
- Description: The thesis studies applications for public transportation. The topic is related to the "Living Lab Bus" project (http:s//llb.sis.uta.fi), which is collaboration between numerous companies and universities. Applications could be developed for mobile platforms, large public displays (in a bus) or they can be a part of the simulation environment in a lab. Several students can address the topic with different approach (e.g., design / implementation / evaluation).
Virtual reality interfaces for real world tasks

- Supervisor: Markku Turunen
- Language: FI / EN
- Description: The thesis explores how virtual reality interfaces for traditional real world tasks, such as playing collaboratively board games, should be designed and implemented. A state-of-the-art virtual reality equipment, such as HTC Vive connected to powerful PCs will be available. Existing software, such as the Tabletop Simulator (http://berserk-games.com/tabletop-simulator/) could be used as well.
Motion capture based sport analysis

- Supervisor: Markku Turunen
- Language: FI / EN
- Description: Motion capture allows interesting possibilities for sport analysis. For example, sport activities (such as disc golf) could be performed in controlled environments, and analyzed as a part of off-season training. A state-of-the-art motion capture hardware and software will be provided.
EyeCoding

- Supervisor: Oleg Špakov
- Language: EN
- Abstract: Develop a simple IDE to be used for software development of using gaze
- Timeline: 10.2018 - 6/2019
- Skills: SE / experiment:
- Other: the experiment is very basic, most of the work is expected in IDE development
User-Manageable Gaze-Controlled Interface

- Supervisor: Oleg Špakov
- Language: EN
- Abstract: Develop a gaze-controlled software with grid-based UI (like GazeTalk) where layouts can be created and customized by users
- Skills: SE / design / experiment:
- Other: the experiment is very basic, most of the work is expected in app development
GazeSearch

- Supervisor: Oleg Špakov
- Language: EN
- Abstract: Optimizing UI on a webpage for search tasks using gaze only
- Skills: SE / design / experiment:
- Other: webapp development + user study
GazeChat

- Supervisor: Oleg Špakov
- Language: EN
- Abstract: Develop a chat client optimized for gaze control
- Skills: SE / design / experiment:
- Other: the experiment is very basic, most of the work is expected in app development
GazeDraw

- Supervisor: Oleg Špakov
- Language: EN
- Abstract: Develop a web-app that allows basic drawing using gaze only
- Skills: SE / design / experiment:
- Other: the experiment is very basic, most of the work is expected in app development
Geo2Map for Gaze

- Supervisor: Oleg Špakov
- Language: EN
- Abstract: Develop a software to display a map when a reader meets a name of some geographical location while reading a text
- Skills: SE / design / experiment:
- Other: webapp + user study
GazeBookmark

- Supervisor: Oleg Špakov
- Language: EN
- **Abstract:** Bookmarks are useful, but people tend to forget what was useful on the pages they bookmarked. Solution: store gaze path in a bookmark, and visualize it on opening the page
- Skills: SE / design / experiment:
- Other: webapp + user study
Relationship radar

• Description: An app for notifying the user of a somehow relevant but so far unfamiliar person being close by (e.g., friend-of-a-friend, your twitter follower, distant family relationships / ancestors). This might help to create new social encounters in everyday life.

• Supervisor: Thomas.Olsson@uta.fi

• Language: FI / EN
How do we experience people recommendations in social media?

(“you might want to follow...”, “Do you know X?”)

What are the issues and the missed opportunities?

Contact: thomas.olsson@uta.fi
System for social matching of event attendees

- Who should I go talk to at a professional event? Who would be the most relevant professional matches?
- The thesis could be about design (and development) of a system that would help relevant unfamiliar people meet each other at events and in large organizations
- Plenty of room for various ideas and study methodologies! Detailed focus TBD together.

- Supervisor: Thomas.Olsson@uta.fi
- Language: FI / EN
Social acceptance of AI, machine learning and algorithmic systems

• What do people think about the fact that algorithms are increasingly defining what information we see in social media and search engines?
• This topic allows user research, design of new (more ethically sustainable) systems, and theoretical research
  - Detailed focus to be defined together

• Supervisor: Thomas.Olsson@uta.fi
• Language: FI / EN
Interacting with autonomous machines

• How do you interact with an autonomous machine like a robot? How do you control one with embodied interaction and how should it inform you about its intentions?

• This topic allows user research, design of new interaction techniques, and evaluation studies
  - Detailed focus to be defined together

• Supervisor: Thomas.Olsson@uta.fi

• Language: FI / EN
Eliciting information about people for professional profiling

- More detailed information about individuals’ and organizations’ skills, goals, interests and other qualities would help developing systems that could match relevant people to each other
  - Such “profiling” can help, e.g., recruitment activities and team formation
  - The data in LinkedIn and similar is not detailed enough!
- How to support collection and refinement such data with persuasive UIs?
- Detailed focus to be defined together

- Supervisor: Thomas.Olsson@uta.fi
- Language: FI / EN
Usability expert evaluation of Eye Blink Pacemaker - medical device

- **Supervisor:** Mirja Ilves / Jani Lylykangas
- **Language:** FI (native speaker)
- **Description:** The device is developed in Academy of Finland funded “Mimeface-project” and it is targeted for people suffering from unilateral facial paresis. It will produce an eye blink that is missing. The aim is to perform an expert evaluation (heuristic evaluation) of the device to evaluate the product and identify possible usability problems.
  - Suitable also for a “duo Thesis” (two students working together)
Remote control interfaces for professional purposes

- Supervisor: Markku Turunen
- Language: FI / EN
- Description: ask more from the supervisor!
eSport interfaces

- Supervisor: Markku Turunen
- Language: FI / EN
- Description: ask more from the supervisor!
Feedback collection from users of indoor environments

- Supervisor: Markku Turunen
- Language: FI / EN
- Description: ask more from the supervisor!
User interfaces for people with cognitive disabilities

- Supervisor: Markku Turunen
- Language: FI / EN
- Description: ask more from the supervisor!
The effect of consistency of 360 video based hyper video navigation on UX

- Supervisor: Jaakko Hakulinen
- Language: FI / EN
- Description: ask more from the supervisor!
Use of head orientation to pan view in CAVE like VR environments, in particular when viewing 360 video content

- Supervisor: Jaakko Hakulinen
- Language: FI / EN
- Description: ask more from the supervisor!
User interfaces for people with cognitive disabilities

- Supervisor: Markku Turunen
- Language: FI / EN
- Description: ask more from the supervisor!
Interactive Visualization of Digital Twins

- Supervisor: Markku Turunen
- Language: FI / EN
- Description: ask more from the supervisor!
Interactive Visualization of Historical Data (esp. War History)

- Supervisor: Markku Turunen
- Language: FI / EN
- Description: ask more from the supervisor!
Educational Applications for Immigrants

- Supervisor: Markku Turunen
- Language: FI / EN
- Description: ask more from the supervisor!
Interactive analysis of gameful applications (e.g., the management game develop at UTA)

- Supervisor: Markku Turunen
- Language: FI / EN
- Description: ask more from the supervisor!
Interface for web-based questionnaire system

- Supervisor: Markku Turunen
- Language: FI / EN
- Description: ask more from the supervisor!