CHALMERS

STUDENT

DIT096-0005-KKL

TENTAMEN

DIT096 VT25 LP4 Omtentamen 1 - J

Kurskod	--
Bedömningsform	--
Starttid	12.06.2025 08:30
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Bedömningsfrist	--
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Skapad av	Lisa Lindén

i Welcome to the exam for Human-Computer Interaction!

Here's some basic information about the exam:

Total Points: The examination is out of a total of 100 points.
Grading Scale: The grades will be allocated as follows:

- To pass you must achieve more than 41 points.
- A grade of 3 is awarded for achieving between 41 and 60 points.
- A grade of 4 is awarded for achieving between 61 and 80 points.
- A grade of 5 is awarded for achieving between 81 and 100 points.

Examination Aids: No external aids are permitted during the examination.

Please read all instructions carefully. Some questions require you to provide the answers in a specific format or order.

We're keeping our fingers crossed for your success in the exam :)

All the best,
The HCI Teaching Team

1 **According to ISO 9241-210, the four principles of human-centered design are**

- active ✅ (active, passive, no) involvement of users

- appropriate allocation of function between users and technology ✅ (for technology over users, between users and technology, for users over technology)

- iteration ✅ (implementation, succession, iteration) of design solutions

- novel ❌ (novel, altenative, multi-disciplinary, creative) design

Which of the following statements best describes the role of Human-Computer Interaction (HCI) in the design of interactive systems?

- ⦿ HCI is important for identifying user needs and ensuring the system is usable and user friendly. ✅

- ◯ HCI is focused solely on visual design, such as choosing colors and fonts.

- ◯ HCI is only concerned with the technical aspects of the system, such as coding and software development.

- ◯ HCI is irrelevant in the design process, as the company knows best what its customers need.

Delvis rätt. 4 av 5 poäng.

2

A nice inclusive design quote is "Good design [enables] ✅ (disables, enables), bad

design [disables] ✅ (enables, disables)."

Consider the following types of disabilities and situations, and chose the right one:

	Permanent	*Temporary*	*Situational*
Touch	[one arm] ✅ (arm injury, holding a bag, one arm)	[arm injury] ✅ (holding a bag, one arm, arm injury)	[holding a bag] ✅ (arm injury, one arm, holding a bag)
Sight	[blind] ✅ (blind, blinded by the sun, cataract)	[cataract] ✅ (cataract, blinded by the sun, blind)	[blinded by the sun] ✅ (blinded by the sun, blind, cataract)
Hearing	[deaf] ✅ (deaf, at a music concert, ear infection)	[ear infection] ✅ (deaf, at a music concert, ear infection)	[at a music concert] ✅ (deaf, at a music concert, ear infection)
Speaking	[mute] ✅ (heavy accent, mute, sore throat)	[sore throat] ✅ (heavy accent, sore throat, mute)	[heavy accent] ✅ (sore throat, heavy accent, mute)

Rätt. 7 av 7 poäng.

3

A [horizontal] ✅ (mixed, diagonal, horizontal, vertical) prototype shows all the features, but does not implement them.

A [vertical] ✅ (horizontal, mixed, diagonal, vertical) prototype shows only one feature, fully implemented.

The following is a type of low fidelity prototype: [paper] ✅ (functional, metal, plastic, paper)

A *conceptual* prototype is more appropriate [at early stages of the work] ✅ (never!, at later stages of work, at any time, at early stages of the work)

A *functional* prototype is more appropriate [at later stages of the work] ✅ (never!, at early stages of the work, at any time, at later stages of the work)

Prototypes are useful mainly because they allow us to

[do a "quick and dirty" evaluation that will inform the next iterations] ✅ (do a thorough and detailed test of the system, determine the price of the final product, conduct user studies and publish academic papers, do a "quick and dirty" evaluation that will inform the next iterations)

Rätt. 6 av 6 poäng.

4

A *Heuristic Evaluation* is done with typically [a few] ✅ (a few, many)

[experts] ✅ (representative users, experts) and the main goal is to

[identify problems] ✅ (get ideas for improvement, identify problems) of the prototype, according to
(pick one)

☐ their performance

☐ their preferences

☑ usability principles ✅

The *Severity Rating* of a Heuristic Evaluation is a combination of which <u>three</u> factors?
(pick three)

☐ impact ✔

☑ aesthetics ❌

☑ cost ❌

☐ productivity

☑ frequency ✅

☐ persistence ✔

Usability Testing is done with typically [many] ✅ (many, a few)

[representative users] ✅ (representative users, experts) and the main goal is to

[get ideas for improvement] ✅ (get ideas for improvement, identify problems) of the prototype, according to

(pick two)

- ☑ their preferences ✅
- ☐ usability principles
- ☑ their performance ✅

The manipulated aspects of an experiment are called [Independent] ✅ (Dependent,

Independent) Variables, and are isolated through [a control condition] ❌ (randomization, a control condition) .

The observed aspects of an experiment are called [Dependent] ✅ (Dependent,

Independent) Variables, and are isolated through [randomization] ❌ (randomization, a control condition).

When participants are assigned to *one condition only*, this is called [between] ✅

(between, within) subjects, or [independent] ✅ (repeated, independent) measures.

When participants are assigned to *all conditions*, this is called [within] ✅ (within,

between) subjects, or [repeated] ✅ (independent, repeated) measures.

Delvis rätt. 16 av 20 poäng.

5 When considering the difference between two conditions, the *alternative hypothesis* would be that

there IS a difference ✅ (there IS a difference, there is NO difference).

If we conduct a statistical test and the calculated *p-value* is more than our predefined *significance*

level, then we must [accept] ✅ (accept, reject, ignore) our *null hypothesis*.

Some typical measures of central tendency are (pick two)

☑ frequency	❌
☐ standard error	
☐ median	✔
☐ interquartile range	
☐ mean	✔
☐ rank	
☐ confidence interval	
☑ standard deviation	❌
☐ sample size	

Some typical measures of variability are (pick three)

- ☐ median
- ☑ confidence interval ✅
- ☐ standard deviation ✔️
- ☑ interquartile range ✅
- ☐ mean
- ☐ rank
- ☐ frequency
- ☐ sample size
- ☑ standard error ❌

Delvis rätt. 4 av 7 poäng.

6 A researcher named Astrid wants to investigate how people use a "checklist" app, on a desktop computer (using the mouse), a handheld tablet (tapping on the screen), or a physical printout of the checklist (marking with a pen).

A task will consist of participants having to select specific items on a checklist, based on instructions given to them by Astrid each time.

She will time how long it takes them to perform such a task, and ask for their impression of the input method(s) they used (computer/tablet/paper).

Each participant's impression will be measured on a *Likert scale* from 1 (would not use) to 5 (would use), after they completed all the tasks they were asked to do using an input method.

There are 16 participants that can be recruited for the study.

Help Astrid to design a user study that *optimally and effectively* evaluates the speed and user preference.

She should use a | within-subjects | ✅ (within-subjects, between-subjects, mixed) experimental design.

The control condition should be the users | marking on the physical printout | ✅ (marking on the physical printout, tapping on the tablet, using the mouse on the desktop).

Each participant should perform a task using an input method | once | ❌ (once,

multiple times), | for multiple different cases | ✅ (for one same case, for multiple different cases).

What should be the ONE independent variable for this study?

- ☐ task completion time

- ☐ participants' impression

- ☐ error rate

- ☑ input method (mouse, tap gestures, writing) ✅

What should be the TWO dependent variables for this study?

☐ error rate

☐ input method (mouse, tap gestures, writing)

☑ task completion time ✅

☑ participants' impression ✅

Select the statistical test which should be used to analyze the (continuous) TIMING MEASUREMENTS; you can consult the provided PDF diagram on the side.

◉ repeated measures ANOVA ✅

○ ANOVA

○ t-test

○ Wilcoxon signed-rank

○ Friedman

○ paired t-test

○ Kruskal-Wallis

○ Mann-Whitney

Select the statistical test which should be used to analyze the (ordinal) LIKERT SCALE MEASUREMENTS; you can consult the provided PDF diagram on the side.

○ ANOVA

○ Mann-Whitney

○ paired t-test

○ repeated measures ANOVA

○ t-test

○ Kruskal-Wallis

◉ Friedman ✅

○ Wilcoxon signed-rank

Delvis rätt. 8 av 9 poäng.

7 Plan your data gathering for the following task:

Patients using physiotheraphy robots are often intimidated by the robot. This requires extra work by the medical personnel. You were hired as a consultant by Life Science Robotics to investigate the possibilities of making the physiotheraphy robot Robert more friendly. As robots may soon be able to work autonomously, the company is wondering how Robert can build trust in patients so that robot physioteraphy can be conducted without constant supervision. Your goal is to present a report on possible directions for the redesign of Robert. You were assigned 10 man-hours for the task and you know that the report will take you 2 hours to write.

You have been allocated 10 hours for data gathering and analysis, with an additional 2 hours designated for report writing. *(i.e. propose something doable within that time frame, that does not require more time from you; justify and argue for your choices carefully otherwise)*

In your plan, you should address the following five important points:

- Research Focus
- Context of use
- Participants
- Research Questions (*the questions that drive your research, not the questions you might ask the participants*)
- Research Plan

Ensure that you complete the task thoroughly. Be concrete, provide practical answers and bear in mind how many resources (and time) you have.

Consult the rubric below to know how we will score your answer and how you can get the most points. Your text answer should be between at least 400 and up to 800 words.

Fill in your answer here

Choice of research focus:

The focus of this research is to identify whether suggested improvements to physiotherapy robots affect the apparent trust of physiotherapy patients interacting with said robots. This study aims to reduce the reliance on medical personnel during physiotherapy procedures by identifying concrete improvements to targeted robots. The study will assess whether robot-patient interactions that resemble human interactions would increase patient trust (by human interactions, I am mainly referring to human speech, as that could easily be prototyped with current mainstream AI solutions).

Choice of context of use:

Physiotherapy robots have been used by Life Science Robotics to aid in patient physiotherapy. While the technology is supposed to be freeing medical personnel time, often times human assistance is needed to ensure that patients feel safe during treatment. The suggested improvement is a standalone, cost effective solution that can be added to any robot and/or treatment room aiming to cover for some of the lacking human to human interaction during a physiotherapy session with a Life Science Robotics robot and reduce the time medical personnel spends on physiotherapy sessions alone.

Participant group:

I have identified the following participant groups and reasoning:
- G1: Physiotherapy patients receiving treatment from robot assisted by medical personnel (control group): This group represents the current scenario where patients would feel safer if the robot is assisted by a human.
- G2: Physiotherapy patients receiving treatment from robot, unassisted: This group will be our

assessment baseline. It reproduces the current target scenario, that is the robot conducting the session autonomously.

As a secondary goal, I would like to assess whether the satisfaction levels actually decreases compared to G1, or if the control group experiences a placebo effect.
- G3: Physiotherapy patients receiving treatment from robot with suggested speech modification: This is our targeted modification group. We want to observe a strong increase in patient satisfaction over the control group, and results close to G2.

Choice of RQs:

- RQ1: Do patients preffer robots exhibiting human traits more over regular robots?
- RQ2: Is human assistance increasing the level of satisfaction experienced by patients?

Research plan:

First of all, the study would have the following characteristics:
- The independent variable will be the treatment method (unassisted robot, unassisted robot exhibiting human trait).
- The dependent variables will be patient trust (i.e. how willing are you, the patient, to experience the same treatment method again) and patient satisfaction (i.e. how satisfied are you with this physiotherapy session).
- H0: There is no difference in patient trust between a regular robot and a robot exhibiting human traits.
- Ha: There is an improvement in patient trust being treated by a robot exhibiting human traits over a regular robot.
- The data would be mostly qualitative, as quantitative data would imply more advanced data gathering techniques (an example would be a heart rate sensor to identify whether a patient is feeling stressed, or brain activity scans that would show which areas of the brain would be stimulated during the procedure)
- The data would be gathered through controlled observation (observing the patient during the physiotherapy session), and interviews before and after the session. Optionally, an optional survey might be presented to the test subject after the session to gather more nominal data about the individual (age, sex, demography, etc.)

In regards to conducting the study (there should be a note-taker throughout the whole process noting any observation made):
- Firstly, I would create a study document encompassing the context, purpose of the study and goals.
- Subjects would be selected by sending e-mails to patients of a clinic using Life Science Robotics robots in their treatments that have appointments scheduled during the target experiment timeframe.
- Patients would then choose to join the experiment by reading the description of the study attached.
- Patients would be randomly split between the groups to minimise biases upon signing up.
- Upon arrival, patients would be once again briefed with the study details, sign a data collection form (of course, compliant with GDPR and any other data protection rule in the jurisdiction), and interviewed to identify their general view of the robots (i.e. figure out before if they are keen or not to having a robot independently treat them).
- Familiarize the patient with the environment.
- Conduct the test (physiotherapy session) and observe the patient interactions with the robot (both verbal and non-verbal clues are important)
- Conduct the final interview, observe how the patient's view shifts or not and present the optional demography survey.

In regards to analysis, after the experiment, a thematic analysis would be conducted. Appropriate bottom-up methods would be use to assess the outcome and then finally, write the results report. Again, ideally some quantitative data gathering would be conducted, with appropriate between-subjects techniques being employed.

Ord: 799

Choice of research focus

4pt - clear focus with logical motivation

2pt - clear focus

0pt - no focus or vague

Choice of context of use

4pt - defined with clear motivation

2pt - defined but lacks motivation

0pt - not defined or generic

Participant group

6pt - clearly identified and explained

3pt - identified but without a logical explanation

0pt - too broad or no indication

Choice of RQs

6pt - explicitly stated, contributing to the design process

3pt - stated but with limited impact on the design process

0pt - vague or generic, not actionable

Research plan

10pt - clear plan, motivated choice of methods, feasible using the available resources

5pt - lacks detailed description, vague motivation of methods, requires additional or not using available resources

0pt - multiple flaws, or hard to understand

Total points: 30

Besvarad.

8   You have probably (and hopefully!) spent a significant amount of time in this course working on your group project.

We would like you now to *reflect* (as an individual member of the group) on the overall experience from this activity, and write a few sentences below on:

- the **user-centered design** approach in general (*not what you specifically did in your project*; maybe compare it with any of your previous projects or work experiences)
- something that you **did not expect** at all when you started working on the project, or something that **turned out differently** to what you hoped
- what you would **do differently** if you were to do it again (either a different direction, approach, or something that might have improved your results)
- what do you think you could **bring forth and apply to your future projects or work**

Each of the above will be scored up to 4 points giving overall 4x4=16 points (less points for not discussing something, more points for fully elaborating; some parts might be overlapping but try to be clear, formal, and precise)

Do not describe or present the your project in detail, focus on the **lessons learned**.

(Suggested text length around 400 to 500 words or so)

Fill in your answer here

User centric design was always an important aspect of developing software in my view, even before this course. I used to work on a project that would help smartphone users spend less time on their screens, identifying mundane tasks that users would repeatedly do and trying to minimize the friction, or, in some instances, increase the friction to do other actions that might not necessarily be productive (i.e. "doom scrolling"). What I've learned is that users mostly dictate how successful and/or helpful a product is. Without doing any research before kick starting the project, I was basically engulfed in subjective observations that wouldn't have represented well the actual target user base. I designed the application to suit my needs thinking that my needs are everyone else's, which was a clear mistake. But slowly, I've started to understand how much more important it is to get to know your users, to build software that would become ubiquitous, software that would fit the user's (as a group) needs.

Regarding the course project, I personally did not expect it being this difficult to come up with ideas. Part of the main UCD process is to identify the need for user centric design. Initially, we believed that a day would be enough to identify such an area; we believed that we figured out a sector to improve and stuck to it throughout the whole project timeline, even though it wasn't ideal. We could've easily shifted our focus after gathering initial data, when we observed that everything is heavily skewed, but we didn't. In hindsight, we should've spend way more time understanding the problem domain, and understanding where user centric design could've been applied.

Regarding what could've been done differently during the project, my team wasn't so keen on actually doing proper usability testing on our prototype. We fell into this bias of believing that if us, the designers, can use the product, everyone else could do so. We heavily relied on expert judgement, we did not have any empirical data and no visualization on the little amount of data that we've gathered. If I were to retake this course, I would lean more on data gathering when it came to product iteration, as more experiments and usability testing would've probably surfaced requirements that we wouldn't have thought of and would've given us a more objective, data driven understanding of the solution we were trying to build.

When talking about what could be applied to my future work, is probably going to be the data driven analysis of usability. This course felt empowering, as it finally clicked, at least for me,

how data analysis can be used to increase the usability of a system. I've always believed that humans should be at the center of technology development, and that we need to create designs that enable, but I've always struggled with iteration. I now know and hope to use most of the evaluation, testing and data gathering techniques learned in this course in future work. After all, I want to become a software engineer, so I better be capable of augmenting humans and crafting experiences that shape the world as we know it :D Thank you!

Ord: 531

Besvarad.

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