[20230613] INFOMMOB - Mobile interaction - 44 - USP

Course: BETA-INFOMMOB Mobile interaction (INFOMMOB)

Duration:	2 hours
Number of questions:	9

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The exam contains nine questions, each with several sub-questions. Be aware that some questions have lots of sub-questions, others have much less. Also, some may just need a few words to answer, others may need more elaborate text. You can go back and forth between the questions and do not need to answer them sequentially.

You have 120 minutes and can get a maximum of 66 points. Notice that the points do not necessarily reflect the level of difficulty of the sub-question. Therefore, it might well be that a sub-question that gives you the similar number of credits than another one can take longer to answer.

Good luck!

Number of questions: 9

1 General aspects of mobile interaction

In the chapter "*Mobile Computing*" of *The Encyclopedia of Human-Computer Interaction*, J. Kjeldskov describes the history of mobile computing by discussing seven waves or trends.

2 pt. **a.** [max. 2 pts] One of these trends is **divergence**. Shortly describe what that means and give an example of a device commonly used today that could be classified under this trend.

2 pt. **b.** [max. 2 pts] Another trend is **convergence**. Shortly describe what that means and give an example of a device commonly used today that could be classified under this trend.

2 pt. **c.** [max. 2 pts] Two other trends are **connectivity** and **digital ecosystems**. Give an example for mobile interaction that involves at least two devices that form a digital ecosystem (i.e., are connected via a network for short- or long-range communication).

2 pt. **d.** [max. 2 pts] Another trend that made mobile interaction possible was **miniaturization**. Because of that, we now also have high-quality digital cameras in mobile phones. Give one example where the camera of a mobile phone is used for interaction (and not for picture taking).

2 Sensors for tilt and orientation-based interaction

[max. 2 pts] Give an example for mobile interaction that only requires orientation of a device relative to itself and state what sensor(s) you would use to realize that.

1 pt. **a.** Example:

1 pt. **b.** Sensor(s):

[max. 2 pts] Give an example for mobile interaction that also requires orientation of a device relative to the world and state what sensor(s) you would use to realize that.

1 pt. **c.** Example:

1 pt. **d.** Sensor(s):

[max. 2 pts] Give an example for mobile interaction that requires relative orientation of a device and its absolute location on earth and state what sensor(s) you would use to realize that.

1 pt. **e.** Example:

1 pt. **f.** Sensor(s):

3 Touch interaction

In the lectures, we saw some examples for **back of device interaction**, that is, approaches where the back of the device is used for touch input.

1 pt. **a.** [max. 1 pt] Name one common touch interaction problem that is resolved by back of device interaction.

The so-called **Midas touch problem** is a potential problem that can appear with both regular and back of device touch interaction.

1 pt. **b.** [max. 1 pt] Explain shortly what it means. (*A few words can be sufficient to answer this correctly. You do not need to explain the Greek mythology that inspired the name for this problem*.)

Give one example for regular touch interaction design that deals with this problem. *("Regular touch interaction" refers to common interaction with a touch screen, on your phone, i.e., not back of device interaction. We saw a concrete one in the lectures, but any convincing example is fine and will give full credits.)*

1 pt. **c.** [max. 1 pt] Describe the problem:

1 pt. **d.** [max. 1 pt] Describe the solution:

For back of device interaction, we always have to deal with the Midas touch problem.

1 pt. **e.** [max. 1 pt] Shortly explain why.

Illustrate one way on how we could deal with this. *(We saw two examples in the lecture. There might be others. You must only describe one of them. It may help to read both of the following sub-questions before answering the first one.)*

1 pt. **f.** [max. 1 pt] Shortly describe how one can deal with the Midas problem for back of device interaction:

1 pt. **g.** [max. 1 pt] What kind of touch technology is needed for the solution that you described in the previous sub-question?

4 Multimodality & mobile evaluation

In the paper *Learn with Haptics: Improving Vocabulary Recall with Free-form Digital Annotation on Touchscreen Mobiles,* S. Sheshadri et al. evaluate vibrotactile feedback (VFT) in the context of vocabulary learning.

2 pt. **a.** [max. 2 pts] The authors mention two potential benefits of VFT in the context of vocabulary learning. What are these?

To prove their statements, they start with some pilot experiments, followed by an empirical study. For the latter, as for any empirical study, they use independent and dependent variables.

1 pt. **b.** [max. 1 pt] What is an independent variable? Shortly explain. *(Write down the general definition. An example from the paper is asked for in the next sub-question.)*

1 pt. **c.** [maxl 1 pt] Name one independent variable used in their experiment.

In empirical studies, we also have to deal with so-called confounding or extraneous variables.

1 pt. **d.** [max. 1 pt] What is a confounding variable? Shortly explain. *(Write down the general definition. An example from the paper is asked for in the next sub-question.)*

1 pt. **e.** [max. 1 pt] Name one confounding variable addressed in the paper and how the authors dealt with it.

Empirical studies are often discussed with respect to their internal and external validity.

1 pt. **f.** [max. 1 pt] Shortly explain what is meant by internal validity.

2 pt. **g.** [max. 2 pts] Shortly discuss the internal validity of the empirical study done by the authors (i.e., not the pilot studies). *(Say if it is high or low and provide some evidence for your claim.)*

5 Touch gestures

Given the small screen space of mobile devices, "zooming" is often used in mobile interaction. There are different ways to do this. For example, discrete (e.g., via dedicated "zoom in" and "zoom out" buttons) or continuous (e.g., via "pinch" and "zoom" multitouch gestures).

Give an example where continuous zooming is used and give a convincing reason why this type of zooming makes most sense in this context.

1 pt. **a.** [max. 1 pt] Example:

1 pt. **b.** [max. 1 pt] Reason why using continuous zooming is better here than discrete zooming:

Give an example where discrete zooming is used and give a convincing reason why this type of zooming makes most sense in this context.

1 pt. **c.** [max. 1 pt] Example:

1 pt. **d.** [max. 1 pt] Reason why using discrete zooming is better here than continuous zooming:

There are also situations where zooming cannot help dealing with the problem of small screen estate. Give a convincing example for such a case and shortly explain why.

1 pt. **e.** [max. 1 pt] Example:

1 pt. **f.** [max. 1 pt] Reason why it would not be good to use zooming here:

In the lectures, we distinguished between three different types of gestures: Ones for *direct manipulation*, *abstract gestures in context*, and *abstract gestures unrelated to content currently shown on the screen.* We also discussed various potential problems that can occur with touch gestures. Name one of these problems and discuss the different types of gestures in this context. *(A short explanation that illustrates if this problem appears here and why is sufficient.)*

1 pt. **g.** [max. 1 pt] A common potential problem with touch gestures is:

1 pt. **h.** [max. 1 pt] Does this problem happen with gestures for *direct manipulation* and why or to what degree?

1 pt. **i.** [max. 1 pt] Does this problem happen with *abstract gestures in context* and why or to what degree?

1 pt. **j.** [max. 1 pt] Does this problem happen with *abstract gestures unrelated to content currently shown on the screen* and why or to what degree?

6 Common interaction problems & innovative solutions

In the lectures, we saw three examples that use sensor technology to create innovative solutions to common interaction problems. One of them was the **Force Picker**.

1 pt. **a.** [max. 1 pt] Shortly state what problem(s) the Force Picker approach addresses.

1 pt. **b.** [max. 1 pt] What kind of hardware or sensor technology was used to realize this solution?

Another approach was the **ForceRay.** It uses the same hardware or sensor technology as the Force Picker but addresses a different problem.

1 pt. **c.** [max. 1 pt] Shortly state what problem(s) the ForceRay approach addresses.

1 pt. **d.** [max. 1 pt] Give one potential issue that both approaches might have *(i.e., a general potential interaction problem with solutions that use this type of technology).*

1 pt. **e.** [max. 1 pt] Give one potential issue that may occur with the Force Picker *(i.e., a specific potential interaction problem of this concrete approach in this concrete context.)*

Another approach we saw is **SWiM (Shape Writing in Motion)**. It uses a different hardware or sensor technology than the ForceRay but addresses a similar problem (although in a slightly different context, i.e., text entry).

1 pt. **f.** [max. 1 pt] Shortly explain how SWiM resolves this problem.

1 pt. **g.** [max. 1 pt] Give one advantage that SWiM might have over the ForceRay approach.

7 Mobile gaming

Because the tip of our fingers is quite big, small buttons are often hard to hit accurately. This is why we have guidelines for optimum button sizes for touch screen interaction on mobiles.

1 pt. **a.** [max. 1 pt] Give a convincing reason why this solution (i.e., making the buttons large enough to easily click them) may cause problems in games and motivate game designers to revert to other interaction modes, such as tilting.

1 pt. **b.** [max. 1 pt] Give one other aspect or example where touch-based interaction design for games differs significantly from touch interaction design for common contexts or applications such as texting, web browsing, and social media apps.

In the article *A Guide To iOS Twin Stick Shooter Usability,* Graham McAllister explains the difference between a *static* and a *dynamic* implementation of these controls.

1 pt. **c.** [max. 1 pt] Explain the difference between static and dynamic controls.

1 pt. **d.** [max. 1 pt] Give one convincing example, context, or reason why a game developer might choose for a static control implementation.

1 pt. **e.** [max. 1 pt] Give one convincing example, context, or reason why a game developer might choose for a dynamic control implementation.

Diegesis theory specifies four different interaction design concepts. One of them is a *diegetic representation,* another one is a *non-diegetic representation.*

1 pt. **f.** [max. 1 pt] Shortly explain what a *non-diegetic representation* means.

1 pt. **g.** [max. 1 pt] Give one example from mobile gaming for a non-diegetic representation and one potential advantage that this implementation might have compared to a diegetic representation of the same example.

8 3D interaction

When interacting with 3D content, we often need to change our perspective or point of view of the 3D visualizations shown on the screen. This is often done by moving or rotating the 3D content in the opposite direction than the input. For example, moving an onscreen joystick to the right or tilting the device to the right causes the 3D content or field of view to rotate to the left.

2 pt. **a.** [max. 2 pts] Give an example where it is done like that and shortly explain why.

2 pt. **b.** [max. 2 pts] Give an example where it is not done like that (i.e., where an interaction in one direction does not cause the 3D content or field of view to rotate in the exact opposite direction) and shortly explain why this makes sense in this context.

In the lectures, we saw two ways of how perspective projection can be used to create a more realistic 3D effect. One was *Fishtank VR,* the other was *Shoebox VR.*

1 pt. **c.** [max. 1 pt] What sensor(s) are used to implement Fishtank VR?

1 pt. **d.** [max. 1 pt] What sensors are used to implement Shoebox VR?

Shoebox VR is generally considered easier to implement than Fishtank VR but has some potential disadvantages compared to the latter.

1 pt. **e.** [max. 1 pt] Give one convincing example where Shoebox VR is sufficient or maybe even the better choice to use than Fishtank VR.

1 pt. **f.** [max. 1 pt] Give one convincing example where Fishtank VR would likely be the better choice to use or might even be needed.

9 Mobile / handheld Augmented Reality (AR)

Touch interactions, such as direct manipulation and touch gestures, work very well for common mobile interaction tasks, but have many disadvantages for AR. **3DMultiTouch** is an approach that addresses one of them.

1 pt. **a.** [max. 1 pt] What is the problem that 3DMultiTouch tries to resolve?

2 pt. **b.** [max. 2 pts] Shortly explain how 3DMultiTouch deals with this.

1 pt. **c.** [max. 1 pt] Give one other potential problem or disadvantage of using touch screen interaction for mobile AR.

Thank you for participating in the course. I hope you enjoyed the lectures and look forward to your project presentations.

Once Caracal opens, I would appreciate it if you could give some feedback!