Mobile Interaction (INFOMMOB) 2017/2018

Exam, Wednesday, June 27, 2017, 11:00-13:00, EDUC-ALFA

Do not start with the exam until being told to do so.
Read the comments on this page carefully.

- The questions for this exam are printed on 14 pages (including this title page).
  The back of each page should be empty.
  It is your responsibility to check if you have a complete printout.
  If you have the impression that something is missing, let us know.
- Use a pen, not a pencil. Do not use a red pen.
  Write your answers below the questions in the designated areas.
  If you need more space, please continue writing on the back of the *preceding* page.
- You may *not* use books, notes, and any other material or electronic equipment (including your cellphone, even if you just want to use it as a clock).
- You have max. 2 hours to work on the questions (notice that this includes distribution & collection of exams).
  If you finish early, you may hand in your work and leave, except for the first half hour of the exam.

GOOD LUCK!

First name	Last name	Student ID

1. Introduction / general aspects

Problem 1a (8 pts) In the chapter "Mobile Computing" of The Encyclopedia of Human-Computer Interaction, J. Kjeldskov describes seven waves or trends from the history of mobile computing, including *connectivity, convergence,* and *divergence.* We want to look at them now in the context of *mobile music players*, that is, devices that allow you to listen to music while you are on the go. *[Note: Short answers are sufficient.]*

Shortly describe what is meant by *convergence*.
See paper

Give one advantage of convergence in relation to music players;
that is, why or how did this trend improve mobile music players and their usage?
Many ways to answer this correctly. One obvious example would be:
By integrating mobile music players into devices that we carry anyhow, e.g., mobile phones, we don't need to bring an additional device with us.

Shortly describe what is meant by *divergence.*
See paper

Give one advantage of divergence in relation to music players;
that is, why or how did this trend improve mobile music players and their usage?
Again, many possible advantages exist here. Generally, divergence has the advantage of being able to better optimize form factor, performance, and interaction. Thus, an example for a correct solutions could be:
For stand-alone music players, it is easier to integrate dedicated buttons for important functions, enabling you, for example, to skip to the next song by pressing a (physical) button while the device is in your pocket.

Shortly describe what is meant by *connectivity*.
See paper (note that the paper actually does not give a good specification of it that you could copy; a good answer would describe this wave by stating the interconnectivity of devices, e.g., via wireless networks with each other and the environment (or internet).). A short, but sufficient answer would have been:
Mobile devices became connected to networks.

Give one advantage of connectivity in relation to music players;
that is, why or how did this trend improve mobile music players and their usage?
And again, you can think of many possible advantages. One good answer would be:
Because of the ability to be always online (and flat rates), you can stream music and have constant access to huge music collections and don't need to preload music to the device.

If we look at today's situation, there are very few stand-alone mobile music players anymore. Instead, people tend to use their mobile phone for this purpose. **Discuss why this happened by providing some convincing reasons (hint: you can relate this to your answers from above).** *[Note: this part requires some speculation, so every reasonable and good argument will give credits. Make sure though to have a "complete" answer and not just provide one single reason.]*
The general point here is that the advantages of convergence in this case outbalance the disadvantages. For music players, we also have the connectivity aspect. Flat rates (and also music abo services like Spotify) make it possible and easy to access huge music archives everywhere (but you need a SIM card and abo for that, which you have in your phone; adding a separate one with separate subscription to the music player would not be reasonable). A good answer that would have given full credit is thus:
The advantages of divergence (e.g., dedicated buttons) are not that important in this context (e.g., because interaction with music players is often very limited anyhow) and do not outbalance the advantage of having it integrated in your phone (which you carry around anyhow) and the comfortable access to large music archives (via a flat rate that you pay for your phone anyhow).
Other good aspects mentioned by some: performance of mobile phones high enough / no need for dedicated solutions due to performance reasons anymore, …

Problem 1b (3 pts) Modern smartphones can support various types of input. Three of them are *touchscreen-based interaction using your fingers or thumbs, touchscreen-based interaction using a dedicated stylus,* and *voice commands using speech recognition. [Note: In the following, Short answers are sufficient. Make sure to give a convincing use case, task or action, not just an advantage and that the advantage clearly relates to the task.]*
Give one use case, task, or action where *touch screen-based interaction using your fingers or thumbs* would be preferred over the other two input types. Shortly explain why it is an advantage to use this method in this context.
Various options exist to answer this correctly. A simple one, which we also talked about in the lecture, would be:
Pressing a button on the screen to start an app is easier and more intuitive to do with your finger than a pen. It can also be done quietly, in contrast to voice commands.
Another good example, used by many in the exam, is multi-touch gestures like zooming.

Give one use case, task, or action where *touch screen-based interaction using a dedicated stylus* would be preferred over the other two input types. Shortly explain why it is an advantage to use this method in this context.
Again, various options (see also Johnny Lee's video and his argument about content creation versus content consumption). An obvious solution could be:
A pen is a natural interaction device for drawing and sketching. It is generally easier to draw with a pen than a finger and not intuitive at all to draw or sketch by voice commands.

Give one use case, task, or action where using *voice commands* would be preferred over the other two input types. Shortly explain why it is an advantage to use this method in this context.
We didn't talk much about voice commands in the lecture, but given the various characteristics of different input types we discussed, it shouldn't be difficult to come up with a good solution here. For example this one:
When using a navigation app while driving a car, using voice commands should be much safer than using finger or pen input.

2. Basic technologies / sensors

Problem 2a (2 pts) In the lecture, we mostly discussed interactions where users are actively providing input to a smartphone. The paper "A survey of mobile phone sensing" by Lane et al. discusses also interaction where the smartphone automatically gathers input. **Give an example where the accelerometer is used for active user input, and an example where it is used for passive input** (i.e., automatic information gathering while you are having your device with you, even when it is only in your pocket and you are not actively using it). **Shortly state the usage and what data is gathered for it from the accelerometer.** *[Short answers are sufficient. You do not have to give an example from the paper but any convincing one is fine.]*

Example for accelerometer usage in active interaction:
Various possible options here (basically every interaction that relies on tilt, but also some others); see lecture. Important here is that the user actively causes this input. E.g.:
In a car racing game, the tilting angle of the device can be measured via the accelerometer and mapped to steering actions in the game.

Example for accelerometer usage in phone sensing (passive input):
*The paper discussed some (e.g. "*For example, accelerometer data is capable of characterizing the physical movements of the user carrying the phone [2].*"), but various others exist, too. Most of them are related to motion profiling based on changes in speed / acceleration (admittedly, the way I explained accelerometers in the lecture, although not wrong, does not really address this well, which is why the grading for the "data" part of this question was done generously).*

Problem 2b (6 pts) Assume you want to implement a stargazing app on a smartphone or tablet; that is, an app where, for example, when you are out on a clear night, take your phone, hold it to the sky, and then get exact information about the star constellations that you see in the direction that you are pointing at with your device.
What kind of sensors would you need to implement that? Name each sensor and shortly state why or for what purpose you need it.
[Short answers are sufficient. Note that different results are possible here and all correct solutions will get full credit (redundant information will not be credited though; this is to avoid that people are just randomly writing down some sensors in the hope that the few correct ones will give credit).]

- GPS to get location on earth
- Accelerometer/gyroscope for orientation of device
- Magnetometer (digital compass) to know where the device is heading / pointing direction of device

3. Touchscreens & touch technology

Problem 3a (6 pts) In the paper "BackXPress: Using Back-of-Device Finger Pressure to Augment Touchscreen Input on Smartphones," Corsten et al. introduce a new interaction technique that lets users create BoD (Back-of-Device) pressure input. They created a prototype with a 2nd phone on the back that provided transient pressure when pressed on the back, which in turn is used for input on the phone facing the user.

What two advantages does this approach have according to the authors? (Hint: we discussed one of them in the lectures, the other one was only in the paper)
First advantage:
Quote from the paper: *"... it mitigates the **occlusion problem** ..."*
(bold-faced words are essential and any phrasing that represents them gave full credits)

Second advantage:
Quote from the paper: *" ... it **enables the use of more fingers for interaction**, since when holding the device in portrait orientation, usually only thumb and/or index finger interact at the front, and in two-handed landscape orientation, only the thumb(s) can interact at the front."*
(bold-faced words are essential and any phrasing that represents them gave full credits)

In their concluding design guidelines, the authors recommend using their approach for interaction with landscape-oriented devices (not portrait mode). Give a reason why.
Quote from the paper: *"... compared to BoDI in portrait orientation, landscape orientation **provides more stability** in holding the device ... and has the **advantage of having up to eight fingers available** for pressure input at the BoD ..."*
(bold-faced words are essential and any phrasing that represents one of them gave full credits)

In the lecture, we discussed another prototype for BoD interaction. There, the authors used *optical touch* (i.e., camera-tracking of fingers) to register interaction on the back side. **Give one advantage that the touch-technology used in the BackXPress paper has compared to the solution with optical touch.**
It allows for transient pressure (i.e., different pressure levels instead of just binary touch/no-touch input).
Other correct answers exist. E.g., one could argue that it results in more stability (since optical touch reacts to all touch input and thus fingers have to "float" across the device if you don't want to activate a touch input).

Give an application, characteristic, or task where it would be better to use optical touch input for BoD interaction instead of the technology used by BackXPress.
Possible answers:

- *For **fine-grained location information input** (quote from paper: "BackXPress does not use fine-grained location information of input at the back"; in the lecture, we saw that the example with the optical touch screen used quite some sophisticated interactions, e.g., map zooming, etc. that require such fine-grained and exact interaction)*
- ***Gestures** might be hard to do if you have to press the BoD as with BackXPress, whereas optical touch screens only require a soft touch of the back (that's kind of related to the above, but not exactly the same)*

The technology used by BackXPress for BoD interaction is the same as used in common high-end smartphones these days. **Give an example where optical touch would be better for regular (non-BoD) interaction, i.e., an application, task, or interaction feature that is useful, but can only be implemented with optical touch.** *[Short answer is sufficient, make sure though that it is clear why this is only possible with optical touch.]*
Many different options exist. We mentioned a few in the lecture, e.g.:

- *You can recognize the interacting object (e.g., finger vs. pen vs. other objects; remember the examples with interactive tables where people were placing objects such as their phones there and they got identified)*
- *Change visual content when approaching the screen (e.g., to enlarge the target area and make a wrong input less likely, or to provide better feedback about what is going to happen when you touch here).*

Problem 3b (2 pts) Standard touchscreens used in today's phones do not provide the rich haptic feedback we get when interacting with physical objects. Electrostatic touchscreens (i.e., the ones from Disney Research we saw in the lecture where electrostatic signals are used for tactile rendering) deal with this problem.

Shortly describe the haptic characteristic that is supported by these touchscreens (i.e., what kind of richer haptic feedback are they providing compared to standard touchscreens).
Feeling textures & edges (*this is a quote from the related slide, which would have been sufficient to get full credits)*

Give an example of a haptic feedback that would be useful for mobile phones but can <u>not</u> be created with this technology.
Simulation of buttons that you can rest your fingers on.
Various other examples exist (this is probably the most obvious one, since it directly relates to the other type of advanced haptic touchscreen approach we discussed in the lecture)

Problem 3c (1 pt) In the lecture, we discussed the paper "The generalized perceived input point model and how to double touch accuracy by extracting fingerprints" by Holz et al. There, the authors studied touch contact points when interacting with touch screens and identified a consistent offset from the target area. They then presented a prototype using a touchscreen with integrated fingerprint sensor to illustrate how accommodating for this offset can improve precision. **Give one reason why the fingerprint sensor in the touchscreen was needed here.** *[There are multiple ones, but it is sufficient to name one of them.]*
Possible reasons include:

- The offset is person dependent (*remember that we talked about a user's mental model in this context*)
- The offset can change for left or right handed input (*I'm not sure if we talked about this, but it's quite obvious that this is the case*)
- The offset depends on finger posture (pitch, roll, and yaw) (*this was actually included in their experiment; see slides and related discussion that we had in the lecture*)

4. Touch interaction design and touch gestures

Problem 4a (3 pts) **Name three common touch problems when interacting with touchscreens that do <u>not</u> appear when using a mouse.** *[One phrase per problem can be sufficient to get full credits. Note that we listed three in the lecture, but others exist and can be correct as well.]*

- Occlusion
- Precision & fat finger problem
- Midas touch problem

Problem 4b (4 pts) In the paper "Use the Force Picker, Luke: Space-Efficient Value Input on Force-Sensitive Mobile Touchscreens," Corsten et al. introduce an alternative design for the selection of values from long ordered lists that minimizes needed screen space and gesture space. The authors also list disadvantages of other techniques that minimize screen space. **For each of them, state one disadvantage.** *[Note that other disadvantages than the ones stated by the authors exist and can give full credits.]*

Speech input: *"… speech is socially awkward and time-consuming …"*
Tilt sensing: *"… tilt sensing makes screens hard to read at an angle and is difficult to use while walking …"*
Remapping existing physical controls like volume buttons: *This "… leads to inconsistent behavior across apps."*
Quotes from the paper. Other correct answers may exist.

Give one characteristic or problem that the Force Picker solution might have that would prevent developers from including it into their apps. *[This is not directly discussed in the paper and thus multiple correct answers may exist.]*
Some of their results only occurred after a significant training. In real life, people might not be willing to train a new input method. (Also, the related test only had 4 subjects, which were likely tech-savvy users, and thus it is not clear if the same results could be achieved with everyday users).

Problem 4c (3 pts) In the BackXPress paper discussed in Problem 3a above, only discrete touch input was used, but no touch gestures. In the lecture, we discussed some issues and potential problems for touch gestures done at the front of the device (i.e., directly on the screen). **For the ones listed below, shortly discuss how these issues change when we use the BackXPress phone prototype for back-of-device gestures.** State if they apply there as well. If not, shortly explain why not. If yes, shortly state if they differ and how. If they do not differ, explain why. *[Mark the correct option below and then shortly explain your choice.]*

Potential problems with gesture recognition:

- How to recognize? ***Applies also for BoD gestures with BackXPress?***

  [No | Yes, but in a different way | Yes, in the same way]

  Gestures on the back do also have to be recognized, so NO is definitely a wrong answer.

  For the other two options, one can argue in both ways.

  If you state that gestures on the back might be harder to do (e.g., because they are not that common and people don't see their finger when doing them, or because they hold the device in a different way and thus will also do gestures differently), the 2nd option is the right answer

  But you might as well argue that it's still a touch gesture, similar to the one done on the front and with the same technology; one might need to modify the algorithms to recognize them a bit to cope with the slight difference in input, but in the end, it's pretty much the same; if you argue like that, the 3rd option is the right answer.

- How to distinguish & resolve conflicts between gestures? ***Applies also for BoD gestures with BackXPress?***

  [No | Yes, but in a different way | Yes, in the same way]

  Pretty much the same as above; the problem exists in the same way as for interaction on the front, but if it is harder than at the front depends on how you explain why (a good explanation for either options gave full credits; I cannot think of a reason why this problem would be easier on the back than on the front and no one actually stated that in the exam as well). Personally, I would argue that it is harder, because of the (more or less fixed) location of the fingers, gestures might look more similar, but if you argued well for the other case, you got full credits, too.

- No hovering state. ***Applies also for BoD gestures with BackXPress?***

  [No | Yes, but in a different way | Yes, in the same way]

  Since the same technology is used on the back than on the front, obviously there is no hovering state at the back of the device either, so the problem remains. I would argue though that it is harder to tackle here. That is, if a gesture requires to consider a hovering of the finger over the screen, it is certainly harder to do on the back, since the users don't see their fingers and thus don't know how far away they are from the screen.

5. Mobile evaluation

Problem 5a (6 pts) In the paper "Subjective and Objective Effects of Tablet's Pixel Density," Lischke et al. study the effect of pixel density of tablet screens. In the paper "Influence of letter size on word reading performance during walking," J. Conradi addresses the impact of letter size. In both cases, the authors also measured the distance between the head of the user and the device during the test.
Shortly state why this was done.
Because this parameter can have an impact on visual perception.

How did Lischke et al. consider this measurement in their experiment and what was the consequence for the result?
They used this as a dependent variable to study in their analysis, and discovered that people did not modify distance for different PPIs (quote from paper: "*Also the results demonstrate that the distance between users' head and device does not change depending on the pixel density of the screen*").

How did J. Conradi consider this measurement in her experiment and what was the consequence for the result?
They enforced a certain distance during the whole experiment, thus eliminating the influence of this factor. This increased the internal validity of their results, but might negatively affect the external validity.

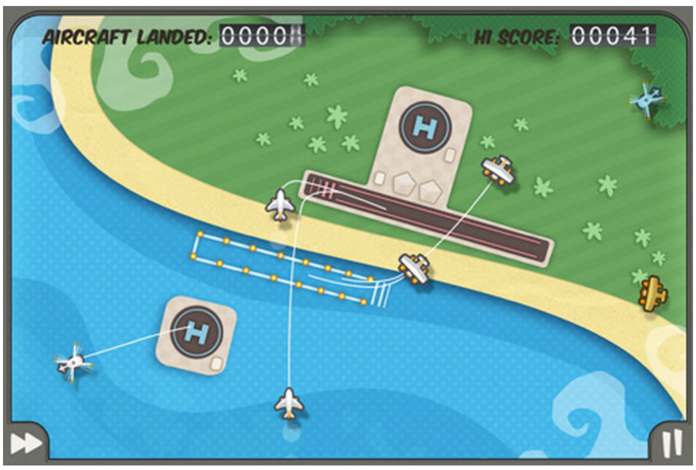
In the paper "BiTouch and BiPad: Designing Bimanual Interaction for Hand-held Tablets," Wagner et al. do a pre-study investigating how people hold tablets in everyday use. They did not measure the distance between the head of the user and the device during this test. **Shortly explain why this was not necessary here.**
The focus of this study was to see where to place objects on the screen so they can easily be reached and interacted with. Thus, there is no reason to assume that distance from the screen has any relevant impact on the results.

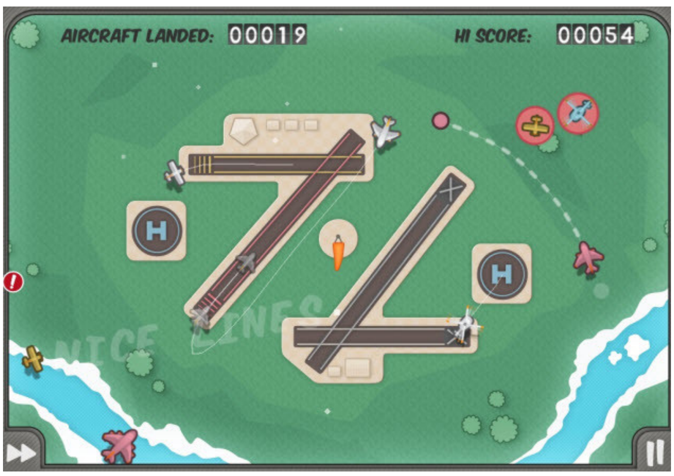
Problem 5b (1 pt) In the paper "Observational and Experimental Investigation of Typing Behaviour using Virtual Keyboards on Mobile Devices" by Henze et al., the authors state that: "To increase the study's internal validity, the same keyboard is used for all devices." **Give one aspect of their study that decreases internal validity**. *[Be specific and bring a reason related to the actual focus of the experiment. A generic statement such as "We don't have background information about the participants" will not give you any credits.]*
Left/right handed, typing with one thumb or two, typing with thumb versus index-finger, etc.

6. Mobile gaming

Problem 6a (4 pts) The four aspects illustrated in the graphic to the right show different design options from the so-called Diegesis Theory.

Below, you see two images from the mobile game *Flight Control*. In this game, airplanes are coming randomly from all sides of the screen and it is your task to direct them to the airport, so they can land safely. You do this by clicking on a plane and drawing a trace to one of the runways. Once drawn, this trace appears as a white line on the screen (see left screenshot). The plane will then follow this trace. If planes get too close to each other, a red circle around them appears to indicate an impending crash (see right screenshot). You can change and redraw an existing trace at any time. At the top of the screen it shows how many aircrafts you have landed and the high score of the game. *[Note: this might be an oversimplified explanation of the game, but it contains all info that is needed to answer this question.]*





For each of the four aspects of the Diegesis Theory indicate if they are applied in this game design. If your answer is YES, give one example how (one word or phrase referring to the above game description could be sufficient in most cases). If your answer is NO, shortly explain what the respective term means and why you think it is not present (again, a few words are sufficient). Answers with no explanation will get no credits.

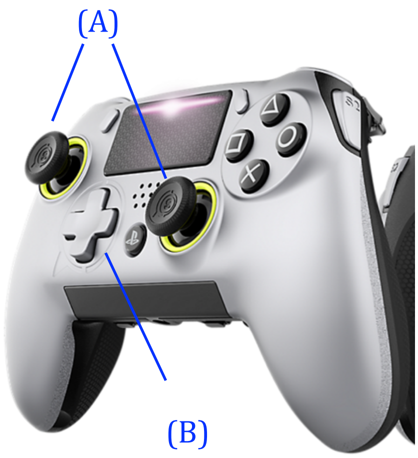
a) Non-diegetic Representations are used in this game: ☐ ***NO, because:*** **X *YES, for example:***
Numbers of aircrafts landed, high score
(also pause and fast forward button at the bottom left and right)

b) Spatial Representations are used in this game: ☐ ***NO, because:*** **X *YES, for example:***
Visualization of flight tracks, red circle around almost colliding airplanes

c) Meta Representations are used in this game: **X *NO, because:*** ☐ ***YES, for example:***
This describes element that are NOT part of the game space but are part of the game story. None of the elements that are not part of the game space (high score, aircrafts landed indication, also the two buttons at the left and right bottom) are not part of the game story.

d) Diegetic Representations are used in this game: ☐ ***NO, because:*** **X *YES, for example:***
The airplanes (and tracks they are following; not the visualization of these tracks though)
Note that this answer is debatable and depends on how you interpret the definition. I explained it this way in the lecture, but if you gave a different answer and justified it convincingly, some or even full credits were given, too.

Problem 6b (4 pts) In the blog post "A Guide To iOS Twin Stick Shooter Usability," G. McAllister discusses the pros and cons of four main design decisions when implementing the controls for twin stick shooters. These controllers usually resemble the joystick-like sticks you have on common game controllers (see (A) in image on the right). Yet, there are also other controls, e.g., ones that only allow for a discrete input in four directions (up/down/left/right; see (B) in image on the right). In the following, we refer to this as a "discrete joystick". Now we want to address two of McAllister's design decisions with respect to such discrete joysticks. *[Note that in both cases below there might be pros and cons. If you think both sides are relevant, include them into your justification.]*



For the design decision "static or dynamic controls": Which of the two options would you recommend for the implementation of a discrete joystick? Shortly justify your answer.
The arguments made by McAllister for either of these cases pretty much stay the same. However, a static representation of a discrete joystick has the advantage that each direction can be clicked directly, whereas with a dynamic implementation, one needs to click first to place the controls, then move to either of the four directions to activate them. While this is true for twin stick shooters, too, it might be more relevant here due to the discrete nature of the controls.

For the design decision "active outside of the VJR (virtual joystick region)": Which of the two options would you recommend for your implementation of a discrete joystick. Shortly justify your answer.
Again, one can argue that the pros and cons pretty much stay the same, but the fact that we have discrete controls might make it less likely that there is a need for or benefit from being active outside of the VJR. It seems reasonable to assume that with a discrete joystick, people will more likely just make discrete inputs and thus not "drift" outside of this area anyhow (esp. when paired with a static implementation).
Note that other reasons are possible; e.g., one could argue that the "drifting" when moving outside of the VJR is not that much of a problem here, since there are only 4 directions, thus making it less likely to unintentionally change directions (which means the major drawback of active outside of the VJR isn't that relevant here).

7. Mobile VR & 3D interaction

Problem 7a (5 pts) When looking at 3D graphics on a mobile device's screen, it can happen that the perspective is not correct (even if it was implemented correctly). **What is the cause of this?**
The FOV of the user mismatches the FOV of the virtual camera
Note: a more informal description not using the correct technical terms got full credits, too, if it was correct.

We can apply perspective correction to deal with this issue (Amazon calls this "dynamic perspective"). In the lecture, we talked about two approaches to do this; one is called "Fishtank VR", to the other we referred to as "Shoebox VR". **For each of them, state which sensor is used to realize it.**
Sensor used for Fishtank VR: Camera
Sensor used for Shoebox VR: Accelerometer/gyroscope

What is an obvious limitation of a Shoebox VR implementation compared to a Fishtank VR implementation?
It assumes that the user stays at a fixed (and correct) position in front of the device and only the orientation of the device is changed.

Shortly explain why in everyday usage of mobile devices, this shortcoming might not be a problem.
Because people generally don't move in front of their devices (be it because it requires more effort, could be socially awkward, etc.), whereas tilting your device when you have it in your hand is not uncommon and easy to do – and you get the same effect in such situations.
Note that this was confirmed by the feasibility study we discussed in the lecture.

Problem 7b (2 pts) In the paper "Around-Body Interaction: Sensing & Interaction Techniques for Proprioception-Enhanced Input with Mobile Devices", Chen et al. discuss how moving the device in the 3D space around your body can be used for interaction.
Give one advantage of such an "around-body interaction" implementation.
Examples from the paper (quotes):
- "leveraging a user's proprioceptive sense"
- "increases the space for interaction, … mitigating the small screen problem"

You can think of other things, too, such as:
- Taking advantage of human spatial memory

Give one disadvantage of it.
Various correct answers exist here, e.g., everything related to the limitations discussed at the end of the paper (parts in quotations are quotes from the paper):
- "in reality, tilting does not always perfectly align with the devices *true* around-body location, thus causing errors"
- The current technical implementation "demands a frequent update of the body's orientation, which requires frequently bringing the device into focus"
- It "relies on face detection, whose accuracy subjects to the physical environment"
- "User error" can happen frequently, e.g., "gesturing with a device in hand during conversations could cause false positives."

Note that it was not necessary to have this or similar phrasing to get full credits, but other formulations of the same issues were credited as well. As were other correct reasons not listed here (with "social awkwardness" and "lack of space in real-world situations" probably being the most obvious ones).

8. Mobile AR

Problem 8 (4 pts) Ray casting or ray picking is a technique that is often used for mobile AR interaction.

Shortly explain how ray picking works. *[Note: one sentence is sufficient to answer this question correctly.]*
Select first object hit by a ray "shot" from touch position perpendicular to device
Note: that's the text from the slide, which was in relation to selection. Many people used "object placement" here (likely because that was done in the SlideAR approach), which is of course totally fine, too.

What is the major problem with ray picking? *[Again, one sentence could be enough here.]*
The location of an object along the dimension of the ray is unknown.
Note: there are other ways to explain this, e.g., referring to depth or 3D location.

In the lecture, we discussed possible solutions to this problem. Explain the basic principle of one of them. *[A short description of the basic idea behind the approach is sufficient. You do not have to describe the details. It is also not required to remember the name of the approach, if you describe the idea behind it correctly (but don't mix the two; focus on one).]*
Two very informal, but totally valid answers are:

The first one (see 3DTouch and HOMER-S video) basically creates a fixed 3D coordinate system around an object. The object can then be moved (or otherwise being modified, e.g., scaled) along all three axes.

The second one (SlidAR) "fixates" a ray and lets the user move an object along the ray by looking at it from another perspective.

9. Mobile video

Problem 9 (6 pts) *Flicking* is a touch gesture that is often used to quickly skim large lists; by quickly swiping your finger over the screen, the list is "pushed" in the direction of the swipe, that is, it scrolls in that direction, first with a high speed, then gradually decreasing until it stops or the user interrupts the scrolling by a tap on the screen.

Assume you want to implement such a flicking gesture to quickly and interactively skim through the content of a video. When doing this, you have to make (at least) two critical design decisions. **What are these and why is it not straightforward how to implement them?** *[Note that there might be more than two and it is debatable which decisions are the most critical ones. If you come up with any other than the ones we discussed in the lecture and they answer this question well, you will get full credit, too.]*

First design decision: How to map scrolling direction to flicking direction?
Difficult / not easy to resolve because: People have different mental models of this situation; some would suggest that, e.g., a flick to the right is mapped to a fast forward scrolling, others that it should be mapped to a fast backward scrolling.

Second design decision: How to map scrolling speed (and slow down) to flick gesture?
Difficult / not easy to resolve because: Research exists on how well people can process video that is played back at faster rates, but here, scrolling speed would change (quick first, then slow down), making it unclear if these results are really applicable in this context.

Give one advantage and one disadvantage that such an approach would have compared to a standard fast forward and fast backward scrolling as it is implemented in standard video players.

Advantage: More flexible and interactive, as it allows for faster and slower scrolling, etc.
Disadvantage: Might be harder to control and behavior could be more unpredictable (compare to issues with design decisions discussed above)