INFOMMMI (Multimodal Interaction) 2016-2017

Exam questions for part 2

(max. 40 points)

FIRST NAME:	LAST NAME:	STUDENT ID:

Please write your answers to these questions only on the pages for this part!

Don't forget to fill in your name and student ID in the dedicated boxes above on both parts!

Question 2-1: Tracking (max. 4 points)

In the lecture, we compared the common "interaction loop" for VR implementations with a similar one for AR implementations. What actions in the AR loop correspond to the step "tracking" in the VR loop?

(Note: Three words should be enough to answer this question correctly.)

Give one example or reason, why tracking in AR is commonly considered more difficult than in VR.

(Note: A short answer should be sufficient to get full credit. No long explanation needed, if the difference between AR and VR is clear. You will NOT *get credits though for mentioning a general tracking issue that appears in AR and in VR.)*

Question 2-2: Display technologies (max. 6 points)

Complete the following sentences to create a correct statement:

(Note: Give a short explanation, and ***do not forget to cross out the part that is wrong*** *in the first part of the sentence. Just complete the sentence. There is no need to explain the terms accommodation and vergence.)*

a) Accommodation is generally **[a problem | no problem]** with video see-through displays, because …

b) Vergence is generally **[a problem | no problem]** with video see-through displays, because …

Question 2-3: Perception & UI design (max. 3 points)

AR implementations on handheld devices (e.g., smartphones) often do not register virtual objects in 3D, but just superimpose them onto the live video stream. To cope with this, pictoral depth cues are often used in interface design for such applications to create more "3D-looking" experiences. Give three examples of such pictoral depth cues.

(Note: It is sufficient to just list the names of three such pictoral depth cues to get full credit. An explanation or concrete description of how they are used in an AR interface is NOT *necessary. Only list* THREE *cues. If you write down more than three, you will get* NO *credit for this question.)*

Question 2-4: AR interaction (max. 4 points)

In the lecture, we discussed how tangible user interfaces (TUIs) can be used for interaction in AR. Other options for AR interaction include using a dedicated (and trackable) device, such as a magic wand, or tracking a user's hand(s).

(Note: A short sentence can be sufficient to get full credit. No long explanation needed. Make sure though that your example clearly states the advantage of TUIs compared to the other method. That is, do not just list any advantage of TUIs, but one that is obviously a disadvantage of the other method.)

Name one advantage TUIs can have over a magic wand for AR interaction:

Name one advantage TUIs can have over hand-tracking for AR interaction:

Question 2-5: Applying Azuma's AR definition to concrete systems (max. 11 points)

In his paper "A survey of augmented reality" (1997), R. Azuma introduced a definition of augmented reality by providing three criteria that an AR system should fulfill. Give one example of a system that one would intuitively consider to be an AR system that does NOT fulfill Azuma's definition (i.e., that according to the definition is technically NOT an AR system, although we normally still call it an AR system, AR program, or AR app. Shortly state which characteristic is violated and why.

(Note: A very short explanation should be sufficient to get full credit. No need for detailed explanation.)

The *Meta cookie* system by Narumi et al. (2010) describes a setup where real cookies with a trackable QR code on top are augmented by smells and related visuals displayed at the location of the barcode. These augmentations are perceived via a head-mounted device containing tubes for blowing odors into your nose and see-through glasses to show the visuals (see image).

Shortly discuss this setup with respect to the three characteristics introduced in the AR definition by Azuma. That is, list each of the three characteristics and then address if and how it is fulfilled for each of the two modalities smell and visuals.

First characteristic:

Discussion:

Second characteristic:

Discussion:

Third characteristic:

Discussion:

Question 2-6: Comparison of different AR systems / display technology (max. 12 points)

Assume you are wearing a head mounted video see-through AR display and you are looking at a table. On the table, there is a virtual coffee mug created by the AR system and a real coffee mug.

(Note that some of the following questions can be answered very shortly. The space between the text does not necessarily represent the size of the expected answer. But if we would make it shorter for some questions, we might give away too much of the answer already.)

a) Situation 1: From your perspective, the virtual coffee mug is partly behind the real coffee mug. Shortly describe what the AR system must do to make the scene look realistic. When doing this, state what information is needed for this, how to get it (e.g., with what kind of sensor), and what approach / technique / algorithm / etc. one might use for this. If the problem is not solvable with today's technology, shortly describe why.

b) Situation 2: Assume the same scenario as in situation 1, but now you are wearing an optical see-through display. Would the situation change and how (or why not)?

c) Situation 3: Assume the same scenario as in situation 1 (i.e., you are wearing the video see-through display again), but now the virtual coffee mug is partly in front of the real coffee mug. Shortly describe what the AR system must do to make the scene look realistic. When doing this, state what information is needed for this, how to get it (e.g., with what kind of sensor), and what approach / technique / algorithm / etc. one might use for this. If the problem is not solvable with today's technology, shortly describe why.

d) Situation 4: Assume the same scenario as in situation 3, but now you are wearing an optical see-through display. Would the situation change and how (or why not)?

e) How would the above issue(s) change if you were using a Retinal display that projects directly onto your retina?