[20220413] INFOMMMI - Multimodal interaction - 3-GS - UITHOF

Course: BETA-INFOMMMI Multimodal interaction (INFOMMMI)

Note: This file only contains the questions covering lectures 5-7 (W. Hürst)

Duration: 2 hours

Number of questions: 12

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EXAM CONTENT AND DURATION

Questions 1-6 cover lectures 1-4 by Peter Werkhoven (max. 50 points).
Questions 7-12 cover lectures 5-7 by Wolfgang Hürst (max. 50 points).

The maximum time to answer all questions is two hours. It is up to you how much time you spend on which questions.

Number of questions: 12

7   Defining and characterizing AR

R. Azuma defined Augmented Reality (AR) as systems that have three characteristics. List each of these characteristics and shortly explain what it means. One sentence can be sufficient for each explanation. The order does not matter.

2 pt.   **a.**   [max. 2 points] First characteristic:

2 pt.   **b.**   [max. 2 points] Second characteristic:

2 pt.   **c.**   [max. 2 points] Third characteristic:

There are several systems that fulfil these three characteristics only partially or not at all but are commonly still referred to as AR systems.

3 pt.   **d.**   [max. 3 points] Give an example for a system that is commonly referred to as AR although it does clearly not fulfil one of the three criteria. Explain your answer. A very short explanation that illustrates why is sufficient.

Milgram and Kishino introduced the so-called Virtuality Continuum to describe different types of mixed realities. While this continuum can be helpful to compare different systems, it can also be confusing, because the systems that you can place at a dedicated position along this continuum are not necessarily unique.

3 pt.   **e.**   [max. 3 points] Give an example of two AR systems that can be placed at the same position of the contiuum but are fundamentally different. Shortly explain your answer.

In the paper "Revisiting Milgram and Kishino's Reality-Virtuality Continuum", R. Skarbez et al. argue that "even if we were to have the Ultimate Display, it would still fall within the realm of mixed reality." They justify this by saying that "even with total control of a user's exteroceptive senses, we still would not have control over their *introceptive senses* -- the senses that monitor the body's internal state, such as the vestibular and proprioceptive senses."

3 pt.   **f.**   [max. 3 points] Give an example that clearly illustrates this.

8   VR-AR comparison

Sensors, such as accelerometer, gyroscope, and magnetometer, are often used for tracking in head-worn displays for VR and AR. They sometimes suffer from sensor noise, resulting in some "jitter" in the data.

2 pt.   **a.**   [max. 2 points] Give one problem that such a "jitter" in the sensor data can cause that is unique for VR but not AR.

2 pt.   **b.**   [max. 2 points] Give one problem that such a "jitter" in the sensor data can cause that is unique for AR but not for VR.

AR is often considered harder and more difficult to realize than VR.

2 pt.   **c.**   [max. 2 points] Give one convincing reason that supports this statement.

9 Tracking

Two approaches for optical tracking are *marker-based or fiducial tracking* and *natural feature-based tracking*.

1 pt. **a.** [max. 1 point] Give one advantage that fiducial tracking has compared to natural feature-based tracking.

1 pt. **b.** [max. 1 point] Give one advantage that natural feature-based tracking has compared to fiducial tracking.

10 Displays

Different display technologies can be used to create AR systems. Imagine you are working for a company that creates such AR systems. For each of the following types of displays, give a convincing use case. That is, give an example of a use case where this choice of display would obviously be the best and shortly explain why.

3 pt. **a.** [max. 3 points] Give a use case where using a handheld device (e.g., a mobile phone or tablet) would be the best and shortly explain why.

3 pt. **b.** [max. 3 points] Give a use case where using a projection (i.e., "projected" or "spatial AR") would be best and shortly explain why.

3 pt. **c.** [max. 3 points] Give a use case where using a non-worn see-through display (so, <u>not</u>, for example, headworn see-through glasses but, for example, a screen placed somewhere in the environment) would be best and shortly explain why.

11 Interaction

In relation to interaction, we talked about two "interaction myths." For each of them, give an example that proves why these are indeed myths.

2 pt. **a.** [max. 2 points] Myth 1: "There is one unique, best interaction approach or design for AR (& VR)." Give a short example that proves that this is not true.

2 pt. **b.** [max. 2 points] Myth 2: "Natural interaction is always better than any other technique." Give a short example that proves that this is not true.

In the lecture, we discussed different approaches for the selection and manipulation of objects in 3D.

1 pt. **c.** [max. 1 point] Probably the most common approach for selecting objects in VR is ray casting. Shortly explain how it works.

2 pt. **d.** [max. 2 points] We also saw various other approches than ray casting. Pick any of those, shortly describe how it works and what major advantage it has compared to ray casting.

2 pt. **e.** [max. 2 points] Despite the advantage that you discussed above, ray casting is still the most common approach used in VR. Shortly explain why this might be.

12   Use case: Remote meetings

In their paper "The sense of being there during online classes: ...", M. Chessa and F. Solari compared the usage of MS Teams with Mozilla Hubs for online classes. In our own class, you also experienced both systems.

1 pt.   **a.**   [max. 1 point] In their study, they identified that students experienced a higher sense of presence with Mozilla Hubs than with MS Teams. Give on reason why this might be the case.

When discussing related work, they also mentioned the terms "social presence" and "copresence", which "refer to all the situations where the user in the VE (Virtual Environment) feels the presence of other people." Yet, they did not evaluate this. Assume you would run an experiment to do this. There are intuitive reasons why MS Teams might lead to a higher sense of social presence. Yet, there are also intuitive reasons why Mozilla Hubs might lead to a higher sense of social presence. For each of them, provide such an intuitive reason in the form of a hypothesis.

2 pt.   **b.**   [max. 2 points] I hypothesize that social presence is higher with MS Teams than with Mozilla Hubs because ...

2 pt.   **c.**   [max. 2 points] I hypothesize that social presence is higher with Mozilla Hubs than with MS Teams because ...

In interaction design for AR and VR, we sometimes distinguish between two somehow conflicting design goals or metaphors: "Naturalism" and "Magic". For the use case above, i.e., an interactive classroom lecture in Mozilla Hubs, give one convincing advantage for each of these approaches.

2 pt.   **d.**   [max. 2 points] An advantage of "Naturalism" as a design metaphor in this context would be:

2 pt.   **e.**   [max. 2 points] An advantage of "Magic" as design metaphor in this context would be:

Thank you for participating in the course. We hope you enjoyed it.