INFOMMMI (Multimodal Interaction) 2014-2015

Exam questions for part 2

(max. 40 points)

FIRST NAME:	LAST NAME:	STUDENT ID:

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

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

Question 2-1: Virtual reality definitions (max. 8 points)

In the paper “Defining Virtual Reality: Dimensions Determining Telepresence” by Steuer (1992) the author introduces a definition of VR, where human experience is assumed to be influenced by two major aspects (or “dimensions”) of the used technology. One of these aspects is *vividness*. The two most important variables contributing to vividness are sensory *breadth* and sensory *depth*.

a) What is the second aspect (or “dimension”)?

Interactivity

b) What are the three most important variables or factors contributing to this second aspect?

Speed, range, mapping

Assume a 3D virtual world simulated on a PC at a resolution of 1280x1024 pixels and using stereo sound.

c) Give one example how the vividness of this system could be increased by improvements with respect to the depth variable.

Depth describes the resolution of a modality, so anything with a better resolution (e.g., more pixels, stereoscopy, HMD, etc. for visuals and 3D audio, Dolby Surround, etc. for sound) would be a correct answer.

d) Give one example how the vividness of this system could be increased by improvements with respect to the breadth variable.

Breadth describes the amount of modalities that are supported, so any additional modality (e.g., any kind of tactile feedback, smell, wind, etc.) would be a correct answer.

Question 2-2: Comparison of VR implementations (max. 4 points)

In Demiralp et al. (2006)[1], the authors present a comparative study between CAVE and Fish tank virtual reality displays demonstrating that the latter achieved better qualitative as well as quantitative results. However, the study published by Prabhat et al. (2008)[2], where the authors compared Desktop, Fish tank, and CAVE systems, led to a different result with the CAVE system outperforming both other systems.

Give two reasons why this may have been the case.

Cf. section 6.1 in the paper

[1] Demiralp et al. (2006) "CAVE and Fishtank Virtual-Reality Displays: A Qualitative and Quantitative Comparison"
[2] Prabhat et al. (2008) "A Comparative Study of Desktop, Fishtank, and Cave Systems for the Exploration of Volume Rendered Confocal Data Sets"

Question 2-3: Mobile VR (max. 8 points)

Modern smart phones contain various sensors, such as cameras (usually one facing the user and one at the back of the device), accelerometers, digital compass, etc. enabling us to implement various virtual reality concepts on such mobile devices.

a) What kind of sensor is needed to implement Fish tank VR on mobiles?

A user facing camera (note: many forgot to say “user facing” but I decided to still give them full credit)

b) What kind of sensor is needed to implement Shoebox VR on mobiles?

Accelerometer or gyroscope (or both ideally)

c) Give one advantage of Fish tank VR over Shoebox VR on mobiles.

Most importantly, it doesn’t assume a fixed head position but enables you to explore a 3D scene by moving your head in front of the device as well (but other advantages exist, which also got full credit, as did other but related phrasings of this characteristic).

d) From computer graphics, we know that there are several depth cues contributing to depth perception. Name one depth cue that may be responsible for better depth perception when using Shoebox VR instead of standard 3D graphics on a mobile device.

Occlusion and motion parallax are the most obvious ones (but others could get credits, too; yet, if they are not obvious or characteristic for Shoebox VR, the phrasing needs to clearly reflect the advantage for the latter)

Question 2-4: Augmented reality (max. 14 points)

a) Explain the difference between immersive and non-immersive augmented reality.

Immersive: No other view than that of the mixed environment
Non-immersive : Mixed environment takes up only portion of field of view
(Note: other phrasings are of course possible)

b) Give an example technology that can be used to create a non-immersive augmented reality.

Anything with a screen and a camera is basically correct (e.g., computer & webcam, or smart phone / tablet with camera)

c) Give one advantage and one disadvantage of video-see-through HMDs compared to optical-see-through HMDs.

See paper, table 1, on page 349

d) Name two potential disadvantages of tangible AR interfaces.

Some disadvantages can be found in the AR board game paper (section 3.2), such as “markers … lack meaning to humans” etc. Others exist of course, e.g., you have to carry them with you, are still restricted to a dedicated set of objects, etc. (some of the disadvantages we discussed for tracking or dedicated devices apply to tangible UIs, too; cf. slide from the lecture).

(Note: there were many wrong answers that suggest that people didn’t really understand (or remember) what tangible AR interfaces are)

Question 2-5: Augmented spaces & mixed environments (max. 6 points)

The IllumiRoom is a proof-of-concept system that augments the area surrounding a television with projected visualizations. In their paper Jones et al. (2013) investigate “how projected visualizations in the periphery can negate, include or augment the physical environment, and thus enhance the content displayed on the television screen. Give one good example for each of these three cases.

See paper for examples