Advanced Human-Computer Interaction

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time allowed: **3 hours**
documents: **exam is open book, no electronic device**

instructions:
Please answer all the questions. All the questions are independent. For each question, the carried marks are indicated. In case of ambiguity, explain your hypotheses.

Tangible Interaction (5 marks)

Consider the interface on the right, called Rubikon, inspired from the Rubik's cube. In order to manipulate an on-screen 3D object (right), the user can rotate on each of the three axes the sides of the cube to rotate the 3D object. The interface also embeds a button on each of the cube's faces to translate the 3D object (right).

Question 1 (1 mark)
Characterize the different elements of Rubikon with Fishkin's metaphors.
Justify your answer.

Question 2 (1 mark)
What themes of the "Reality Based Interaction" framework does Rubikon use?
Justify your answer.

Question 3 (1.5 mark)
What benefits and drawbacks of Rubikon can you expect compared to an interaction using the tracking of rotations and translations of a 3D printed version of the on-screen object?
Justify your answer.

Question 4 (1.5 marks)
Design as many, different interface alternatives using Fishkin's metaphor and/or the "Reality Based Interaction" framework. Justify the differences between the solutions you propose using Fishkin's taxonomy and the "Reality Based Interaction" framework.
If current technology does not allow your proposed interaction, you can assume that it will in the future. Present your alternatives in a manner as intelligible as possible.

Multi-user Interaction (5 marks)

Consider the example given in the course involving fours co-localized users interacting with digital artefacts thanks to a single and shared multiuser and multitouch interactive table (slide 34, M2R-UIS-S2.pdf). These users are able to achieve cooperative gestures (i.e. synchronized actions involving multiple users simultaneously to execute a single command).
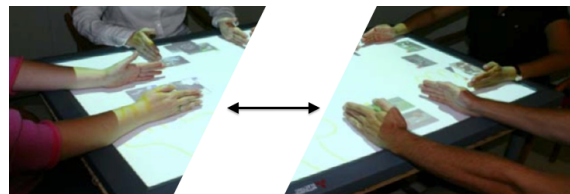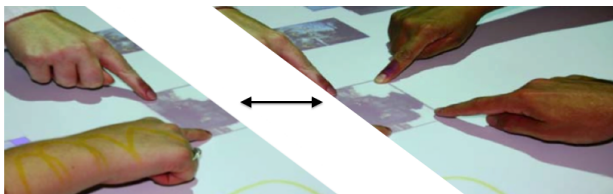
Question 1 (1 mark)
Characterize multi-user interactions based on Dix' taxonomy (slides 16-19, M2R-UIS-S1.pdf).
Justify your answer.

Question 2 (1,5 mark)
Based on the guidelines for collaborative tabletop (slides 17-33, M2R-UIS-S2.pdf), identify two guidelines that are satisfied.
Justify your answer (you can make assumptions).

Now the group is split into two groups of two collocated users. The two groups are able to interact remotely and synchronously with the shared digital artefacts thanks to two connected interactive tables (mixed-presence collaboration, combining co-localized and distant interactions).

Question 3 (2,5 mark)
Based on the guidelines for collaborative tabletop (slides 17-33, M2R-UIS-S2.pdf), identify two unsatisfied guidelines.
Justify your answer (you can make assumptions).

How would you improve the interactive system in order to support these two unsatisfied guidelines?
Justify your answer.

Foundations / Survey of recent advances (5 marks)

The photograph below illustrates an Augmented Reality system on a mobile tablet computer: the camera at the back of the device shoots the scene in front of the user. The video stream is displayed on the tablet screen. The system adds informations on top of the video image using icons. When the user moves the tablet to orient the field of view, the system updates the icons' locations so that they seem glued to the real-world objects that they describe.
We are focusing on the pointing task. Assume for example that the user wants to point at the statue, at the top of the monument, to get informations. Assume now that it is the bird (small target), at the top of the statue, that the user wants to designate.


Question 1 (5 mark)
Submit one or several interaction techniques for pointing with this kind of AR system on tablet computer. For each technique, describe it in details and with *no ambiguity*. Provide an analysis of the strengths and weaknesses of the technique(s). You should refer to fundamental models and theories in your analysis.

Information Visualization (5 marks)

Question 1 (2 mark)
The figures below give an overview of the interface of the FilmFinder system (left), and its characterization according to Card et al. taxonomy (right).
Explain each piece of information that is provided by this characterization.
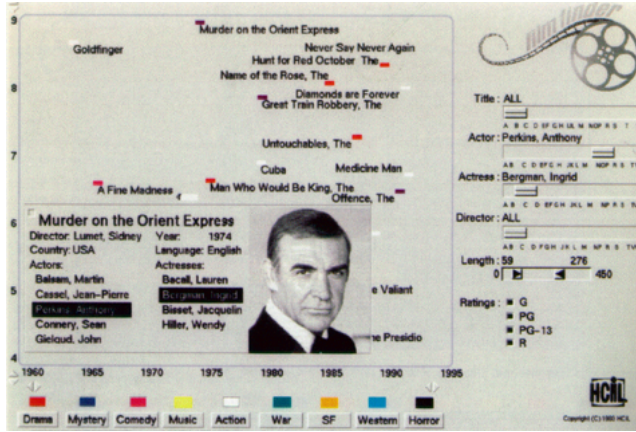
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Quality	Q	>	Q		P						
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Director	O	sl>									
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Question 2 (3 mark)
The figure below shows the interface of Gapminder World.
a) Give the characterization of the current visual mapping of the chart according to Card et al. taxonomy.
b) For each possible interaction, give its position in the Information Visualization Pipeline as described by Chi & Riedl.