

## 2015 CS PHD-HCI QUALS

### HCI Core questions (Answer 2 of 4)

1. Mark Weiser's 1991 paper "The Computer of the 21st Century" presented a vision of computing that "disappears" into the functionality of a device. Recently, his vision has been realized due to improvements in wireless networking, sensors, tiny microprocessors and cameras. These technologies have enabled what we now call "The Internet of Things": smart, internet-enabled objects such as automobiles, home automation systems, and medical devices that can self-diagnose malfunctions and self-report status or sensor information. These smart devices connect with other smart device as well as humans to share information. Therefore, interaction design for devices in the Internet of Things must include interfaces for both humans and other devices, possibly interchangeably.

- In the formative stages of requirements and design, how will we adapt current design and research methods to generate and compare designs for the Internet of Things?
- In the summative stages of evaluation, what issues may arise with current evaluation techniques?

2. Claim: "Apple's new iWatch device will succeed in the marketplace whereas other wristwatch-like devices have not taken off." You will be asked to make an argument either in agreement with or disagreement with the claim above, as follows:

- List and discuss the attributes a new iWatch-type device must have to be successful. Consider both form and functionality. Be broad, specific, and consider the entire ecosystem, not only the features of the device itself. Ground your response in a specific theoretical framework, and include citations from the reading list to support your list and discussion.
- Discuss the features of the new Apple iWatch (as best you can determine from the publicly available information; perhaps start at <http://www.apple.com>), in relation to the list you presented in (a), and make your case for or against the claim at the top of the question.
- What process(es) would you engage in to attempt to improve the iWatch (regardless of how good you think it may be at the outset)? Refer to the literature for examples of processes or methods or approaches to improving an existing system or device.

3. We are besieged with a plethora of interaction devices. No more just mouse or touchpad and keyboard. Now we have tablets - large (think CAD systems, Photoshop users), medium (think iPad) and small (think smart phones). Some tablets sense a stylus; others, finger(s). Then there is the Kinect or 3D leap motion, and there is voice recognition.

With these myriad devices, there are various interaction methods to specify a command (action).

Compare/contrast 3 of the following interaction techniques to specify a command in terms of pros and cons.

- Menu selection with mouse/touchpad
- Gesture recognition on table surface with multi-touch tablet (such as iPad)
- Gesture recognition in three-space, such as with leap motion (stick figure of your two hands are superimposed on display of the object(s) being operated on.)
- Speech recognition 5.2-handed interaction, as demonstrated by the add magic lens

Start by listing the criteria on which you will compare/contrast, and then go through each of the above interaction methods for each criteria.

4. Consider a large, high-resolution wall display. a) Thinking of each of the main HCI subareas on the Qualifying exam (CSCW, InfoVis, UbiComp, and UIST), what challenges in successfully using these types of displays has (or perhaps could) each of these area contribute? Cite one specific research article that would be relevant for each. You only need to answer these questions for three of the four areas. b) Interaction is particularly challenging on these types of displays. Select two fundamentally different ways of interacting with such a display, and compare and contrast the two using principles from human-computer interaction.

## HCI SPECIALIZATIONS

### User Interface Software Technology (Answer 1 of 2)

#### 1. Validating UIST research

- What was the contribution of the Phidgets project? How was this research contribution validated?
- When a new research idea has been introduced to support the development of graphical user interfaces, what are the ways that research idea can be validated?
- Contrast the validation of Hinckley et al.'s UIST 2001 paper, which added sensors to a PDA platform, with a proposed 2015 research contribution which is attempting to demonstrate a better way to program novel user experiences using sensor data on a smartphone.

2. The exploration and design of mechanisms for rich input handling have a long history in UI Toolkit related research. As one example from the readings, the subArctic toolkit has an extensible input system that allows applications developers to easily swap out input processing (Hudson, Mankoff, and Smith, "Extensible Input Handling in the subArctic Toolkit," CHI 2005).

subArctic was developed in an era of mouse and keyboard input, however. Imagine that you're working within the mechanisms provided by subArctic to create an application for a modern, multitouch device. 1) What are the challenges you would face in order to accommodate this new type of input? In other words, how does it differ from the input processing pipeline used by the mouse and keyboard events that subArctic was designed for? 2) How would you use the extensibility features provided by the toolkit in order to accommodate this new form of input? Please be specific about how the mechanisms provided by the toolkit could be used to mitigate the challenges you enumerated in part 1.

### Ubiquitous Computing (Answer 1 of 2)

#### 1. Beyond Ubicomp (Abowd)

- Name 3 concurrent visionaries who worked on concepts of ubiquitous computing in the 1980s. Briefly describe what projects and activities that these visionaries explored.
- How does the recent interest in the Internet of Things compare to the vision of ubiquitous computing? Is it different, or is it a natural extension of ubicomp? Support your opinion with examples and published literature.
- Weiser described three scales of ubicomp devices and ways in which those technologies might impact the human-computing experience. List two technologies, either a device or a computational technique, that have emerged in the 25 years since Weiser first started thinking about ubicomp that offer a significantly different view of the human-computer relationship than that suggested from Weiser's vision.

2. Recently, wearable computers have gotten a lot of attention in Silicon Valley. Head-up display based systems include Google Glass, Vuzix M100, and Epson's Moverio. Audio earbud systems include Motorola's Hint and the Dash on Kickstarter (for the purpose of this question, assume these systems also contain a camera). Of course, all of these systems are trying to distinguish themselves from smartphones.

Imagine you are working with a major car manufacturer to help improve their quality control systems. Currently, they use a PC on a stationary stand next to the assembly line. They scan each car's VIN number, and then the PC shows approximately 20 inspection points on paint, molding, and fabric that the worker needs to check. They walk around the car, sometimes getting into it, inspecting each of these 20 points. If there is a problem, they take a picture of it. When they return to the PC, they scroll through the 20 points and indicate where the car failed. At breaks, they associate the pictures with each of the cars.

The car manufacturer wants to determine whether a smart phone, an earbud, or a HUD-based wearable is most appropriate. All have speech recognition and a camera and whatever other reasonable (<\$200) peripherals you decide to add. They wish to optimize errors first and speed second.

Use task decomposition to help the car manufacturer which systems makes the most sense for them to develop for the problem.