CS3106 - HCI Exam

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1 Interaction Design and Qualitative Analysis

a) (i) One potential issue that may arise with this interface is in catering for universal usability. Current virtual reality often requires users to control the interface using their hands, whilst moving their head. Not giving alternatives for motor disabilities may break this heuristic.

Another potential issue would come from the heuristic "designing dialogues to yield closure". Virtual reality offers immersive environments, but the architecture of these virtual worlds is difficult to design as to guide users to their goal.

(ii) The first issue that may arise is preventing errors. People often gesture unintentionally, and accurately determining when a gesture should be considered an intentional input may become an issue.

The next comes from the heuristic of reducing short-term memory load. Smart watches must be small to be comfortable, and so only a very limited amount of perceivable data can be displayed to the user which may lead to issues with overloading short-term memory requirements.

b) Having a traditional text display, along with a voice reading out the potential options could allow those with visual disabilities to interact with the ticket machine, making the system more equitable, as those who cannot see at all are now able to use the machine, and makes the system's use more flexible, as those with differing levels of hearing and sight could then get the information in through either sight or sound depending on their individual preferences.

c) Fitts' Law predicts that the average movement time to press a button is directly proportional to the 1 dimensional distance (the straight line) from the cursor to the buttons, and the width of the buttons on that line.

Therefore, it will take, on average, the longest amount of time from the same distance to press the buttons labelled (iii), and the shortest amount of time to press the icons labelled (ii).

Increasing the size of the buttons labelled (iii) will increase the usability of the design, as it will increase the width of the click target, reducing the accuracy requirements of the mouse movements.

Reorganizing the two columns of 9 icons at (i) to a circle arrangement around the other icons would improve the usability of the UI because it would decrease the distance of the icons from each-other, which would decrease the average time taken to click the buttons given Fitts' law having time directly proportional to distance.

d) This is not likely the best approach, as there are many different types of interactive displays at museums. This means there would be many different categories of independent variables which would be difficult to setup.

Additionally, there are often no measurable "goals" of use, such as time-spent with the interactive device, as the goal is usually for learning or entertainment. Therefore, there is no clear dependent variable to test.

Qualitative approaches allow more specific subjective and emotion-based data to be collected such as specific things that worked or did not

One data collection technique for this could be interviews, where people are asked a series of questions after experiencing the interactive displays, and given a chance to elaborate on what worked or not.

Another method could use focus groups, where different types of interactive displays are shown to a group, and then they discuss their thoughts about each one, lead by a set of questions.

e) (a) The validity of responses could be affected by the question suggesting that "normal" people use ClickChat, and not the new social media app X. Therefore, participants may either want to fit in or not, which may affect their responses.

Additionally, the question may give unreliable results as people are likely to receive different numbers of messages each day, and the question doesn't suggest if an estimated mean or mode or median should be given.

An improved version would have no statements, and would specify the response to give an average: "On average, how many messages do you get on X every day?"

(b) This question is easy to misread as it asks about a negative "not difficult". This may affect the reliability of the responses as some participants answer with what makes the interface difficult or not-difficult.

The question also suggests a correct answer, as participants may feel that the interface is difficult to use.

A better version would ask a clear positives without requiring an answer such as "What, if anything, makes the ClickChat interface easy to use"

(c) This question may provide invalid and unreliable answers because no descriptions about the features are given making "new avatars" and "Sign in with Google" ambiguous and so could be interpreted differently by different people.

A solution to this problem could be adding more context about exactly what the features mean with descriptions.

2 Design

a) Simultaneously accessible resources is important so that users in different places can collaborate on the work itself, not just communication. An example of the need for this is with documentation writing, where users around the world collaborate, but need to be able to see the changes others are making to validate it and update in real time.

Additionally, communication tools are essential, such as voice and video. This is because it is the most direct communication, and allows for free-flowing discussions where everyone feels involved whether they are in the same place or not. This requirement is useful whenever decisions need to be made, such as for designers of a product.

b) A use cas for sticky-notes is for a project backlog for a project development process. A team can work on the project at different times, and come to a board with sticky notes with what needs to be done written. These can be added or removed at any time to show the progress of the project, or moved into categories to show the status of that requirement. Different users could then know what requirements are being worked on or not.

This can be converted to a digital "kanban" where sticky notes are replaced by individual to-do items which can be drag-and-dropped into different columns representing the status of each item.

c) Auction systems are collaborative, as different users bid on items, which acts as a digital auction service.

Another feature supporting colloborative shopping is the review systems which allow previous customers to post ratings and comments about the product and service for future potential customers to be aware of.

d) Wikipedia is collaborative as experts go to the pages relevant to their expertise and give detailed explanations and information. Wikipedia is open to anyone posting information and trusts to some degree that their responses are accurate.

Additionally, Wikipedia is collaborative in that contributors can communicate with eachother to discuss the contents of each page. They also can continuously come back and update with more information which is not often the case for crowdsourcing.

However, the site also has moderation which ranks contributors to accept or reject their changes. This is more like crowdsourcing, as it views the contributors as potentially malicious where collaborative platforms usually assume good intentions.

e) First, golden-standard questions can be employed, which ask the workers a question with an a-priori known answer. If they answer incorrectly, they can be marked as untrustworthy, to flag for moderation. This can be used to prevent invalid answers being accepted.

Next, these platforms can use measurements such as the total time taken to complete tasks, which can then flag potentially malicious workers. This is because often malicious workers will seek to complete tasks as quickly as possible without considering the questions. This can check the validity and integrity of the data.

Finally, these platforms can ask further questions at the end of the task which ask the workers the degree to which they understood the questions, with details on any questions which were unclear. This can validate the reliability of questions.

f) Parametric tests such as ANOVA are only appropriate for continuous data. Movie ratings are ordinal, which means they have discreet values to choose from, meaning ANOVA is inappropriate for analysis as a normal distribution requires probability frequencies for continuous data.

g)   (i) The null hypothesis for this sign test states that the difference between the population medians of the paired star rating data of Avatar and The Matrix is zero.

  (ii) First, I calculated the differences between the paired values, seen in Table 1. There were 10 values, and 0 zero values. I then found the middle value which is found by getting the value at index $\frac{n+1}{2}$ of the ordered values Table 2, which is 5.5.

2
-1
1
2
2
2
-1
1
3
1

Table 1: Differences between paired star rating data for two movies (Avatar and The Matrix)

-1
-1
1
1
1
2
2
2
2
3

Table 2: Ordered differences between paired star rating data for two movies (Avatar and The Matrix)

(iii) The two-tailed p value would split the probability to the upper and lower probability regions, the two-tailed p-value for $N = 10$ with the r value being the greater of R^+, R^- would be $r = R^- = 8$. Therefore, the one-tailed p value would be 0.05469, giving a two-tailed p value of $0.05469 \div 2 = 0.027345$.

Therefore, this result is statistically significant at a confidence evel of 0.05.
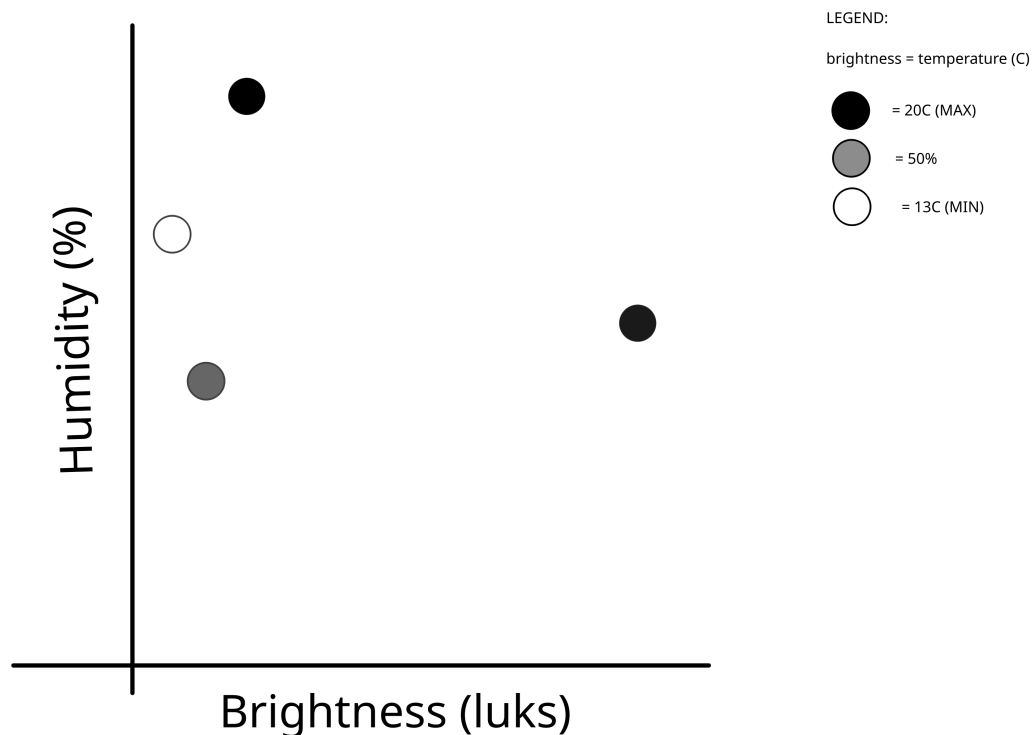
3   UbiComp, IUI, and CSCW

Figure 1: Visualisation of the relationship between temperature, brightness, and humidity of a house.

a) (i) Question 1: How does the temperature of my house change with it's humidity and brightness ?
        Question 2: How does the brightness of my house correlate to it's humidity?
        See Figure 1 for the sketch.

    (ii) All of the variables shown are continuous scales, meaning they can be ordered.
        I have chosen to represent the brightness and humidity with position attributes, as it is continuous and relatively easy to distinguish different values, and can show whether humidity and brightness are correlated depending on whether there are patterns in the positions as the two values change.

        Additionally, this style focuses on temperature as it is uniquely displayed. Often users seek to a desired temparature over the other factors, and so this display lets users see how changing their humidity or brightness may change the temperature of their house.

        I have chosen this different display method of brightness to represent temperature, as it is also continuous, but easier to distinguish then area sizing, and suggests an ordering (from coldest to hottest).

b) (i) You may make it easier to use by providing more communication methods to the user. This could be adding icons to suggest directionality of change, or labelling

parts which are directly interacted with to change the temperature. Simplifying the device by categorizing information, as when they look at the temperature category, they would then be more likely seeking to change the temperature when interacting in this menu category.

This is referring to the universal design principle of simple and intuitive use.

(ii) The first additional consideration is programmability. This refers to the ease of the smart thermostat to become a component in a broader smart-home system, such as linking the device to a phone for remote control, or connecting it to different services for automation.

The next consideration is invisibility, which aims to predict the desires of users. This could mean that the smart thermostat learns the preferred temperatures for a user at different times of the day, and automatically adjusts without the need for user input.

The final consideration would be discoverability - this considers how easily a new user can integrate the usability and functions of the device into their lives. For the smart thermostat, this could mean making the display and interactions match those they are familiar with, such as showing temperature as a thermometer, or having a dial to change continuous-value settings.

c) Ubiquitous home automation aims to make people safer, more economical, and comfortable with less effort. Allowing home controls to be accessed from mobile devices reduces the likelihood of fires and theft, as you can be notified of activity when you are not home. It also allows users to save electricity by turning things off remotely if they forgot to.

One of the concerns that the team member may have is with digital privacy, as there is a lot of potentially sensitive information being generated. However, the risk of data-leaks can be mitigated by through the use of private servers, where all of the data is stored locally, which reduces the centralisation of data so that users data is not at risk if a company is attacked.

Additionally, a challenge that is often posed is the intrusiveness of all of the technology entering the home. However, with ubiquitous home automation the goal is to be less intrusive then the current technology, which requires constant interaction. Having automation lets users focus on living rather than managing everything manually.