

Human Computer Interaction (In English)

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Data Gathering and Analysis

Hi, everyone. I'm Ritwik Bamba, and I'm the teaching assistant for the course Human-Computer Interaction. And today's topic is data gathering and analysis. Before we dive into data gathering and analysis, we need to look at what we have covered so far. So the first thing that we looked at was good design versus bad design, which was followed by what makes a design good or what makes a design bad. Next we looked at inclusivity and accessibility along with the design principles, which are visibility, feedback, consistency, affordance, and constraints.

Then we looked at how inclusivity, accessibility comes together with usability to form an inclusive design. Next we covered the four basic activities in the interaction design process, which were identifying need and establishing requirements developing alternative designs building interactive versions of the designs or as we call it prototyping and then evaluating the designs and this process repeats over and over again until we arrive at a final product next thing that we discussed was the double diamond of attracting design where we start off by learning everything about the problem Then we converge to narrow down to just one problem, which is where we get our problem statement. Then we move on to considering every potential solutions to the problem. And finally, we find the perfect solution, which is our final product.

Then we looked at what are user personas, how to create a persona, and empathy mapping. The persona right here is pretty simple. We have the personal name, a picture, demographic details, core needs, motivation, some pain points, and a small quote to represent their personality. Then we looked at mental model and conceptual model, what's the difference between them, and the information architecture, which comes under the conceptual model. Next, we discussed cognition.

What is cognitive load? What increases cognitive load? What decreases cognitive load? Some laws like Miller's and Gestalt's laws, distributed cognition, external cognition, experiential and reflective cognition. This was it for the recap. Now diving into data gathering and analysis. Well, for starters, we will look at data collection methods. So data collection methods can be of three types, questionnaires, interviews, and observation studies.

As for the questionnaires, they may be of two types, quantitative and qualitative. Quantitative ones contain closed-ended questions for numerical or statistical analysis. Qualitative questionnaires contain open-ended questions for a thematic insight. Interviews are usually qualitative, which aim at exploring personal experiences and perspectives. Finally, we have observation studies, which may be mixed or visual.

Mixed may be like quantitative fault frequency counts, while qualitative for the behavior analysis. Mixed observation studies implicate the features of both qualitative and quantitative data. Then we also have visual observation studies, which have icons for questionnaires, a mic for interviews, and an eye for observations. Looking at the interviews, well, interviews are of a few types, which include Structured interviews, semi-structured interviews. Structured interviews are, as the name suggests, totally structured.

The questions are predefined, and they are asked in the same order for consistency. This method ensures reliable and comparable data, but it limits depth and flexibility. Next, we have semi-structured interviews. It combines the structured ones with some open-ended ones, offering a balance between consistency and detailed insights. It requires some skill to guide the conversation effectively.

Next, we have unstructured interviews, which is totally free-flowing and flexible, allowing for rich, in-depth responses. However, it lacks consistency, and analysis gets a little more challenging. We also have focus groups where group discussions guided by facilitator encourages diverse opinions. While it is efficient for collecting data, the group dynamics can sometimes bias the individual responses as people tend to change their responses when they are in a group rather than when they are alone.

Interview questions are of generally two types, which are closed questions and open questions. Well, closed questions have a predetermined answer, which may be yes or no, true or false, or on the same lines. Well, open-ended questions are exactly opposite. They are totally up to the interviewee and do not have a predetermined format. And obviously, closed questions are much easier to analyze.

While interviewing the users and collecting data, we need to take care of some guidelines. These include avoiding long questions, avoiding compound sentences and instead splitting them into two. We also need to avoid jargon and language that interviewee may not understand. And they also need to avoid leading questions that make assumptions. For example, why do you like something we need not make any assumptions about the users while interviewing someone finally we also need to avoid

unconscious biases like gender stereotypes etc moving on to questionnaires well questionnaires what are questionnaires it is simply a tool with structured questions that still helps us systematically collect data.

It may be of two types, open-ended and closed-ended. Well, closed-ended is usually quantitative, that is, multiple choice, while open-ended are usually qualitative with free text responses. Well, questionnaires do have some benefits, which include that it is efficient, it is scalable, and as you guessed it right, it is very easy to analyze. But well, With these advantages come some challenges as well. These include poorly designed questions can result in bias and the depth in which questionnaires operate is much less than the interview.

Also, another tip for interviews, we need to use clear, concise language and test the questionnaire before we actually put it to use. These are some of the guidelines which may be followed while designing a questionnaire that the impact of a question can definitely be influenced by the question order. Different version of the questionnaire may be needed for different questionnaire. We also need to provide clear instructions on how to complete the questionnaire. Like, think about it.

If you are a student, You may need to fill different kinds of questionnaires if you are studying different subjects. Your course feedback forms, they are different for different courses. And we need to have clear instructions on how to fill the form so as not to cause a mistake. You also need to consider whether the questionnaire is too long. We need to strike a balance between getting in-depth data and boring the user with a too long of a questionnaire, which will eventually end up with the user not filling up the form honestly and would randomly start filling up chances.

If the questionnaire is long, we need to allow participants to opt out at certain stages and we need not force them into filling the questionnaire. We also need to look at how questions and response formats go against each other. Well, close-ended questions have a predefined list, which may include radio buttons, which are simply single response buttons for a question. If a question has single response answer, it will most likely have a radio button, as we will see next. For multiple responses, we have checkboxes.

For rating scales, we have many rating scales, which may include Likert scale, semantic differential scales, or three, five, seven more point scale. As you can see right here, this is a five point scale, which gives us a spectrum of expensive to inexpensive as we go from one to five. Similarly, it gives us friendly to unfriendly and modern to old fashioned. Questionnaires may also include some open-ended responses. Yeah, these are the radio buttons.

And intuitively, it feels like it is only single choice correct. While as for the checkboxes, you may have multiple response for the same. Finally, we come to the 5-1 Likert scale We have strongly agree at 1 and strongly disagree at 5. This helps us identify how much the user likes or dislikes a feature. Next, we look at how to administer the questionnaires.

Well, first of all, we need to plan the timeline and design it properly. Next, we also need to complete the online template if we are using one. Finally, we test the survey to make sure it behaves as one would expect. And then we test it with a group that will not be a part of survey to check if the questionnaires are clear. These steps are important to ensure a good quality and a fair survey using questionnaires.

After all these testing steps are taken and completed successfully, we go on to recruit the participants. While we decide the participants, it is really important to decide between the two alternatives of between group or within group design of a questionnaire, or shall I say, the design of a survey. So what is the difference between between group and within group? Well, as it goes semantically as well, between group is that you have two groups which are given different designs and they fill up different response forms for the designs that they looked at. No one is given the other team's design. They only get one design and they respond to the same.

As for the within group design, well, there is only one group that is given all the designs and then asked for feedback in context of how the one goes against the other. Well, within group design is preferred sometimes because it is less expensive and obviously requires less logistics because less participants are required. Next we come to capturing the data. Other than the questions, some more data can be collected from the user which may include notes, audio, videos and photographs. They may be used individually or in a combination like notes along with photographs, audio along with photographs, or videos may be used.

Well, different challenges and advantage come with each types of data recording. Like while one is doing a video recording, there may be an issue of a lag coming up or various technical issues that may arise. And finally, we come to the data analysis part. Well, it is simply the process of inspecting, cleaning, transforming, and finally modeling the data to help discover useful information and inform inclusions. Well, data analysis is not just about gathering insights from the data.

It also includes communicating those insights to the stakeholders. The key types of data analysis include qualitative and quantitative. Qualitative is descriptive and thematic, while quantitative is numerical and statistical. Quantitative analysis uses various

numerical methods to ascertain size, magnitude, or amount, while qualitative analysis expresses the nature of elements and is represented as a pattern or a theme or a story. For quantitative analysis, we can use various statistical techniques that may include mean, median, mode, Well, mean is simply the average.

We add up all the values and divide it by the number of data points and we get the average. Median is simply the center or the middle entry of the value. Mode is simply the value that appears most often in the data. We can also use graphical representations to give overview of the data. Finally, we can also use percentages for the same.

As for the basic qualitative analysis techniques, while coding is central to qualitative analysis, we can use an inductive approach that is bottom-up or deductive approach top-to-down. We also need to ensure that meaningful codes will overlap. Next, we need to identify the themes. that emerged from the data dependent on the observation framework which is used. And this also includes using inductive analysis.

Next we categorize the data which is done by a categorizing theme which is pre-specified or we may also use deductive analysis. It is not hard and fast. A combination of deductive and inductive analysis is pretty common. We can also look at conversation analysis where we examine the semantics of a conversation in fine detail.

Look at the example right here. Discourse analysis can also be used when trying to identify the subtle meaning. Well, container analysis may be time consuming, but it can help as long as context isn't lost. Content analysis also involves classifying data into themes and categories and then studying their respective frequencies. Content analysis can be used for any content. It may include text, video, newspapers, advertisements, images, and sounds.

Content analysis is often used along with other data analysis techniques. Once we are done with the process of analysis, we need to present those findings. We can use structured notations, which can help us explain our viewpoint much better. Structured notations seem to have a clear syntax and semantics, which help us communicate our story better. Using stories is also an easy and intuitive approach to communicate various ideas.

Finally, we summarize the findings using a wide range of notations. While we do so, we also need to look at some of the common pitfalls or roadblocks that may come across via data analysis. These may include bias in data collection, leading questions, or unrepresentative samples. If the sample of the participants chosen does not reflect of how the actual users are going to look like.

A bias may creep in into the survey. Next, overgeneralization can also happen when drawing conclusions from limited data. There also may be misrepresentation. Well, data may always give something. correlation may not always mean causation. Poor visualization is also another common pitfall of data analysis where inappropriate or misleading graphs may be used.

Finally, we also use visuals. We can Take care of these items while doing data interpretation. That may actually help us improve the whole process overall. We need to understand the context of the data, use appropriate statistical methods, and cross-check the findings with multiple methods if possible. Next, we avoid cherry-picking of data that supports a preconceived notion. Again, this is done to avoid any kind of biases that may have crept in.

Finally, we tailor visualizations to our audience. We come to our in-class assignment. Well, your task is analyzing the usability of a fitness tracking app. The app allows the users to log their daily workouts, view their progress, and set goals accordingly. During usability testing, the following data was collected from six participants. The data contains task completion time, task success, error count, and satisfaction rating.

And we need to calculate all these descriptive statistics, that is, average task completion time, determine the median satisfaction rating. You also need to calculate the task success rate and success to error ratio. And finally, we aim to get two insights from the data which focus on usability and satisfaction.

Take some time to complete this activity. OK. OK. So well, first we calculate the average task completion time, which comes out to be approximately 120 seconds. We just sum all the task completion times and divide it by 6, which is the number of observations here. The next, we determine the median satisfaction rating, which is 4. If we organize the data in a series, the median will be 4.

That is the middle observation. Then we come on to task success metrics, which include calculating the task success rate as a percentage. Well, it comes out to be 66%. Four out of the six participants completed the task successfully. You also need to calculate success to error ratio, which on calculation comes out to be 0.

27. Finally, we aim to reveal some key insights which are, despite the moderate success rate, the median satisfaction rating of four indicates that most participants found the app generally satisfactory. However, outliers like participant five have a very low satisfaction score of one. This points to specific usability issues that negatively impact the user

experience. You can use the given resources to read more about data gathering and analysis. Thank you so much