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Course : COMP6176 / Human - Computer Interaction

Year : 2019

DATA ANALYSIS, INTERPRETATION, AND PRESENTATION

SESSION 09

LEARNING OUTCOMES

- LO 3: Choose the data gathering technique from user to develop successful interaction design
- LO 4: Design the user requirements with interaction styles

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OUTLINE

- Introduction
- Qualitative and Quantitative
- Basic Quantitative Analysis
- Basic Qualitative Analysis
- Using Theoretical Frameworks
- Tools to Support Data Analysis
- Interpreting and Presenting the Findings

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INTRODUCTION

- The kind of analysis that can be performed on a set of data will be influenced by the goals identified at the outset, and the data actually gathered.
- Most analysis, whether it is quantitative or qualitative , begins with initial reactions or observations from the data.
- This initial analysis is followed by more detailed work using structure frameworks or theories to support the investigation.

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INTRODUCTION

- Interpretation of the finding often proceeds in parallel with analysis, but there are different ways to interpret results and it is important to make sure that the data supports your conclusions.
- Finding the best way to present your findings depend on : your goals, the audience for whom the results were produced.

QUALITATIVE & QUANTITATIVE

- Quantitative data :
  - Data that is in the form of numbers, or that can easily be translated into numbers.
  - Example : the number of years' experience the interviewees have
- Qualitative data :
  - It is not expressed in numerical terms.
  - Example : quote from interviewees, vignettes of activity, and images.

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QUALITATIVE & QUANTITATIVE

The First Steps in Analyzing Data

- There is some initial processing of the data required before data analysis can begin in earnest.
- Data gathered and typical initial processing steps for the main data gathering techniques. See Table 9.1

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QUALITATIVE & QUANTITATIVE

Table 9.1 Data Gathered and Initial Processing

	Usual raw data	Example qualitative data	Example quantitative data	Initial processing steps
Interviews	Audio recordings. Interviewer notes. Video recordings.	Responses to open-ended questions. Video pictures. Respondent's opinions.	Age, job role, years of experience. Responses to close-ended questions.	Transcription of recordings. Expansion of notes. Entry of answers to close-ended questions into a spreadsheet
Questionnaires	Written responses. Online database.	Responses to open-ended questions. Responses in "further comments" fields. Respondent's opinions.	Age, job role, years of experience. Responses to close-ended questions.	Clean up data. Filter into different data sets. Synchronization between data recordings.
Observation	Observer's notes. Photographs. Audio and video recordings. Data logs. Think-aloud Diaries.	Records of behavior. Description of a task as it is undertaken. Copies of informal procedures.	Demographics of participants. Time spent on a task. The number of people involved in an activity. How many different types of activity are undertaken.	Expansion of notes. Transcription of recordings.

BASIC QUANTITATIVE ANALYSIS

- The technique for simple quantitative analysis are : **average and percentages**.
- There are three different types of average :
  - Mean : the commonly understood interpretation of average
  - Median : the middle value of the data after ranked
  - Mode : the most commonly occurring number
- The Quantitative data can usually be translated into rows and columns, where one row equals one record, e.g. respondent or interviewee

How Question Design Affects Data Analysis

- For example : You have asked the question : “How do you feel about e-readers “ ?
- Responses to this will be varied and there are many possibilities and the responses would need to be treated qualitatively

How Question Design Affects Data Analysis

- Assumed that you have asked " In your opinion, are e-readers easy to handle or cumbersome ?
- This clearly reduces the number of options and you would then record the response as 'easy to handle' ,'cumbersome', or 'neither'.

How Question Design Affects Data Analysis

- Assumed that you have asked " In your opinion, are e-readers easy to handle or cumbersome ?
- This clearly reduces the number of options and you would then record the response as 'easy to handle' ,'cumbersome', or 'neither'.

BASIC QUANTITATIVE ANALYSIS

Respondent	Easy to Handle	Cumbersome	Neither
A	1		
B		1	
C		1	
…			
Z			1
Total	14	5	7

Based on data above, there are 26 respondent, 14 out of 26 (54%) think e-readers are easy to handle, 5 out of 26 (15%) think they are cumbersome, and 7 out of 26 (27%) think they are neither easy to handle nor cumbersome.

How Question Design Affects Data Analysis

- Another alternative which might be used in a questionnaire is to phrase the question in terms of a Likert scale, such as the one below.

I[illegible]e :

Strongly Agree	Agree	Neither	Disagree	Strongly Disagree
❑	❑	❑	❑	❑

BASIC QUANTITATIVE ANALYSIS

Then the data could be analyzed using a simple spreadsheet or table :

Respondent	Strongly Agree	Agree	Neither	Disagree	Strongly Disagree
A		1			
B	1				
C				1	
…					
Z					1
Total	5	7	10	1	3

For example : The result is 4 out of 26 (15%) disagreed with the statement that e-readers are easy to handle (and of those, 3 (11,5%) strongly disagreed.

BASIC QUANTITATIVE ANALYSIS

- For simple collation and analysis, spreadsheet software such as Excel is often used as it is commonly available, well-understood and it offers a variety of numerical manipulations and graphical representations.
- Producing a graphical representation of the data helps to get an overall view of the data and any patterns it contains.

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BASIC QUALITATIVE ANALYSIS

- The first step in qualitative analysis is to gain an overall impression of the data and to start looking for the patterns.
- There are **three basic types of qualitative analysis** :
  - Identifying themes
  - Categorizing data
  - Analyzing critical incidents
- There are not mutually exclusive and can be used in combination.

Identifying Themes

- As you become more familiar with the data, possible themes or patterns will emerge.
- One common technique in qualitative analysis is the affinity diagram, which is used in contextual design.(Beyer and Holtzblatt,1998). It aims to organize individual ideas and insights into a hierarchy showing common structures and themes.

Categorizing Data

- The principle is that the data is divided up into elements and each element is then categorized.
- Elements identified in the data are usually categorized first using a categorization scheme.
- Which categories to use determined by the goal of the study.

Categorizing Data

- To illustrate categorization, we present an example derived from a set of studies looking at the use of different navigation aids in an online educational setting (Armitage,U.,2004). These studies involved observing users working through some online educational material, using the think-aloud technique.
- An excerpt from the transcription is shown in Figure 09.01

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BASIC QUALITATIVE ANALYSIS

Categorizing Data

I'm thinking that it's just a lot of information to absorb from the screen. I just I don't concentrate very well when I'm looking at the screen. I have a very clear idea of what I've read so far . . . but it's because of the headings I know OK this is another kind of evaluation now and before it was about evaluation which wasn't anyone can test and here it's about experts so it's like it's nice that I'm clicking every now and then coz it just sort of organizes the thoughts. But it would still be nice to see it on a piece of paper because it's a lot of text to read.

Am I supposed to, just one question, am supposed to say something about what I'm reading and what I think about it the conditions as well or how I feel reading it from the screen, what is the best thing really?

Observer: What you think about the information that you are reading on the screen . . . you don't need to give me comments . . . if you think this bit fits together.

There's so much reference to all those previously said like I'm like I've already forgotten the name of the other evaluation so it said unlike the other evaluation this one like, there really is not much contrast with the other it just says what it is may be . . . so I think I think of . . .

Maybe it would be nice to have other evaluations listed to see other evaluations you know here, to have the names of other evaluations other evaluations just to, because now when I click previous I have to click it several times so it would be nice to have this navigation, extra links.

Figure 09.01 Excerpt from a transcript of a think-aloud protocol

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BASIC QUALITATIVE ANALYSIS

Categorizing Data

- This excerpt was analyzed using a categorization scheme derived from a set of negative effects of a system on a user given in van Rens (1997).The categorization scheme is shown in figure 09.02

1. **Interface Problems**
   - 1.1. Verbalizations show evidence of dissatisfaction about an aspect of the interface.
   - 1.2. Verbalizations show evidence of confusion/uncertainty about an aspect of the interface.
   - 1.3. Verbalizations show evidence of confusion/surprise at the outcome of an action.
   - 1.4. Verbalizations show evidence of physical discomfort.
   - 1.5. Verbalizations show evidence of fatigue.
   - 1.6. Verbalizations show evidence of difficulty in seeing particular aspects of the interface.
   - 1.7. Verbalizations show evidence that they are having problems achieving a goal that they have set themselves, or the overall task goal.
   - 1.8. Verbalizations show evidence that the user has made an error.
   - 1.9. The participant is unable to recover from error without external help from the experimenter.
   - 1.10. The participant suggests a redesign of the interface of the electronic texts.
2. **Content Problems**
   - 2.1. Verbalizations show evidence of dissatisfaction about aspects of the content of the electronic text.
   - 2.2. Verbalizations show evidence of confusion/uncertainty about aspects of the content of the electronic text.
   - 2.3. Verbalizations show evidence of a misunderstanding of the electronic text content (the user may not have noticed this immediately).
   - 2.4. The participant suggests re-writing the electronic text content.

Identified problems should be coded as [UP, << problem no. >>].

Figure 09.02 The Categorization Scheme

BASIC QUALITATIVE ANALYSIS

Categorizing Data

- This scheme developed and evolved as the transcript were analyzed. The transcript is divided up using square brackets to indicate which element is being identified as showing a particular usability problem. (See Figure 09.03).
- Having categorized the data, the results can be used to answer the

[I'm thinking that it's just a lot of information to absorb from the screen. **UP 1.1**][I just I don't con-centrate very well when I'm looking at the screen **UP 1.1**]. I have a very clear idea of what I've read so far . . . [but it's because of the headings **UP 1.1**] I know OK this is another kind of evaluation now and before it was about evaluation which wasn't anyone can test and here it's about experts so it's like it's nice that I'm clicking every now and then coz it just sort of organises the thoughts. [But it would still be nice to see it on a piece of paper **UP 1.10**] [because it's a lot of text to read UP 1.1].

Am I supposed to, just one question, am supposed to say something about what I'm reading and what I think about it the conditions as well or how I feel reading it from the screen, what is the best thing really?

Observer: What you think about the information that you are reading on the screen . . . you don't need to give me comments . . . if you think this bit fits together.

[There's so much reference to all those previously said **UP2.1**] [like I'm like I've already forgotten the name of the other evaluation so it said unlike the other evaluation this one like, there really is not much contrast with the other it just says what it is may be . . . so I think I think of . . . UP 2.2]

[Maybe it would be nice to have other evaluations listed to see other evaluations you know here, to have the names of other evaluations other evaluations **UP 1.10**] just to, [because now when I click previous I have to click it several times **UP 1.1, 1.7**] [so it would be nice to have this navigation, extra links **UP 1.10**].

Figure 09.03 The excerpt using the categorization scheme

Looking for Critical Incidents

- The Critical Incident technique is :
  - a set of principles that emerged from work carried out in the United States Army Air Forces where the goal was to identify the critical requirements of good and bad performance by pilot (Flanagan,1954)
- In interaction design, critical incident analysis has been used in a variety of ways, but the main focus is :
  - to identify specific incidents that are significant,
  - focus on these and analyze them in detail
  - Using the reset of the data collected as context to inform interpretation.

Looking for Critical Incidents

- For example is reported in Curzon et al (2002), it identified **a set of critical incidents** through field trials of **an in-car navigation device**. One example incident in this context was " *On one journey, the system gave directions to turn right when the destination was to the left. Its route was tog o round the block to go in the other direction. A car following ignored this turn and went the more obvious way, arriving first*.

USING THEORETICAL FRAMEWORKS

- There are several different analytical frameworks that can be used to analyze and interpret data from a qualitative study.
- Six different approaches are outlined, ordered roughly in terms of their granularity, that is, the level of detail involved.
- For example See Table 09.02

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USING THEORETICAL FRAMEWORKS

Table 09.02 Overview of analytical frameworks used in interaction Design

Framework	Data	Focus	Expected outcomes	Level of granularity
Conversation analysis	Recordings of spoken conversations	How conversations are conducted	Insights into how conversations are managed and how they progress	Word-level, or finer, for instance, pauses and inflection
Discourse analysis	Recordings of speech or writing from individuals or several participants	How words are used to convey meaning	Implicit or hidden meanings in texts	Word, phrase, or sentence-level
Content analysis	Any form of "text" including written pieces, video and audio recordings, or photographs	How often something is featured or is spoken about	Frequency of items appearing in a text	A wide range of levels from words, to feelings or attitudes, to artifacts or people
Interaction analysis	Video recordings of a naturally-occurring activity	Verbal and non-verbal interactions between people and artifacts	Insights about how knowledge and action are used within an activity	At the level of artifact, dialogue, and gesture
Grounded theory	Empirical data of any kind	Constructing a theory around the phenomenon of interest	A theory grounded in empirical data	Varying levels, depending on the phenomenon of interest
Systems-based frameworks	Large-scale and heterogeneous data	Large-scale involving people and technology, such as a hospital or airport	Insights about organizational effectiveness and efficiency	Macro-level, organizational level

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TOOLS TO SUPPORT DATA ANALYSIS

- Tools to support the organization and manipulation of data include :
  - facilities for categorization
  - Theme-based analysis
  - Quantitative analysis
- These typically provide facilities to associate labels (categories, themes, and so on) with section of data, search the data for keywords or phrases, investigate the relationships between different themes or categories, and help to develop the coding scheme further, some packages can also generate graphical representation.

TOOLS TO SUPPORT DATA ANALYSIS

- One popular qualitative data analysis package is **Nvivo** from QSR International and **SPSS** (Statistical Package for the Social Sciences).

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INTERPRETING & PRESENTING THE FINDINGS

- The best way to present findings depends on the audience and the original goals of the study . And also is dependent on the data gathering and analysis techniques used.
- There are **three kinds** of presentation style :
  - Structured Notations
  - Using stories
  - Summarizing the findings

INTERPRETING & PRESENTING THE FINDINGS

- **Structured Notations** :
  - These notations follow a clear syntax and semantics, which have been developed to capture particular viewpoints.
  - For example : the work models promoted in contextual design (Beyer and Holtzblatt,1998) use simple but clear conventions for representing flows, breakdowns, individual roles, and so on.
  - Advantages using a rigorous notations :
    - The meaning of different symbols is well-defined, and so it provides clear guidance on what to look for in the data and what to highlight and that it enforces precision in expression.
  - Disadvantage :
    - By highlighting specific elements, it inevitably also downplays or ignores other aspects,
    - The precision expressed by the notation may be lost on

INTERPRETING & PRESENTING THE FINDINGS

- **Using Stories**
  - Storytelling is an easy and intuitive approach for people to communicate ideas and experiences.
  - There are three different ways to tell the story :
    1. Participants may have told stories of their own during data gathering.
    2. Stories about participants may be employed.
    3. Stories may be constructed from smaller anecdotes or repeated patterns that are found in the data.

INTERPRETING & PRESENTING THE FINDINGS

- **Summarizing the Findings**
  - Clearly written reports with an overview at the beginning and a detailed content list make for easy reading and a good reference document.
  - Including anecdotes, quotations, pictures, and video clips helps to bring the study to life, stimulate interest, and make the written description more meaningful.

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