

Data Collection Methods

CSCI 497T/597T

Today's Topics

- Interviews and Focus groups
- Surveys
- Diaries
- Case Studies
- Automated data collection methods

Interviews and Focus Groups

Ask the users

- Direct conversations as tools for data collection
 - Understand requirements, needs, problems
- Interviews – one at a time
- Focus groups – many

Applications of interviews

- Initial exploration
- Requirements elicitation
- Evaluation and Subjective Reactions

Types of Interviews

- Fully structured – Orally-presented survey
 - Stick with the script
 - Good for comparison across individuals
- Semi-structured
 - pre-specified questions
 - starting point for discussion
 - Digression is ok

Focused & contextual interviews

- Go beyond asking questions
- Ask participant to
 - Demonstrate use of technology
 - Show artifacts (papers, photos, etc.)
 - React to “probes” - props or prototypes designed to elicit reaction

Interviews vs. focus groups

- Interviews take time
 - Often 1 hour or more/response
 - Several hours for analyzing notes
- Focus groups
 - More people in less time
 - Up to 8-12 people at once

Focus groups: pros and cons

- Pros
 - Broad range of viewpoints and insights
 - Each group will likely have at least one person who will stimulate others to talk
- Cons
 - Hard to manage group dynamics
 - Generally can't be fully structured
 - May need to ask fewer questions

Closed-ended questions

- Specific answers
 - “On a scale of 1-10, 10 being best, how did you like the web page?”
 - Yes/No
- Easy to analyze, but may not be informative

Open-ended questions

- “What did you think about the web page?”
- Invite elaboration, discussion
- Ask users to complete a sentence
 - “My favorite web browser feature is...”

Other guidelines

- Simple questions – no jargon
- Avoid compound questions with multiple parts
 - Not "“What were the strengths and weaknesses of the menu layout and the toolbar?”"
 - Ask two separate questions instead.
 - Or four...
- Avoid judgmental phrasing or tone
 - Possible bias

Preparing for interviews

- Pilot test – w/ colleagues and participants
 - Good for logistics and for confidence
- Write an interview guide listing what to do and when
 - Particularly good if multiple researchers are involved
- Logistical backups
 - Batteries for laptop, audio recorder, extra paper, etc.

Notes

- Audio and video recordings are fine..
 - But, paper notes are still important
- Record insights, non-verbal responses, etc.
 - Try to record what you can, but
 - Don't do so at the expense of listening
- Summarize written notes as soon as possible after the interview
- before you forget...

During the interview

- You're the host:
 - build rapport
 - Be friendly, respectful, nonjudgmental
 - Listen carefully
 - Ask for clarification
- Outline
 - Briefly introduce research goals
 - Complete paperwork (informed consent)
 - Simple questions first, hard questions later

Closing it out

- Ask for any final comments
- Provide more detail about research goals
- Turn off recording devices
 - Interviewees might make additional useful comments
 - Ask before including these comments in analyses
- Say “thank you!”
- Reflect and summarize notes immediately

Reporting results

- Be as specific as possible
 - not “most respondents”
 - Instead, “7 out of 10 respondents”
- Use quotes or paraphrases from respondents
 - But don't use participant name
 - use identifiers (Participant 3) or pseudonyms

Surveys

Surveys

- Surveys are very commonly used research method
- Surveys are often maligned because they are not done properly (no pilot testing is done, the wrong respondents are chosen, etc.)
- A survey is a well-defined and well-written set of questions to which an individual is asked to respond
- Surveys are typically self-administered

Surveys

- Doing a survey research study is easy, but doing a well-planned, valid survey study takes a lot of work
 - Surveys must reach the actual population of interest
 - Questions must be well-worded and tested
- Researchers are not present when users fill out a survey, so it must be easy to use, easy to understand, and easy to return
- In HCI, surveys are often used in conjunction with other data collection methods

Benefits of Surveys

- You can collect data from a large number of people, at a relatively low cost
- You can get an overview of a population of users in a short amount of time
- Surveys do not require any special equipment
- Surveys are generally approved by institutional review boards because they are typically non-intrusive

Drawbacks of surveys

- Surveys are good at getting shallow data from a large number of people, but are not good at getting “deep” data
- Since surveys are usually self-administered, it is usually not possible to ask follow-up questions
- Surveys can lead to biased data when the questions are related to patterns of usage, or feelings about a previous experience, rather than clear factual phenomena

Target user population

- The target population, or the population of interest, are the computer users who you want to study
- Is it a well-defined population? Do you know approximately how many people are in the target user population?
- Set some parameters:
 - Age, gender, education, computer experience, disability, geographic location, a specific profession?
 - Users of certain web sites, applications, OS?
- How will you contact the members of the target user population?

Potential sources of error and bias

- Sampling error (not enough responses)
- Coverage error (not all members of the population of interest have an equal chance of being sampled)
- Measurement error (questions are poorly worded)

Demographic data

- Collecting demographic information is always important in survey data, but becomes more important when using non-probabilistic sampling
- The goal should be to demonstrate either:
 - Diverse, cross-section of respondents
 - A response that is somewhat representative of already-established, baseline data

Developing survey questions

- The overall goal is to develop well-written, non-biased questions
- Since most surveys are self-administered, the questions need to stand alone, without any explanations
- You need to focus on both:
 - The overall structure of the entire survey
 - The wording of specific questions

Types of questions

- Open-ended questions
 - Respondents can be flexible in their responses, and therefore may provide more information, but it can be harder to do data analysis
 - Make sure to ask specific, not general questions. The answer should be open-ended, but the question should not be
- Closed-ended questions
 - Ordered response (e.g. ranking or Likert scale)
 - Unordered response (e.g. multiple choice)

Common problems w/questions

- Asking two separate, and possibly related questions in one question (respondents often don't answer both questions)
- The use of negative words in questions can cause confusion
- Biased wording in questions

Overall survey structure

- All surveys must begin with instructions
 - Should all respondents fill out all questions?
 - A reminder of who qualifies to participate, and who does not
- Each section of the survey should have a heading
- What path through the survey should the respondent take?
- Is contact info (e-mail, phone, web site, etc.) provided if the respondent has any questions?

Overall survey structure

- Questions related to a similar topic should be grouped together
- It's generally NOT a good idea to randomize the order of the questions
- Provide interesting questions at the beginning of the survey
- If there are any sensitive or objectionable questions, leave them until the end, when the respondent has become interested and committed to the survey!
- Be reasonable about the length of the survey

Existing surveys from HCI

- There are some existing surveys that have been tested and validated in the HCI literature, primarily for usability testing and evaluation:
 - [System Usability Scale \(SUS\) Questionnaire](#)
 - [NASA Task Load Index](#)
 - [Questionnaire for User Interaction Satisfaction](#)
 - [Website Analysis and Measurement Inventory](#)
 - [Disability-related questionnaires](#)
 - [Blind or low vision access information form](#)

Pilot testing the survey tool

- You must test both:
 - The survey interface/structure
 - The survey questions themselves
- In an ideal world, you should:
 - Have experts review the survey tool
 - Have interviews with potential respondents to evaluate content/motivational qualities
 - Have a pilot study of the survey tool and implementation procedures
- Pilot studies of HCI surveys are often much simpler!

<https://labinthewild.org/>

<https://www.surveymonkey.com/>

Techniques for improving the response rate

- Send an introductory letter from a respected member of the respondent community
- Send out reminders
- Send a replacement paper survey (or link to an electronic survey) 2-4 weeks after the initial one was sent out
- Make a final contact using a different form of communication

Data analysis

- Separate the quantitative and qualitative data
- “Clean” the data, looking for:
 - Invalid responses where the values are not within the acceptable and logical range
 - Invalid responses because the individual does not meet the inclusion criteria
 - Repeats (the same person submitting the same survey twice)
 - Incomplete responses
- Descriptive and inferential statistics

Diaries

What is a Diary?

- A diary is a document created by an individual who maintains regular recordings about events in their life, at the time that those events occur
- Diaries are useful for recording information that is fluid and changes over time, such as user mood
- If recall after-the-fact will be hard, inaccurate, or subject to biases, diaries might be a useful data collection method

What is a Diary?

- Many users already keep informal diaries in social networking, without realizing it
- These are all informal diaries, because entries are made as they occur, in real-time (although there are no stated research purposes)
- Diaries have been adopted, from sociology and history, for use in human-computer interaction research

What is a Diary?

- User mood and feelings, such as frustration, anger, and pain, can be best understood using a diary
- Diaries can be time-focused or not
- A time diary is when there is a focus on how time is used, and entries need to be made on a regular basis (with a specified dimension of time)
- Time diaries are useful, because people often remember time inaccurately

Why use diaries in HCI?

- Diaries fill the gap between observation in naturalistic settings, fixed laboratory settings, and surveys
- Users may have different reactions when being observed, and observers may not always understand what is going on
- If interested in collecting data that is fluid and changes over time (rather than factual data), surveys can lead to biased data due to biases in recall
- Diaries are good at studying usage patterns that cross multiple technologies, locations, and environments

Why use diaries in HCI?

- Diaries allow for more collecting more detailed research than surveys
- Diaries are good at understanding not only what users are doing, but WHY they are doing it
- Diaries ask users about themselves, their perceptions, and their mood?
- Time is an important dimension, because asking users to recall after-the-fact how much time they spent or wasted will lead to inaccurate answers
- Combining diaries with other research methods, will offer the most complete research understanding

Challenges with diaries

- Users sometimes are not introspective and are not even aware of the specifics of what they are doing and therefore may have trouble recording it in a diary entry
- Users may not follow through and record (via paper or electronic) a sufficient number of entries
- Time recording may still be less accurate for time diaries than for controlled laboratory setting or automated data collection

Diaries can be used to investigate the use of technology that exists at multiple stages:

- Technology that does not exist yet but could (where researchers investigate communication or information usage patterns, separate from technology)
- Technology that exists but needs to be improved (how people use existing technology)
- Prototypes of new technology that need to be evaluated

Participants for a diary study

- Determine in advance who appropriate participants/users are
 - Demographic, education, computer experience, job responsibility
- Try to get a representative group of participants, but it is more important to have users who can provide useful insight
- Potential diarists must understand the purpose, be motivated, and use any required technology for diary entries

Participants for a diary study

- The diary study would be structured so that it yields useful data, without imposing an unreasonable burden on users
- The diary study should not negatively impact on employment, health, or relationships
- Participants should be paid for taking part in the diary study
- Participants need to be informed of their rights, including the right to remain anonymous

Two main types of Diaries

- Feedback diary- the data recorded in the diary is itself the purpose of the research
 - Users make entries when a certain event or threshold occurs, or on a stated time basis
- Elicitation diary- the users record only basic information about important events occurring in their day
 - These data points are used as prompts for expansion at a later time

Data collection

- How will the diaries be recorded?
 - Paper?
 - Electronic?
 - Voice recording?
 - Pictures?
 - Smart phones? Tablets?
- If a specific technology is being studied in a diary study, you may want to use a different, common technology for the diary recordings
 - Use whatever is most natural for the participants

When to record an entry?

- Participants should be given clear guidance on when to perform an entry in the diary
 - What activities are of interest?
 - What events, incidents, or feelings should result in a diary entry?
 - How often should diary entries be made?
 - How detailed should the entries be?
- Make sure NOT to pay participants based on the number of diary entries

When to record an entry?

- Two weeks is often an appropriate length of time for a diary study
- If diary reports are turned in during the study period, researchers should monitor the incoming reports, check on who is not reporting diary entries, or if the entries are not providing useful data
- Reminders and feedback can be sent during the period of the diary study
- Possibly, sensors can be used to determine when it is appropriate to remind users (e.g. during strenuous activities)

Analysis of diaries

- Transfer all records to an easy-to-analyze electronic format
- Do statistical analysis on quantitative data
- Prepare and examine qualitative data, potentially do a content analysis
- With qualitative data, you can contact the participants after the fact to see if your interpretations are correct

Case Studies

Case Study

- In-depth study of a specific instance (or a small number of instances) within a specific real-life context
- Build understanding, generate hypotheses, document behavior that would otherwise be hard to document
- Time and labor intensive, but potentially informative

One or many – the HCI conundrum..

- More often seen as better
- Especially for controlled studies looking for statistically significant results, but..
- Large groups not necessarily available, and
- Going “in-deep” with small, fewer can provide more insight

Observing Sara: A case study of a case study

- Understand case studies by looking at a published study in the research literature
- Shinohara, K. and Tenenbergs, J. (2007) Observing Sara: A case study of a blind person's interactions with technology. Proceedings of the ACM Conference on Assistive Technology (ASSETS), 171–178.

Observing Sara: Goals/Methods

- Goal: develop in-depth understanding of how a blind person uses assistive technologies
- Method: in-depth and in-context interviews and observations with one person
 - Digital and physical objects
 - Specific tasks
- Results: insights that might be used to improve designs

What is a case study

Four key aspects:

1. In-depth examination of a small number of cases
2. Examination in context
3. Multiple Data Sources
4. Emphasis on Qualitative Data and analysis

Small number of cases

- Sara: 12 hours of interviews, transcriptions, etc.
- Couldn't easily do this for 20-30 people
- Case study: small numbers: 1,2,3 cases
- Don't worry about statistical significance

In context

- Lab studies don't reflect how people work and live
 - Not “ecologically valid”
- Real environments
- Real users
- Real tasks
- .. provide more realistic understanding of how technology is actually used

Multiple data sources

- Combine observations from
 - Artifacts
 - Observations
 - Interviews
- Triangulation: multiple sources of evidence increase confidence in observations
- But, they might contradict...dig deeper

Focus on qualitative data

- Broad and open-ended questions
- “How does Sara use technology?”, not
- “How fast can she complete this specific task”
- Answers (data) often (but not always) descriptive, not quantitative

Goals of case studies

Exploration of novel problems or situations, possibly to inform new designs

Explanation: development of models to understand technology use

Description: document a context that led to a design

Demonstration: show how a tool was successfully used

Single or multiple cases

- Multiple cases ($n > 1$) possible
- Similarities between cases might support generalization
- Only limited generalization possible on 2-3 cases

Literal vs. theoretical replication

- **Literal Replication**: Repetition of two or more similar cases designed to demonstrate consistency
 - Another blind college student alongside Sara
- **Theoretical Replication**: Cases that differ in some crucial way
 - Differences between cases might explain differences in observations
 - Blind college student vs. blind executive..

Components of case study designs

- Questions
 - What are you interested in understanding?
- Hypotheses or propositions
 - Statements of what you expect to find
- Units of analysis
 - Granularity of what you expect to focus on
- Data analysis plan
 - How will you interpret data?

Observing Sara: goals

Understanding how a blind person might use a variety of assistive technologies to accomplish tasks and to recover from task failures using workarounds

Propositions.. expect to see...

- Common types of failure and workaround strategies
- Influence of choice of implementing features in hardware or software on user interaction, including failures and response to those failures

Choosing cases

- Often no choice
 - Mandate of project
 - Convenience
- How to choose
 - Identify participants who are committed
 - Maximize convenience for participants
 - Representative participants, if possible
 - Greater external validity

Collecting Data

- **Documentation** and archives
 - good for studying past history
- **Interviews** – perceptions, concerns, needs, reactions
- **Observation** – what do people do?
- **Artifacts** – How do people bridge gap between physical and computational worlds

Logistics

- Each data source is a mini-experiment
 - Develop questions, procedures, etc.
- Protocol
 - Guide to reproduction establishes reliability
- Draft of write up
 - Describe what you can,
 - fill in observation, analysis, and conclusion later.

Case study protocol

- Introduction – questions and hypotheses
- Details of data collection
- Case selection criteria
- Contact information for relevant individuals
- Plans for each data source
- Specific questions and methods
- Outline of report

Pilot case study

- As with other research methods, a dry run can help debug
- Not always possible, particularly if there are no other suitable cases
- Pilot selected materials if complete pilot is not possible

Analysis and interpretation - Ex. Matrix Displays

Units of analysis in rows, aspects of analysis in columns

Object/Task	Description	Intentions/Goals	Limitation (what exactly is going on?)	Explanation (why does limitation happen?)	Workaround (how is limitation overcome?)
Navigating with JAWS	Incorrect key strokes may cause her to lose her bearings.	Execute an action through specific hotkeys.	JAWS is doing something other than the intended action.	Other keys may have been hit by mistake.	Keeps trying different key combinations to execute intended action.
Searching for a CD to play.	Linearly searches all CDs.	To select a specific CD to listen to.	She cannot quickly read CD covers.	CD jewel cases not easily identifiable. Labels do not fit on case spines.	Labeled CDs, mentally organized by preference, read one at a time.

Pattern matching

- Match observations to predictions
- Researchers believed that Sara would use a range of approaches and workarounds
- Description of tasks in terms of
 - situations that led to difficulties
 - characteristics of workarounds
- Result - matches between observations and theory

Developing models

- Combine observations to develop model or framework
 - Higher-level patterns
 - Common concerns
 - Recurring ideas
- Sara: criteria for technologies
 - Efficiency, portability, distinguishability, suitability for socially appropriate use
- Quantitative data when available

Writing up the study

- Descriptive – construct a narrative
 - Start early
 - Use protocol document as basis for writeup
- Present theories, data, methodologies, analytic steps, and models
- Summaries followed by analysis, or interspersed
- Thematically or chronologically organized
- Tell the story – quotes, specific incidents

Automated Data Collection Methods

Automated Data Collection Methods

- Web logs
- Stored application data
- Activity-logging tools
- Custom or instrumented tools

Automated Data Collection Methods

- Use Web logs to understand how your site is being used
- Counts of which pages are accessed
- Referrers tell which links (internal or external) are being followed
- Infer paths through the site
- May need to use web cookies
- Use insights to drive design

Web logs: Capturing event timing

- Select starting link -> beginning of task
- Select final target -> end of task
- Task time is elapsed time between two events
- Extracting times
 - Read server logs manually
 - Use custom programs

Stored application data

- What do users do?
- How do they organize data?
- With whom do they communicate, and when?
- Pros
 - “Ecologically valid”: real computer use
- Cons
 - Extraction may be challenging
 - Potential privacy concerns
 - Interpretation might be difficult or time-consuming..

Observation/Recording software

- Software tools specifically used to collect data
- Proxies: intercept and record user actions before passing them on to end programs.
- Store info in log files
- Can be more fine-grained than web logs or stored application data

Keystroke and activity loggers

- Local proxies
- Record.
 - Mouse movements
 - Keyboard input
 - Window operations
- Can invade privacy
- *Very* fine-grain

Example: <https://www.techsmith.com/morae-features.html>

Instrumented software

- Modify software to collect data on its own usage
- Log each user action
- Advantage – can track specific menus, items, etc.

Analysis

- Frequency of
 - Accessing various resources
 - Menu/tab selections
- Patterns?
 - Clicking “save” before “print”
 - Infer “sessions”
 - Data mining
- Visualization?

Hybrids

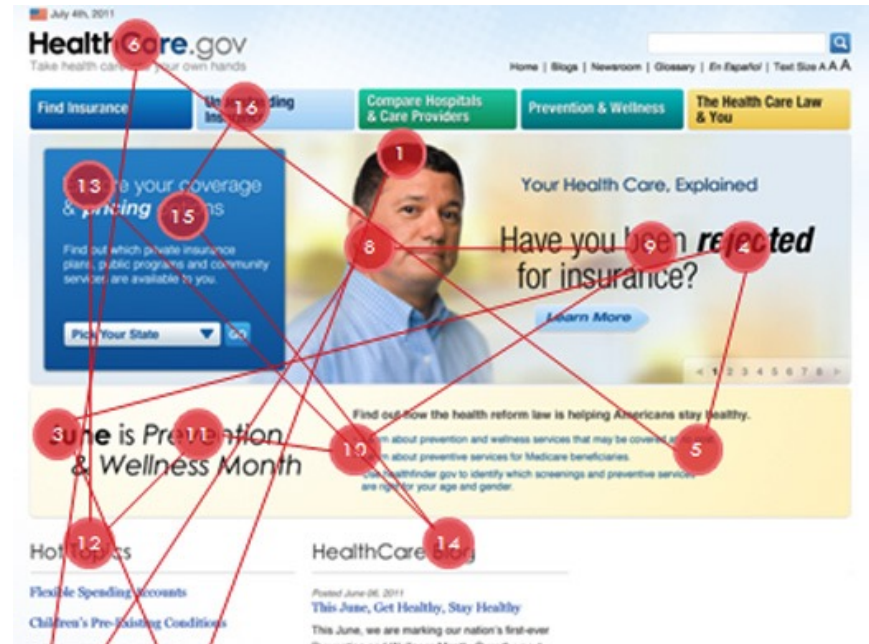
- Multiple forms of automated collection
 - Proxies and instrumented software
- Automated capture + other approaches
 - Observation
 - Qualitative

Automated interface evaluation

- Automated inspection tools
 - Assess compliance with guidelines
 - Frequently used for web accessibility

Other Data Collection Methods

- Video and Eye Tracking



References

- Lazar, Jonathan, Jinjuan Heidi Feng, and Harry Hochheiser. *Research methods in human-computer interaction*. Morgan Kaufmann, 2017.
- <https://www.usability.gov/>