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Session 6

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**Data Analysis**

**Abbas Moallem, Ph.D.**

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Session 6 Part 2

## DATA ANALYSIS

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## Objective

Qualitative and Quantitative data and analysis.

- Questionnaires.
- Interviews.
- Observation studies.

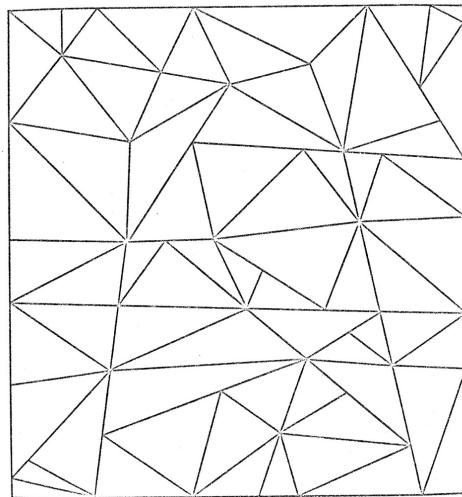
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## **Mass Data**

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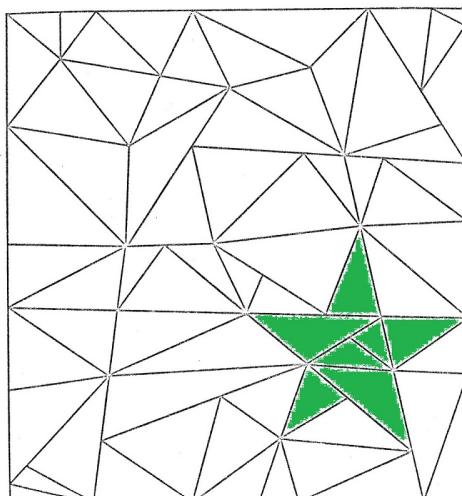
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## **Focus**

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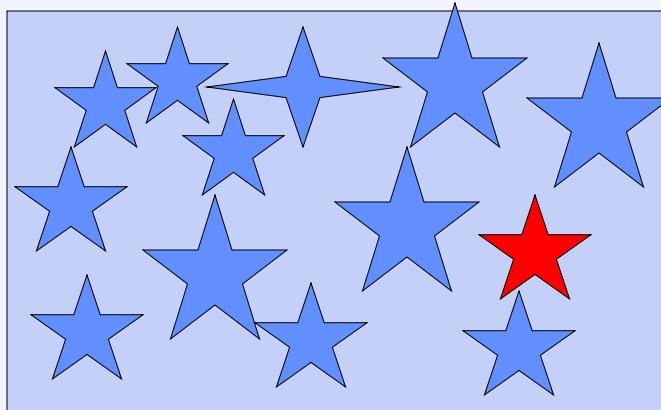
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## **Example**

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## **Quantitative and Qualitative**

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- Quantitative data – expressed as numbers
- Qualitative data – difficult to measure sensibly as numbers, e.g. count number of words to measure dissatisfaction
- Quantitative analysis – numerical methods to ascertain size, magnitude, amount
- Qualitative analysis – expresses the nature of elements and is represented as themes, patterns, stories
- Be careful how you manipulate data and numbers!

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## Simple Quantitative Analysis

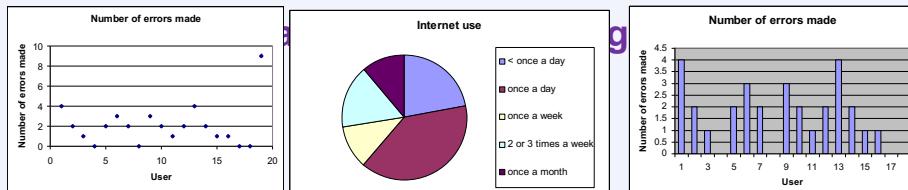
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- Averages

- Mean: add up values and divide by number of data points
- Median: middle value of data when ranked
- Mode: figure that appears most often in the data

- Percentages

- Be careful not to mislead with numbers!



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## Data Visualization

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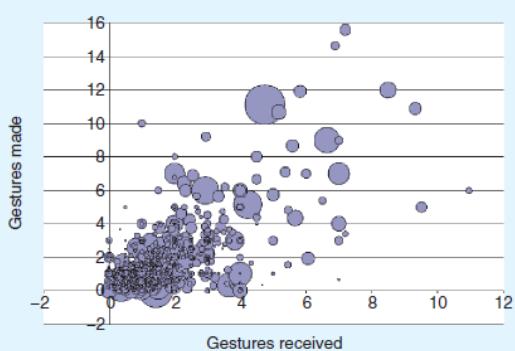


Figure 8.6 Interaction profiles of players in the cantina

Source: N. Ducheneaut and R.J. Morris (2004); "The social side of gaming: a study of interaction patterns in a massively multiplayer online game" in *Proceedings of CSCW 04*. ©2004 Association for Computing Machinery, Inc. Reprinted by permission.

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## **Qualitative Analysis**

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- Recurring patterns or themes
- Emergent from data, dependent on observation framework if used
- Categorizing data
- Categorization scheme may be emergent or pre-specified
- Looking for critical incidents
- Helps to focus in on key events

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## **Tools to Support Data Analysis**

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- Spreadsheet – simple to use, basic graphs
- Statistical packages, e.g. SPSS
- Qualitative data analysis tools
  - Categorization and theme-based analysis
  - Quantitative analysis of text-based data
- Nvivo and Atlas.ti support qualitative data analysis
- CAQDAS Networking Project, based at the University of Surrey  
(<http://caqdas.soc.surrey.ac.uk/>)
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## **Theoretical frameworks for qualitative analysis**

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- Basing data analysis around theoretical frameworks provides further insight
  - Three such frameworks are:
  - Grounded Theory
  - Distributed Cognition
  - Activity Theory

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## **Grounded Theory**

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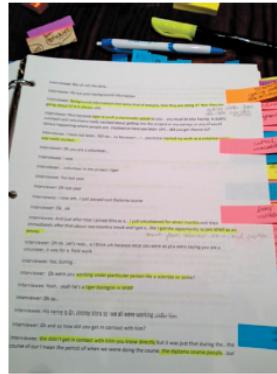
- Aims to derive theory from systematic analysis of data
- Based on categorization approach (called here ‘coding’)
- Three levels of ‘coding’
  - Open: identify categories
  - Axial: flesh out and link to subcategories
  - Selective: form theoretical scheme
- Researchers are encouraged to draw on own theoretical backgrounds to inform analysis

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## **Code book used in grounded theory analysis**



**Figure 8.13** Code book used in a grounded theory analysis of citizens' motivations to contribute to citizen science

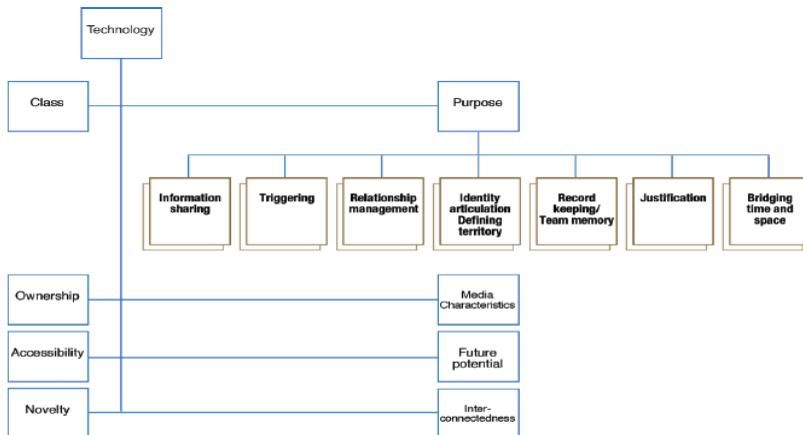
Source: Rotman, D. et al (2014). Does motivation in citizen science change with time and culture? In *Proceedings of the companion publication of the 17th ACM conference on Computer supported cooperative work & social computing (CSCW Companion '14)*. ACM, New York, NY, USA, 229–232. ©2014 Association for Computing Machinery, Inc. Reprinted by permission.

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## **Excerpt showing axial coding**



**Figure 8.14** Axial coding for the technology category

Source: S. Sarker, F. Lau and S. Sahay (2001): "Using an adapted grounded theory approach for inductive theory building about virtual team development". *The Data Base for Advances in Information Systems*, 32(1), pp. 38–56 ©2001 Association for Computing Machinery, Inc. Reprinted by permission.

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## **Distributed Cognition**

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- The people, environment & artefacts are regarded as one cognitive system
- Used for analyzing collaborative work
- Focuses on information propagation & transformation

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## **Activity Theory**

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- Explains human behavior in terms of our practical activity in the world
- Provides a framework that focuses analysis around the concept of an ‘activity’ and helps to identify tensions between the different elements of the system
- Two key models: one outlines what constitutes an ‘activity’; one models the mediating role of artifacts

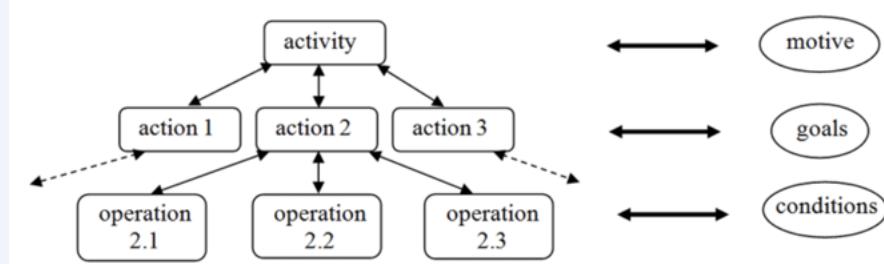
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## **Activity Theory**

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## **Individual model**

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Activity - Motive  
↑ ↓      ↑ ↓  
Action - Goal  
↑ ↓      ↑ ↓  
Operation - Conditions

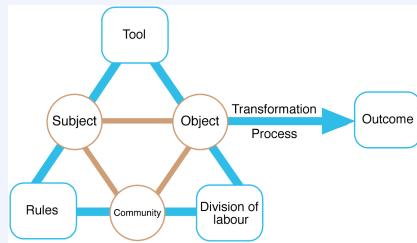
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## *Engeström's (1999) activity system model*

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## *Presenting the Findings*

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- Only make claims that your data can support
- The best way to present your findings depends on the audience, the purpose, and the data gathering and analysis undertaken
- Graphical representations (as discussed above) may be appropriate for presentation
- Other techniques are:
- Rigorous notations, e.g. UML
- Using stories, e.g. to create scenarios
- Summarizing the findings

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## **Summary**

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- The data analysis that can be done depends on the data gathering that was done
- Qualitative and quantitative data may be gathered from any of the three main data gathering approaches
- Percentages and averages are commonly used in Interaction Design
- Mean, median and mode are different kinds of ‘average’ and can have very different answers for the same set of data
- Grounded Theory, Distributed Cognition and Activity Theory are theoretical frameworks to support data analysis
- Presentation of the findings should not overstate the evidence

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## **Questions**

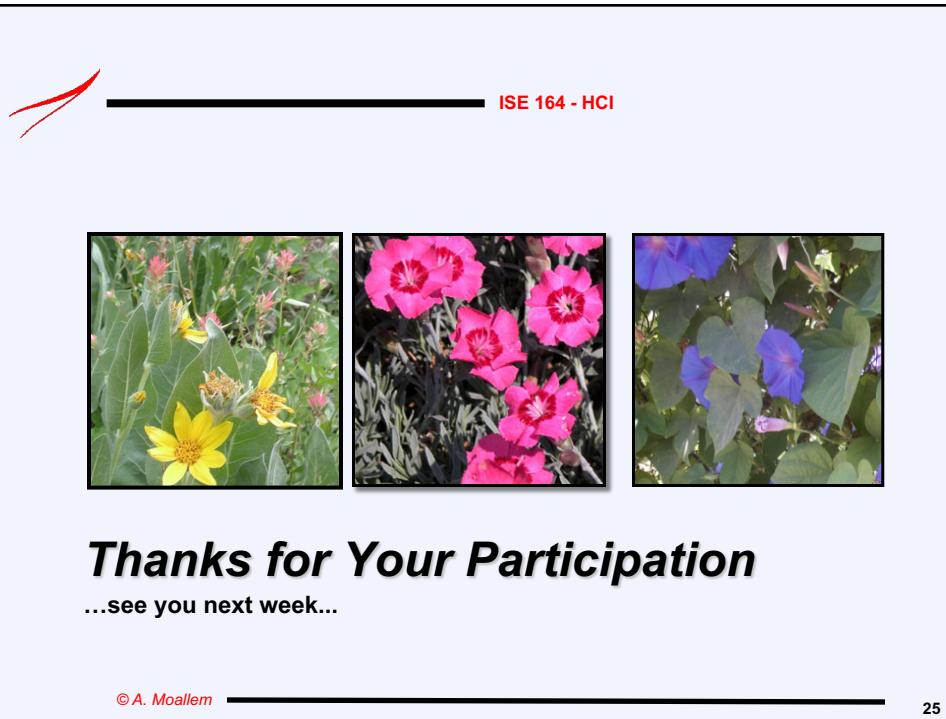
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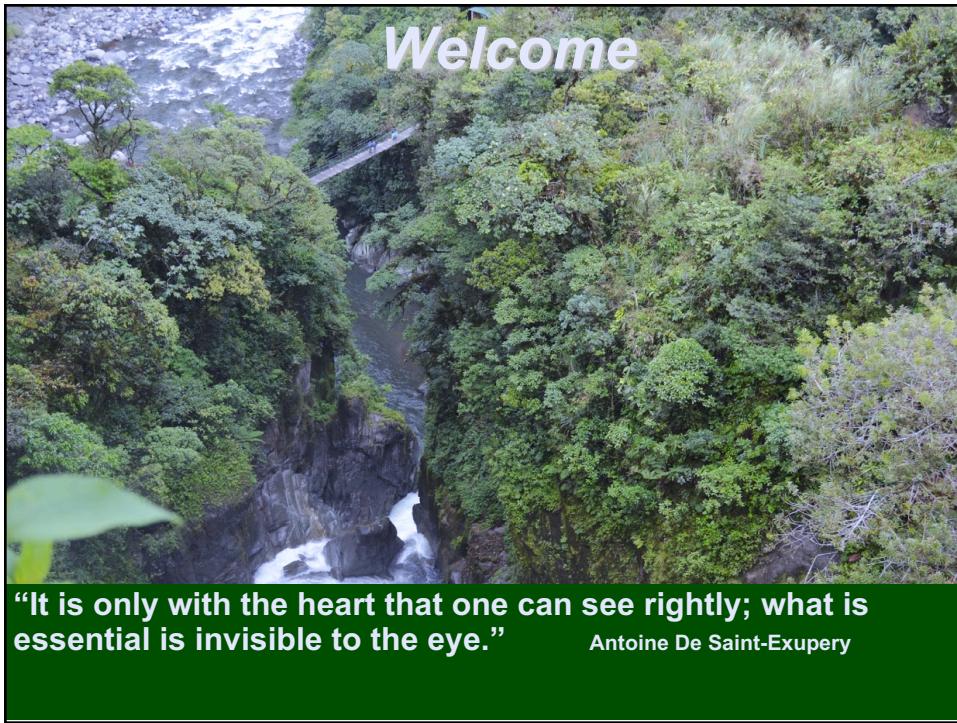
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**User Study : Data Gathering  
and Data Analysis**

Abbas Moallem, Ph.D.

Session 6

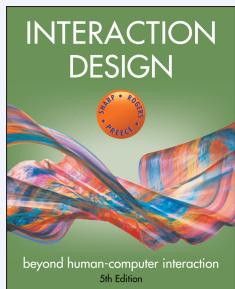
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## **Required Reading**

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Chapter 8, 9  
Data Analysis, Interpretation and  
Presentation

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## **Overview**

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- **User Study/ User Research**
- **Data Gather in Users Study program.**
- **Tools and Techniques**
- **Data Analysis**
  - Quantitative
  - Qualitative
- **Tools and Techniques**

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## **Five key issues Data Gathering**

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- Setting goals
  - Decide how to analyze data once collected
- Identifying participants
  - Decide who to gather data from
- Relationship with participants
  - Clear and professional
  - Informed consent when appropriate
- Triangulation
  - Look at data from more than one perspective
  - Collect more than one type of data, eg qualitative from experiments and qualitative from interviews
- Pilot studies
  - Small trial of main study

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## **Data Recording**

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Notes



Audio



Video



Photographs



Eye tracking



Combination

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## Interviews

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- Unstructured - are not directed by a script. Rich but not replicable.
- Structured - are tightly scripted, often like a questionnaire. Replicable but may lack richness.
- Semi-structured - guided by a script but interesting issues can be explored in more depth. Can provide a good balance between richness and replicability.



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## Interview Questions

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- Two types:
  - ‘closed questions’ have a predetermined answer format, e.g. ‘yes’ or ‘no’
  - ‘open questions’ do not have a predetermined format
  - Closed questions are easier to analyze
- Avoid:
  - Long questions
  - Compound sentences - split them into two
  - Jargon and language that the interviewee may not understand
  - Leading questions that make assumptions e.g.. why do you like ...?
  - Unconscious biases e.g.. gender stereotypes



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## Conducting Interview

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- Introduction – introduce yourself, explain the goals of the interview, reassure about the ethical issues, ask to record, present the informed consent form
- Warm-up – make first questions easy and non-threatening
- Main body – present questions in a logical order
- A cool-off period – include a few easy questions to defuse tension at the end
- Closure – thank interviewee, signal the end, eg. switch recorder off.

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## Questionnaires

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- Questions can be closed or open
- Closed questions are easier to analyze, and may be distributed and analyzed by computer
- Can be administered to large populations
- Disseminated by paper, email and the web
- Sampling can be a problem when the size of a population is unknown as is common online evaluation



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## **Questionnaire Design**

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- The impact of a question can be influenced by question order.
- You may need different versions of the questionnaire for different populations.
- Provide clear instructions on how to complete the questionnaire.
- Strike a balance between using white space and keeping the questionnaire compact.
- Avoid very long questionnaires
- Decide on whether phrases will all be positive, all negative or mixed.

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## **Question and Response Format**

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- ‘Yes’ and ‘No’ checkboxes
- Checkboxes that offer many options
- Rating scales
- Likert scales
- semantic scales
- 3, 5, 7 or more points
- Open-ended responses

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## **Encouraging a Good Response**

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- Make sure purpose of study is clear
- Promise anonymity
- Ensure questionnaire is well designed
- Offer a short version for those who do not have time to complete a long questionnaire
- If mailed, include a stamped addressed envelope
- Follow-up with emails, phone calls, letters
- Provide an incentive
- 40% response rate is good, 20% is often acceptable

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## **Online Questionnaires Advantages**

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- Relatively easy and quick to distribute
- Responses are usually received quickly
- No copying and postage costs
- Data can be collected in database for analysis
- Time required for data analysis is reduced
- Errors can be corrected easily



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## Activity

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- You want to create a 5 questions online survey asking a group of participant about how much of the information and News they get are coming from social media. And how do check to see if the news and information share on special networking are trustworthiness

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## Example of an online questionnaire

D. Internationally-agreed development goals outlined in the Millennium Declaration : Is this activity relevant to achieving the MDGs listed below? (see [www.un.org/millenniumgoals/](http://www.un.org/millenniumgoals/) and the targets for each goal)  Yes  No  
If yes, please tick all goals that apply

1.  Eradicate poverty and hunger  
2.  Achieve Universal Primary Education  
3.  Promote gender equality & empower women  
4.  Reduce child mortality  
5.  Improve maternal health  
6.  Combat HIV/AIDS, Malaria and other diseases  
7.  Ensure environmental sustainability  
8.  Develop a global partnership for development

E. More Information : Please provide a website for this activity  
Website (URL)

F. Geographical Coverage \* : Please tick a box to indicate the geographical coverage  
 Local  National  Regional  International  
Please specify coverage

G. Timescale \* : Please tick a box to indicate the timescale of the activity  
 Completed  Planned for future  Ongoing  
Specify dates using the format day/month/year (dd/mm/yyyy) :  
From:  To:

H. Activity Type \* : Please tick one or more boxes to indicate the type of activity described above  
 Project  Programme  WSIS Thematic Meeting  Conference  Publication  Training initiative  
 Guidelines  Tool-kit  Website  Database  
Other (please specify)

Figure 7.8 An excerpt from a web-based questionnaire showing check boxes, radio buttons, and pull-down menus

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## ***Issues With Online Questionnaires***

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- Sampling is problematic if population size is unknown
- Preventing individuals from responding more than once can be a problem
- Individuals have also been known to change questions in email questionnaires

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## ***Observation***

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- Direct observation in the field
  - Structuring frameworks
  - Degree of participation (insider or outsider)
  - Ethnography
- Direct observation in controlled environments
- Indirect observation: tracking users' activities
  - Diaries
  - Interaction logging
  - Video and photographs collected remotely by drones or other equipment

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## **Observation Guide**

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- Three easy-to-remember parts:
  - The person: Who?
  - The place: Where?
  - The thing: What?
- A more detailed framework (Robson, 2014):
  - Space: What is the physical space like and how is it laid out?
  - Actors: What are the names and relevant details of the people involved?
  - Activities: What are the actors doing and why?
  - Objects: What physical objects are present, such as furniture
  - Acts: What are specific individual actions?
  - Events: Is what you observe part of a special event?
  - Time: What is the sequence of events?
  - Goals: What are the actors trying to accomplish?
  - Feelings: What is the mood of the group and of individuals?

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## **Conducting Observation in the Field**

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- Decide on how involved you will be: passive observer to active participant
  - How to gain acceptance
  - How to handle sensitive topics, eg. culture, private spaces, etc.
- How to collect the data:
  - What data to collect
  - What equipment to use
  - When to stop observing

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## **Ethnography**

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- Ethnography is a philosophy with a set of techniques that include participant observation and interviews
- Debate about differences between participant observation and ethnography
- Ethnographers immerse themselves in the culture that they study
- A researcher's degree of participation can vary along a scale from 'outside' to 'inside'
- Analyzing video and data logs can be time-consuming
- Collections of comments, incidents, and artifacts are made

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## **Ethnography**

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- Co-operation of people being observed is required
- Informants are useful
- Data analysis is continuous
- Interpretivist technique
- Questions get refined as understanding grows
- Reports usually contain examples

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## Ethnography

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(a)



(b)

**Figure 7.10** (a) The situation before MERboard; (b) A scientist using MERboard to present information

Source: J. Trimble, R. Wales and R. Gossweiler (2002): "NASA position paper for the CSCW 2002 workshop on Public, Community and Situated Displays: Merboard".

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## Online Ethnography

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- Virtual, Online, Netnography
- Online and offline activity
- Interaction online differs from face-to-face
- Virtual worlds have a persistence that physical worlds do not have
- Ethical considerations and presentation of results are different

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## ***Observations and materials that might be collected (Crabtree, 2007)***

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- Activity or job descriptions.
- Rules and procedures that govern particular activities.
- Descriptions of activities observed.
- Recordings of the talk taking place between parties.
- Informal interviews with participants explaining the detail of observed activities.
- Diagrams of the physical layout, including the position of artifacts.
- Other information collected when observing activities:
  - Photographs of artifacts (documents, diagrams, forms, computers, etc.)
  - Videos of artifacts.
  - Descriptions of artifacts.
  - Workflow diagrams showing the sequential order of tasks.
  - Process maps showing connections between activities.

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## ***Observation in a Controlled Environment***

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- Direct observation
  - Think aloud techniques
- Indirect observation – tracking users' activities
  - Diaries
  - Interaction logs
  - Web analytics
- Video, audio, photos, notes are used to capture data in both types of observations

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# Web Analytics

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- A system of tools and techniques for optimizing web usage by:
  - Measuring,
  - Collecting,
  - Analyzing, and
  - Reporting web data
- Typically focus on the number of web visitors and page views.

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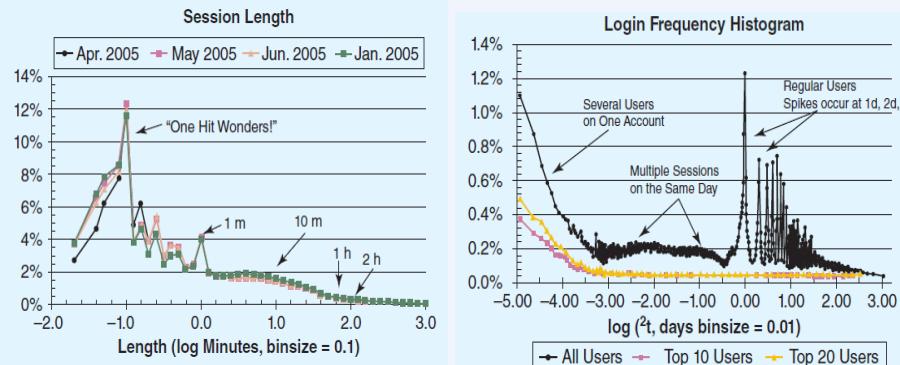
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# Web Analytics

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session length data of four different months from Teachers' Domain (NSDL)

Source: Khoo, M., Pagano, J., Washington, A. L., Recker, M., Palmer, B., and Donahue, R. A. (2008) Using web metrics to analyze digital libraries. *Proceedings of Joint Conference on Digital Libraries*, Pittsburgh, June 16–20. ©2008 Association for Computing Machinery, Inc. Reprinted by permission.

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## ***Choosing and Combining Techniques***

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- Depends on the:
  - Focus of the study
  - Participants involved
  - Nature of the technique(s)
  - Resources available
  - Time available

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## ***Summary***

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- Data gathering sessions should have clear goals.
- An informed consent may be needed.
- Five key issues of data gathering are: goals, choosing participants, triangulation, participant relationship, pilot.
- Data may be recorded using handwritten notes, audio or video recording, a camera, or any combination of these.
- Interviews may be structured, semi-structured or unstructured
- Focus groups are group interviews
- Questionnaires may be on paper, online or telephone
- Observation may be direct or indirect, in the field or in controlled settings.
- Techniques can be combined depending on the study focus, participants, nature of technique, available resources and time.

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## **Questions**

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***Thanks for Your Participation***

*...see you next week...*

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