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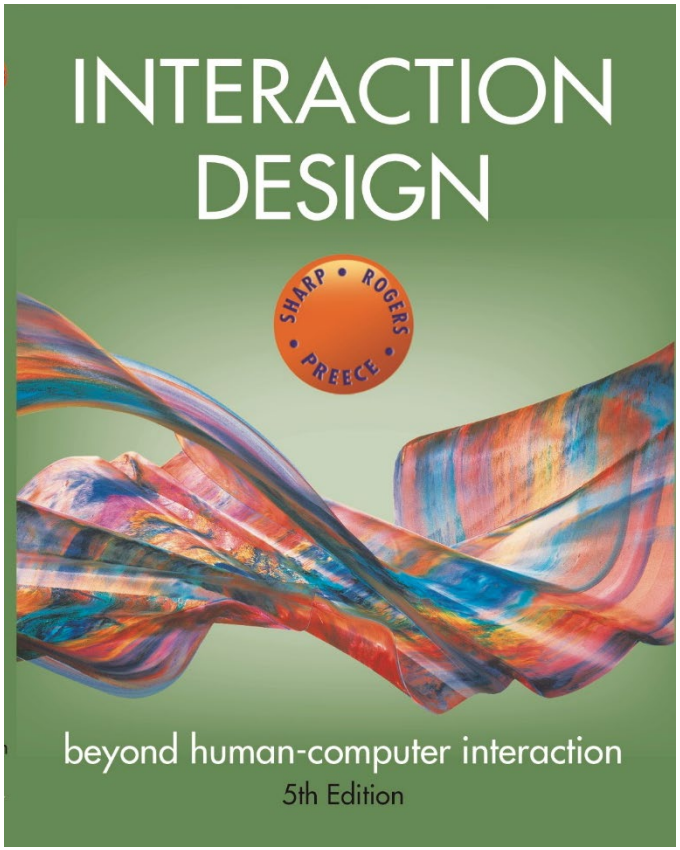


Chapter 9
Data Analysis, Interpretation, and Presentation

Goals

- Discuss the difference between qualitative and quantitative data and analysis
- Enable you to analyze data gathered from:
  - Questionnaires
  - Interviews
  - Observation studies
- Make you aware of software packages that are available to help your analysis
- Identify common pitfalls in data analysis, interpretation, and presentation
- Enable you to interpret and present your findings in appropriate ways

Quantitative and qualitative

Quantitative data: Expressed as numbers

Qualitative data: Difficult to measure sensibly as numbers, for example, count number of words to measure dissatisfaction

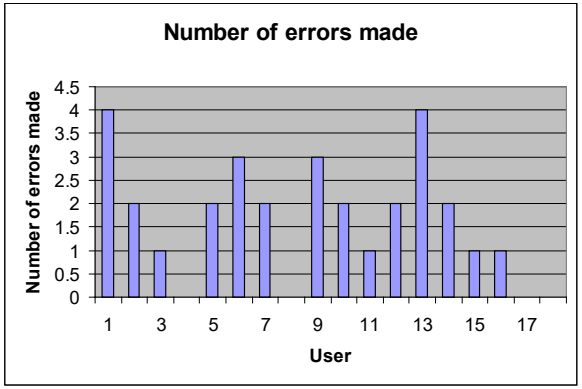
Quantitative analysis: Numerical methods to ascertain size, magnitude, and amount

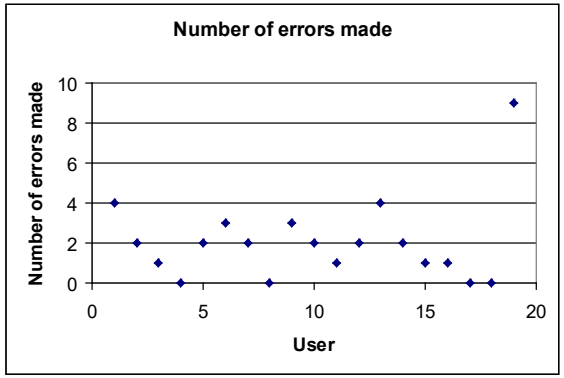
Qualitative analysis: Expresses the nature of elements and is represented as themes, patterns, or stories

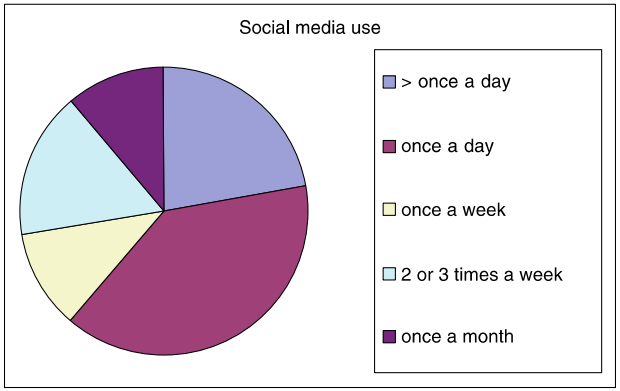
Be careful how you manipulate data and numbers!

Basic quantitative analysis

- 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!
- Graphical representations give overview of data







How question design affects data analysis

- Question design affects analysis

  Open question: Each answer analyzed separately

  Closed question: Analyzed quantitatively

- Fixed alternative answers restrict what can be said in findings

Basic qualitative analysis

- Looking for critical incidents
  - Helps to focus in on key events
  - Then analysis can proceed using specific techniques
- Identifying themes
  - Emergent from data, dependent on observation framework if used
  - Inductive analysis
- Categorizing data
  - Categorization scheme pre-specified
  - Deductive analysis
- In practice, combination of inductive and deductive

Which analytical framework?

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

Conversation Analysis

Examines the semantics of a conversation in fine detail

01	SUS	i'd like to play beat the intro in a minute
02	LIA	[oh no::]
03	SUS	[**alexa**][**(1.1)**] **beat the in**[**tro**
04	CAR	[°yeah°]
05	LIA	[°no:::...°
06	CAR	(0.6) it's mother's day? (0.4)
07	SUS	it's ( ) yep (.) listen (.) you need to keep
08		on eating your orange stuff (.) liam
09		(0.7)
10	CAR	and your green stuff
11	SUS	**alexa (1.3) alexa (0.5)**=
12	CAR	=°and your brown stuff°
13	SUS	**play beat the intro**

An extract of the conversation between a family and Alexa

Discourse Analysis

- Focuses on dialogue; that is, the meaning of what is said and how words convey meaning
- Assumption that there is no objective scientific “truth”
- Language is viewed as a constructive tool
- Discourse analysis is useful when trying to identify subtle meaning

Content Analysis

- Involves classifying data into themes or categories and studying their frequencies
- Can be used for any “text”: video, newspapers, advertisements, images, and sounds
- Often used in conjunction with other techniques

Interaction Analysis

- A way to investigate and understand interactions between people and between people and artefacts
- Based on empirical observations such as videos
- Inductive process in teams, collaboratively
- Contents of the material is logged
- Materials are extracted, classified, or removed
- Instances of a salient event are assembled and played one after the other
- The team of researchers studies the assemblage together

Grounded Theory

- Seeks to develop theory from systematic analysis of empirical data
- Three levels of 'coding'

  Open: Identify categories

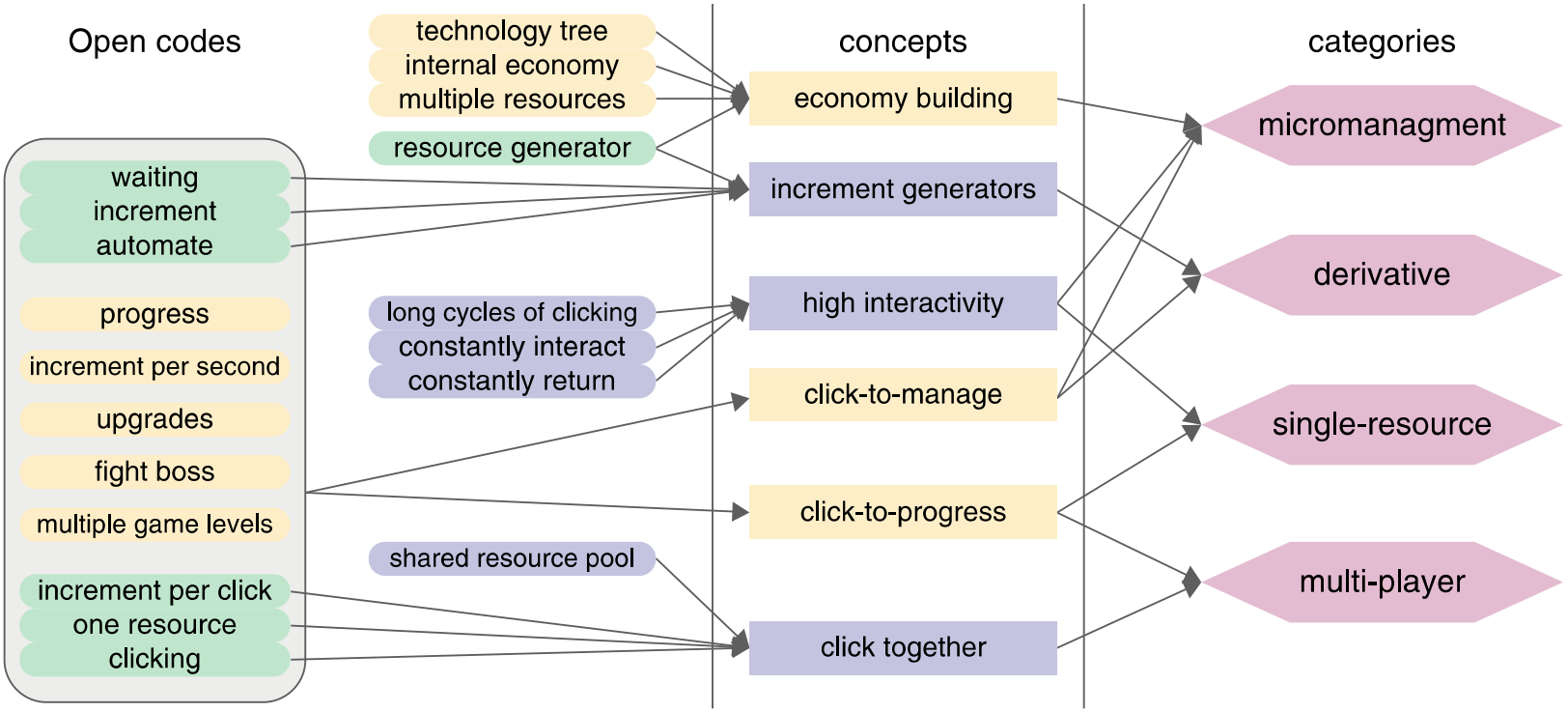
  Axial: Flesh out and link to subcategories

  Selective: Form theoretical scheme
- Researchers are encouraged to draw on own theoretical backgrounds to inform analysis
- Analytic tools to help stimulate:
  - Question the data
  - Analyze words, phrases or sentence
  - Comparisons between objects or abstract categories

Illustration of open coding

Game Feature	Observations
Game name	*AdVenture Capitalist* [G38]
Play description	You start CLICKING on a lemonade stand and collect money. Spend money to make upgrades, INCREASE PRODUCTION PER CLICK. Start hiring workers and INCREASE PRODUCTION PER SECOND. When you have enough money, you can buy new businesses, automate all your businesses to INCREMENT more money, and leave the game progress.
Game mechanics	Click to gain money, AUTOMATE production, make upgrades to DAMAGE/SEC.
Rewards	ONE CURRENCY, which is money, is rewarded in return.
Interface	GRAPHICAL
Interactivity level	7
Progress rate	9
Overview	This is a SINGLE-PLAYER game, which requires LONG CYCLES OK CLICKING at the start, and making a number of upgrades. Production rate reaches $390/sec in less that 10 minutes and you gain 1M in cash making the game progress faster.

Development of open coding



The analysis process that developed the incremental games super-category (each category above is part of incremental games). The process started with open coding of observations on idle games: multiple codes are created. Concepts are discovered through analyzing the open codes and identifying common features. This is an iterative process, where new codes are added, combined, or deleted. Each code is connected to one or more games and can be combined to form new concepts. Concepts are analyzed to find common relationships, and, thus, categories emerge. In the diagram, coloration is only to aid in reading. The left grouping is to show that all contained codes are part of click-to-manage and click-to-progress.

Source: Alharti et al (2018)

System-based frameworks

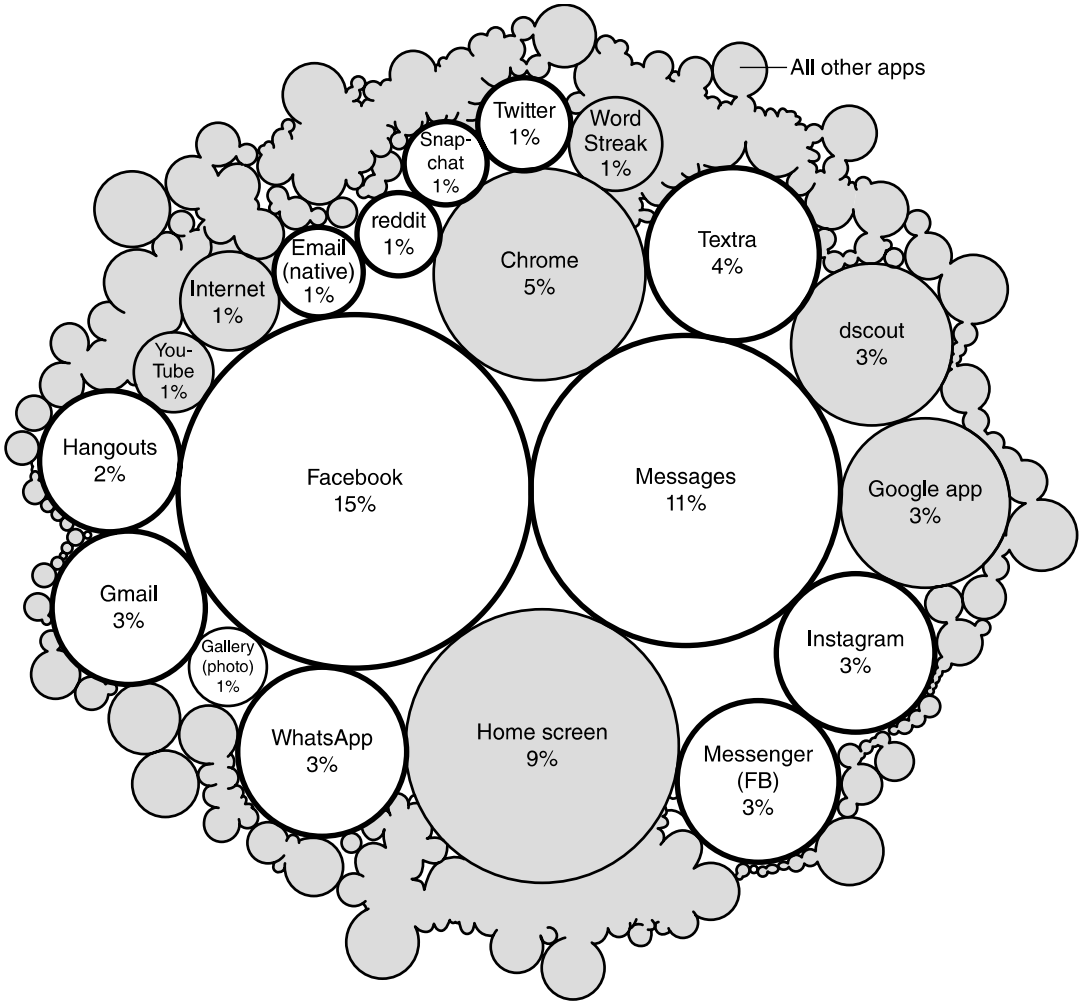
Understanding a whole socio-technical system requires different analytical framework

- Socio-technical systems theory
- Distributed Cognition of Teamwork

Tools to support data analysis

- Spreadsheet – Simple to use, basic graphs
- Statistical packages, for example, SAS and SPSS
- Qualitative data analysis tools
  - Categorization and theme-based analysis
  - Quantitative analysis of text-based data
- Nvivo and Dedoose support qualitative data analysis
- Computer Assisted Qualitative Data Analysis (CAQDAS) Networking Project, based at the University of Surrey

Interpreting and presenting the findings



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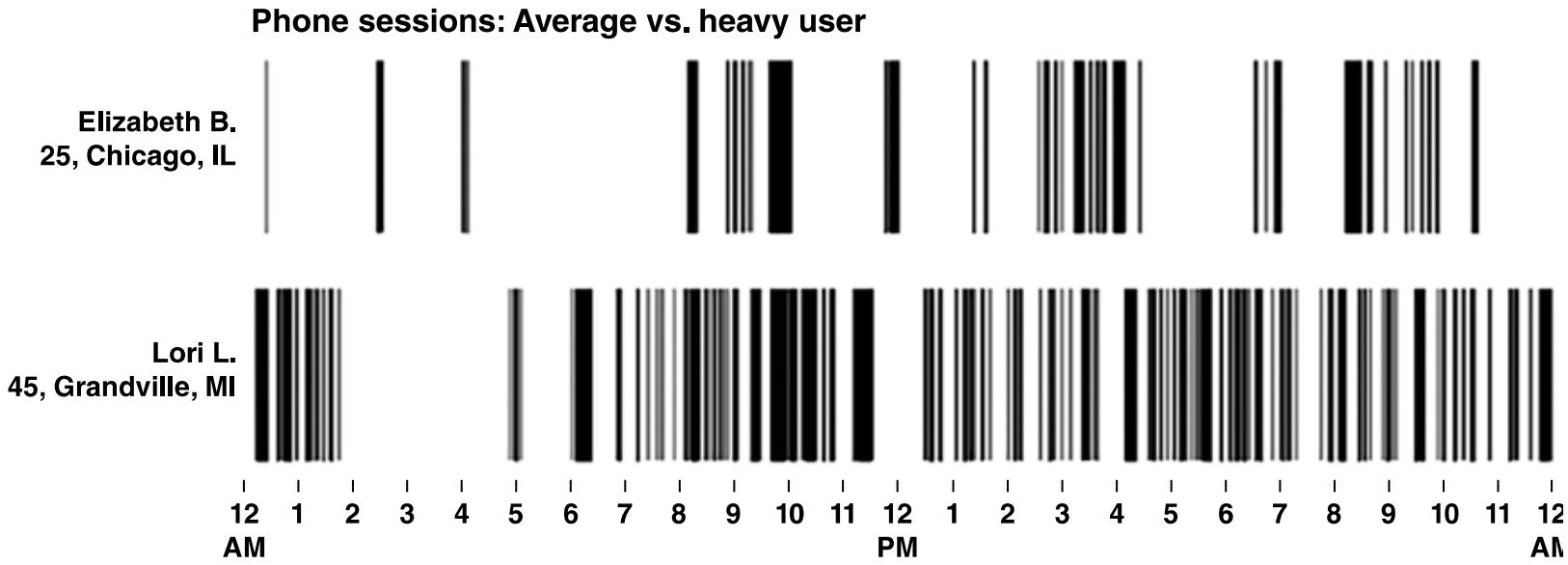

Presenting findings

- Structured notations have clear syntax and semantics to present particular viewpoint
- Stories are easy and intuitive approach to communicate ideas
- Summarize findings using a range of notations

Summary

- 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
- Analysis of qualitative data analysis may be inductive (extracted from the data), or deductive (pre-existing concepts)
- Several analytical frameworks exist that focus on different levels of granularity with different purposes