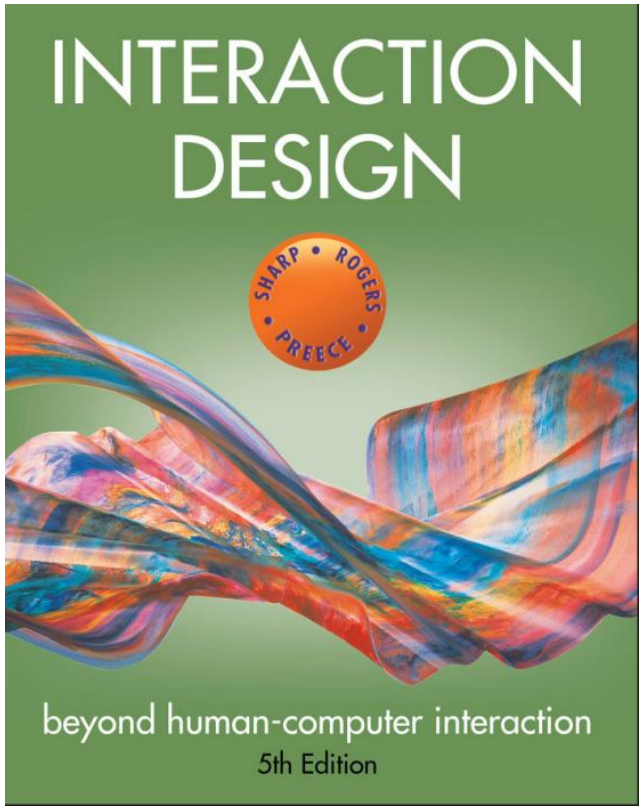


Chapter 9
Data Analysis, Interpretation and Presentation

Aims

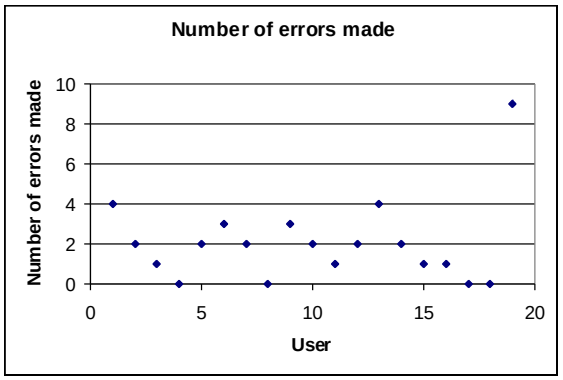
- Discuss the difference between qualitative and quantitative data and analysis.
- Enable you to analyze data gathered from:
  - Questionnaires.
  - Interviews.
  - Observation studies.
- Make you aware of software packages that are available to help your analysis.
- Identify common pitfalls in data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

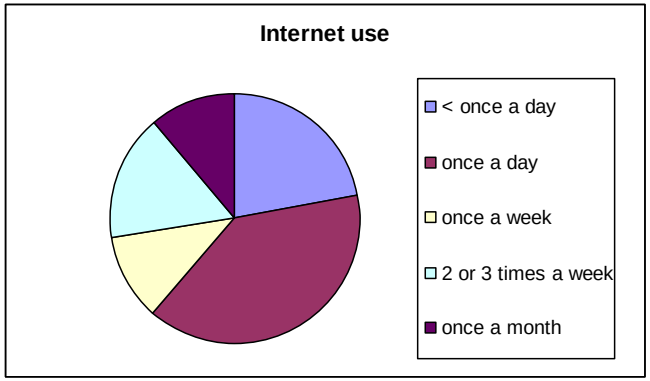
Quantitative and qualitative

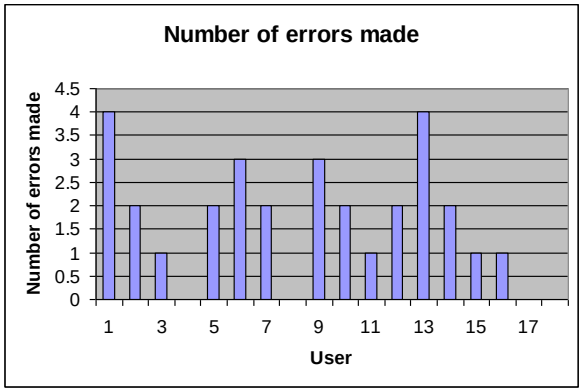
- Quantitative data – expressed as numbers
- Qualitative data – difficult to measure sensibly as numbers, e.g. count number of words to measure dissatisfaction
- Quantitative analysis – numerical methods to ascertain size, magnitude, amount
- Qualitative analysis – expresses the nature of elements and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

Simple 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







Visualizing log data

Interaction profiles of players in online game

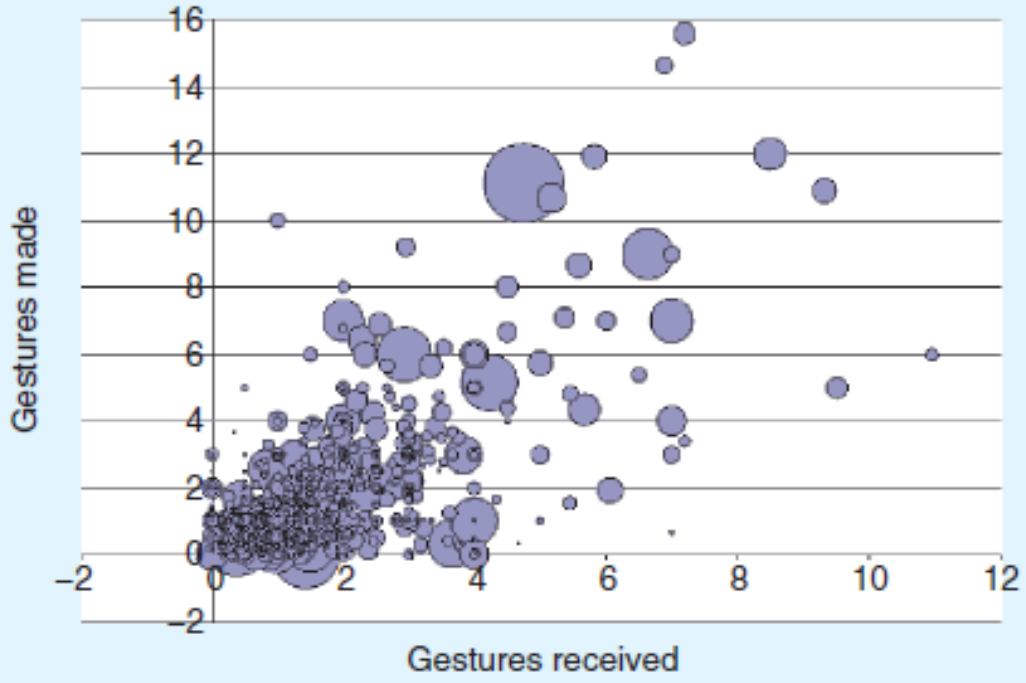


Figure 8.6 Interaction profiles of players in the cantina

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.

Visualizing log data

Log of web page activity

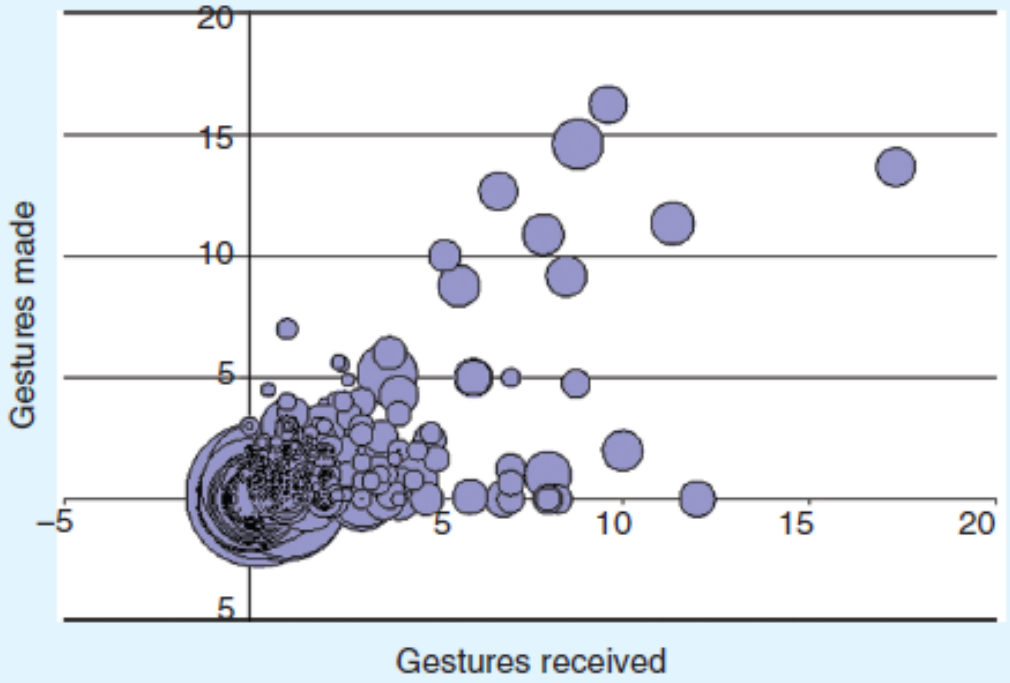
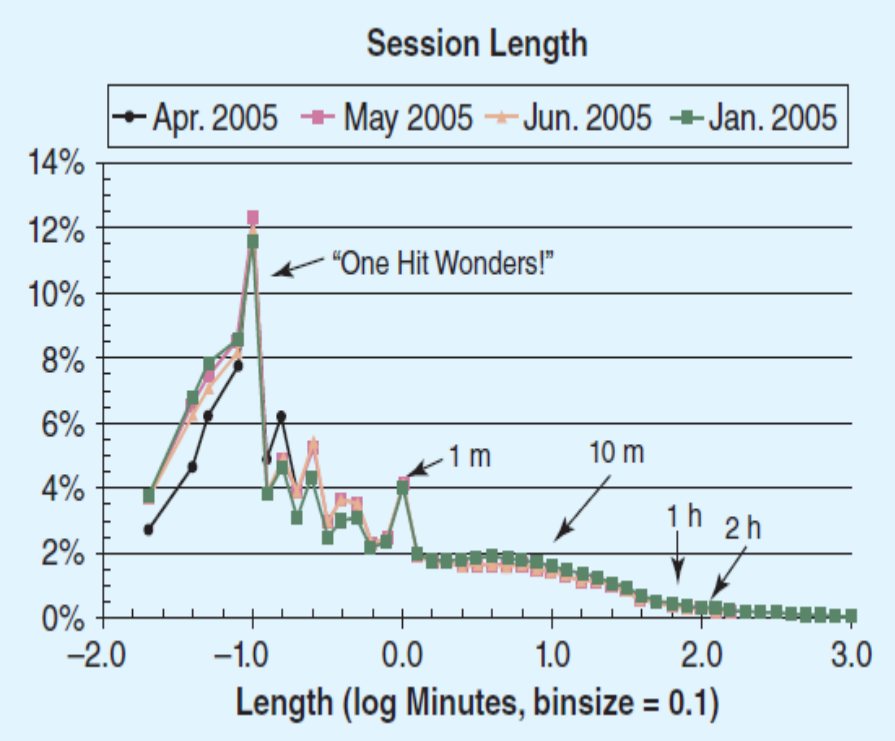
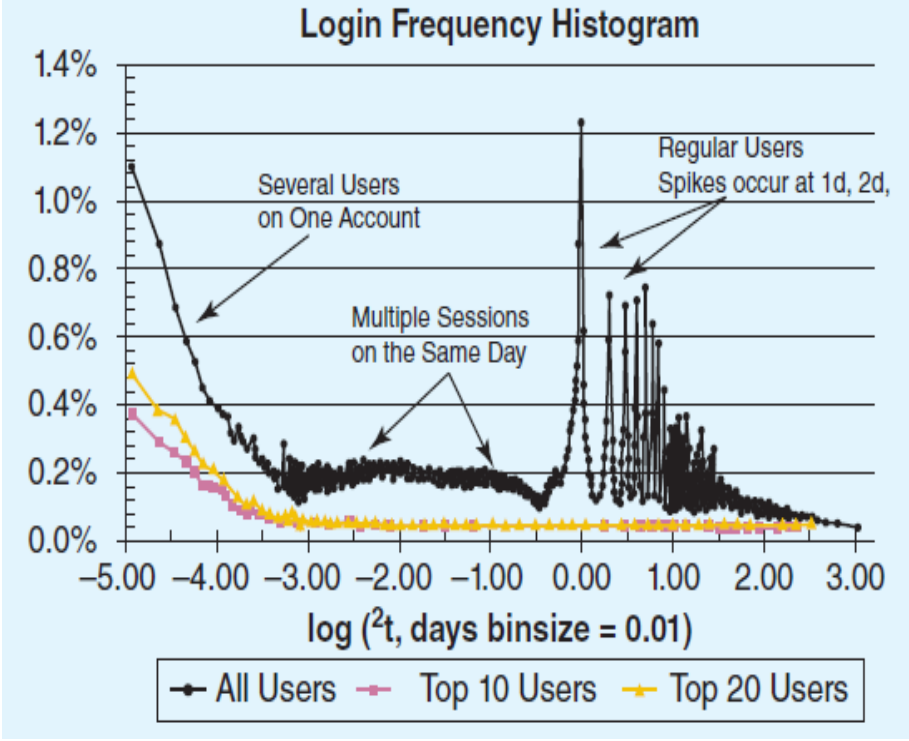


Figure 8.7 Interaction profiles of players in the starport

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.

Web analytics





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.

Simple qualitative analysis

- 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

Figure 8.8 Building the affinity diagram of Indian ATM usage

Source: Figure 1, A. DeAngeli, U. Athavamker, A. Joshi, L. Coventry and G.I. Johnson (2004) "Introducing ATMs in India: a contextual inquiry", *Interacting with Computers* 16(1), 29–44. Reproduced with permission.

Tools to support data analysis

- 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/)

Theoretical frameworks for qualitative analysis

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

Grounded Theory

- 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

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.

Excerpt showing axial coding

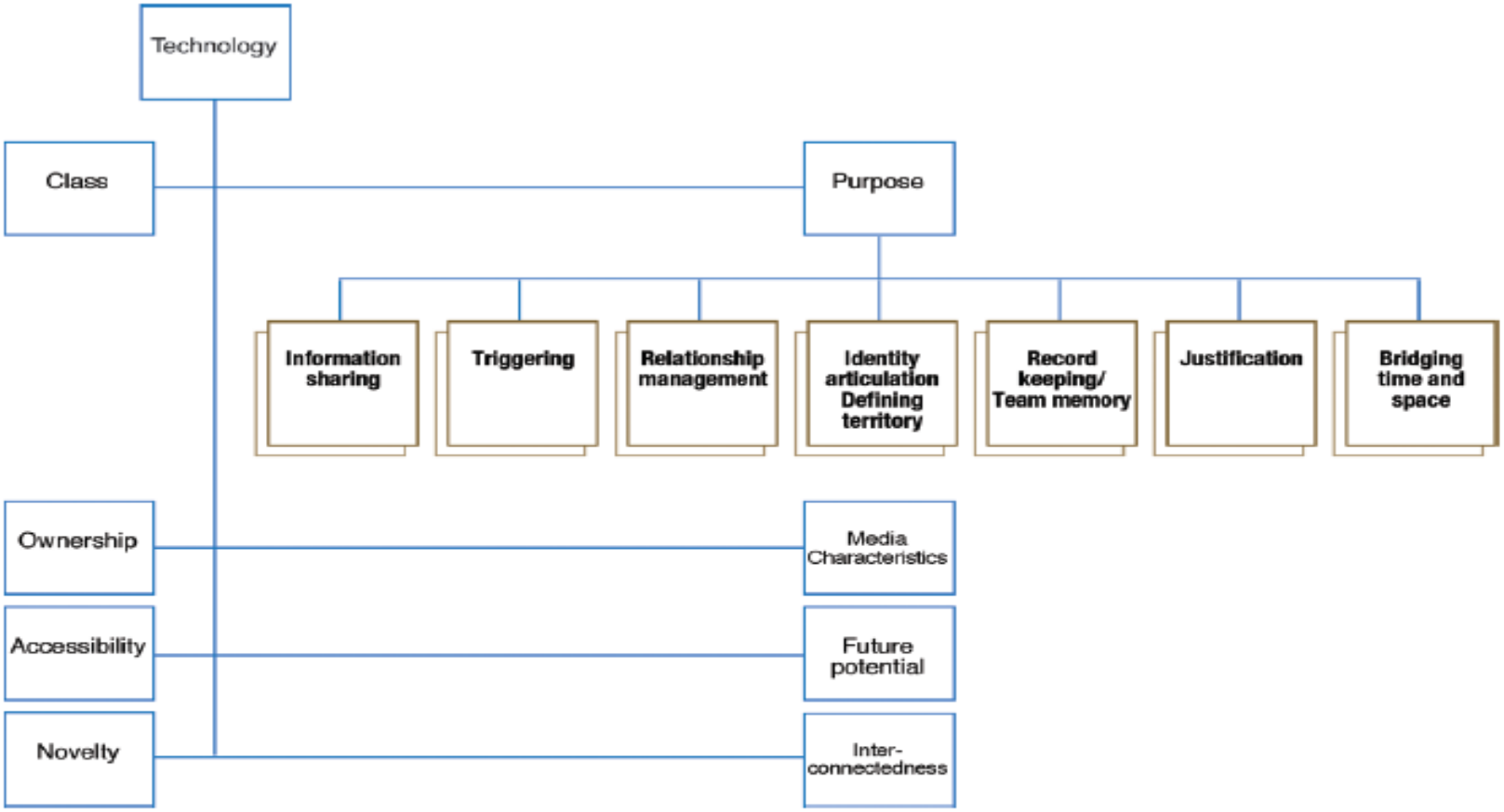


Figure 8.14 Axial coding for the technology category

Source: S. Sarker, F. Lau and S. Sahay (2001): "Using an adapted grounded theory approach for inductivetheory 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.

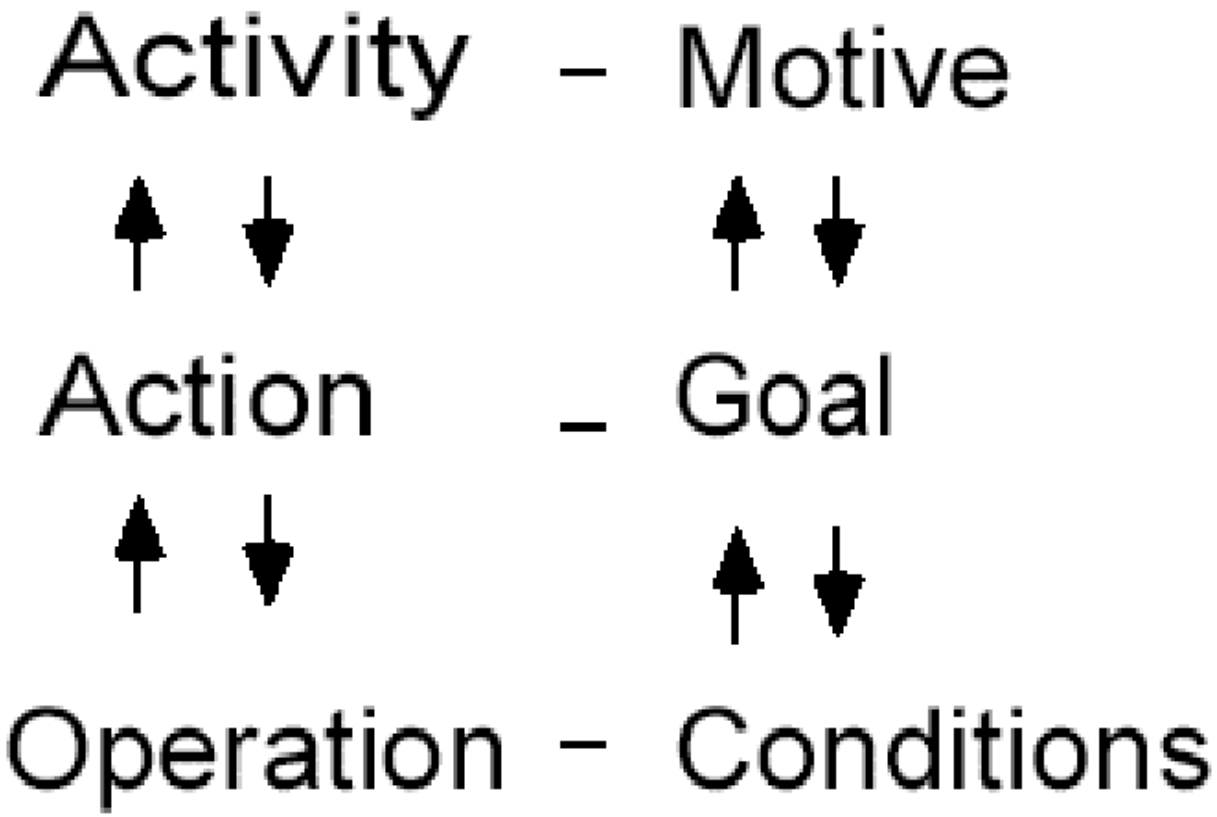
Distributed Cognition

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

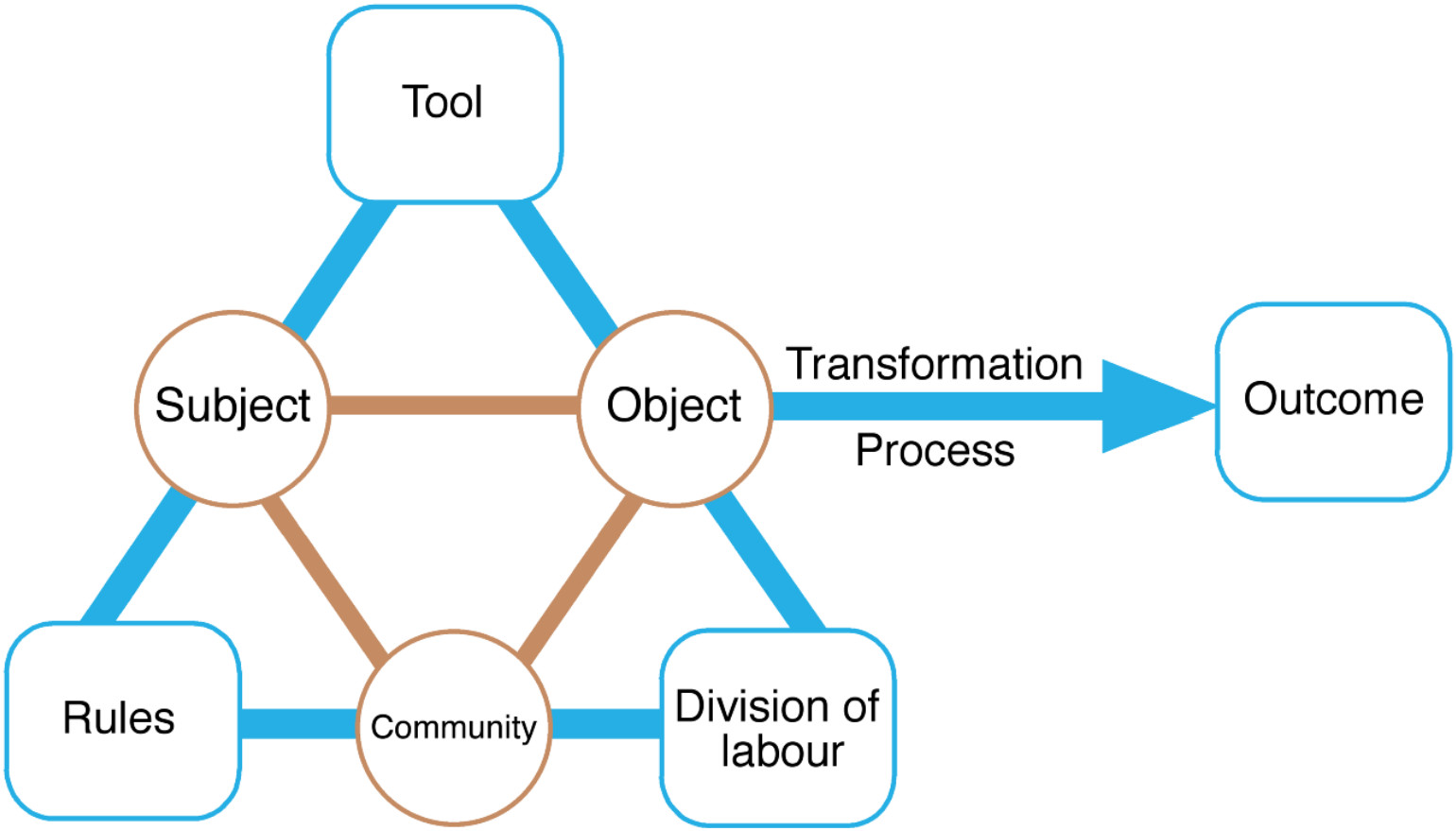
Activity Theory

- Explains human behaviour 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

Individual model



Engeström's (1999) activity system model



Presenting the findings

- 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

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
- Grounded Theory, Distributed Cognition and Activity Theory are theoretical frameworks to support data analysis
- Presentation of the findings should not overstate the evidence