



## Lecture 7: Presentation, Data Analysis and Case Studies

**Naureen Nizam**

CSCC10H3: Human-Computer Interaction  
Department of Computer and Mathematical Science

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UNIVERSITY OF TORONTO SCARBOROUGH  
1265 Military Trail, Toronto, Ontario M1C 1A4

## Administrivia

- **Assignment:**
  - Assignment 3 – Posted, Due: July 15, 2022
- **Project:**
  - Phase III – Due: July 12, 2022

## Assignment 2 - Presentations

### Recap

- Evaluation
  - Heuristic Evaluation
  - Usability Testing
  - Ethics

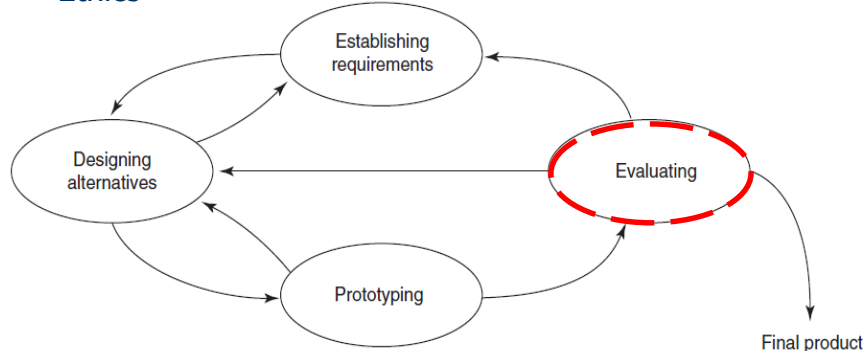


Figure 9.3 A simple interaction design lifecycle model

## 3

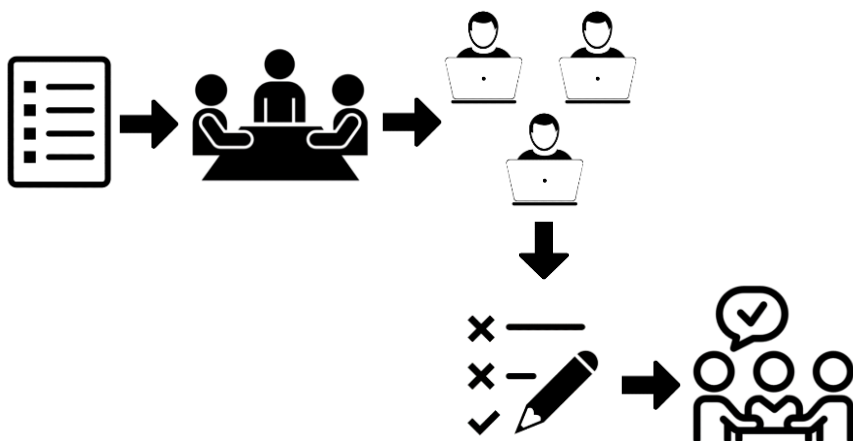
## Heuristic Evaluation (10) by Nielsen (1994)

1. Visibility of system status.
2. Match between system and real world.
3. User control and freedom.
4. Consistency and standards.
5. Error prevention.
6. Recognition rather than recall.
7. Flexibility and efficiency of use.
8. Aesthetic and minimalist design.
9. Help users recognize, diagnose, recover from errors.
10. Help and documentation.

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## Steps in Heuristic Evaluation



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## The plan for today ...

- Quiz, Data Analysis & Case Studies



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## Overview

- Qualitative Data Analysis
- Quantitative Data Analysis
- How to analyze data gathered from:
  - Questionnaires
  - Interviews
  - Observations
- Software Packages that help you analyze?
- How to present findings?

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## Qualitative & Quantitative Data

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

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## Question!

### *Quantitative Analysis*

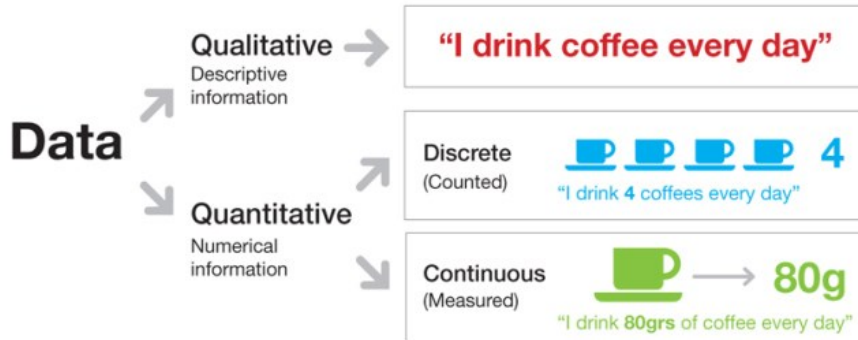
*An average person is 5ft. 11 inches tall, weights 180 pounds, and is 45 years old.*

### *Qualitative Analysis*

*An average person is tall, thin, and middle-aged.*

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## Qualitative & Quantitative Data



Source: <http://valientmarketresearch.com/tag/qualitative/>

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## Question!

*Certain forms of data gathering can only result in quantitative data and others can only result in qualitative data.*

*True | False*

*Questionnaires?*

*Observations?*

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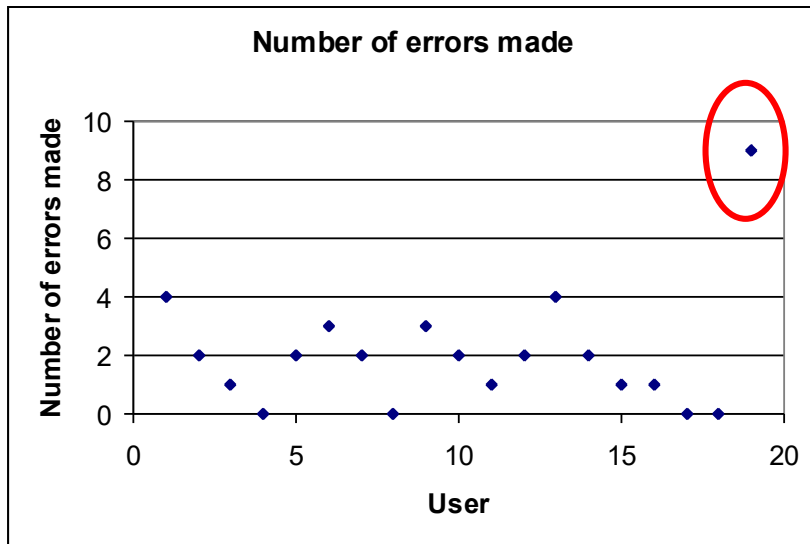
Data Gathered and Initial Steps				
	Raw Data Format	Example qualitative Data	Example quantitative Data	Initial processing steps
Interviews				
Questionnaires				
Observation				

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Quantitative Analysis
<ul style="list-style-type: none"> <li>Averages           <ul style="list-style-type: none"> <li>Mean: add up values and divide by number of data points</li> <li>Median: middle value of data when ranked</li> <li>Mode: figure that appears most often in the data</li> </ul> <p>Example: {2, 3, 4, 6, 6, 7, 7, 7, 8}</p> </li> <li>Percentages</li> <li>50% (1/2)</li> <li>Be careful not to mislead with numbers!</li> <li>Graphical representations give overview of data</li> </ul>

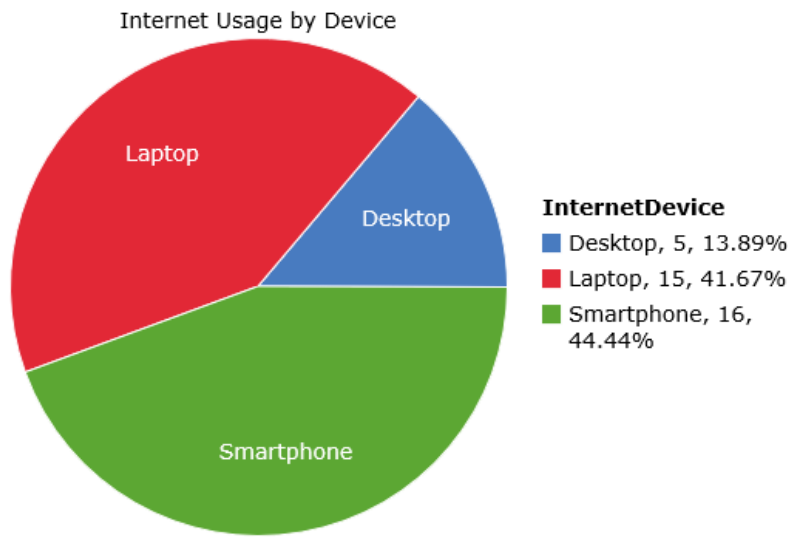
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## Quantitative Analysis



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## Quantitative Analysis

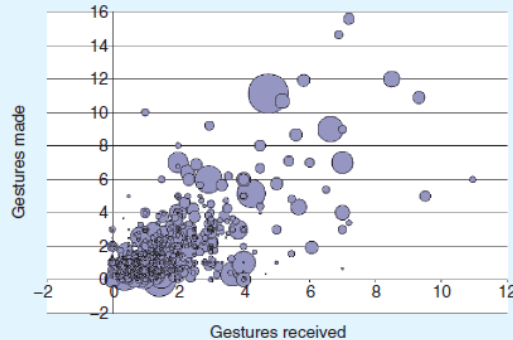


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## Quantitative Analysis

- Visualizing Log Data – interaction profiles of players in online game.

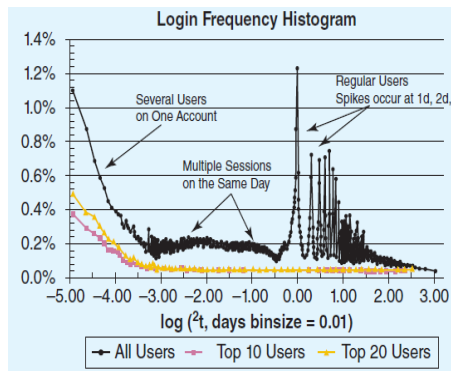
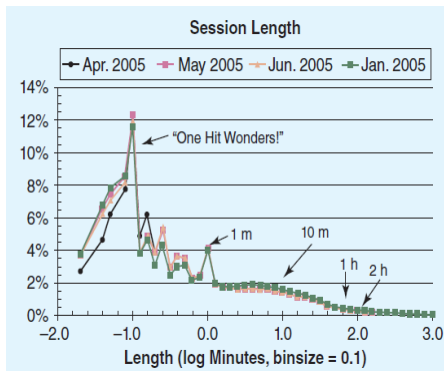


**Figure 8.6** Interaction profiles of players in the cantina

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.

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## Web Analytics

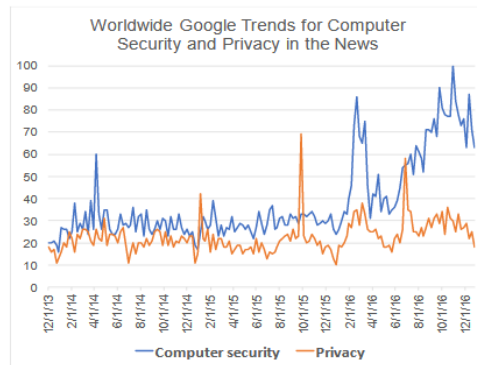


session length data of four different months from Teachers' Domain (NSDL)

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.

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## CHI 2018 - Proceedings

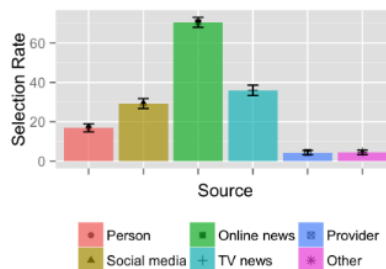


**Figure 1. Worldwide Google Trends for the "computer security" and "privacy" topics from December 1st, 2013 to December 31st, 2016. The two topics have steadily been gaining increasing media exposure.**

Source: [Breaking! A Typology of Security and Privacy News and How It's Shared](#)  
Sauvik Das, *Georgia Institute of Technology*, Joanne Lo, *Carnegie Mellon University*  
Laura Dabbish, *Carnegie Mellon University*, Jason I. Hong, *Carnegie Mellon University*

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## CHI 2018 - Proceedings



**Figure 2. Distribution of how participants reported hearing about security and privacy news events. Most people heard about news events through online news sources.**

Source: [Breaking! A Typology of Security and Privacy News and How It's Shared](#)  
Sauvik Das, *Georgia Institute of Technology*, Joanne Lo, *Carnegie Mellon University*  
Laura Dabbish, *Carnegie Mellon University*, Jason I. Hong, *Carnegie Mellon University*

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# CHI 2018 - Proceedings

	Online News	Another Person	Social Media	TV / Video	Service Provider
Intercept	0.93 <sup>†</sup>	-0.97 <sup>†</sup>	-0.29	-1.28 <sup>†</sup>	-3.01 <sup>†</sup>
<i>Individual-level variables</i>					
Age	-0.10*	-0.20 <sup>†</sup>	-0.24 <sup>†</sup>	0.21 <sup>†</sup>	0.13
Male (vs. Female)	0.35 <sup>†</sup>	-0.21	-0.04	-0.13	-0.89 <sup>†</sup>
Security Behavioral Intention	0.38 <sup>†</sup>	-0.11	-0.11	-0.12	0.04
<i>Event-type comparisons</i>					
F vs. C	0.42	0.29	0.36	0.17	0.61
P vs. C	0.02	0.04	0.20	-0.22	-0.79*
S vs. C	-0.12	0.27	-0.40	0.01	-0.08
P vs. F	-0.41	-0.25	-0.16	-0.39	-1.40 <sup>†</sup>
S vs. F	-0.54	-0.02	-0.76*	-0.16	-0.69
S vs. P	-0.14	0.23	-0.60*	0.23	0.70

Table 2. Logistic regression coefficients of information source modeled against individual-level factors and event-type comparisons. Rows represent IVs, columns DVs. Both individual-level factors (age, gender, security behavioral intention) and event-types significantly correlated with how people heard about news events.

\* $p < 0.001$  † $p < 0.01$  \* $p < 0.05$

F=financial data breaches, C=corporate data breaches, S=high sensitivity systems breaches, P=politicized / activist cybersecurity

Source: [Breaking! A Typology of Security and Privacy News and How It's Shared](#)  
 Sauvik Das, Georgia Institute of Technology, Joanne Lo, Carnegie Mellon University  
 Laura Dabbish, Carnegie Mellon University, Jason I. Hong, Carnegie Mellon University

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## CHI 2018 – Proceedings – Paper 20

ID	Age/ Sex	Diagnosis C: Congenital, A: Adventitious	Visual Acuity L: Left, R: Right	Tools Used
P1	35/M	Retinitis pigmentosa (C)	L:20/200, R:0	OM, MagicPro, JAWS, ZT
P2	48/M	Macular Telangiectasia (A)	20/150	Windows Magnifier, ZoomText
P3	46/M	Congenital cataracts (C)	L:20/240, R:20/200	OM, Pocket magnifier, Audio book, NVDA, ZT
P4	64/F	Retinopathy of prematurity (C)	L:20/200, R:20/200	Hand magnifier, Telescopic lens, iPhone camera, ZT
P5	62/F	Macular degeneration (C)	L:0, R:20/300	CCTV, Window 's Magnifier, ZT
P6	37/M	Congenital cataracts (C)	20/800	JAWS, NVDA, VO, Mac's Zoom, ZT
P7	34/M	Albinism (C)	L:20/200, R:20/400	NVDA, AppVision, GW-Micro, Large display, iPhone, ZT
P8	27/F	Myopia strabismus (C)	20/600	Magnifier, Narrator, iPhone camera, ZT
P9	29/F	Albinism (C)	20/240	OM, CCTV, Portable CCTV, Zoom, ZT
P10	70/M	Glaucoma (A)	Unknown	Magnifier, Narrator, Larger Key Caps, Telescopic lens, ZT
P11	33/F	ROP & Glaucoma (C)	L:20/200, R:20/400	Zoom, VO, JAWS, Handheld magnifier, ZT
P12	52/M	Optic atrophy (C)	20/800	JAWS, iPhone, ZT
P13	32/M	Nystagnus (C)	20/120	Telescopic lens, Magnifier, ZT
P14	26/F	Pathological Myopia (A)	20/200	JAWS, Magnifier, Phone camera, Large display, ZT
P15	31/F	Pathological Myopia (A)	20/280	Large display, Narrator, JAWS, Amazon Echo, ZT

Table 2. Demographic Information of the 15 Participants.

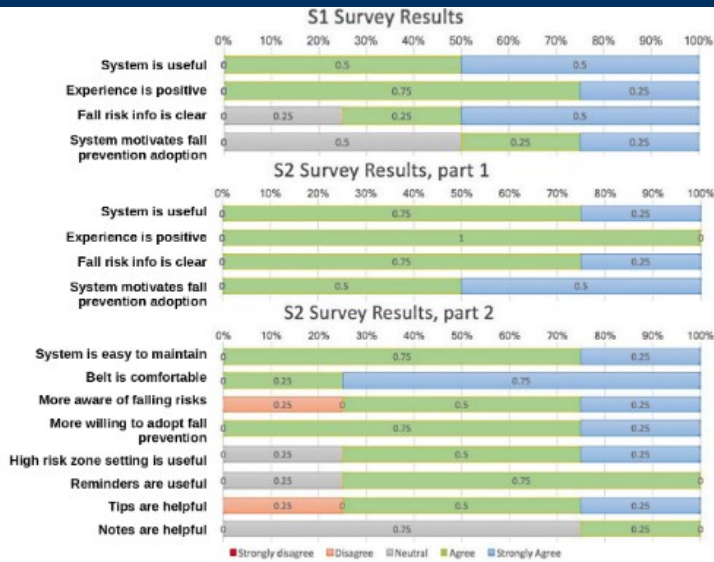


Figure 4: The results of the early- and post-deployment surveys.

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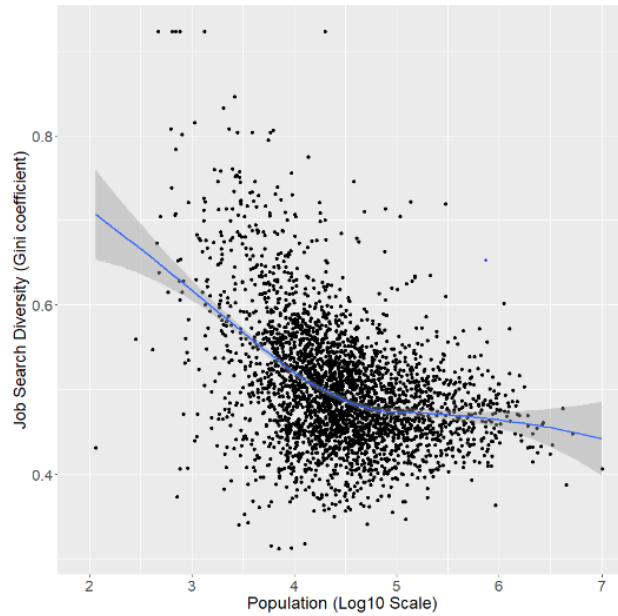
Question	Response (1 to 5)				
	1	2	3	4	5
1. How easy is it to rotate the Dial compared to panning with the mouse?	0	0	2	8	5
2. How easy is it to learn SteeringWheel?	1	2	0	4	8
3. How important is it to view the segment boundaries?	0	0	4	3	7
4. How useful is audio feedback?	0	1	6	6	2
5. How useful is haptic feedback?	0	0	0	6	9
6. How easy is it to perform gestures?	1	1	6	5	2
7. How easy is it to use Dial and Mouse together with both hands?	1	2	2	3	7
8. How easy is it to fill forms with SteeringWheel?	0	0	1	7	7
9. How easy is it to customize the interface with the Dashboard?	0	1	2	7	5
10. How noticeable were the effects of locality preservation?	0	0	1	9	5

Color Legends (5 color bins):

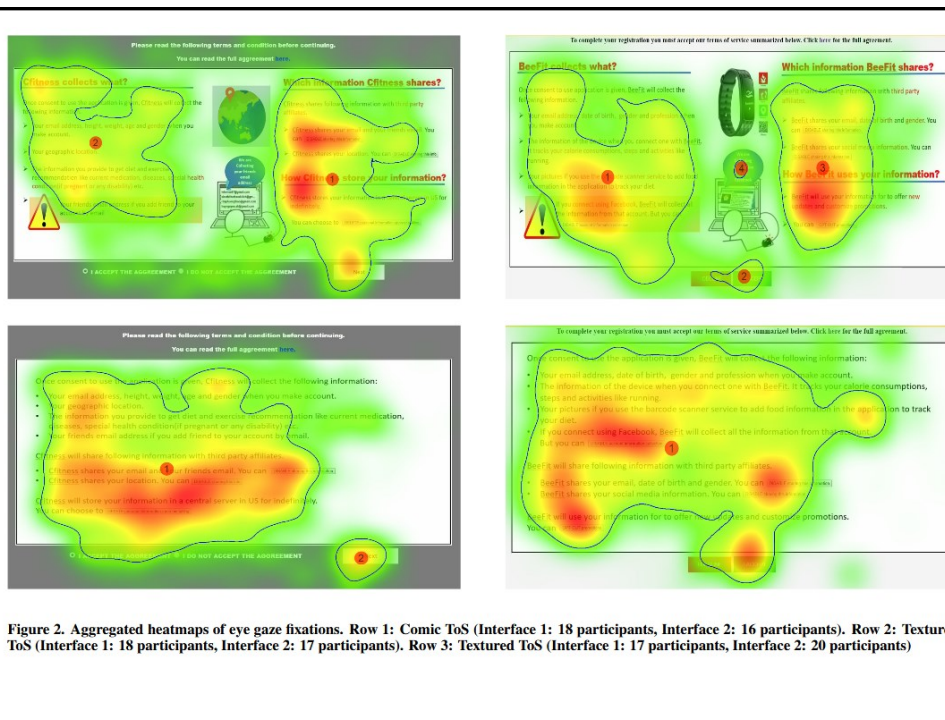
0-3 4-6 7-9 10-12 13-15

Table 3. Post-experiment questionnaire and responses. The columns labeled as 1 to 5 show how many times a particular

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**Figure 3. Diversity of employment demand versus population size over U.S. counties (2016). Loess fit line shown to illustrate the inflection point in job search diversity at population size of about 50,000.**



**Figure 2. Aggregated heatmaps of eye gaze fixations. Row 1: Comic ToS (Interface 1: 18 participants, Interface 2: 16 participants). Row 2: Textured ToS (Interface 1: 18 participants, Interface 2: 17 participants). Row 3: Textured ToS (Interface 1: 17 participants, Interface 2: 20 participants)**

## 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.

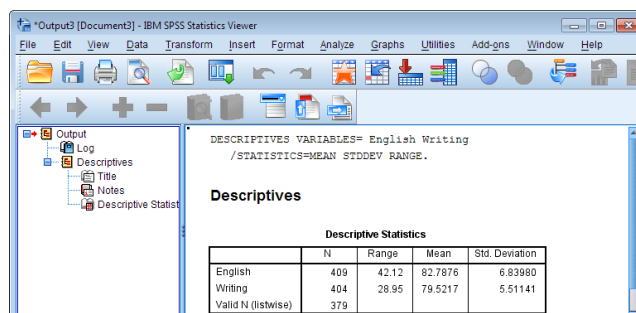
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## Tools to Support Data Analysis

- Spreadsheet – simple to use, basic graphs (Microsoft Excel)



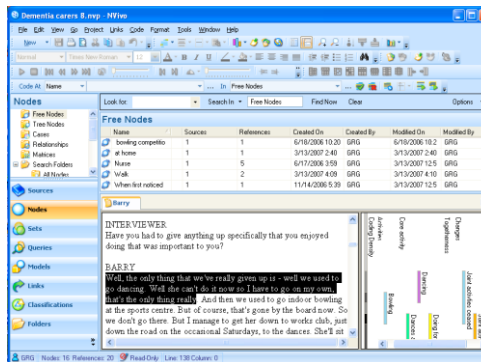
- Statistical packages, e.g. SPSS



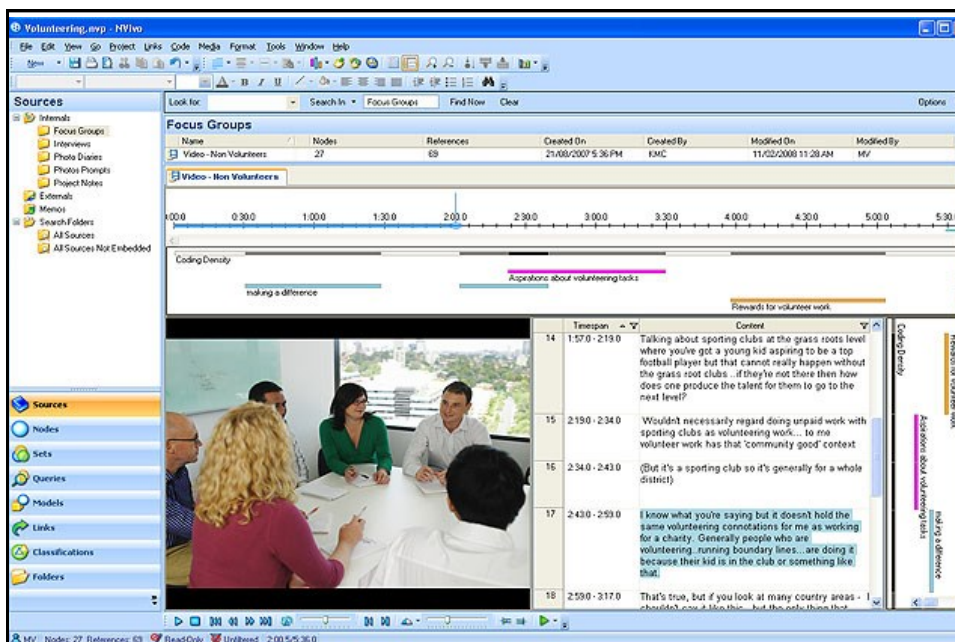
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# Tools to Support Data Analysis

- Qualitative data analysis tools
  - Categorization and theme-based analysis
  - Quantitative analysis of text-based data
- Nvivo and Atlas.ti support qualitative data analysis



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### Sociograms

Using **NVivo Plus**, create **Egocentric Sociograms** to see all Cases connected to one central Case (the Ego), and **Network Sociograms** to visualize connections among a group of Cases.



### Word Clouds

Quickly discover the **most frequently occurring words and phrases** in your data using Word Frequency Queries and display your results in a Word Cloud, where font sizes represent how frequently terms occur.



### Word Trees

Search for **words and phrases** using Text Search queries, then visualize results in a Word Tree. See the **context surrounding words and phrases** from across your data.



### Charts

Available in **NVivo Pro** and **NVivo Plus**, tree maps and sunbursts use nested shapes of varying sizes and colors to **visualize and compare data and themes**, and see **how data has been categorized**.



### Cluster Analysis

Available in **NVivo Pro** and **NVivo Plus**, Cluster Analysis offers a **visual way to see similarities and differences** in your data by grouping sources or nodes that share similar words, similar attribute values, or are coded similarly.

## Theoretical Framework for Qualitative Analysis

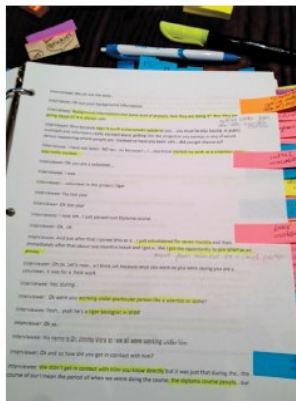
- Basing data analysis around theoretical frameworks provides further insight
- Three such **frameworks** are:
  - Grounded Theory
  - Distributed Cognition
  - Activity Theory

## 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 (word, phrase, sentences, etc.)
  - Axial: flesh out and link to subcategories
  - Selective: form theoretical scheme (backbone of a theory)
- Researchers are encouraged to draw on own theoretical backgrounds to inform analysis

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## Grounded Theory: code book



**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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## Grounded Theory: axial coding

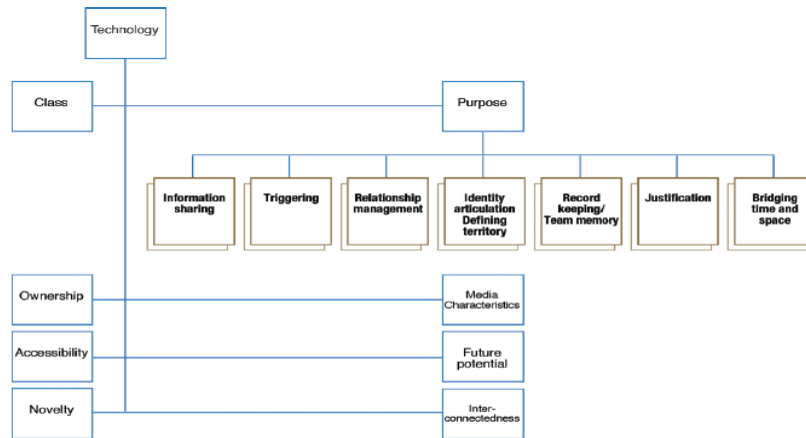


Figure 8.14 Axial coding for the technology category

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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## Grounded Theory

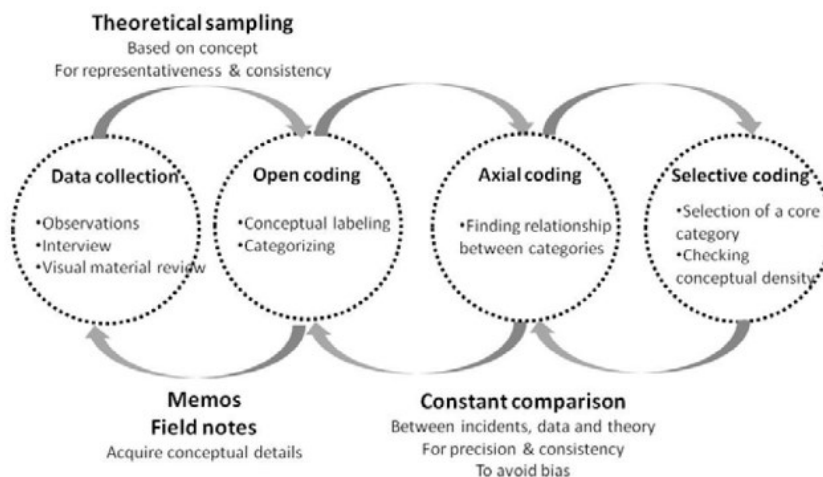


Figure 1. Data analysis procedure of grounded theory method.

Source: <http://dohwan.tistory.com/entry/Grounded-Theory%EC%99%80-Qualitative-Content->

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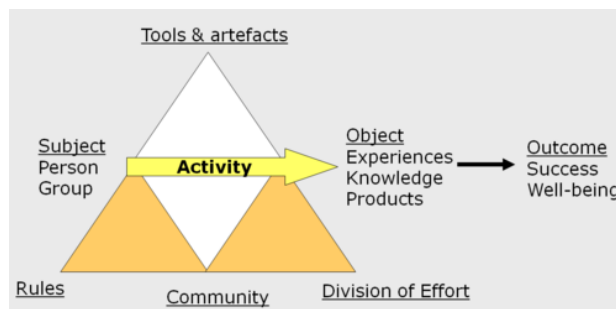
## Distributed Cognition

- 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

- 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



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## Theoretical Framework for Qualitative Analysis

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

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## 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 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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## Exercise 1/3

- **Finding:** 2 out of 4 people who filled the questionnaire ticked the box that said they prefer not to use the ring-back functionality on their cell phone.
- **Statement:** Half of the users don't use the ring-back functionality.

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## Exercise 2/3

- **Finding:** John who works in the design department was observed one day walking for 10 minutes to collect printout from the high-quality colour printer.
- **Statement:** Significant time is wasted by designers who have to walk a long distance to collect printout.

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## Exercise 3/3

- **Finding:** A data log of 1000 hours of interaction with a website recorded during January, February and March records 8 hours spent looking at the help files/documents.
- **Statement:** The website's help files were used less than 1% of the time during the first quarter of the year.

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## 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

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## Coding Exercise

### Participant A:

We have an upstream delivery method, primarily to retailers, a 3<sup>rd</sup> party vendor keeps track and sends the bulbs out. The idea is to lower the price of shelves. The major constraint is it's difficult to know our customers – hard to evaluate who is buying the bulb and what sockets they are putting them into. However there are some advantages. We can control consumer choice, working with retail partners, we have dominant displays of incentivized bulbs. Yet we think EISA is going to really impact future savings....

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## Coding Exercise

Participant	Excerpt	Code	Themes or Categories
A			
A			
A			
A			
A			
A			

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