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Week 05

Data Gathering / Data Analysis & Interpretation

HCI 이론 및 실습 2020 Spring

Human-Computer Interaction+Design Lab _ Joonhwan Lee

오늘 다룰 내용

- Data Gathering
- Data Analysis & Interpretation
- Workshop: Data Gathering

Data Gathering

Understanding Users

- Who are they?
  - Who are the target users?
    - E.g., movie player
      - young vs. old?
      - educational purpose vs. killing times?
    - Understanding generic users are difficult
      - e.g. kids.yahoo.com vs. miclub.com vs. daum.net

Understanding Users

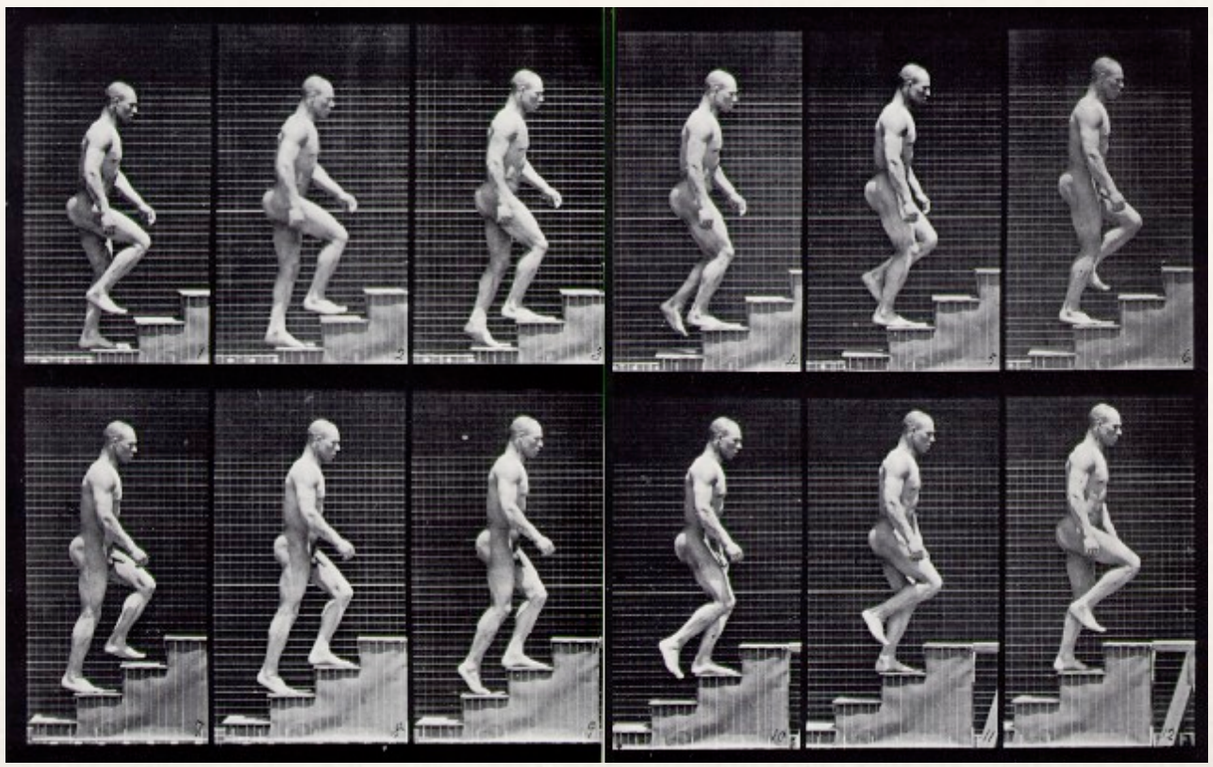
- Probably not like you!
- do not consider yourself as an expert of a system.
- there’s no obvious thing to do!
- consider gender differences, cultural differences.

Understanding Users

- **Talk** to them
- involved in the context where the system is used by users → participatory design
- understand user's needs in the context

Understanding Users

- **Watch** them
  - users CANNOT tell you everything.
    - they may ignore familiar but awkward things
    - they can’t recognize every steps
  - Muybridge - Ascending Stairs



Eadweard Muybridge
Ascending Stairs, 1884-85

Understanding Users

- **Watch** them
  - cultural probes & diary studies
  - contextual inquiry - talk & watch users within their context
    - similar to interviews, but CI should be done in the real context
  - think aloud - clarify the user's thinking process
  - observations tell us **wha**t they do and **why**

Understanding Users

- Use your imagination
  - you can’t talk to everyone, can’t watch every moment.
    - hospital consultant or surgery, website browsing etc.
    - use imagination to understand unobserved situations
- persona: a user in imagination
  - personas let us imagine what a user might be doing
- scenario: task process in imagination
  - let us imagine what a user want to do
  - let us infer user’s task procedure

Five key issues

- 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 quantitative from experiments and qualitative from interviews
- Pilot studies
  - Small trial of main study

Data Recording

- Notes, audio, video, photographs can be used individually or in combination:
  - Notes plus photographs
  - Audio plus photographs
  - Video
- Different challenges and advantages with each combination

Interview

- 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.
- Focus groups – a group interview

Interview Questions

- 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

Running the Interview

- 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.

Enriching the Interview Process

- Props - devices for prompting interviewee
  - e.g. use a prototype, scenario

Questionnaire

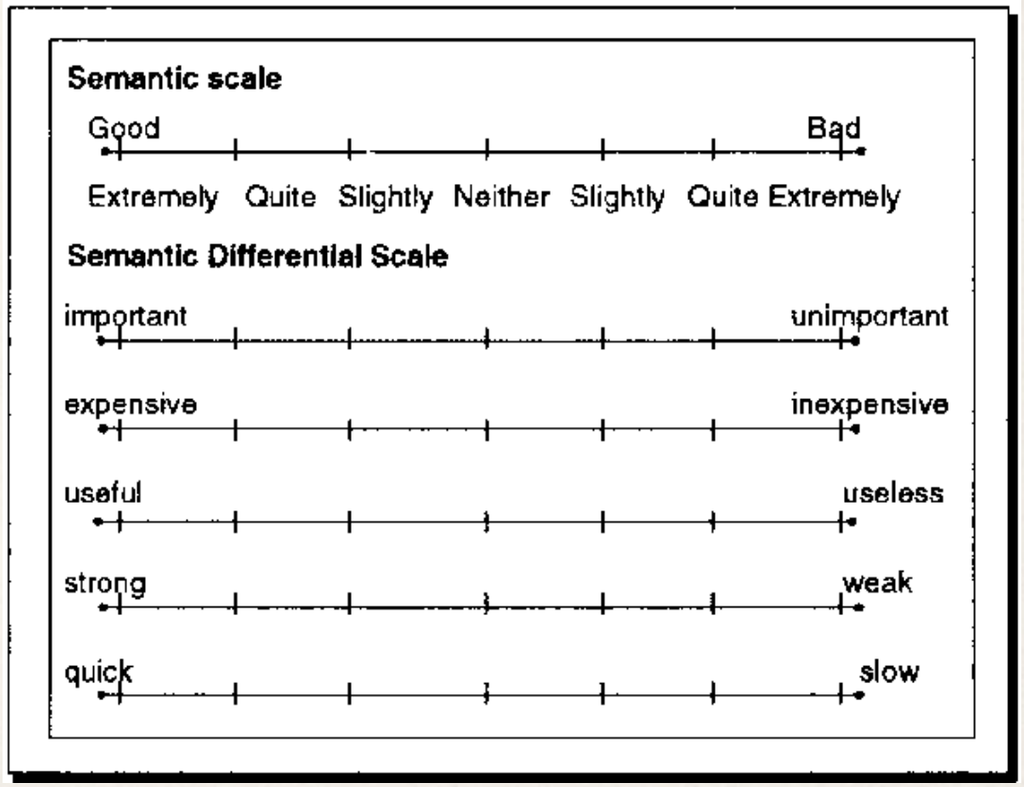
- Questions can be closed or open
- Closed questions are easier to analyze, and may be distributed and analyzed by computer
- Can be administered to large populations
- Disseminated by paper, email and the web
- Sampling can be a problem when the size of a population is unknown as is common online evaluation

Questionnaire Design

- 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.
- Avoid very long questionnaires
- Decide on whether phrases will all be positive, all negative or mixed.

Question and Response Format

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



Encouraging a Good Response

- 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

Advantages of Online Questionnaires

- 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

Example of an Online Questionnaire

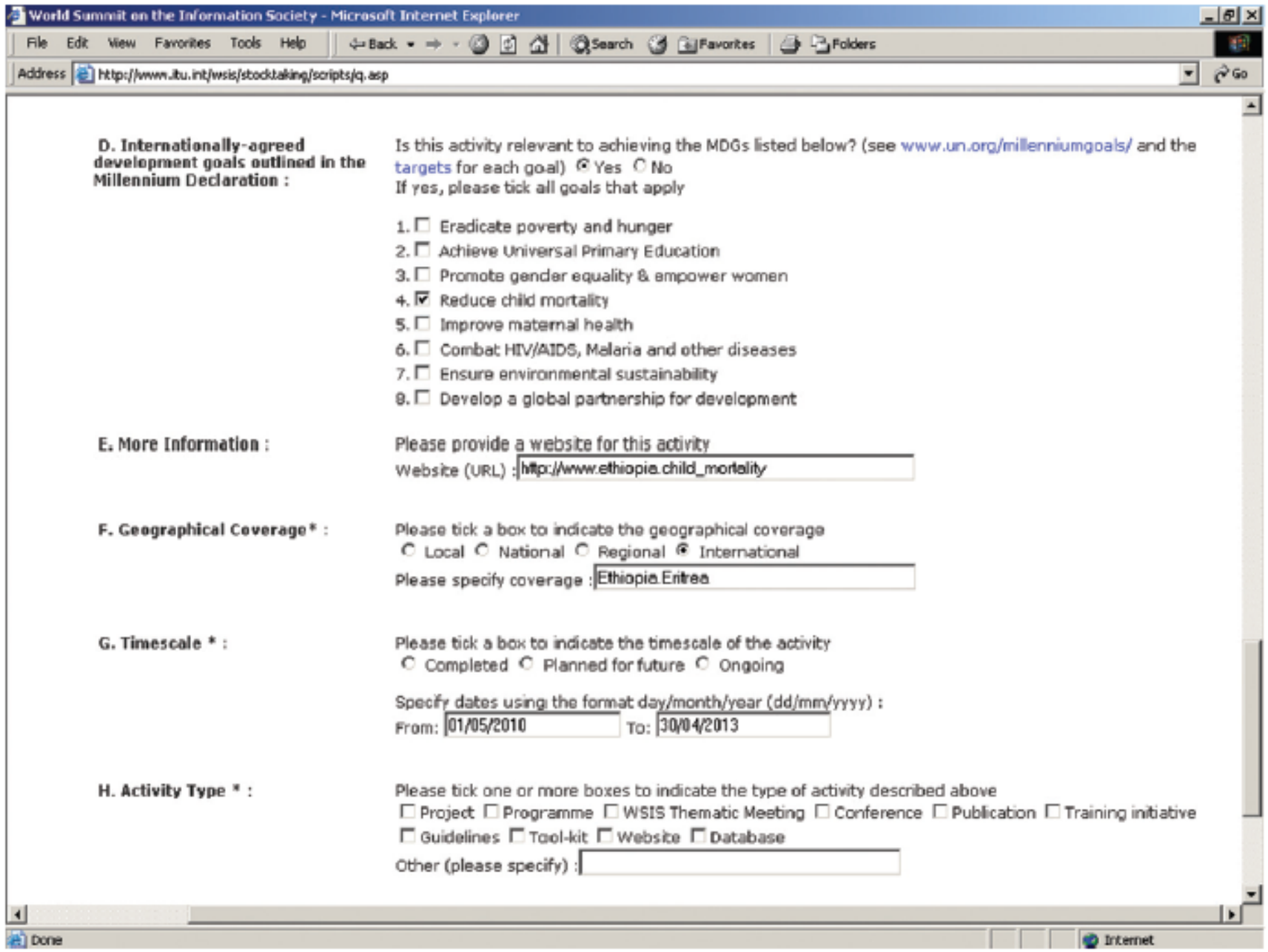
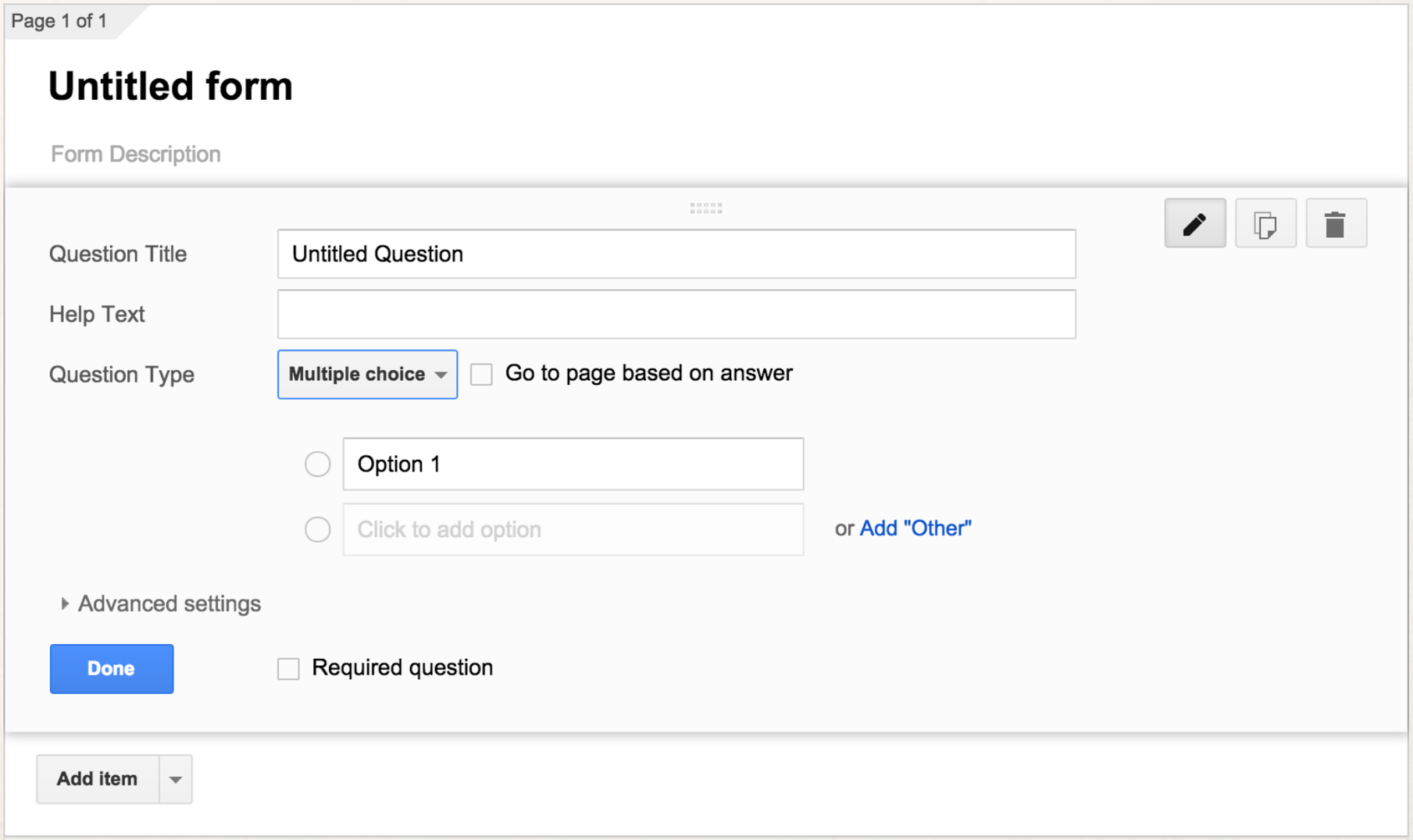


Figure 7.8 An excerpt from a web-based questionnaire showing check boxes, radio buttons, and pull-down menus

Tools for Online Questionnaire

- SurveyMonkey: https://www.surveymonkey.com/
- Google Doc: https://docs.google.com/forms/



Tools for Online Questionnaire

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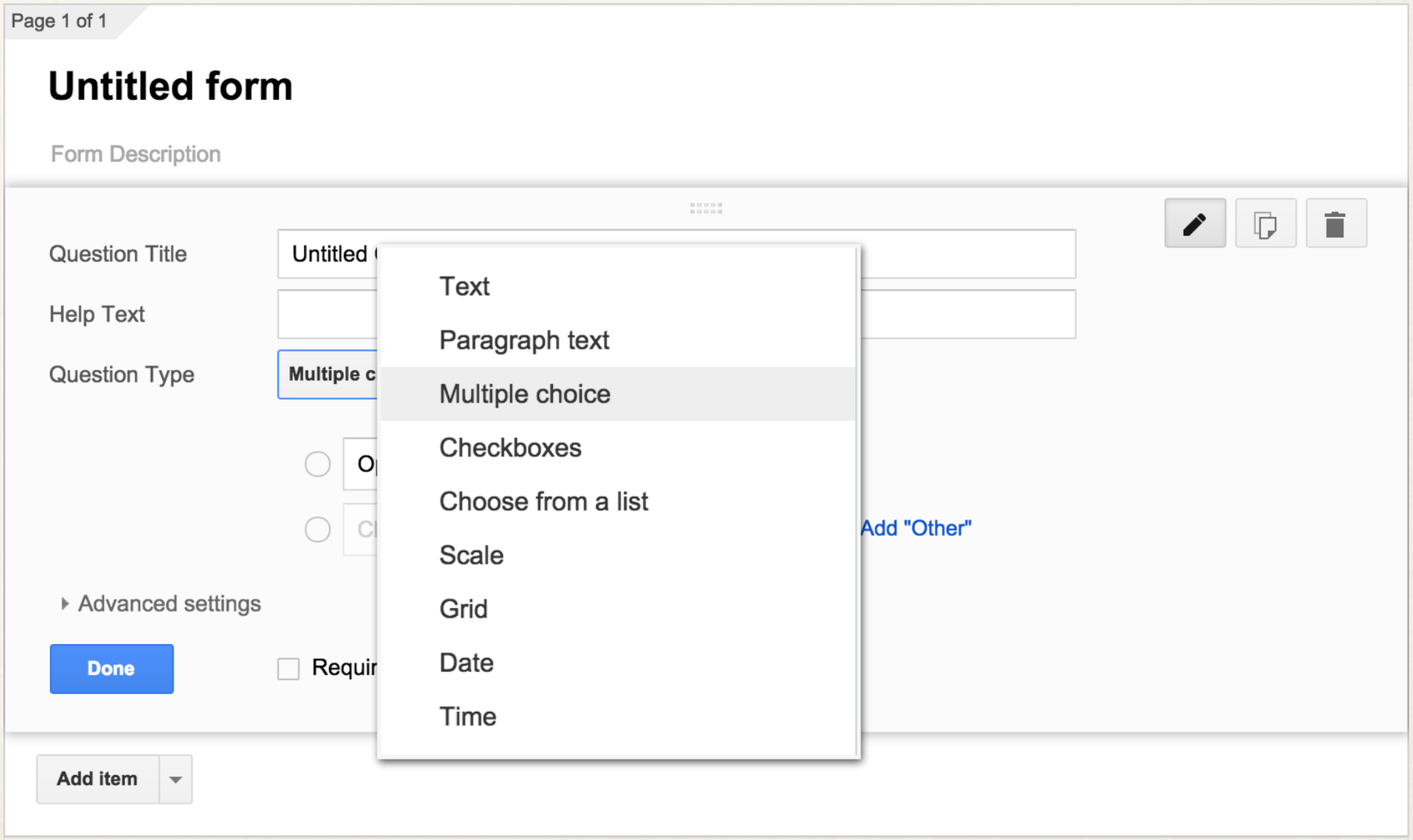
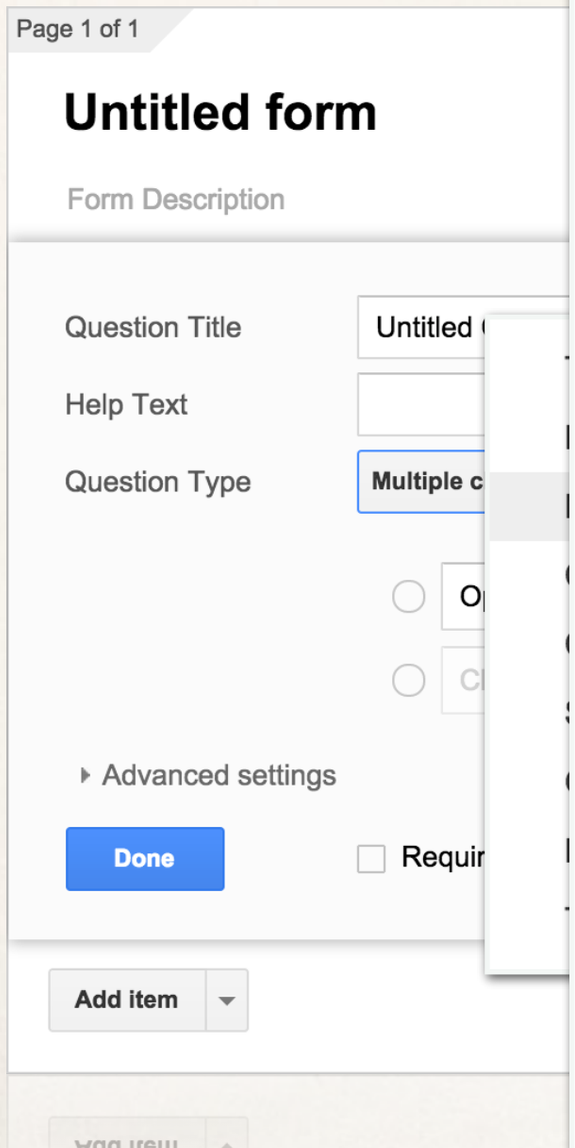
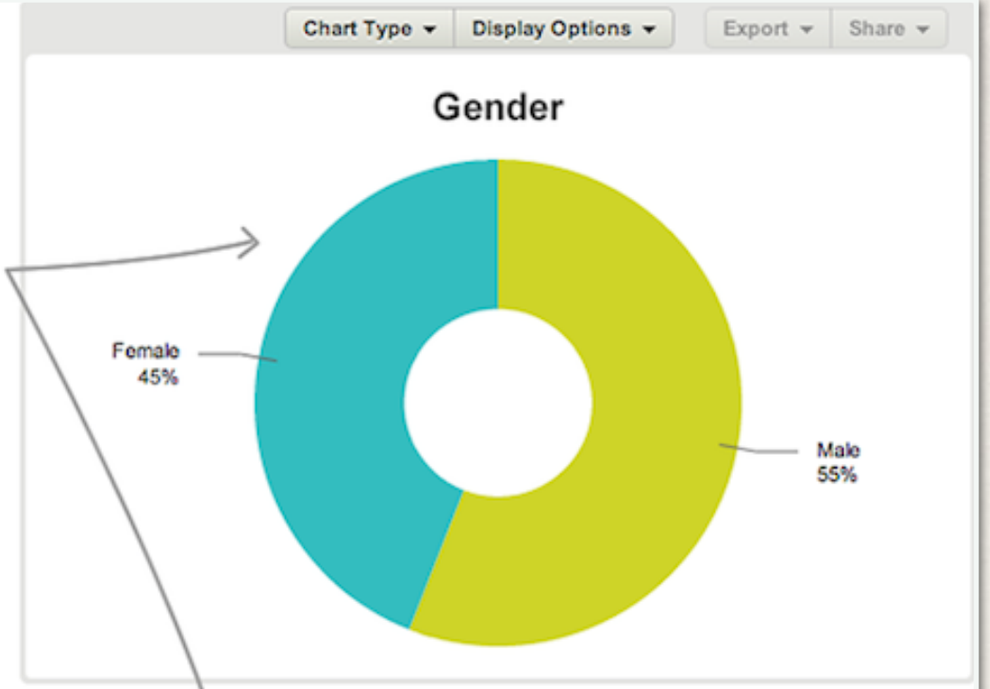


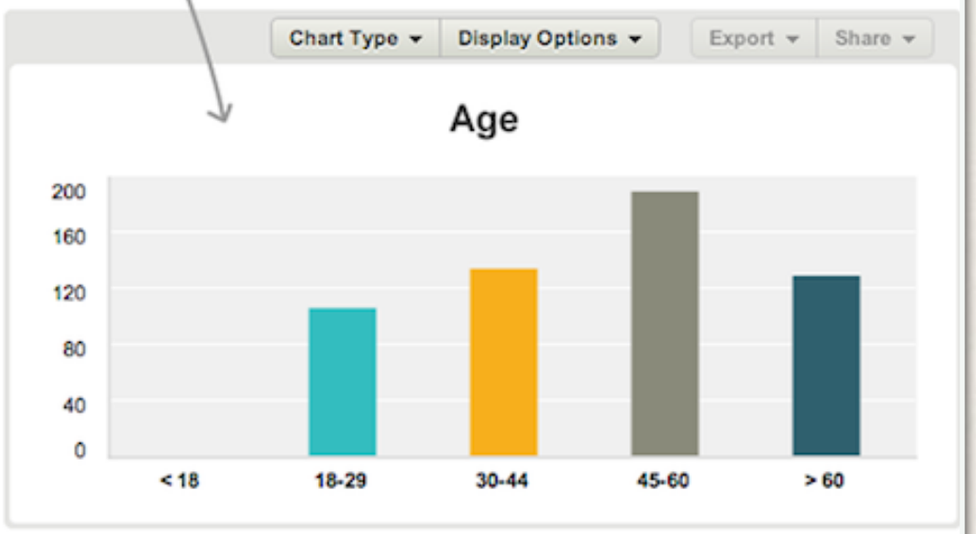
Tools for Online

- SurveyMonkey: h
- Google Doc: http

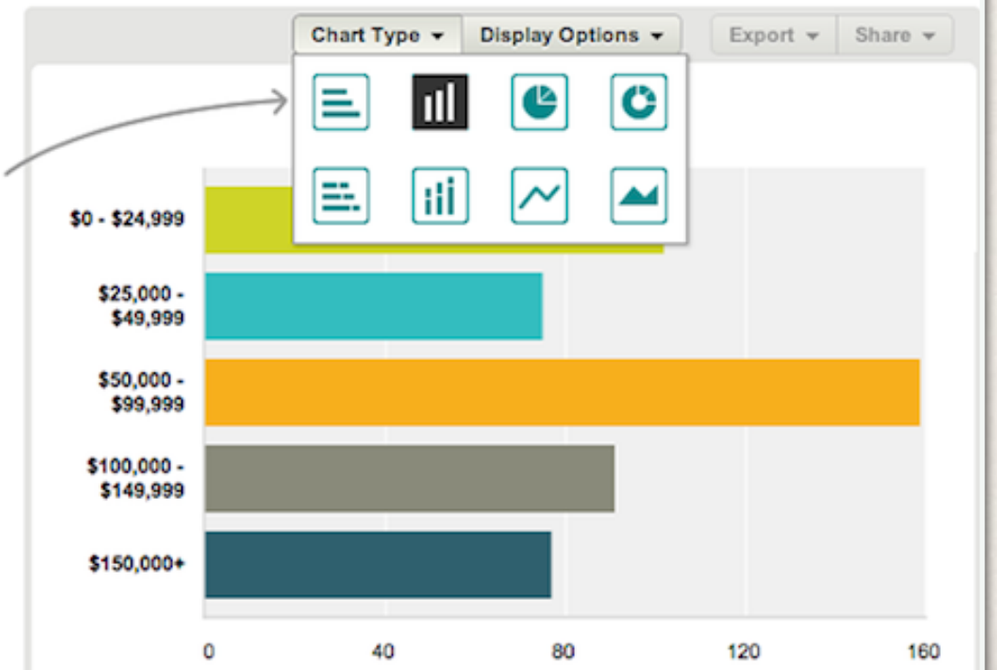


Gender, age, household income, education, and census region: automatically included!





choose from 8 chart types and display options



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Problems with Online Questionnaires

- 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

Observation

- 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

Structuring Frameworks to Guide Observation

- Three easy-to-remember parts:
  - The person: Who?
  - The place: Where?
  - The thing: What?

Structuring Frameworks to Guide Observation

- 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?

Planning and Conducting Observation in the Field

- 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

Ethnography

- Ethnography is a philosophy with a set of techniques that include participant observation and interviews
- 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

Ethnography

- 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

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

- 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.

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

- 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.

Observation in a Controlled Environment

- 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

Diary

- A method to record everyday life events
- A method to collect sequence of events and related mood that users feel
- Most observation methods in HCI → direct observation
- Diary study can collect natural user's interaction data with the system and also collect implicit needs - need longitudinal study

Diary

- Downside of Diary study
  - participant doesn’t know what’s happening - do not record the event
  - recorded event time is incorrect
    - e.g. recored time → 10 min, measured time → 7:35 min
  - could be intrusive, so hard to find participants
  - data types are usually qualitative form → take times for analyzing the data
  - not easy to collect “enough” data → participants sometimes forgot to record data

Diary

- Types of Diary
  - Feedback Diary
    - record event what researchers are interested in
    - researcher record the event
    - instructed participants recorded the event
  - Elicitation Diary
    - participants record the event what they are interested in

Appendix A Frustration Experience Form (Time Diary)

Source: Ceaparu, I., Lazar, J., Bessiere, K., *et al.* (2004) Determining causes and severity of end-user frustration. *International Journal of Human–Computer Interaction,* **17**(3):333–356. Reproduced by permission.

FRUSTRATING EXPERIENCE

Please fill out this form for each frustrating experience that you encounter while using your computer during the reporting session. This should include both major problems such as computer or application crashes, and minor issues such as a program not responding the way that you need it to. Anything which frustrates you should be recorded.

1. What were you trying to do?
2. On a scale of 1 (not very important) to 9 (very important), how important was this task to you?

Not very important 1 2 3 4 5 6 7 8 9 Very Important

3. What software or program did the problem occur in? If the problem was the computer system, please check the program that you were using when it occurred (check all that apply).

___ email
___ chat and instant messaging
___ web browsing
___ other internet use
___ word processing
___ file browsers
___ spreadsheet programs (e.g. Excel)
___ graphic design
___ programming tools
___ database programs
___ presentation software (e.g. PowerPoint)
___ other: _____

4. Please write a brief description of the experience:

5. How did you solve this problem?

4. Please write a brief description of the experience:

5. How did you solve this problem?
___ I knew how to solve it because it has happened before
___ I figured out a way to fix it myself without help
___ I asked someone for help. Number of people asked ___
___ I consulted online help or the system/application tutorial
___ I consulted a manual or book
___ I rebooted
___ I ignored the problem or found an alternative solution
___ I was unable to solve it
___ I tried again
___ I restarted the program

6. Please provide a short step by step description of the process you used to resolve this incident.

7. How often does this problem happen? ___ more than once a day ___ one time a day ___ several times a week ___ once a week ___ several times a month ___ once a month ___ several times a year ___ first time it happened

8. On a scale of 1 (not very frustrating) to 9 (very frustrating), how frustrating was this problem for you?

Not very frustrating 1 2 3 4 5 6 7 8 9 Very frustrating

9. Of the following, did you feel: ___ Angry at the computer ___ angry at yourself ___ helpless/resigned ___ determined to fix it ___ other

10. How many minutes did it take you to solve this problem? _____

11. Other than the amount of time it took you to solve the problem, how many minutes did you lose because of this problem? (if this has happened before, please account only for the current time lost)._____

Please explain:

Appendix B Excel Time Diary Form

Source: Czerwinski, M., Horvitz, E., and Wilhite, S. (2004) A diary study of task switching and interruptions. *Proceedings of the ACM Conference on Human Factors in Computing Systems*, 175–182. Reproduced by permission.

Please enter your daily activities in the columns below (you might need to scroll to the right to see all columns). For each activity, please enter:

a) the time you started it
b) a brief description of the task
c) the application or the device you used to perform the task
d) the priority of the task (hi, med or low)
e) what caused you to switch to the task
f) level of difficulty getting started (hi, med, or low)
g) what other documents or data you needed to find to start the task
h) whether or not it was on your to do list
i) whether you forgot anything related to the task, or any other comments you might have

Remember to use the worksheet at the bottom of the spreadsheet corresponding to the day of the week.

At the end of each day, please go to row 50 and fill out the 3 questions listed there. Thanks again!

Please email your diary as it stands at the end of each day to marycz@microsoft.com.

(a) Time (HH:MM)	(b) Project/task description	(c) Application or device	(d) Priority (hi, med, low)?	(e) What caused the switch?	(f) Difficulty initiating task (hi, med, low)? Why?	(g) What docs/data needed to be found?	(h) On ToDo List (if keep one)?	# of Interruptions?	Time completed (if done)?	(i) Forget anything? Comments?

Cultural Probe

- A method to gathering inspirational data about people's lives, values and thoughts.
- Participants record data by themselves.
- Criticism
  - hard to get scientifically valid information from data that is so subjective.
  - the data generated it not suitable for deep analysis and requirements list.
  - a risk of few returns.

Cultural Probe

- probe packs
  - The probes are small packages that can include any sort of artifact (like a map, postcard, camera or diary) along with evocative tasks, which are given to participants to allow them to record specific events, feelings or interactions.
- Informal data collection method
  → help to understand cultural aspect of users and their environment
  - e.g. emotions, values, connections, trust

- http://www.infodesign.com.au/ftp/CulturalProbes.pdf

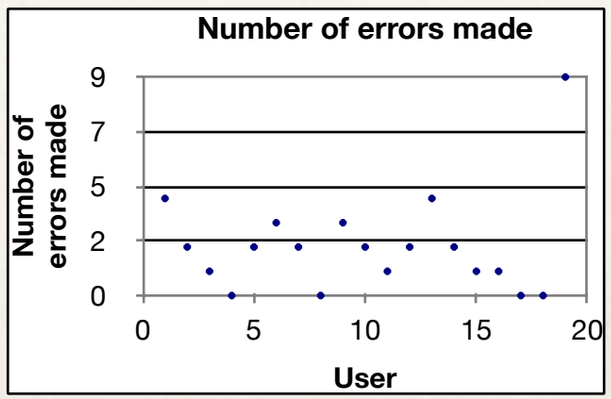
Data Analysis & Interpretation

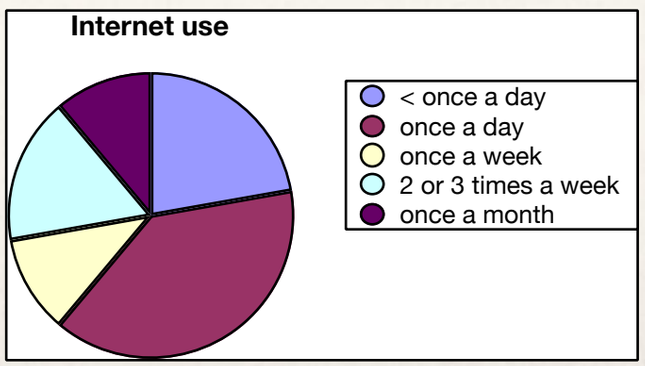
Quantitative and Qualitative

- 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

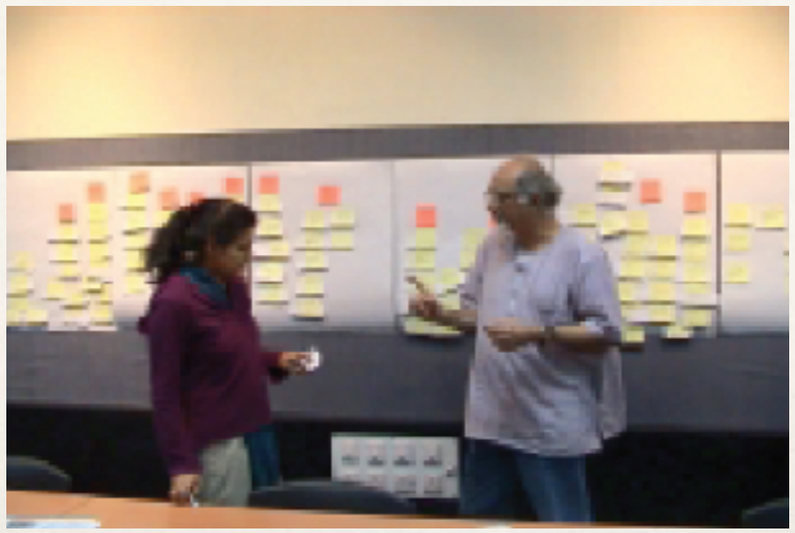
- Averages
  - Mean: add up values and divide by number of data points
  - Median: middle value of data when ranked
  - Mode: figure that appears most often in the data
- Percentages
- Be careful not to mislead with numbers!
- Graphical representations give overview of data

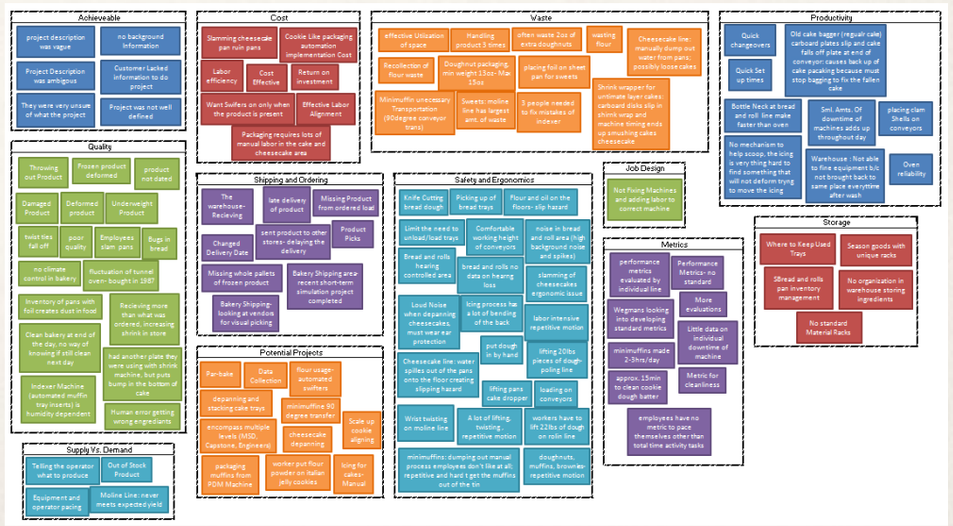




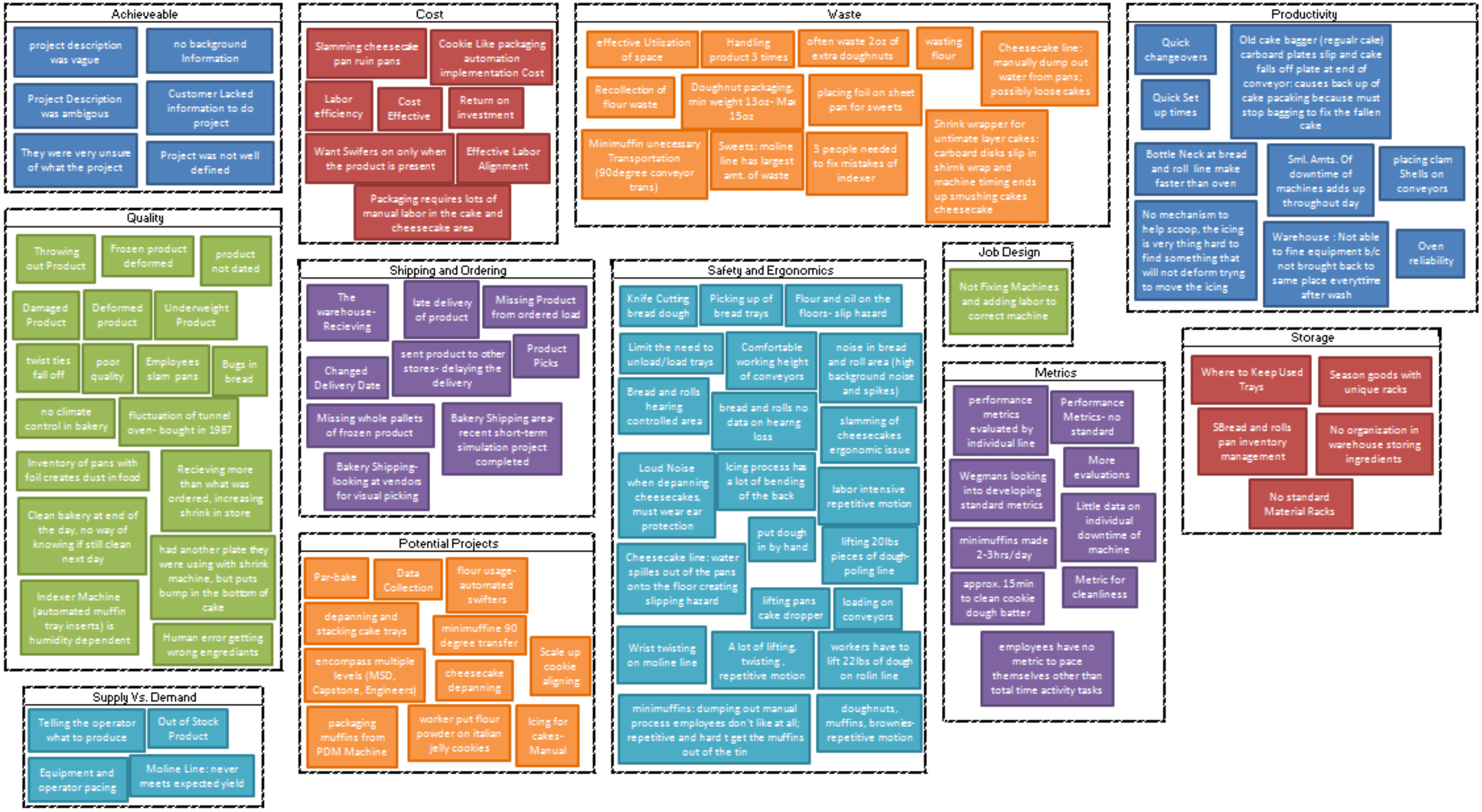
Simple Qualitative Analysis

- 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





Simple Qualitative Analysis



our criteria for bad incident

1. The user articulated a goal and does not succeed in attaining that goal within 3 minutes (then the experimenter steps in and shows him or her what to do--the next step).

2. The user articulates a goal, tries several things or the same thing over again (and then explicitly gives up).

3. The user articulates a goal and has to try three or more things to find the solution.

4. The user accomplishes the task, but in a suboptimal way

5. The user does not succeed in a task. That is, when there is a difference between the task the user was given and the solution the user produced.

6. The user expresses hesitation, surprise.

7. The user expresses some negative affect or says something is a problem.

8. The user makes a design suggestion (don't ask them to do this, but sometimes they do this spontaneously as they think-aloud).

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

Workflow of Grounded Theory

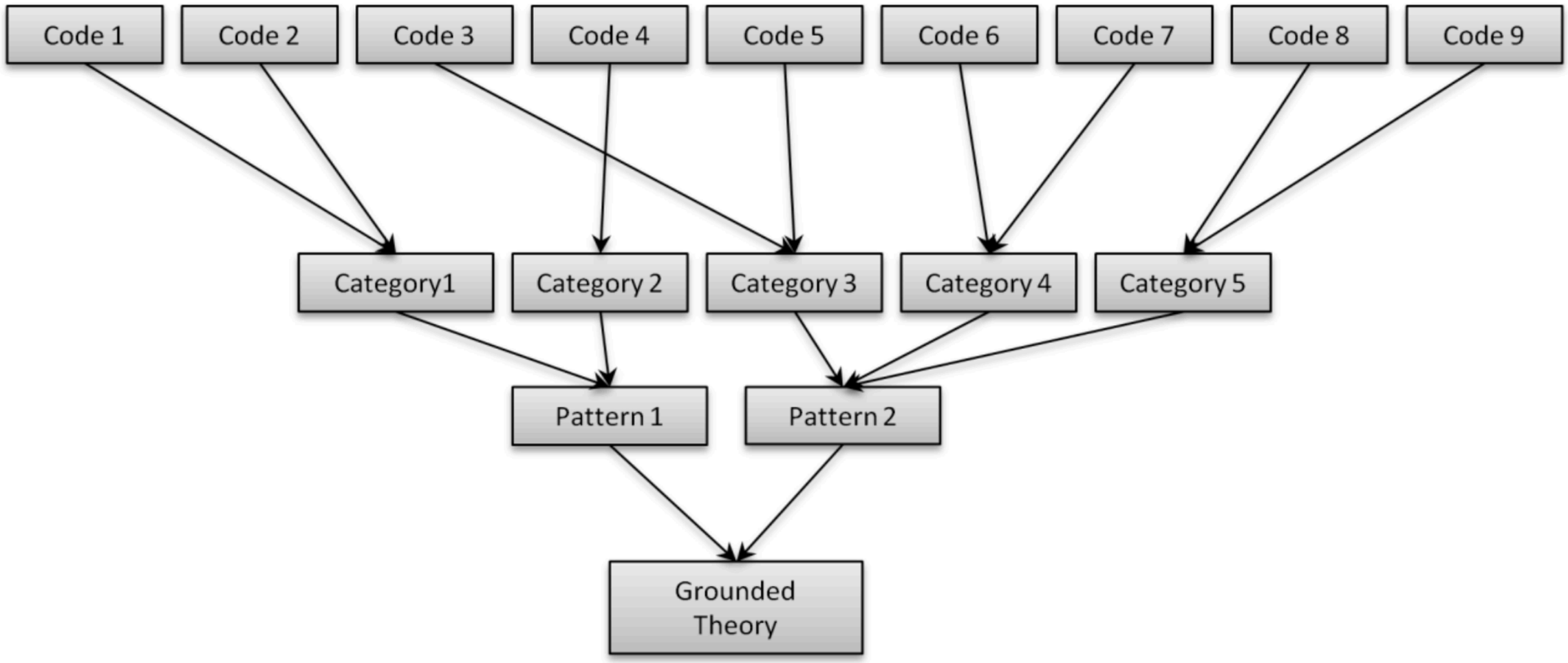


Figure 3: Workflow of Grounded Theory methodology

Grounded Theory: Overview

- Read through field notes
  - Produce analytic categories—potential themes that arise
- As categories emerge
  - Pull data from categories together and compare them
- Think about how categories
  - Fit together into an explanation, or model
- Take models developed
  - Check them against the data—particularly negative cases
- Present results using examples from the data

Grounded Theory: Getting Started

- Before you commence analysis
  - Theoretical sensitivity is about developing insight into data
    - Being able to give the data meaning, understand it, and separate pertinent from not
- Theoretical sensitivity
  - Use literature: readings on theory, research, and supporting evidence
    - Ground yourself in the multiple contexts that surround the data your analyzing
  - Professional experience
    - Use background knowledge of practitioners in the field (including yourself)

Open Coding

- Open coding
  - Process of breaking down, examining, comparing, conceptualizing and categorizing data
  - Data reduction (although it doesn't feel like "reduction" when you're doing it)
  - Inductive
- Open coding consists of
  - Labelling phenomena
  - Discovering categories
  - Developing categories: properties and dimension

Open Coding: Labelling Phenomena

- Break down raw full descriptive field notes
  - By asking questions about notes
    - What is this?
    - What does it represent?
    - For each phenomenon (incident, idea or event)
- Give each discrete phenomenon a name
  - Give it a name that captures its essence in a more general way:concept
- Compare it to others already discovered
  - Could it be labelled in a way that others are labelled preserving integrity

Open Coding: Discovering Categories

- At the end of even a small piece of field notes
  - Lots of concepts
    - It is quite normal to feel overwhelmed and concerned at this point
- Next, group concepts into *categories*
  - Category: classification of concepts, discovered when concepts compared
    - What's similar (may want to note why you think it's similar)
  - This started when you labelled
    - Now you're asking questions about the concepts and the category
      - What are the phenomena in this category about, what are they instances of
    - Use answer to label category

Open Coding: Properties and Dimensions

- Properties
  - Characteristics or attributes of a category
    - Eg: color has the properties of intensity and hue
- Dimensions
  - Locations of a property along a continuum
    - Eg: intensity varies from high to low, hue from darker to lighter
- These will help us develop broader relations later

Workshop: Data Gathering & Analysis

Workshop: Data Gathering & Analysis

- 주제: 자유 선택
  - e.g., smart shopping, future news, smart traveling, AI Speakers..
- 인터뷰, 관찰 방법 등을 통해 서비스 사용 행태/니즈 분석
- 데이터 분석
  - Ground Theory 에 기반하여 데이터 코딩
  - 패턴 등 분석하고 범주화
  - 발견된 insight 정리
- 제출: 4/26에 슬라이드 형태로 보고서 제출
  - Field note
  - Affinity Diagram
  - Ground Theory 분석 결과

Example


“집에 갈때쯤엔 배터리가 없어서 폰을 못써서 심심해요.”
“밤에 받아놓은 무한도전을 폰으로 옮기는게 귀찮을때가 많아요.”
“아침마다 시끄러운 알람으로 일어나는게 싫어요. 알람이 좀 조용했으면 좋겠어요.”

“집에 갈때쯤엔 배터리가 없어서 폰을 못써서 심심해요.”

“배터리가 조금 남았을 때는 카메라가 작동이 안되서 재밌는 장면을 많이 놓쳤어요.”

“밤에 받아놓은 무한도전을 폰으로 옮기는게 귀찮을때가 많아요.”

“아이폰을 쓸때는 음악이 자동으로 들어왔는데 안드로이드는 안되요.”

“아침마다 시끄러운 알람으로 일어나는게 싫어요. 알람이 좀 조용했으면 좋겠어요.”

“일어나자마자 폰으로 오늘 일정을 확인해요.”

“집에 갈때쯤엔 배터리가 없어서 폰을 못써서 심심해요.”

“배터리가 조금 남았을 때는 카메라가 작동이 안되서 재밌는 장면을 많이 놓쳤어요.”

배터리 상태를 실시간으로 보여주고 아끼는 방법을 제안하는 서비스

“밤에 받아놓은 무한도전을 폰으로 옮기는게 귀찮을때가 많아요.”

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“아침마다 시끄러운 알람으로 일어나는게 싫어요. 알람이 좀 조용했으면 좋겠어요.”

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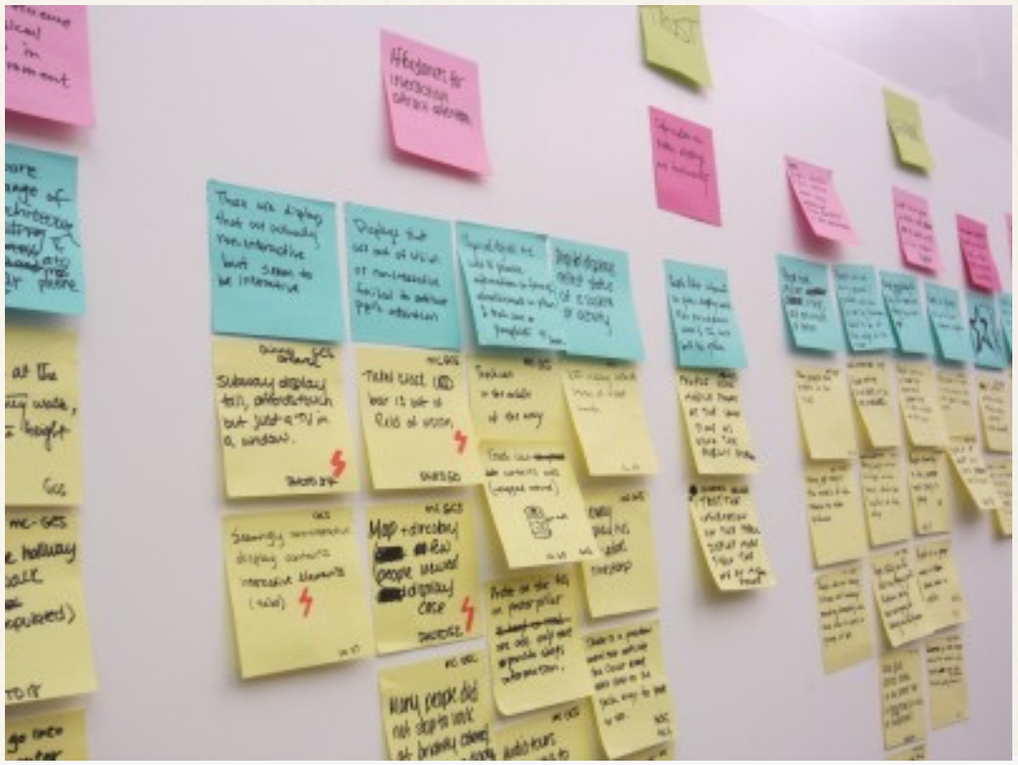
"일어나자마자 폰으로 오늘 일정을 확인해요."

→ 아침에 일정을 읽어주는 나만의 알람 서비스

Affinity diagram



Affinity 분석 데모

- 온라인 협업 도구인 miro.com 을 이용
  - 무료로 사용가능. 계정 당 최고 3개의 워크스페이스 제공
- 샘플 데이터:
  https://docs.google.com/spreadsheets/d/1vxzO8qxNs_W5VdaT7XJIt7r1Um8JyQ_8xzWXx2gEL-k/edit?usp=sharing

Reading Assignment

- Chapter 9: The Process of Interaction Design
- Chapter 10: Establishing User Requirements

Questions…?