

Empirical research basics

CS-C3120 - Human-Computer Interaction

Antti Salovaara

15 November 2022

Contents of this lecture

Research designs:

Open-ended vs close-ended research questions

Triangulation: How you can choose the right research methods

Saturation

Participant recruitment:

How do you choose which participants you should recruit?

How do you estimate how many participants you will need?

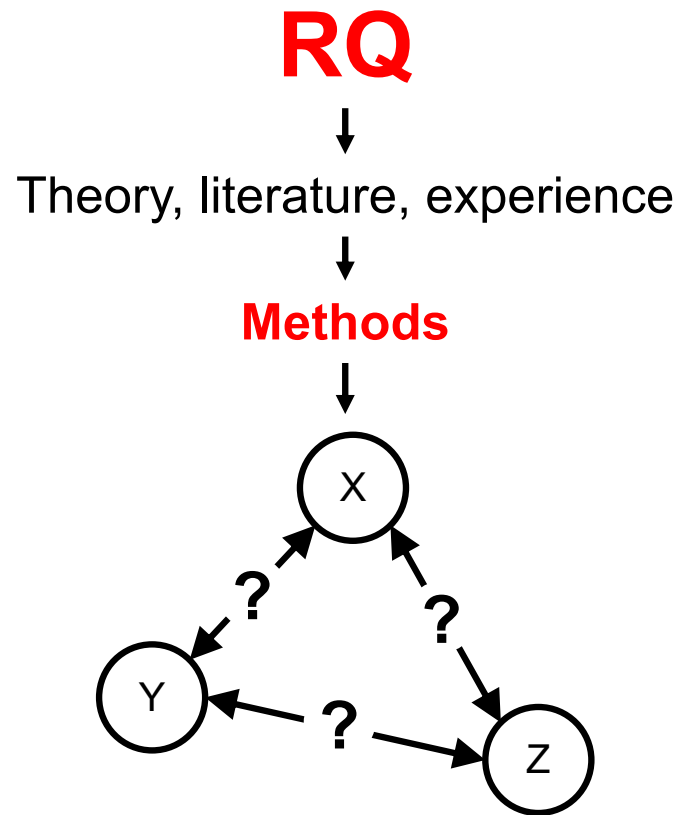
Practical tips:

Interviews: how to prepare for interviews

Questionnaires: some dos and don'ts

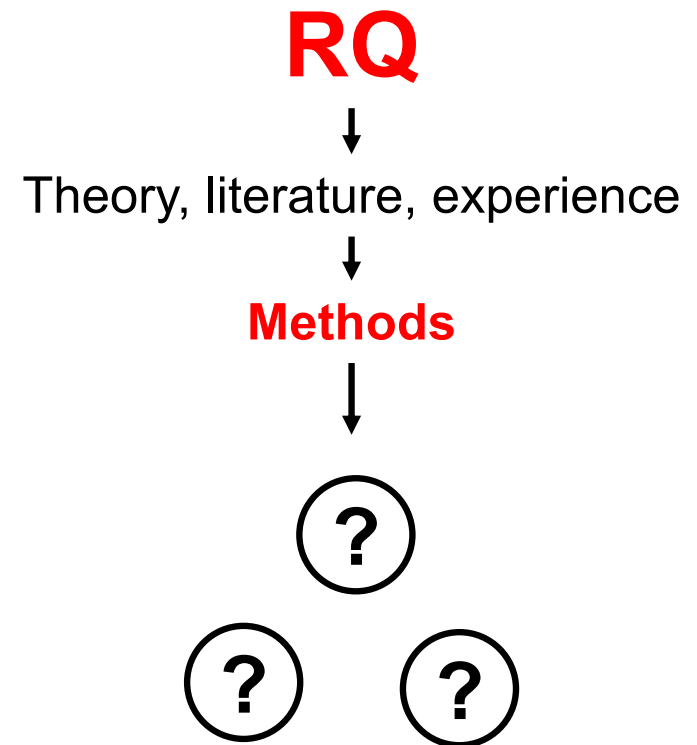
“Bringing order to chaos”

Quantitative research



Relationships between elements

Qualitative research



Identifying the elements

Research designs

Matching your methods with your research questions

A simplistic view on user studies

“Let’s ask people to explore our prototype. Then we’ll observe their problems and listen to their feedback”

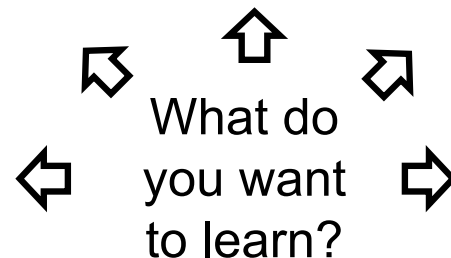
Observe how?

With what instructions?

Which people?

Which problems in particular?

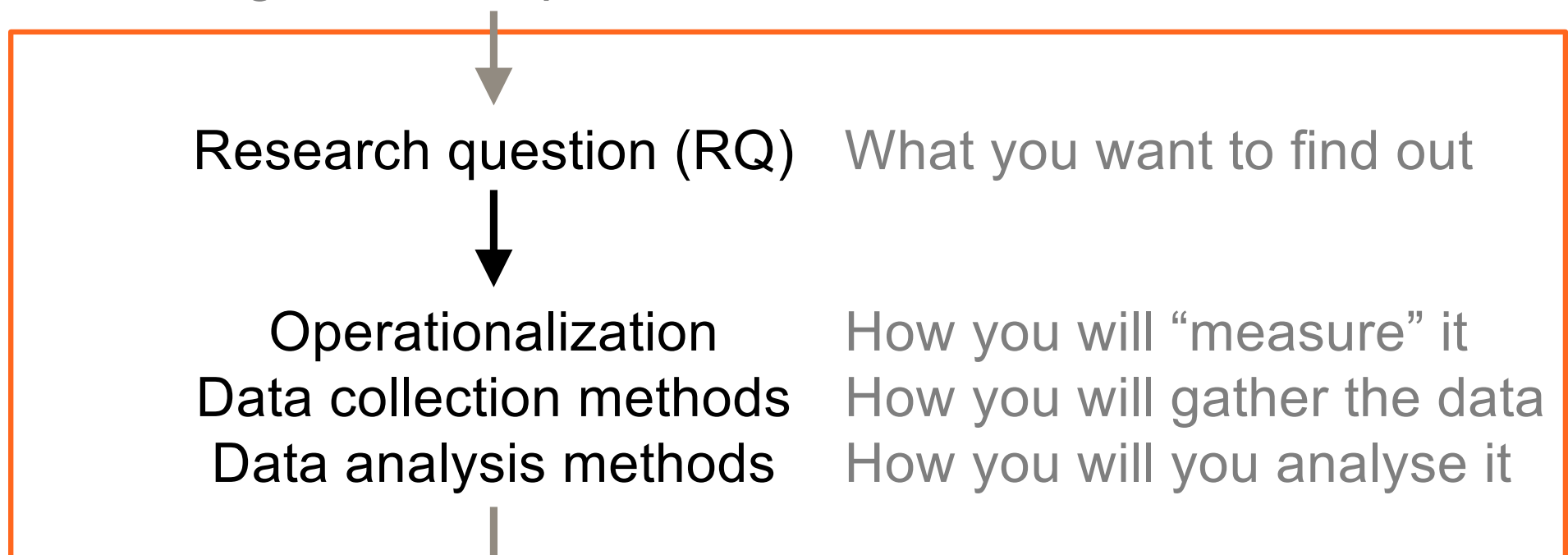
Which parts?



If you figure out answers to these questions, you are on a good path for a well-focused user study!

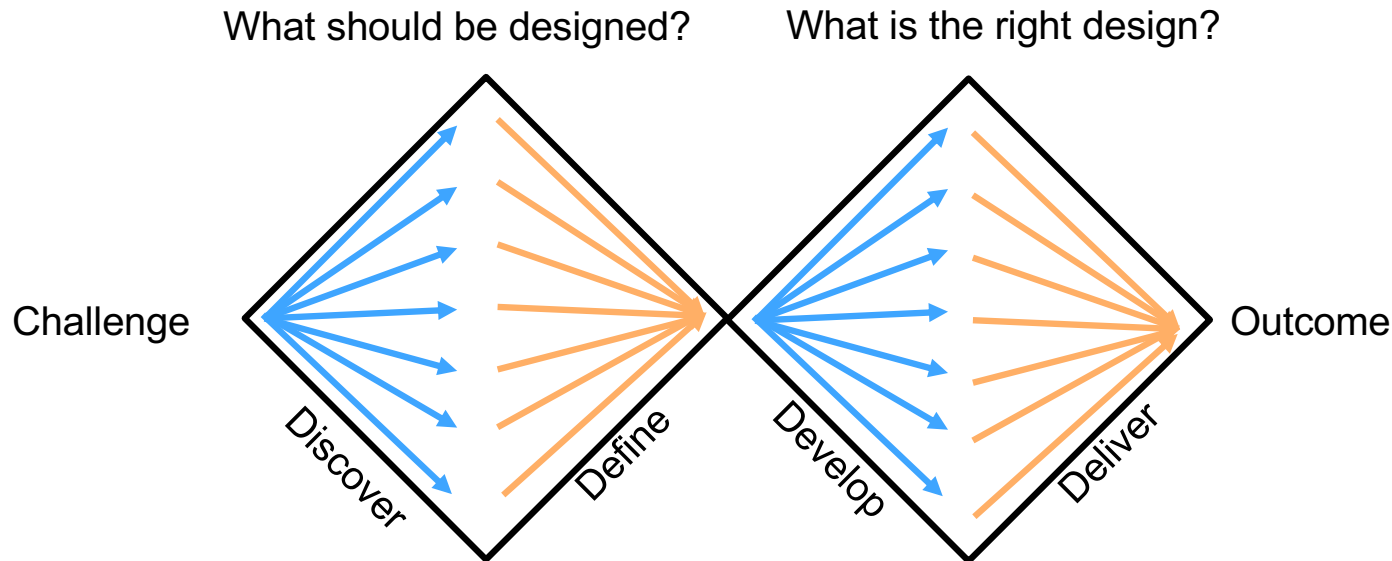
**Research design =
how you “design” (= plan) your evaluation process**

Framing what is important to learn



Findings

Research questions (RQs)



Where are you in your design process?

Diverging stage: you are searching for alternatives

=> Create an **open-ended** research question

Converging stage: you make decisions based on alternatives

=> Create a **close-ended** research question

Open-ended vs. close-ended questions

Open-ended (wide) question:

The space of possible answers is unlimited

Close-ended (narrow) question:

The answer can be only one among predefined alternatives that the researcher has specified

You can change a question from close-ended to open-ended, and vice versa:

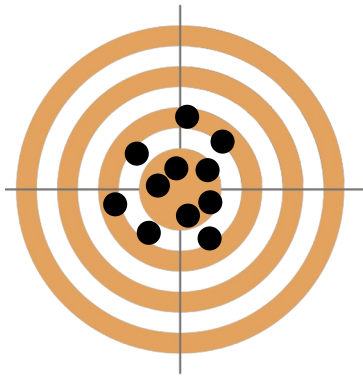
How do people use the system?



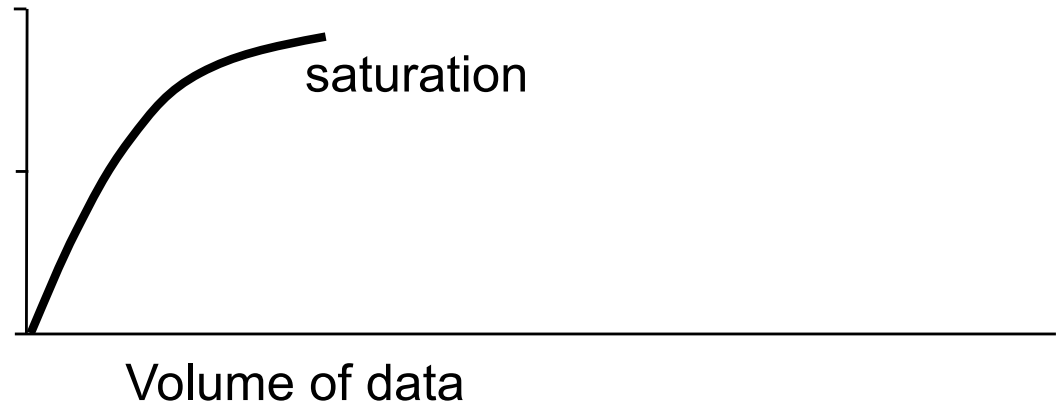
Which of the following ways to use a system are most common?

Closer-ended RQ gives faster findings (but may miss something important)

Narrow
RQ

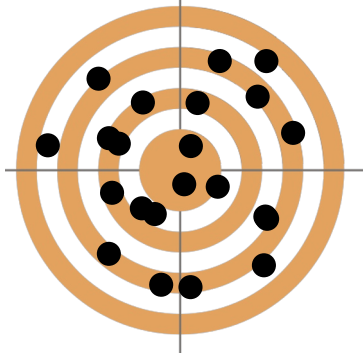


Number
of
findings

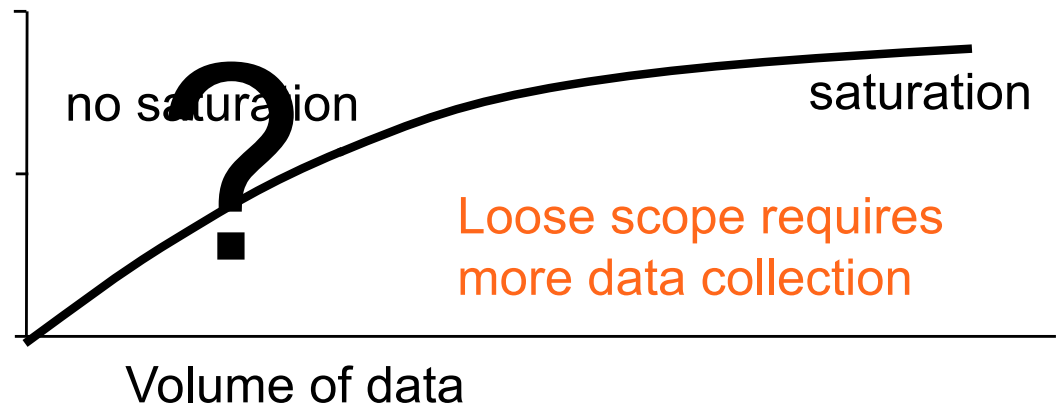


more data!

Wide
RQ



Number
of
findings

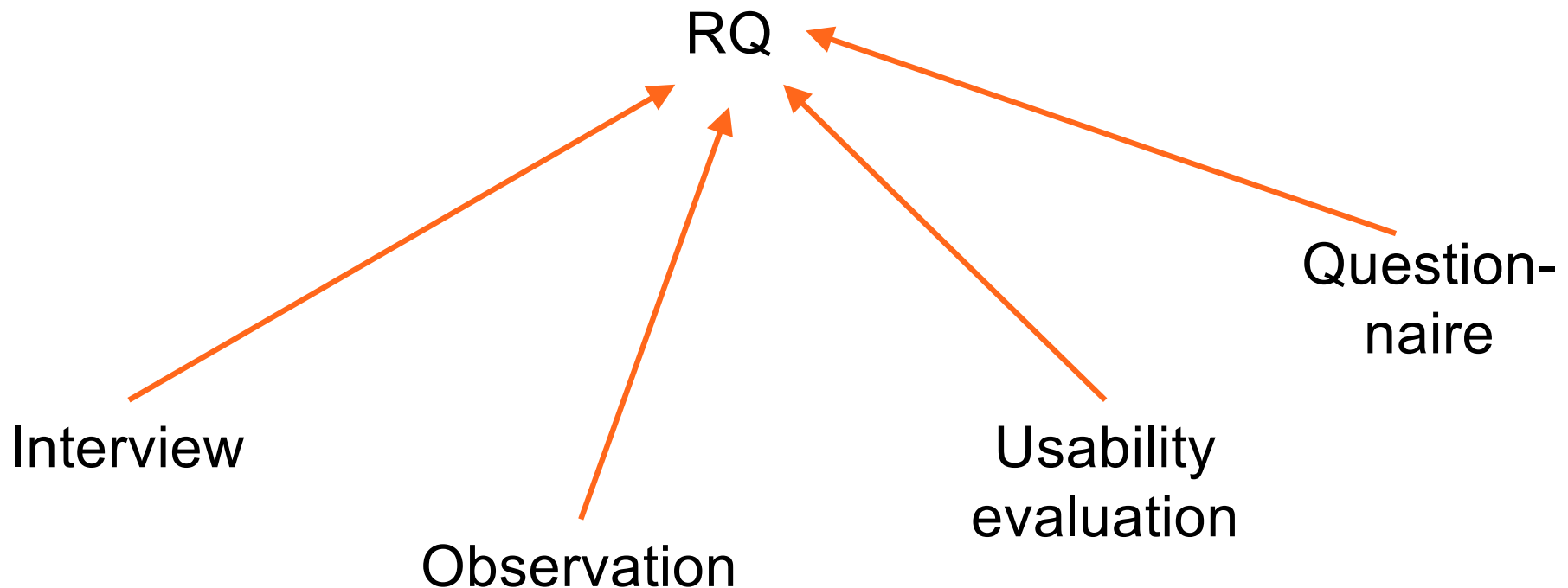


Typical result of
excessive open-
endedness

Operationalization: From RQ into methods

The challenge:

All RQs can be studied in several ways.
Which method(s) should one choose?



Pair exercise

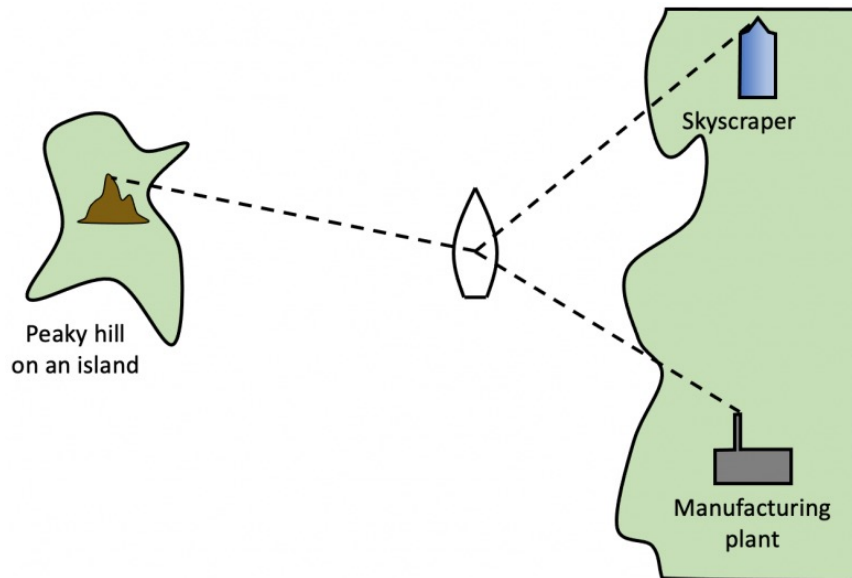
Discuss weaknesses and strengths of the following methods:

	Strengths	Weaknesses
Interviews
Observation
Usability evaluation
Questionnaires

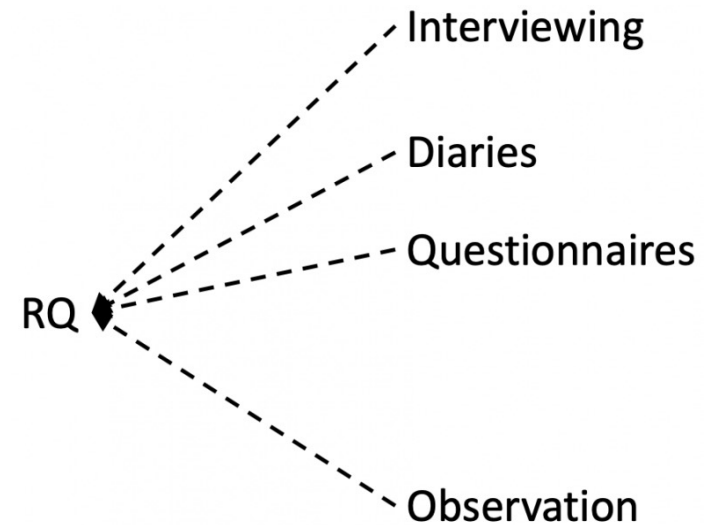
Bonus question: what other methods can you think of?

Finding best methods via triangulation

Choose methods that eliminate each other's weaknesses

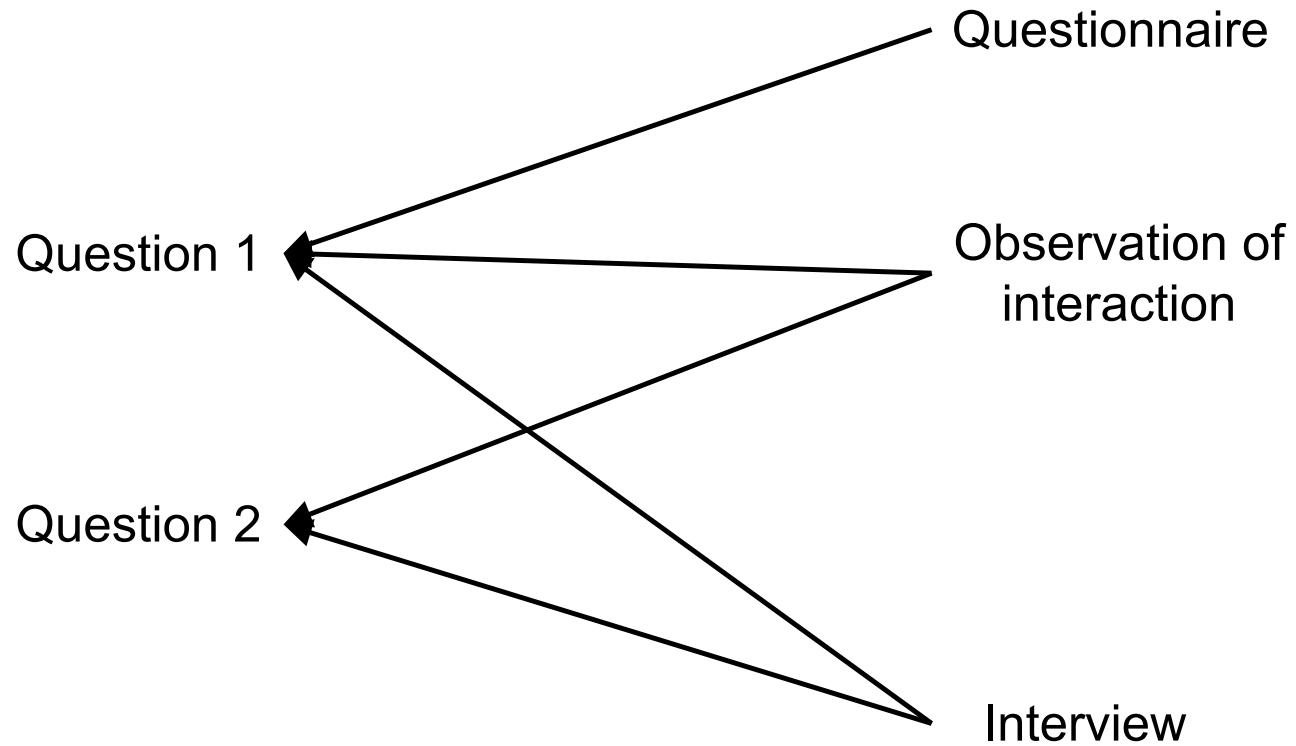


How a ship without GPS
would choose the landmarks
to locate itself



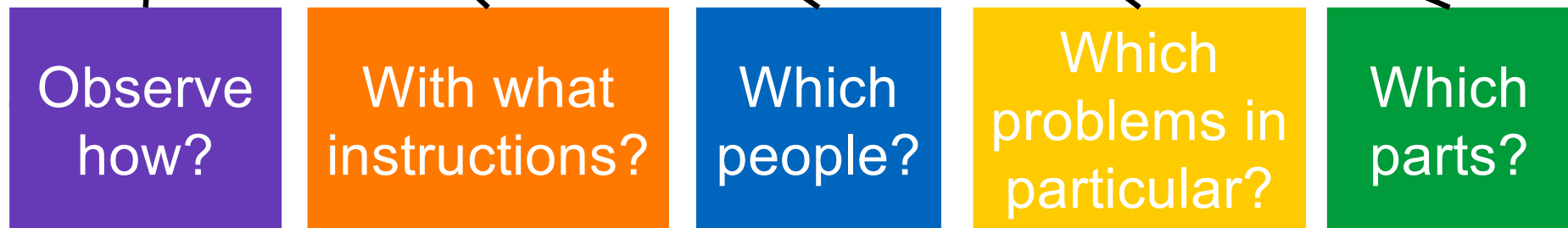
Consider your choice of
methods as a similar problem

Example of a possible research design



A simplistic view on user studies (again)

“Let’s ask people to explore our prototype. Then we’ll observe their problems and listen to their feedback”



Participant recruitment

What users should be recruited?

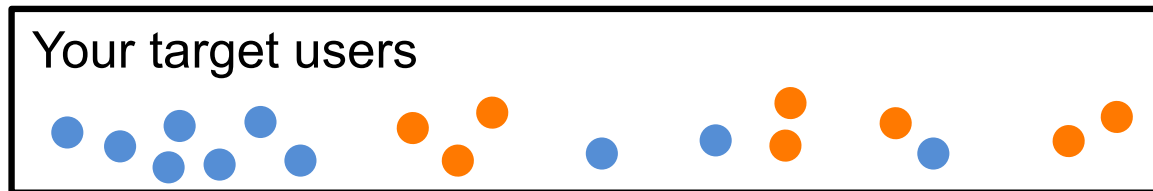
Random sampling

Each participant that you recruit has a **known probability** of being chosen for the study

Practically impossible in studies on humans

Convenience sampling

Studying people who you have a good access to (the typical method)



Choosing between heterogeneous vs homogeneous samples

Homogeneous (users very similar): If you need “deep” findings

Heterogeneous (users differ a lot): Generalizable but shallower findings

Choose between heterogeneous vs homogeneous samples

Homogeneous sample:

Users are very similar

Little noise in your data => You can get “deeper” findings

Heterogeneous sample:

Users differ a lot (e.g., in terms of age, gender, expertise, life values)

A lot of noise and variability => Generalizable but shallower findings

Unprincipled sample



Homogeneous sample

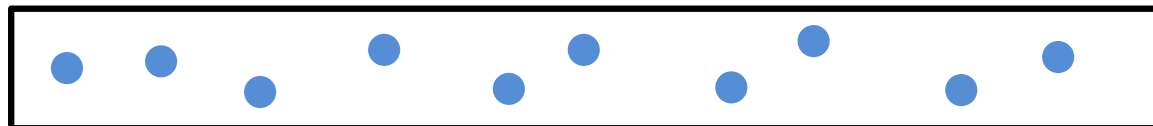


Heterogeneous sample I



Triangulation with user recruitment!

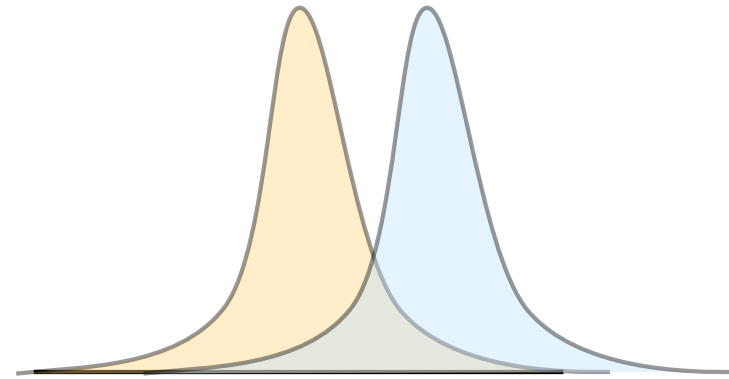
Heterogeneous sample II



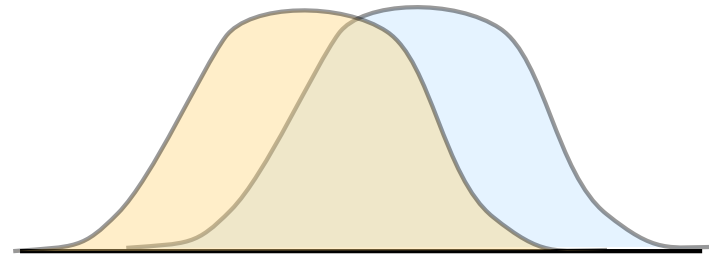
How many users are needed?

Quantitative research:

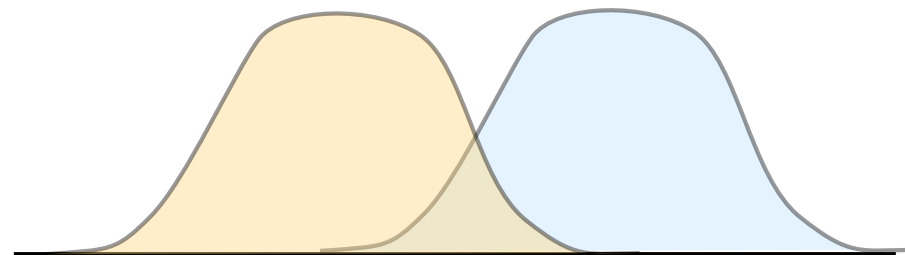
Depends on the variance and distance between the means



Small variance
⇒ small N needed



High variance
⇒ bigger N needed



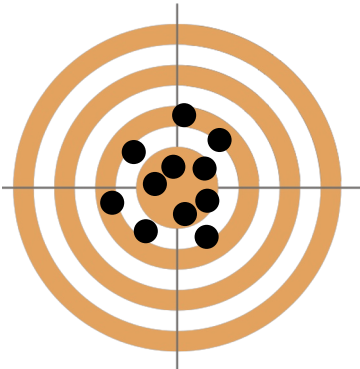
High distance between means
⇒ small N needed

How many users are needed?

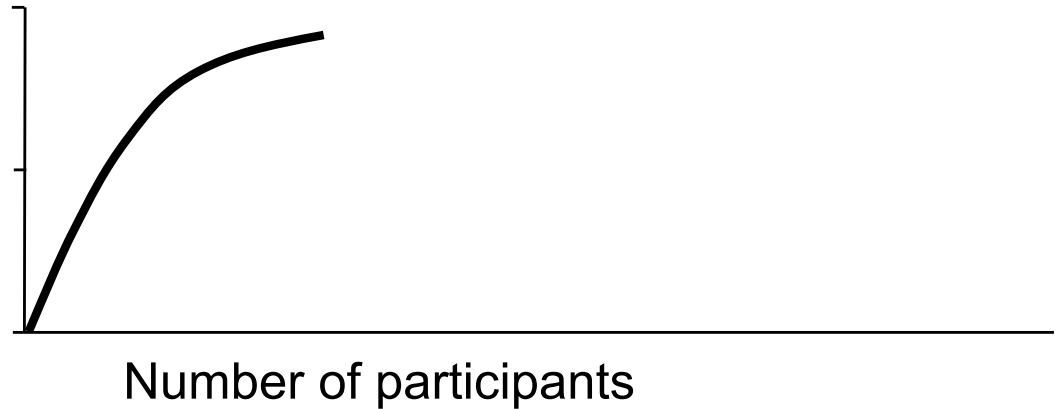
Qualitative research:

Depends on the focusedness of your research questions

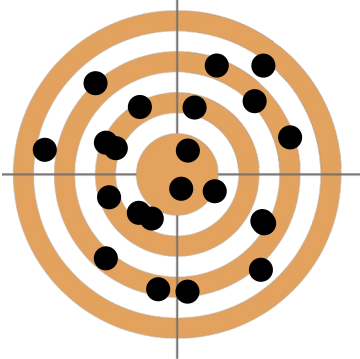
Narrow
RQ



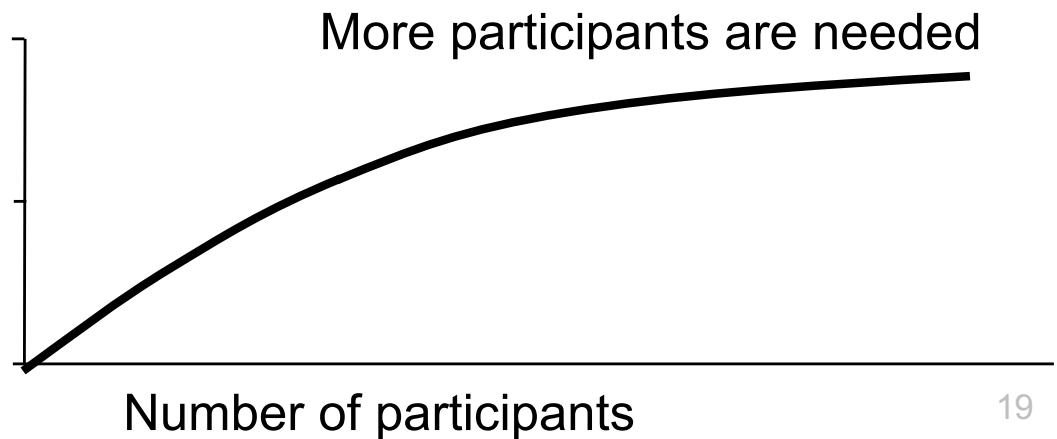
Number
of
findings



Wide
RQ



Number
of
findings



Practical tips

Interviews: Gathering rich and detailed data

Ask follow-up questions

Do not leave loose ends, or unexplainable behaviours

Prepare a set of follow-up questions in advance: “if they answer this way, I’ll ask about X, otherwise I’ll ask about Y”

Tailor your questions for each participant

Make sure that the participant understands your question.

=> If needed, you can ask the same question with a different wording from every participant

In abstract questions, verbalize your question several times with different words, and allow time for user to elaborate on the answer.

Interviews: planning your time

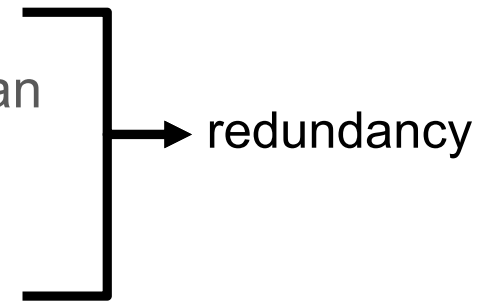
0-10 Introduction, informed consent etc.

10-20 A background questionnaire

→ Triangulation with interview: numbers vs what people say

20-30 Writing ideas on small cards

Cards help you gather more material that can be easily compared and categorized



30-45 Participants explain the card contents

45-60 More detailed discussion about your RQ

60-65 Direct question to your abstract RQ

↑
└─ Plan how you'll use the time so that you don't run overtime!

Interviews: Tips for making the user feel relaxed

Explain the anonymity and confidentiality in the beginning

No names or other identifiable information will be revealed to Suomi-Seura or other people in the course

User is free to terminate the evaluation at any time, with no need to explain why

The recording and notes from the evaluation will be destroyed after the course

But those contents that are relevant to the prototype's success will be kept and may also be used in presentations

Express interest in what user does

Good also for gathering detailed data: if you ask for clarifications you both express interest and also don't leave unexplained user behaviours in your data

Don't:

Don't sigh or yawn

Don't express anxiety if user struggles

Don't try to speed up the user if s/he is slow – Instead prepare the tasks so that some elements can be skipped without user noticing it

Do:

First task has to be easy

Present the tasks both verbally and visually on text => improves user's comprehension

Questionnaires: General challenges

Length:

Length leads to loss of complete answers

Engagement:

Questionnaires are often boring and repetitive

Ambiguity:

Questions that you may find understandable and unambiguous may not be so for the respondents

Sampling:

Self-selection bias: e.g., overrepresentation of educated middle-aged females

You usually cannot repeat your data collection because re-recruitment of the same people involves a sampling bias

Data quality:

Erroneous and incomplete answers, data omissions

Questionnaires: Practical tips 1/2

Ask very precise open-ended questions:



Respondents never write long open-ended answers

Without clear instruction, respondents rarely focus on topics that are relevant for your research

Use radio buttons (i.e., forced-choice questions):

What social media do you use?

- Facebook
- Instagram
- Twitter





Do you use Facebook? yes no

Do you use Instagram? yes no

Do you use Twitter? yes no

Don't ask ask two things in one question:

If you don't like Facebook, explain why:



Do you like Facebook? yes no

Why? _____

Questionnaires: Practical tips 2/2

Conduct pilot tests

With yourself as respondent and other people as respondents

Helps test the length, inconsistencies, unclear questions, the logical flow

In online questionnaires, use engines (e.g., SurveyHero) that accept clicks also around the radio button

Google Forms do not have that feature!

I think that I would like to use this system frequently.
I found the system unnecessarily complex.
I thought the system was easy to use.
I think that I would need the support of a technical person to be able to use this system.
I found the various functions in this system were well integrated.
I thought there was too much inconsistency in this system.
I would imagine that most people would learn to use this system very quickly.
I found the system very cumbersome to use.
I felt very confident using the system.
I needed to learn a lot of things before I could get going with this system.

	1	2	3	4	5
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Accept click from entire table cell and not only from "o" in the middle

Contents of this lecture

Research designs:

- Open-ended vs close-ended research questions

- How you can choose the right research methods by applying a concept of triangulation

- Saturation

Participant recruitment:

- How do you choose which participants you should recruit?

- How do you estimate how many participants you will need?

Practical tips:

- Interviews: how to prepare for interviews

- Questionnaires: some dos and don'ts