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IT3010

Empirical research methodologies in IT and digitalization

Data, paradigms, research contributions

February 1, 2022
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Learning goals

1. Designing an empirical research project in IS/SE/CS.
 1. Distinguish between IS, SE, and CS research fields.
 2. Understand the meaning of empirical research.
2. Writing research objectives/purpose for an IS/SE/CS research project.
3. Formulating research topics and questions for an IS/SE/CS research project.
4. Describing research contributions for an IS/SE/CS research project.
5. Understanding various research strategies, and how and when to use/not use each in an IS/SE/CS research project.
6. **Understanding various data generation tools, and how and when to use/not use each in an IS/SE/CS research project.**
7. **Data analysis.**
8. Evaluating empirical research.
9. Research ethics.
10. Presenting research.

IS = Information Systems
SE= Software Engineering
CS= Computer Science

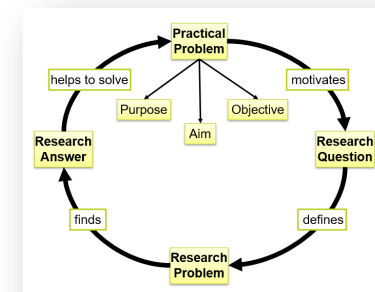
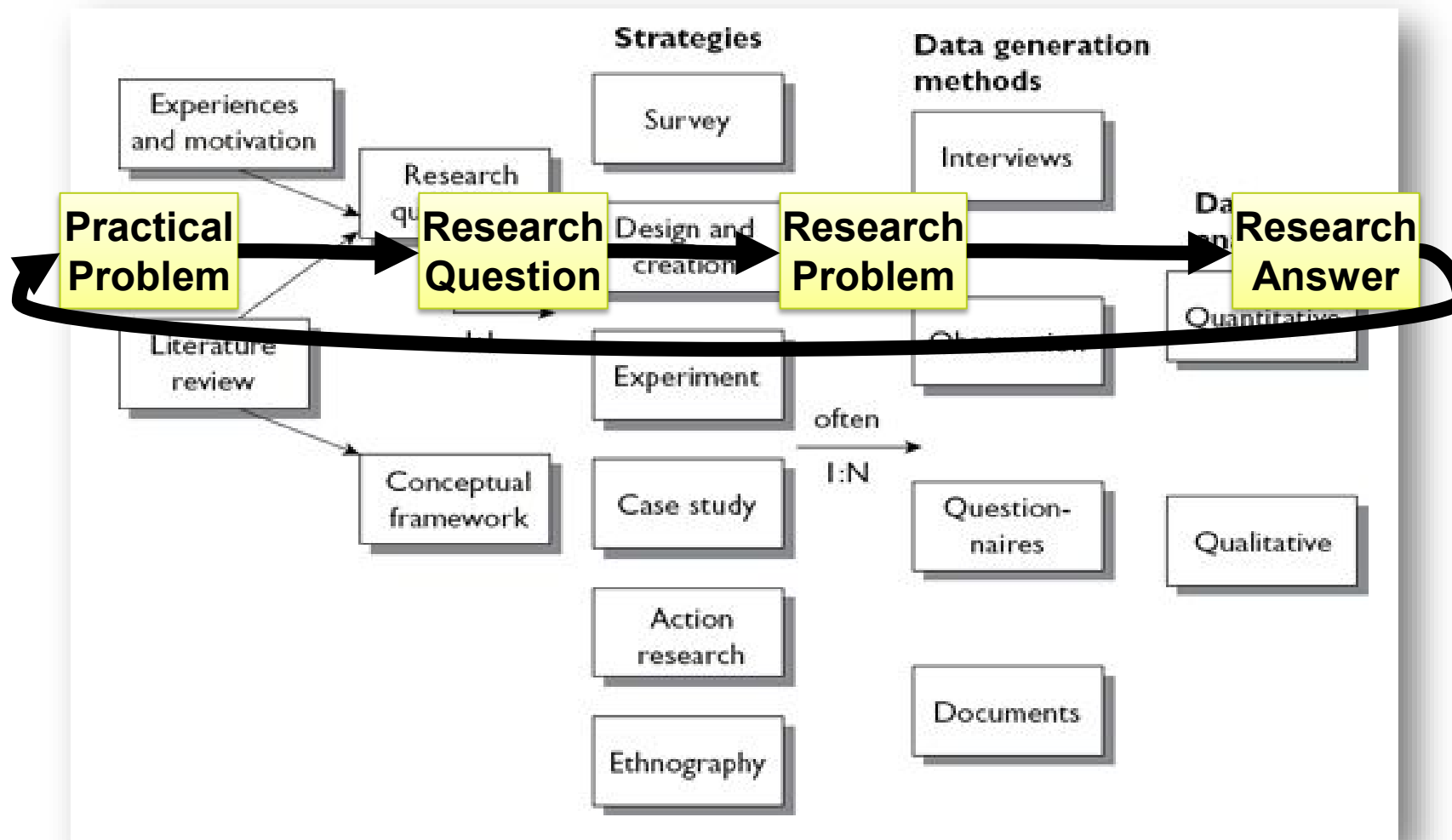
Agenda

- 0- Housekeeping.
- 1- Research design framework recap.
- 2- Primary and secondary data recap.
- 3- Data generation tools overview.
- 4- The ladder of evidence.
- 5- Strategy-led data generation.
- (Break 15 minutes)
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- 7- How to make a research contribution.
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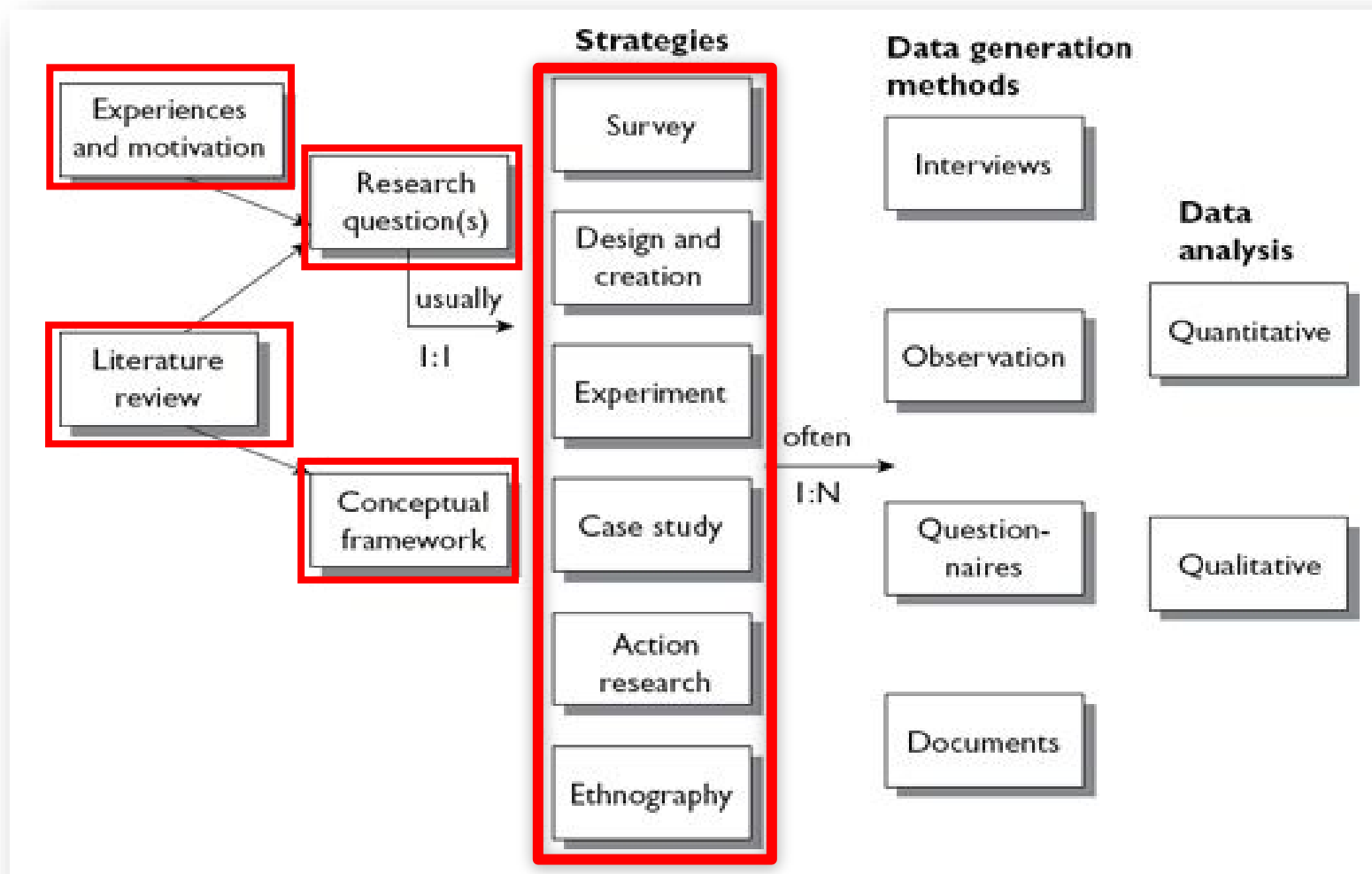
Housekeeping

- Assignment 1A:
 - Deadline February 11.
 - A draft of parts of your research proposal + draft of NSD report.
 - Early feedback from course staff the week after.
 - A f-2-f meeting with course staff to discuss the feedback
 - Groups book meetings, more info to come in Blackboard.
- Reference group:
 - All groups: Please provide one representative by end of week.
 - Reference group constitution next week.
 - You will participate in 3 meetings during the semester.
 - You will create a short evaluation of the course.
 - Important for improving the course now and for coming years.

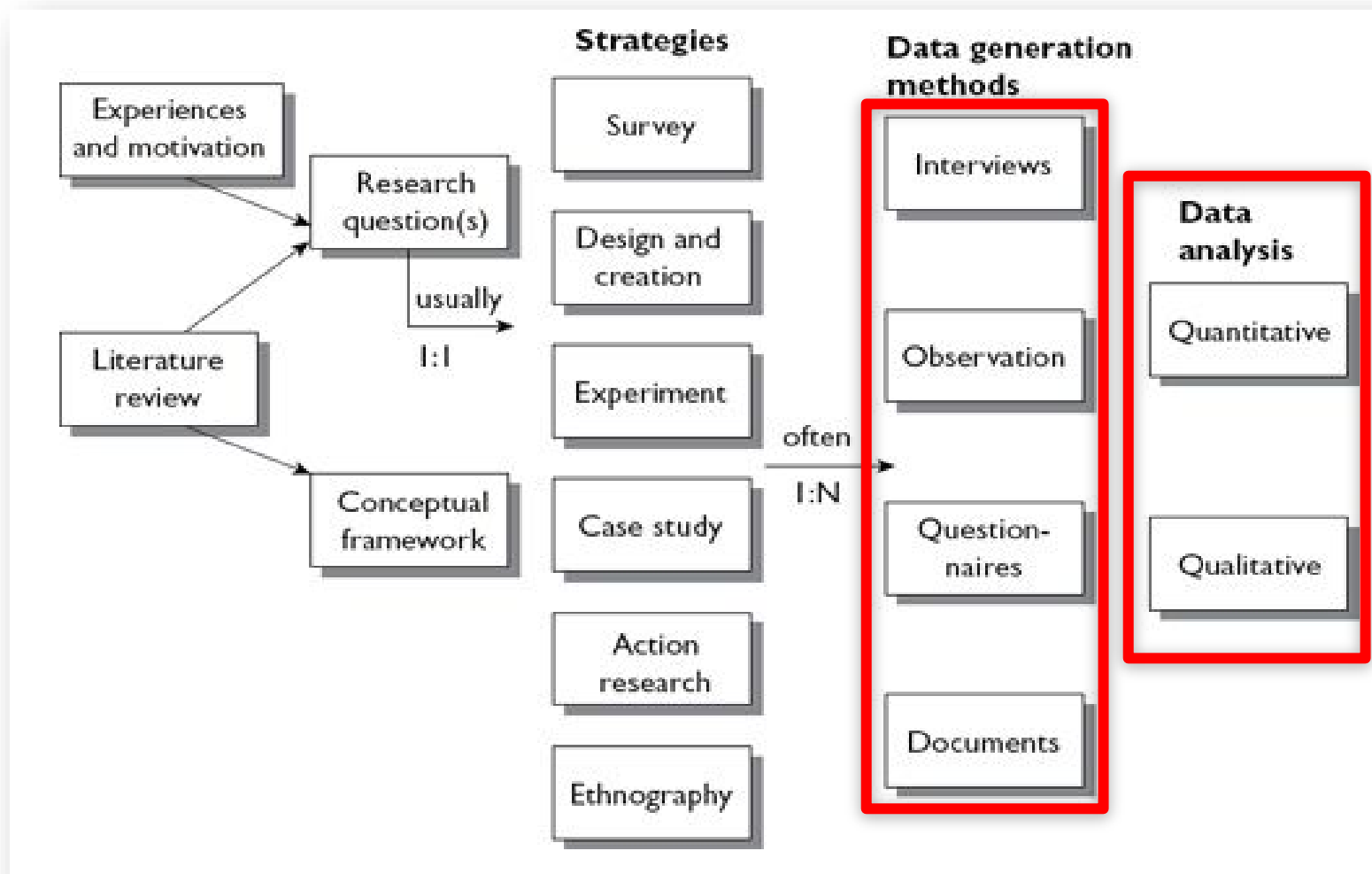
A research design framework



In last lectures



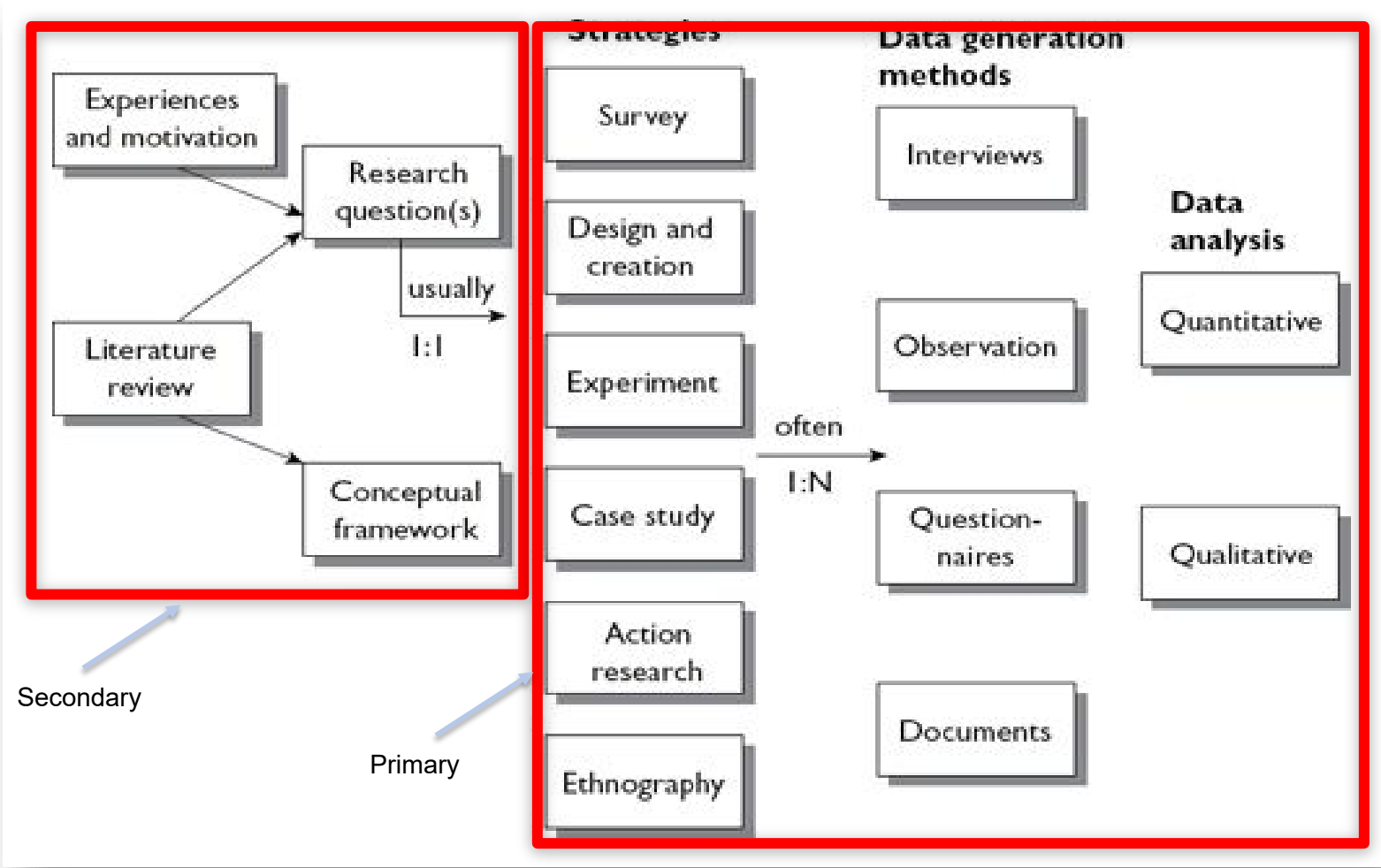
In this lecture



Primary and secondary data

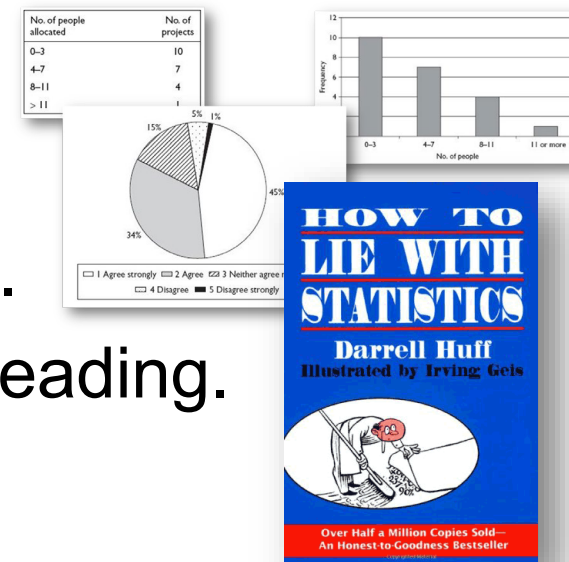
- Primary sources:
 - Are first-hand narratives, original documents/objects or factual accounts.
 - Are created during or close to the event or period of time.
 - Have a direct connection to a person, time, event or place.
 - Have not been subject to processing, manipulation, analysis or interpretation.
- Secondary sources:
 - Interpret, analyze and critique primary sources.
 - Provide a second-hand version of events or an interpretation of first-hand accounts.
 - Can tell a story one or more steps removed from the original person, time, place or event.

Primary and secondary data



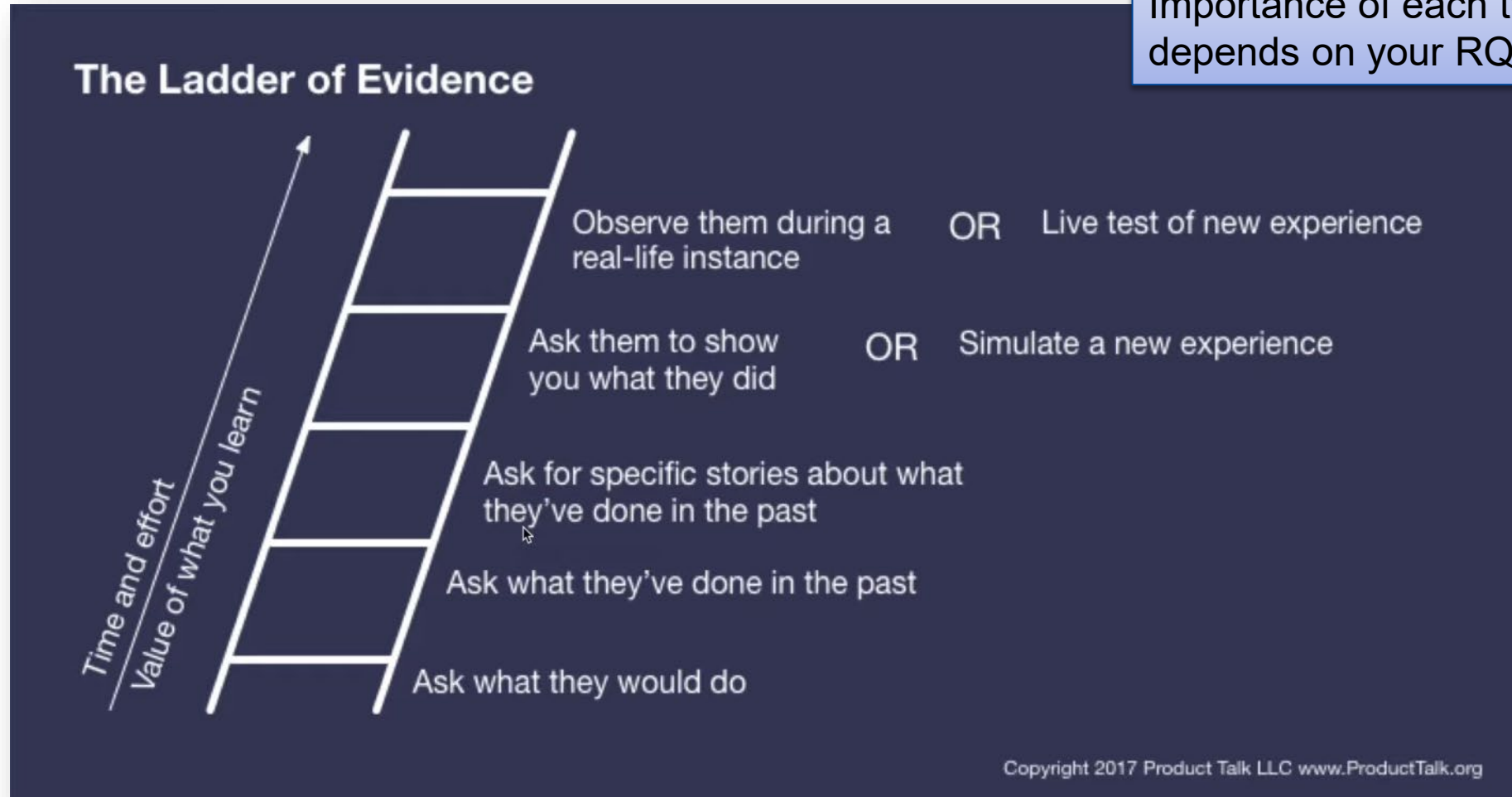
Quantitative and qualitative data

- Quantitative data:
 - Numeric summaries from questionnaires.
 - Numeric data/summaries from usage log files.
 - "Hard facts," can be both convincing and misleading.
- Qualitative data:
 - All non-numeric data, e.g. text, pictures, video, ...
 - Generated commonly in case studies, action research and ethnography....
 - ...in interviews, field notes etc.
 - Rigorous analysis requires experience.

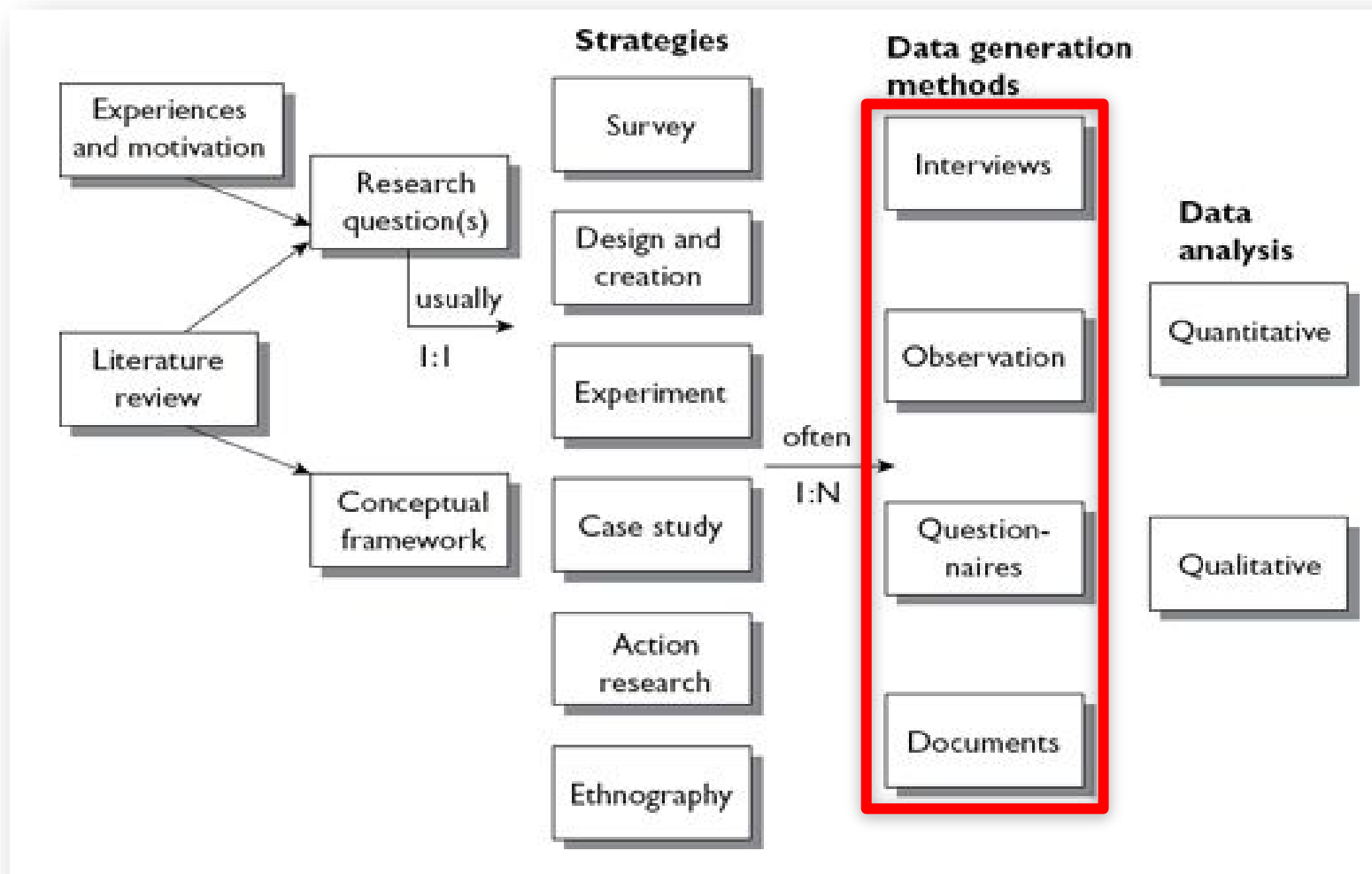


Ladder of evidence

Actually not a ladder but a collection of data types. Importance of each type depends on your RQ



Data generation methods



Research interviews

- Direct input collected from a specific person through a dialog.
- Types of interviews:
 - Structured (often quantitative)
 - Similar to questionnaire.
 - Predefined questions, predefined answer alternatives.
 - Semi-structured (qualitative)
 - Predefined topic and themes, open-ended questions.
 - Unstructured (qualitative)
 - Predefined topic, open-ended themes and questions.
- Semi-structured and Unstructured are more explorative, while Structured is more validating.

Group interviews

- E.g. focus groups.
- Used frequently in new product design and evaluation.
- Has advantages and disadvantages compared to normal interview:
 - Can give better results because of the discussions among the interviewees.
 - Can give worse results because of the social hierarchies or other issues among the interviewees.

Questionnaires

- A pre-defined set of questions assembled in a pre-defined order, answered by people.
- Can be:
 - Researcher-administered: Structured interviews.
 - Respondent-administered: Online or paper-based form.
- Mostly used in the survey research strategy.
- Suitable for collecting same data from many people.
- Suitable for verifying or falsifying hypotheses.
- Mostly quantitative, but can also include open-ended qualitative questions ("What is your opinion about...")



Observations

- Find out what actually happens, rather than what people think or say happens.
- Observations of sociotechnical events (people interacting with technology), but also of technical events (e.g., system logs).
- Prone to researcher bias.

Systematic observation

- Pre-defined observation focus and plan.
- Focus on e.g. "interactions among group members".
- Plan for what to observe, e.g. "number of times each member talks" and "to whom each member talks".

Date:		Observer:		
Lab number	Time	No. of students	No. of working computers	No. of out-of-order computers

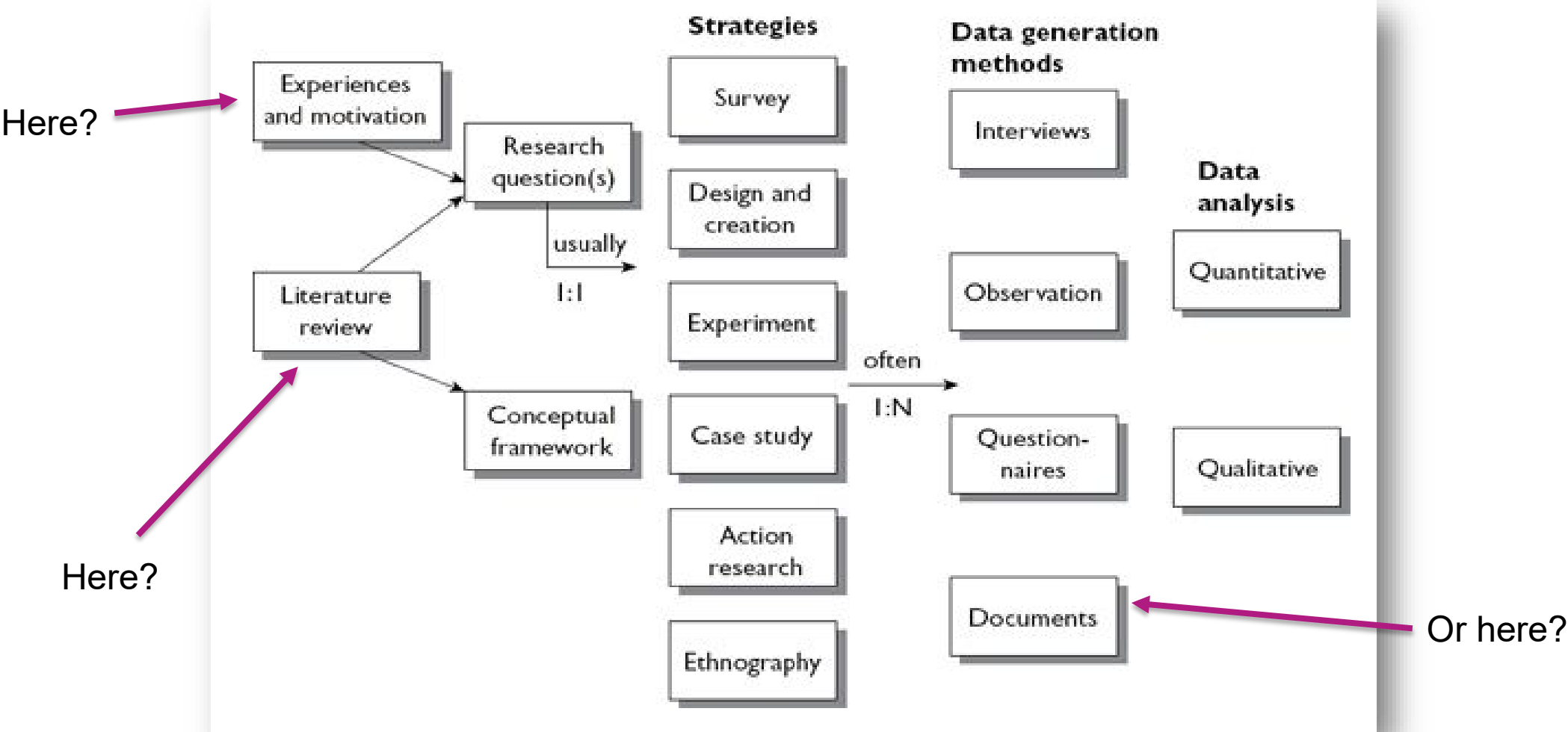
Participant observation

- Researcher is a participant in the phenomenon being observed.
- No observation plan or schedule, open-ended notes.
- Often long-term.
- Overt or covert. Important to be clear about the "rules of the game".

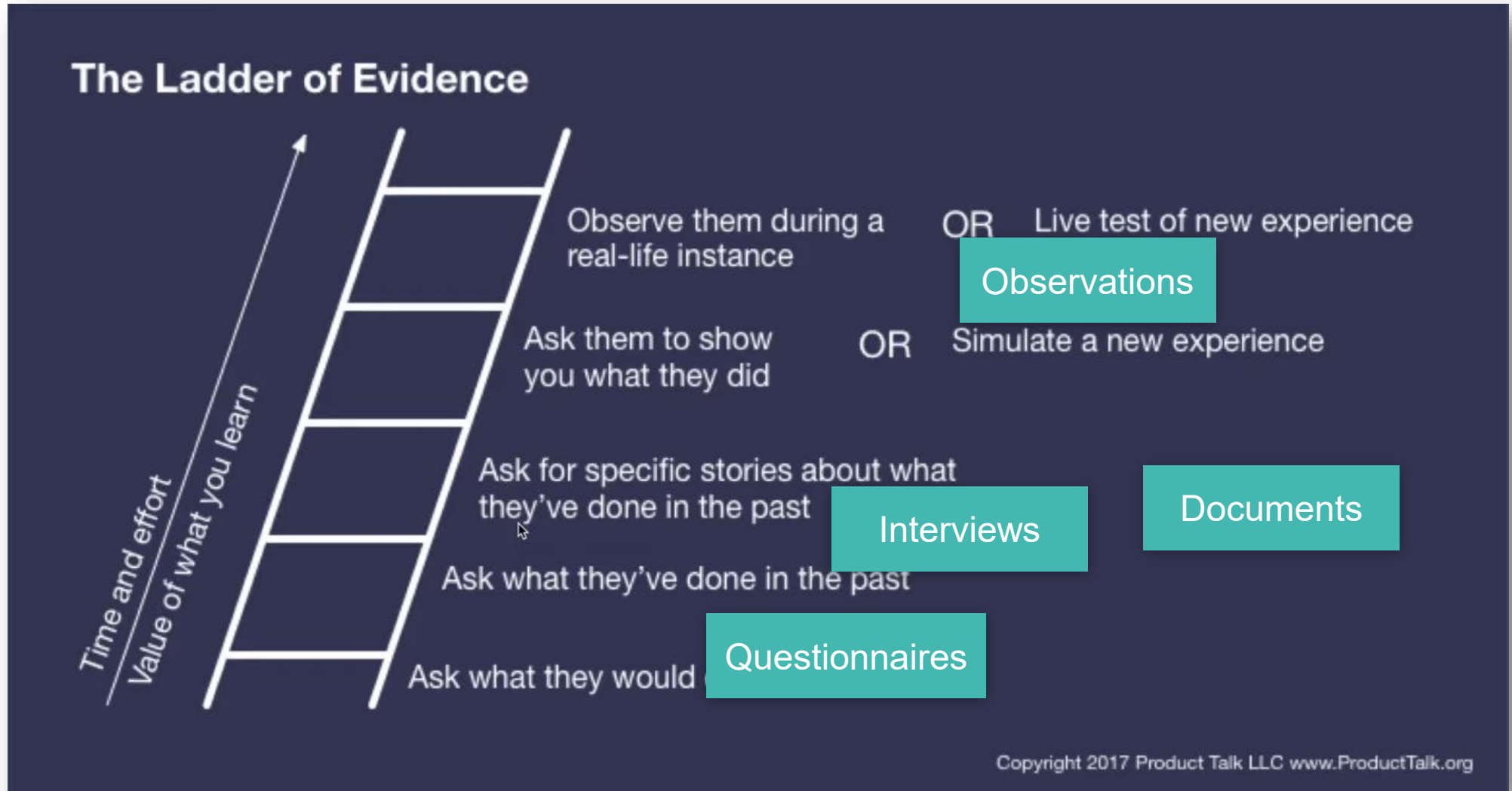


Kitchen Stories (Salmer fra kjøkkenet)

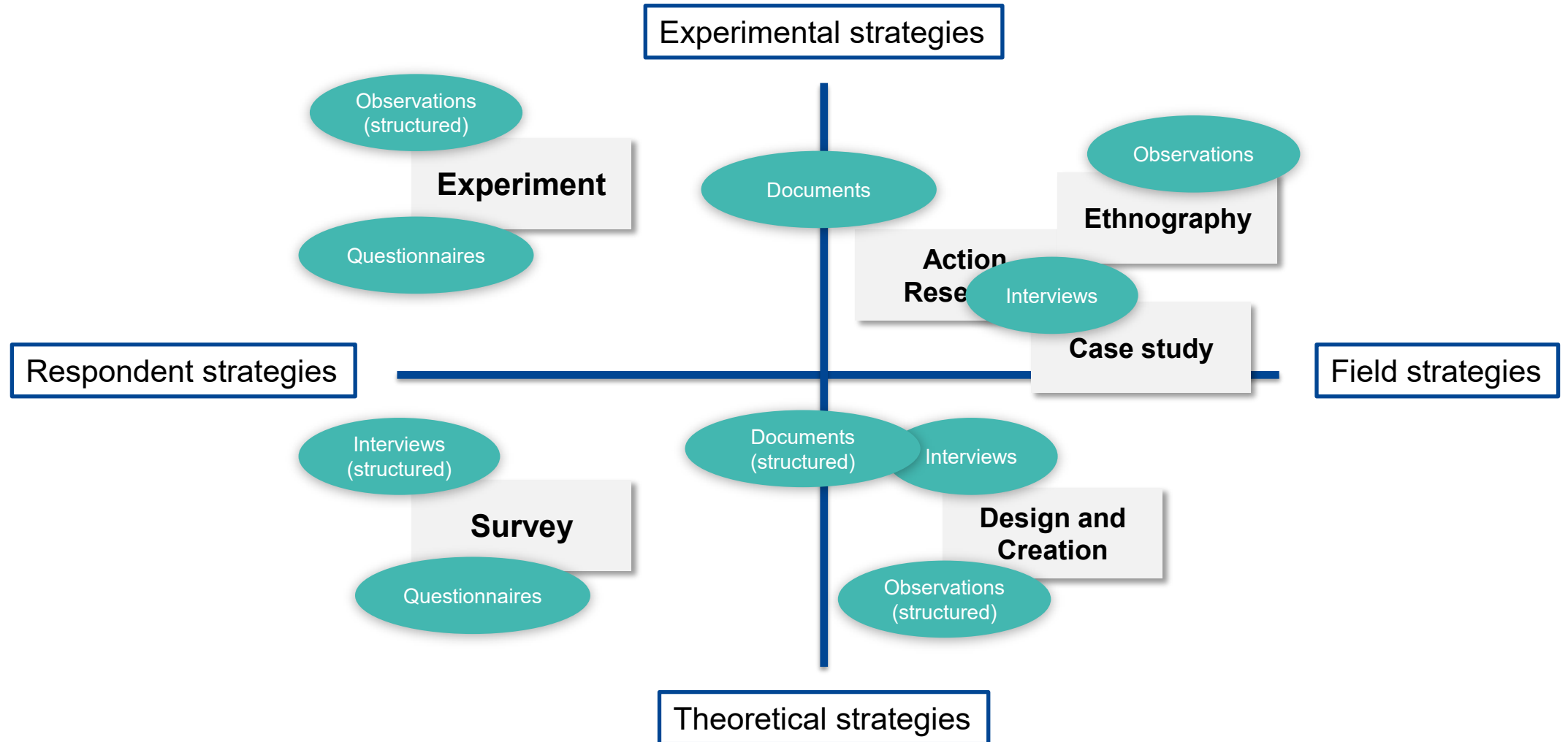
Documents (as primary data source)



Ladder of evidence



Research strategies



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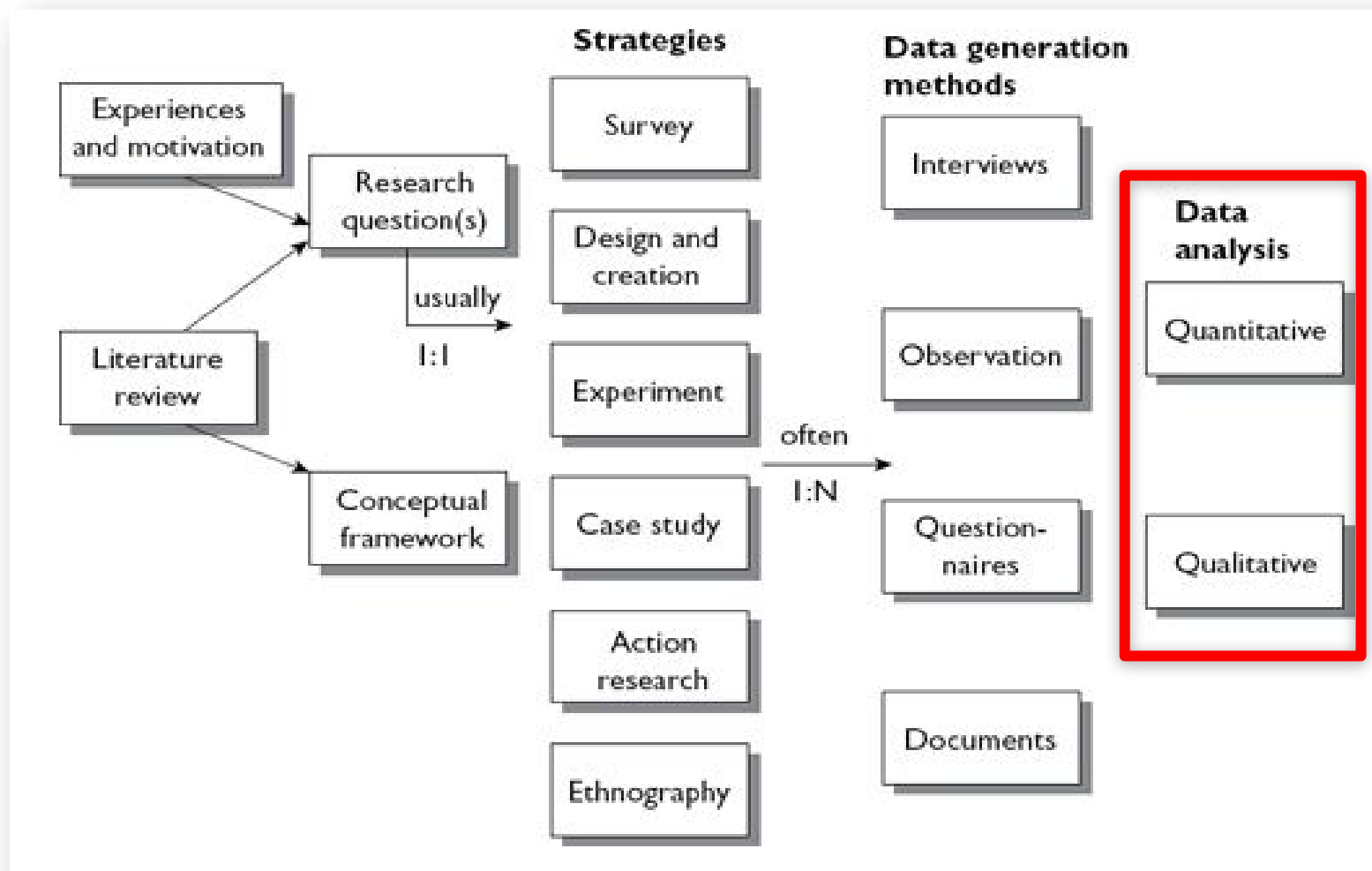
Strategy-led data generation

- Breakout rooms 10 minutes.
- Choose one of the following research questions:
 1. (Groups with odd numbers) What is the effect of the app "Smittestopp" on the physical activity of its users?
 2. (Groups with even numbers) How does an efficient Covid-19 contact tracking app look like?
- Discuss the question and choose a research strategy and two data generation methods that you believe are best suited for the question.
- Write down your choices and add a short justification.
- If you want, you can add it to Padlet.

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Data analysis



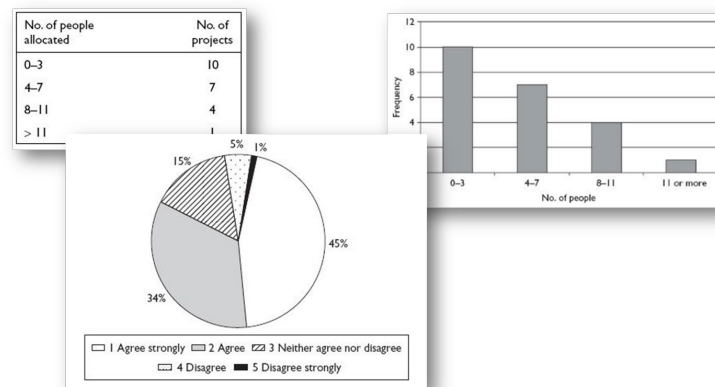
What is data analysis?

- Looking for (hidden) patterns in collected/generated data.
- Drawing conclusions based on patterns
 - Proposing new theories/answering research questions.
 - Discovering evidence in support of existing theories or evidence for fallacy of such.
 - Identifying the need for new research opportunities.

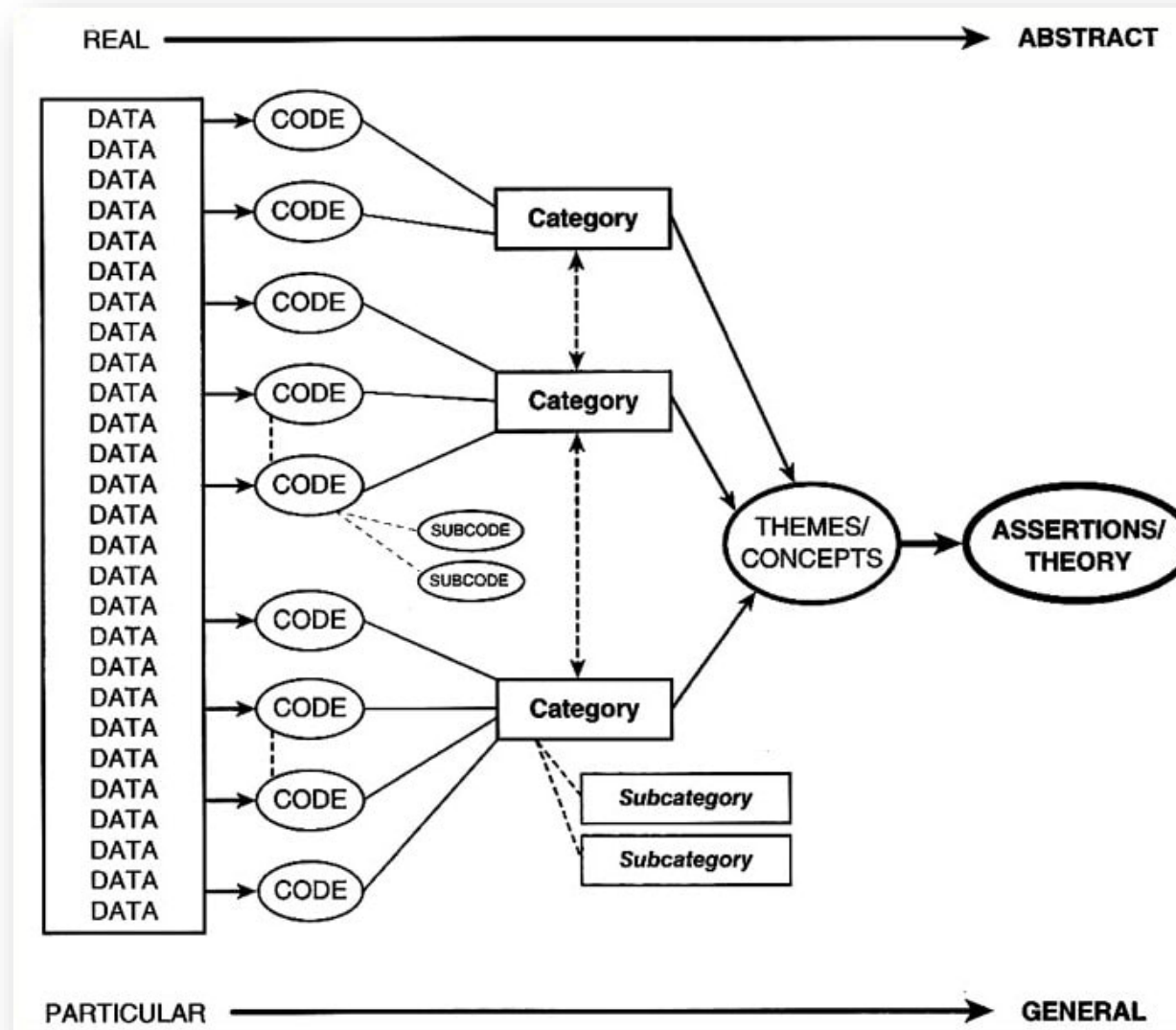


Quantitative Data Analysis

- Examples of data:
 - Numeric summaries from questionnaires.
 - Numeric data/summaries from usage log files.
- Levels of analysis complexity:
 - Organize data into tables and charts.
 - Apply descriptive statistical techniques.
 - Apply complex statistical techniques.
- Cons and pros:
 - Most people like quantitative data if presented nicely.
 - Easy to "lie with statistics."



Qualitative Data Analysis



(Saldaña, 2015, p. 14)

Qualitative Data Analysis

- Qualitative data includes all non-numeric data.
- Generated commonly in case studies, action research and ethnography.
- Not to be confused with "quantitative analysis of qualitative data".
 - E.g. number of times "love" is mentioned in an interview transcript.
- Qualitative data analysis is about abstracting, from qualitative data, the verbal, visual or aural themes and patterns.

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Research contribution

- Research is about creating **new** knowledge.
- Research contribution defines what is new about a research result.
- Important to distinguish:
 - **The deliverable** of a research project: A prototype, an evaluation report, a synthesis of existing knowledge.
 - **The contribution** of a research project: What is new about the prototype, the evaluation report, the synthesis?
- The contribution should be justified by presenting sufficient state-of-the-art evidence.

Types of contributions expected

- **Build:** Create a novel user interface concept based on a theory from psychology.
- **Evaluate:** Observe users and interview them after they have used the system.
- **Theorize:** Describe how your system can be said to support the underlying theory.
- **Justify:** Explain how the results of your evaluation supports or refutes the underlying theory.

		Research Activities			
		Build	Evaluate	Theorize	Justify
Research Outputs	Constructs				
	Model				
	Method				
	Instantiation				

Examples of contributions

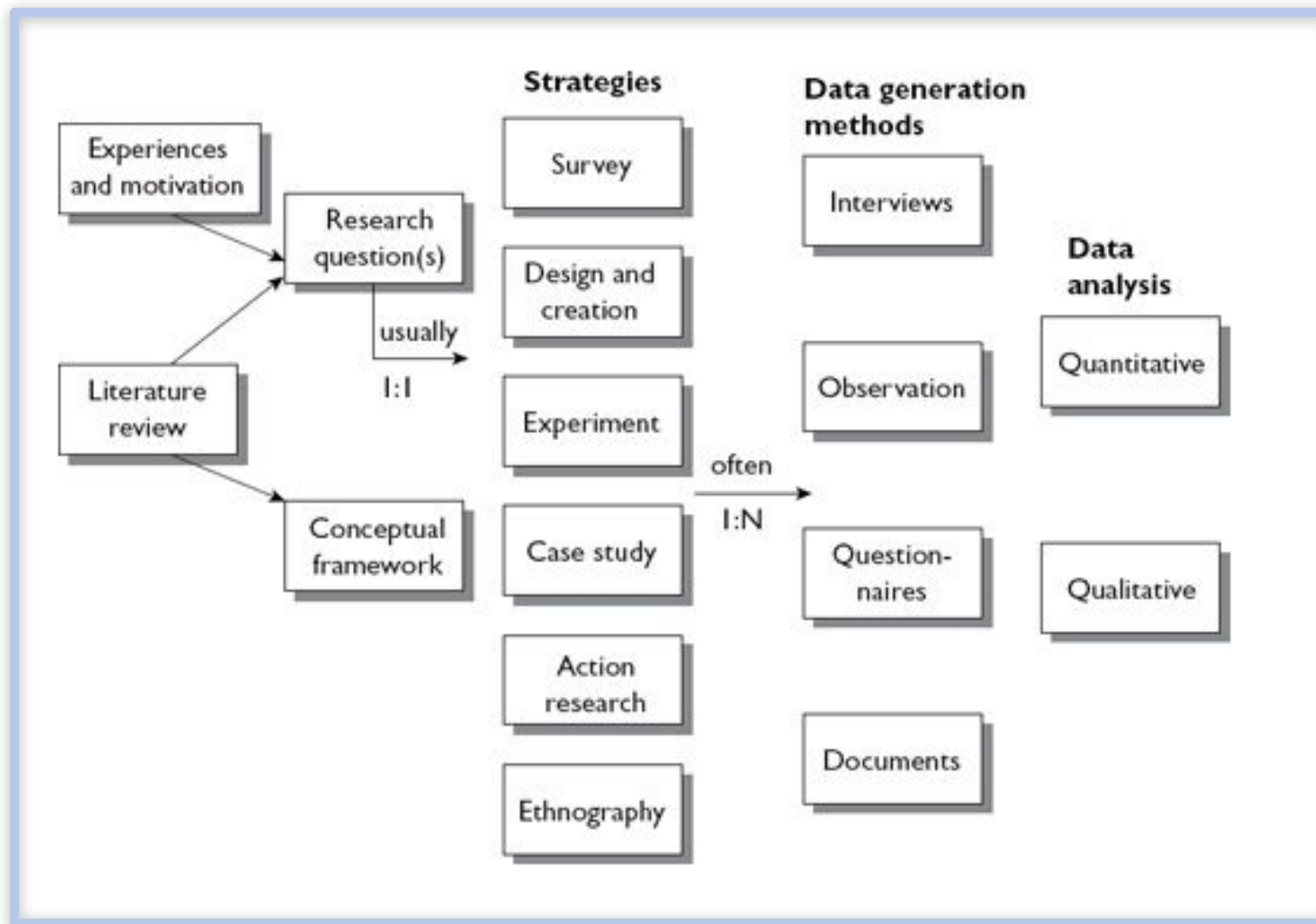
- Build and evaluate a prototype.
- Evaluate a method.
- Evaluate a model and build a theory.

		Research Activities			
		Build	Evaluate	Theorize	Justify
Research Outputs	Constructs				
	Model		✕	✕	
	Method		✕		
	Instantiation	✕	✕		

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The research paradigm affects all our choices



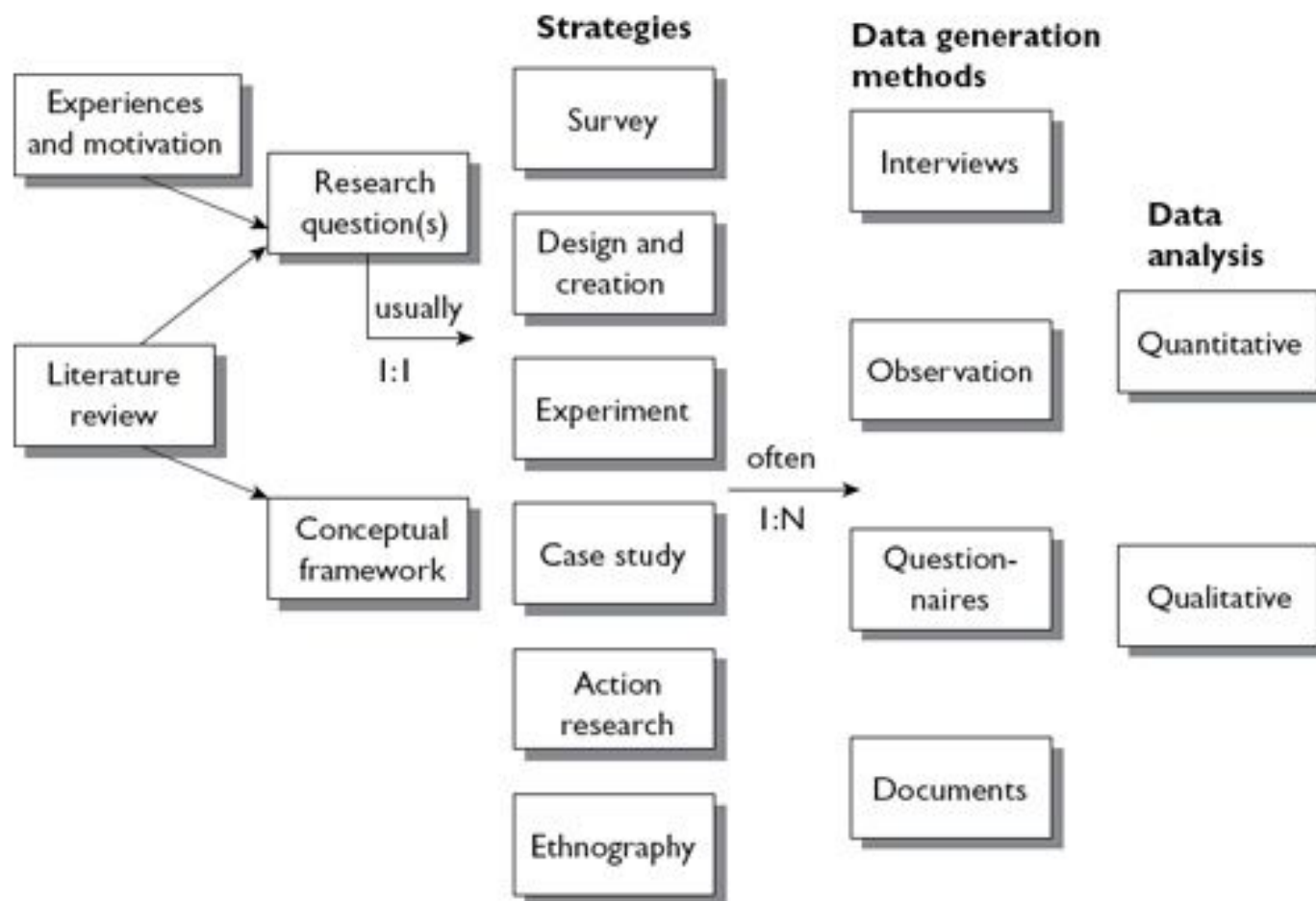
What type of person/ researcher are you?

- 1) Interested in facts?
- 2) Interested in complex social contexts?
- 3) Or maybe someone in between?

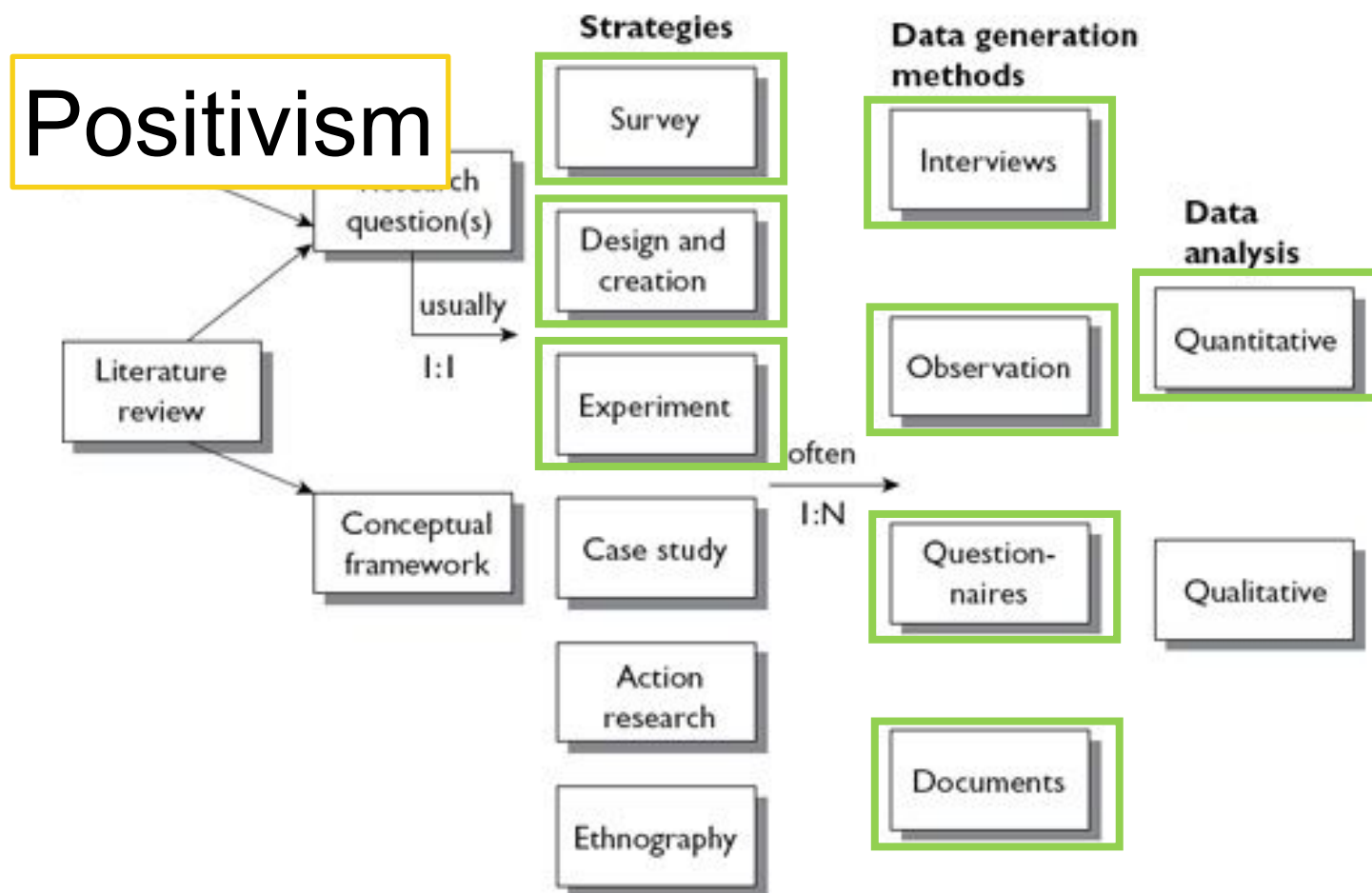
Main philosophical paradigms

- Positivism
 - We can investigate the world objectively through experiments.
- Interpretivism
 - Everything is subjective. Concerned with understanding the social context of an information system.
- Fundamental world views (**held by you as researcher**) that will affect research questions, strategy, data collection and analysis methods.

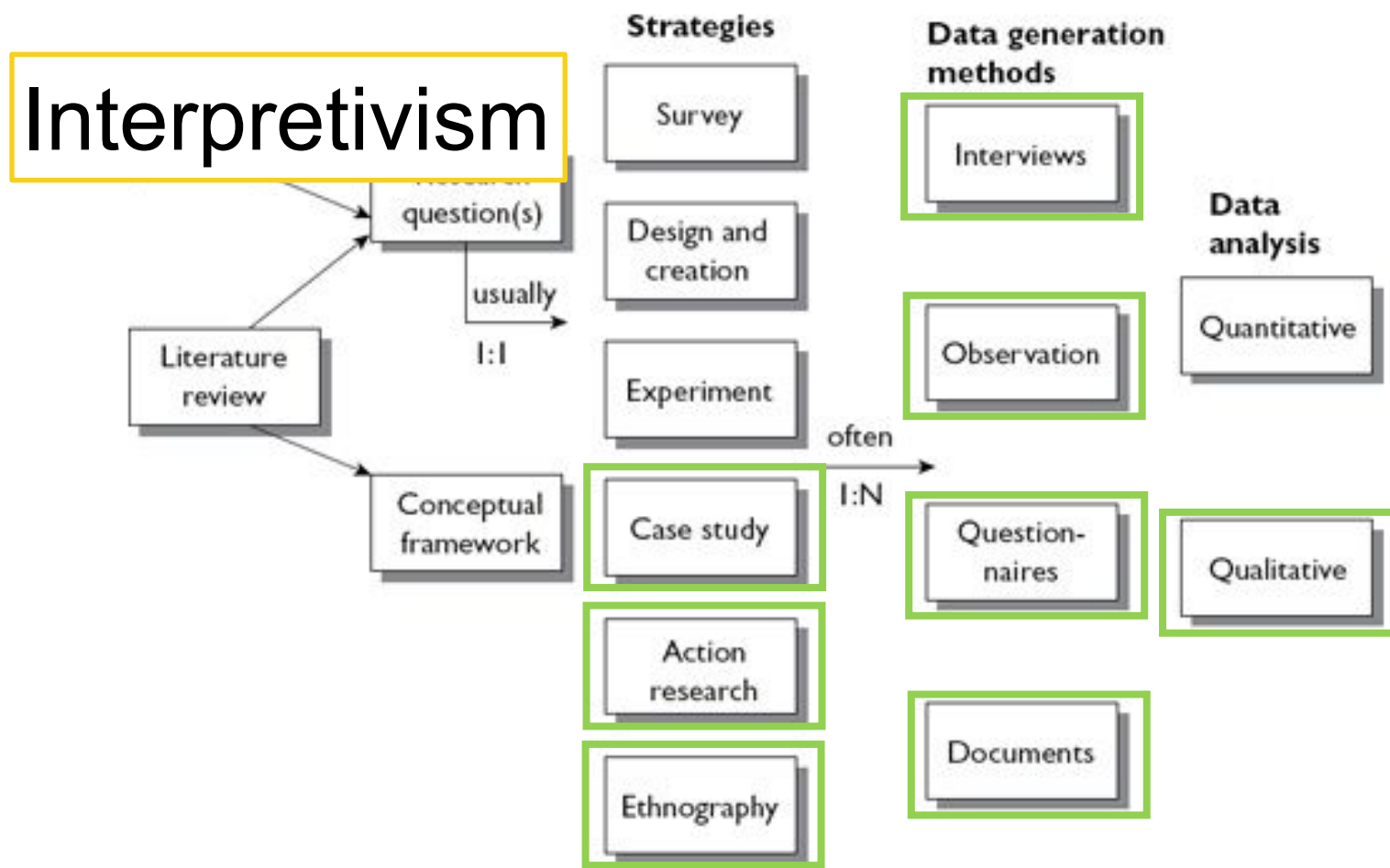
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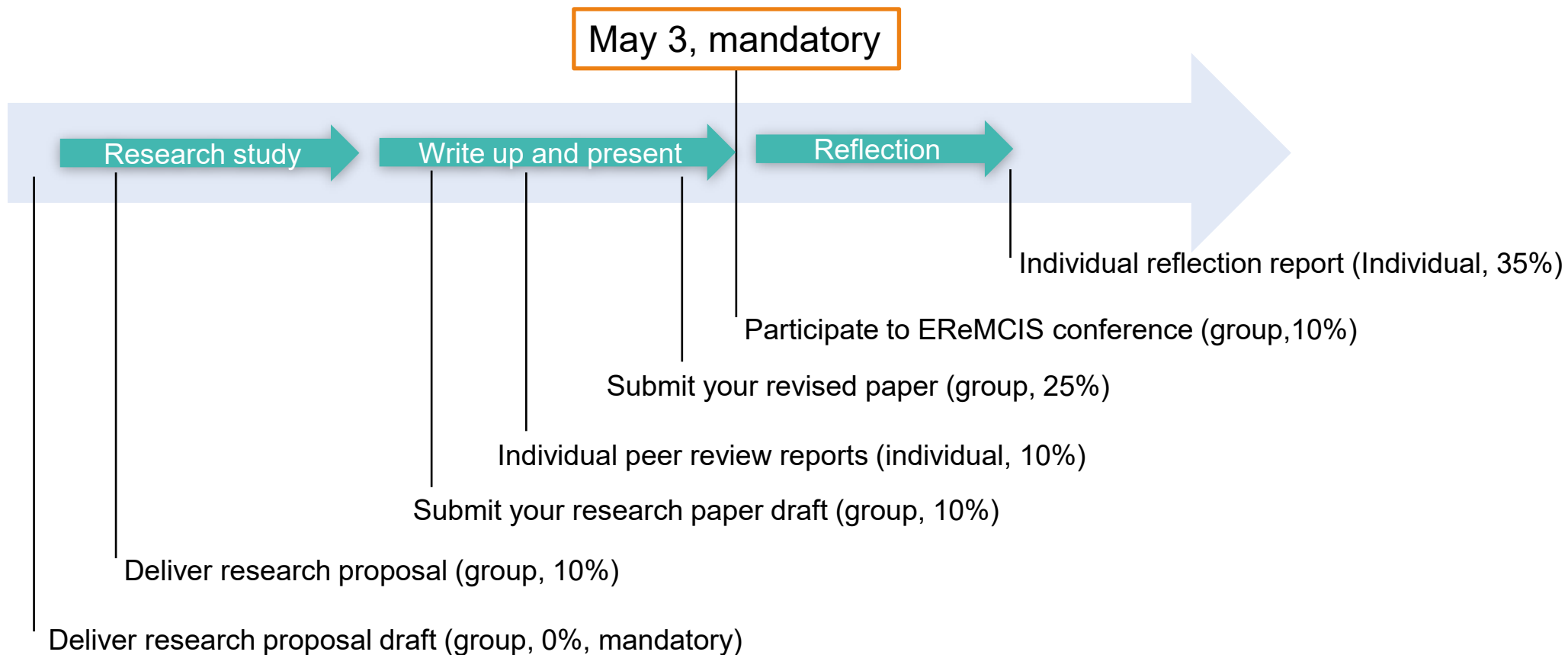
The research paradigm affects all our choices



The research paradigm affects all our choices



What lies ahead



Next hour:

Lecture on Ethics in research by Nora Othilie Ringdal

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