University of Hertfordshire UH

# Research design – Lecture notes

## 7COM1085 – Research Methods

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# Objectives

The objectives of this unit are to understand:

- various methods available to answer research questions;
- how to choose a method based on research question;
- how to design a research program.

# Methods

# Categories of Methods

There are two broad categories:

**Qualitative** Produce answers from narrative statements obtained by observation, interviews, open-ended surveys, document analysis.

**Quantitative** Produce answers based on numbers.

# Qualitative Methods

- Interviews[1].
- Surveys with open-ended questions[1].
- Document analysis.
- Observation[1].

[1] Requires ethics approval.

# Quantitative Methods

- Measurement.
- Quantitative surveys[2].
- Content analysis[2].

[2] Requires ethics approval.

# Design

# Design

Adapted from “Organizing Academic Research Papers: Types of Research Designs,” Sacred Heart University Library. Web page, accessed 15 February 2020. https://library.sacredheart.edu/c.php?g=29803&p=185902

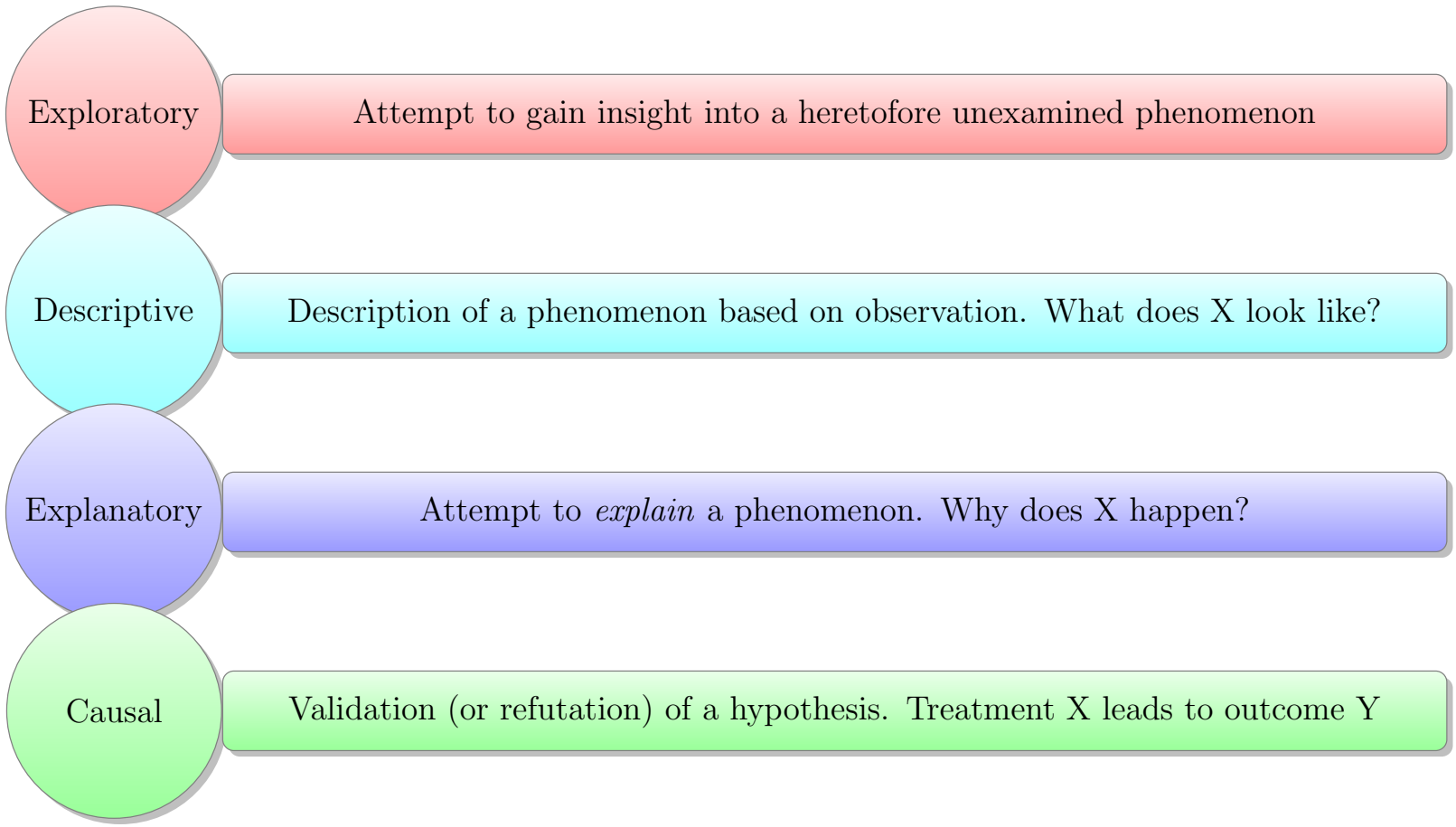
# Designs

Designs are characterized by

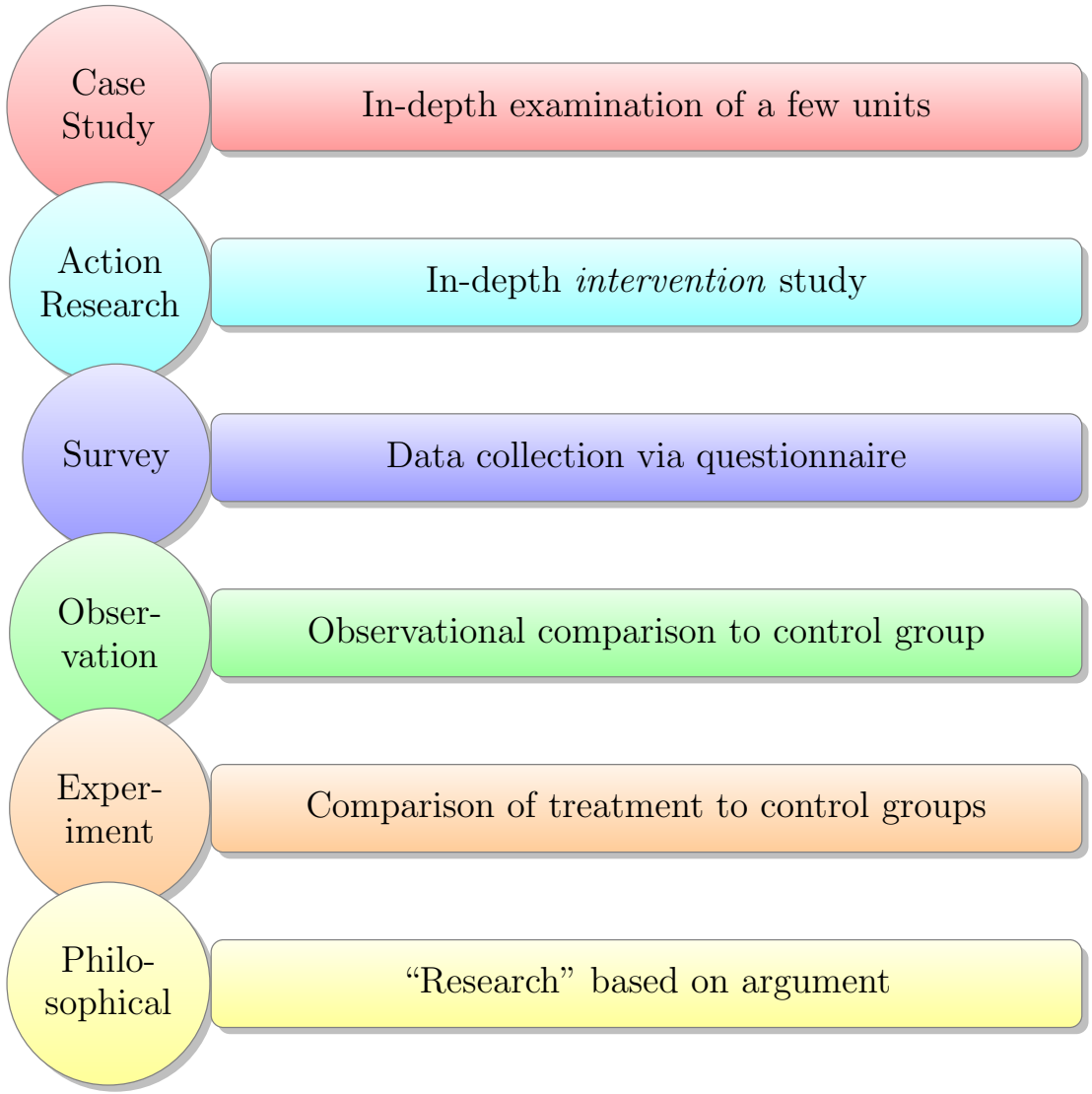
- purpose,
- approach,
- organization.

# Purpose of Study

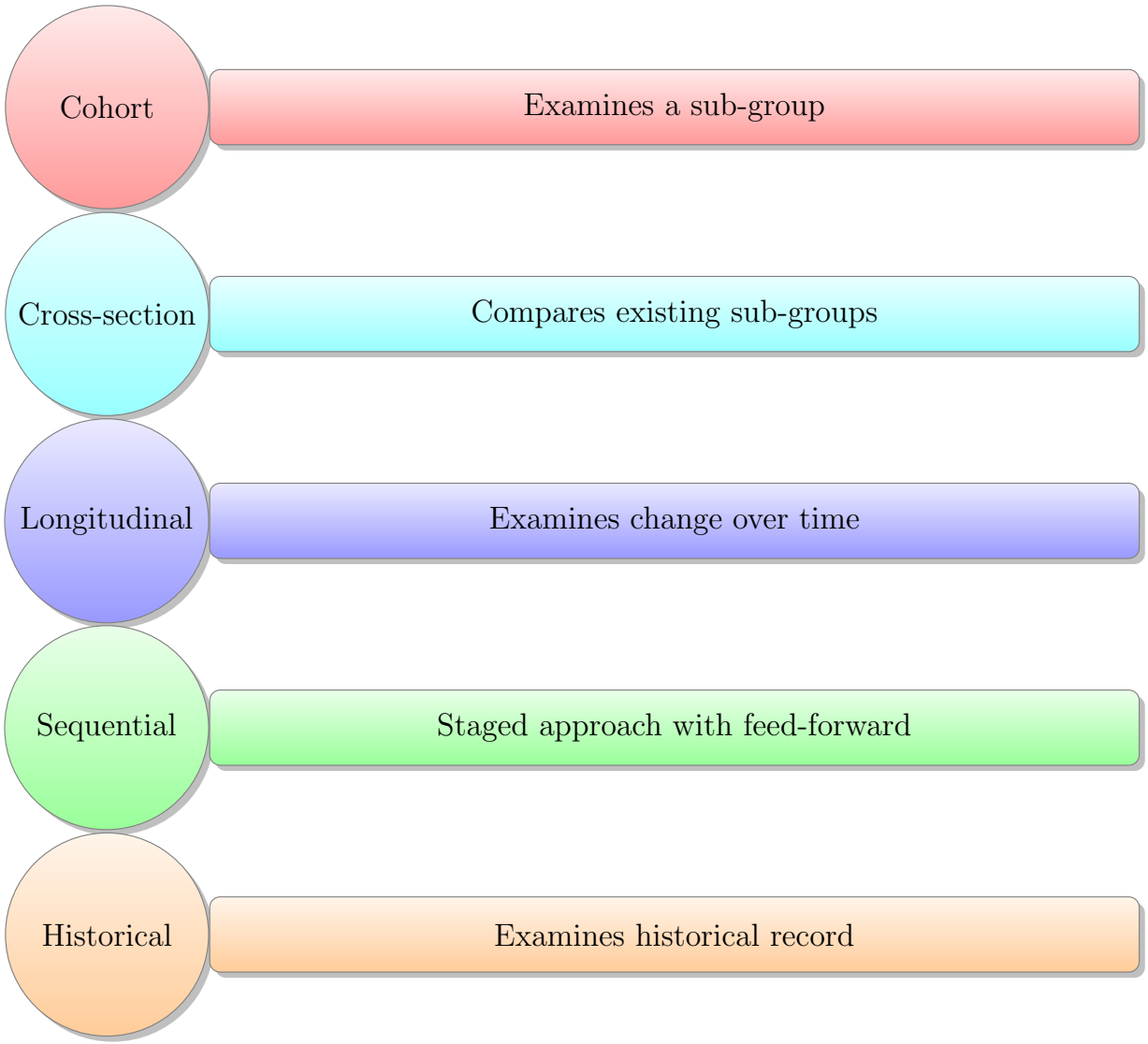
What is the study attempting to achieve?



# Method


Case Study
In-depth examination of a few units
Action Research
In-depth *intervention* study
Survey
Data collection via questionnaire
Obser-vation
Observational comparison to control group
Exper-iment
Comparison of treatment to control groups
Philo-sophical
"Research" based on argument

# Organization



# Method

# Case Study

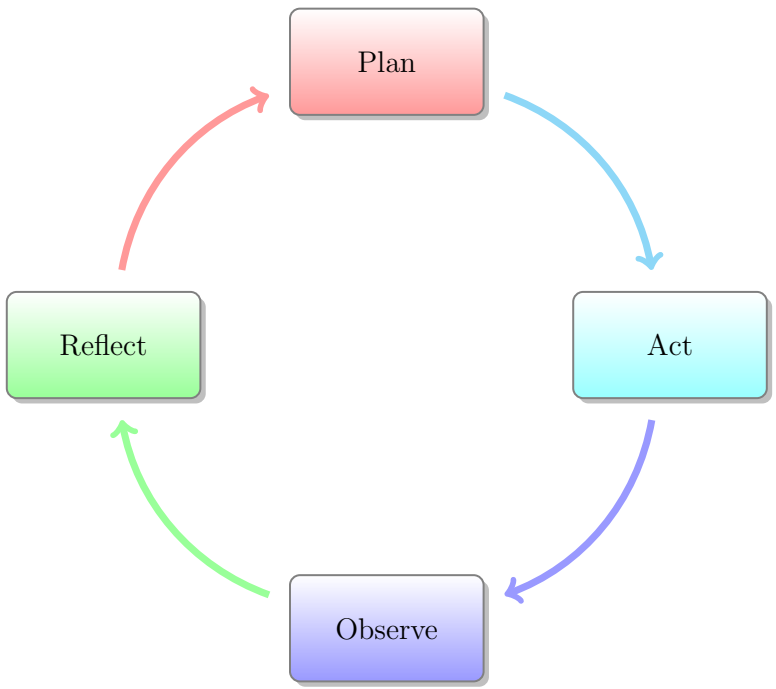
An in-depth study of a phenomenon in a particular instances or small set of instances.

Good for exploration, and in-depth study of a phenomenon, developing hypotheses.

Not (usually) generalizable

# Action research

The researcher introduces an intervention as an active participant in an organization. Similar to case study, except that researcher is an active participant, not just an observer.




Good for developing and confirming hypotheses.

# Survey

A study of human subjects who answer a questionnaire comprising open and/or closed-ended questions:

open-ended "Fill in the blank" style questions where participants write narrative answers.

closed-ended Questions with a fixed set of answers (rating scale, multiple choice)

Good for confirming hypotheses; generalizable.

# Observation

A study that compares a set of subjects to a control group, where the researcher does not have control over the intervention or setting.

Less expensive than experiments.

# Experiment

Test of a cause-effect relationship between an intervention and an outcome, with as many variables controlled as possible.

Comparison of control and treatment groups. Generalizable, when sample is representative.

# Philosophical

Attempts to establish or overturn hypotheses based on argumentation rather than empirical study.

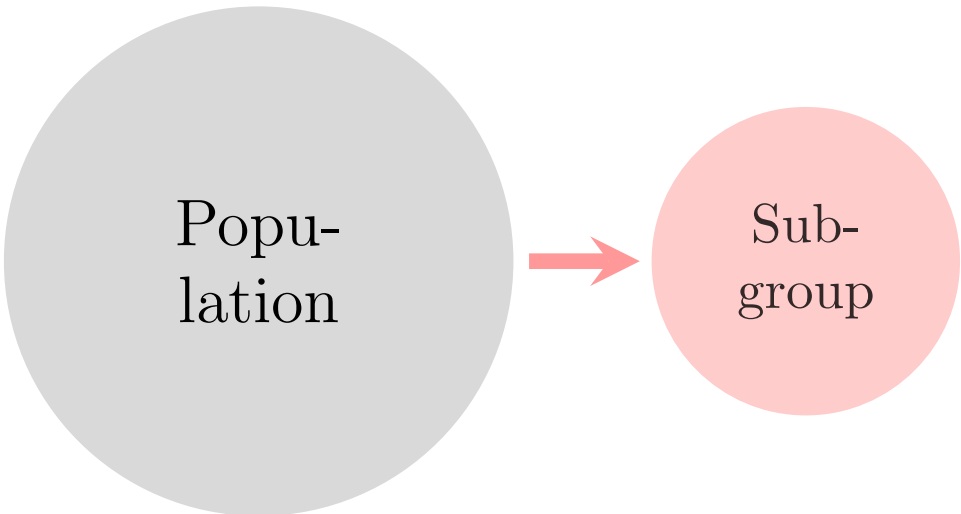
Not really a *research* method.

# Organization

# Cohort

An examination of a sub-group of a population, to establish some kind of statistical difference resulting from an intervention.

The sub-group shares a characteristic that distinguishes it from the general population, which may be the result of an intervention.




Example: students who use pair programming in lab exercises.

# Cross-section

An examination of *existing* differences among sub-groups of a population.


Example: projects that use agile vs hybrid methods.

# Longitudinal

A study that occurs over an extended period of time, in attempt to assess the lasting effect of an intervention.

Example: programmer productivity at the beginning of the COVID-19 pandemic, vs. now[3]

[3] NicCanna et al, “Globally Distributed Development during COVID-19.” To appear, Workshop on Software Engineering Research and Industrial Practice, 2020.

# Sequential

Research is staged, and results of one stage influence design of next stage.

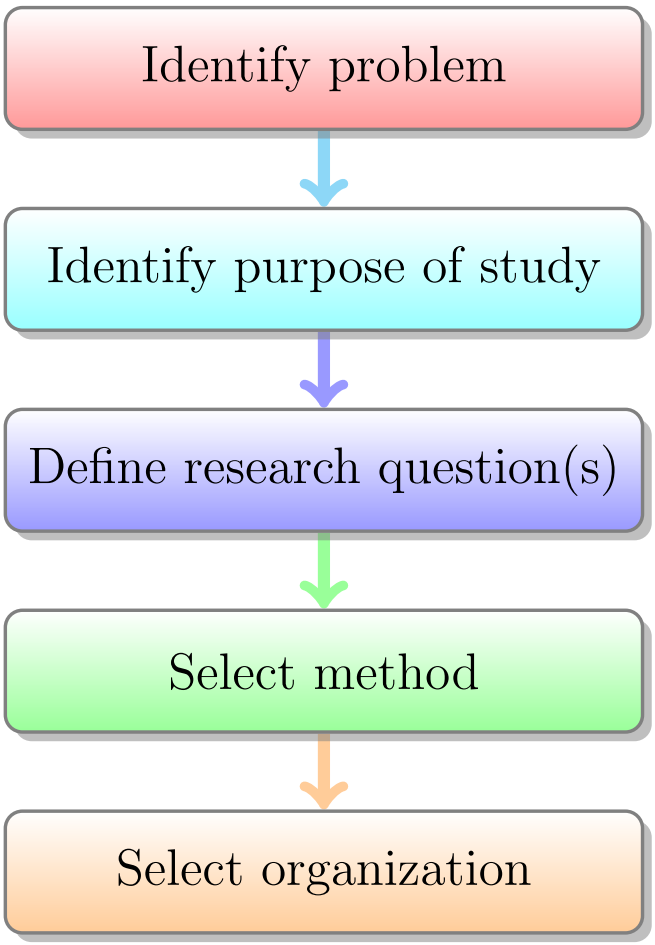

Example: software engineer motivation:

# Historical

Attempts to support (or refute) a hypothesis based on historical evidence.

# Process

# Research Design Process



# Identify Purpose

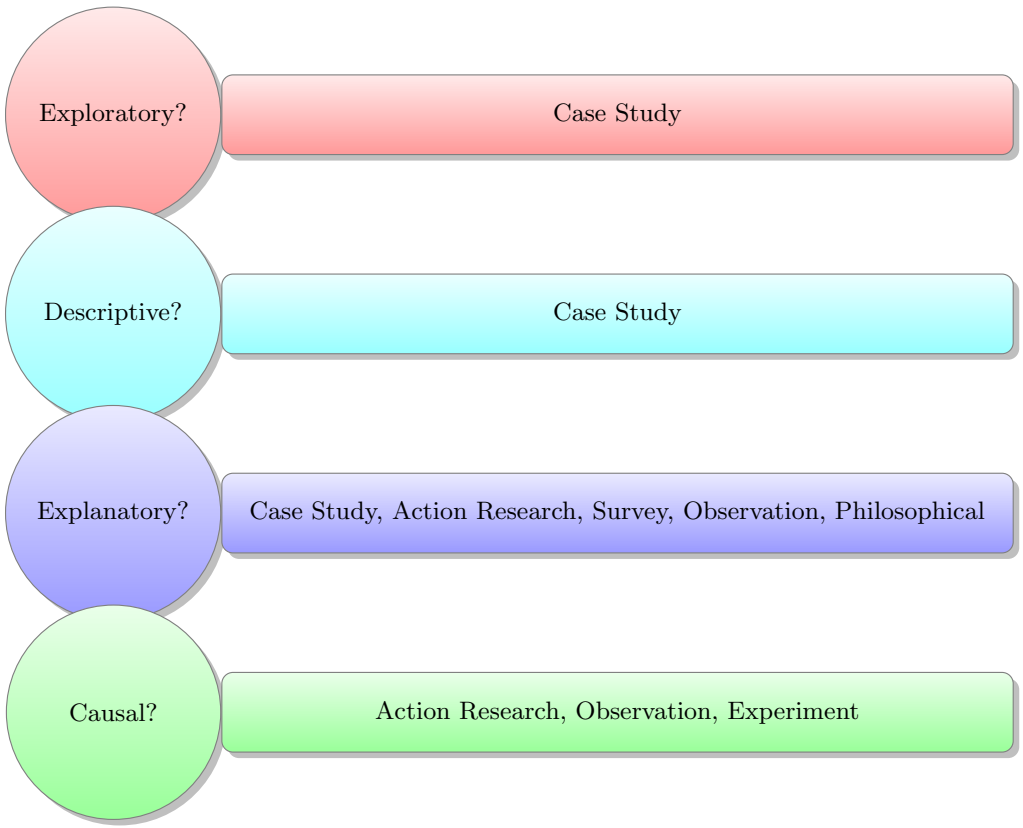
- Something new? *Exploratory*.
- Phenomenon *identified*? *Descriptive*.
- Phenomenon *described*? *Explanatory*.
- Phenomenon *explained*? *Causal*.

# Define Research Question

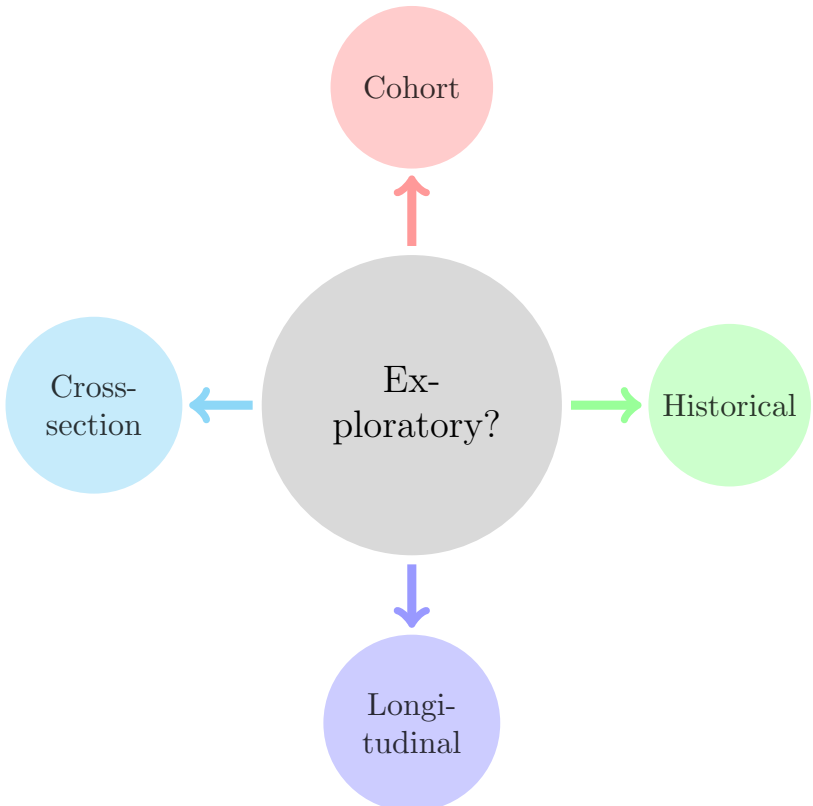
Specify:

- context,
- population,
- intervention,
- comparison,
- outcomes.

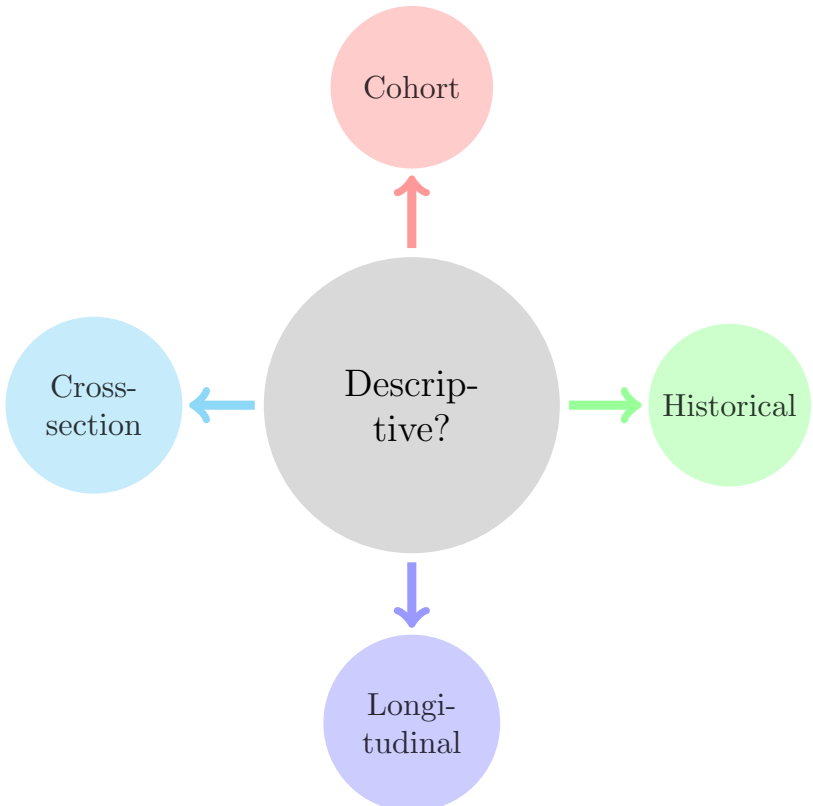
# Select Method



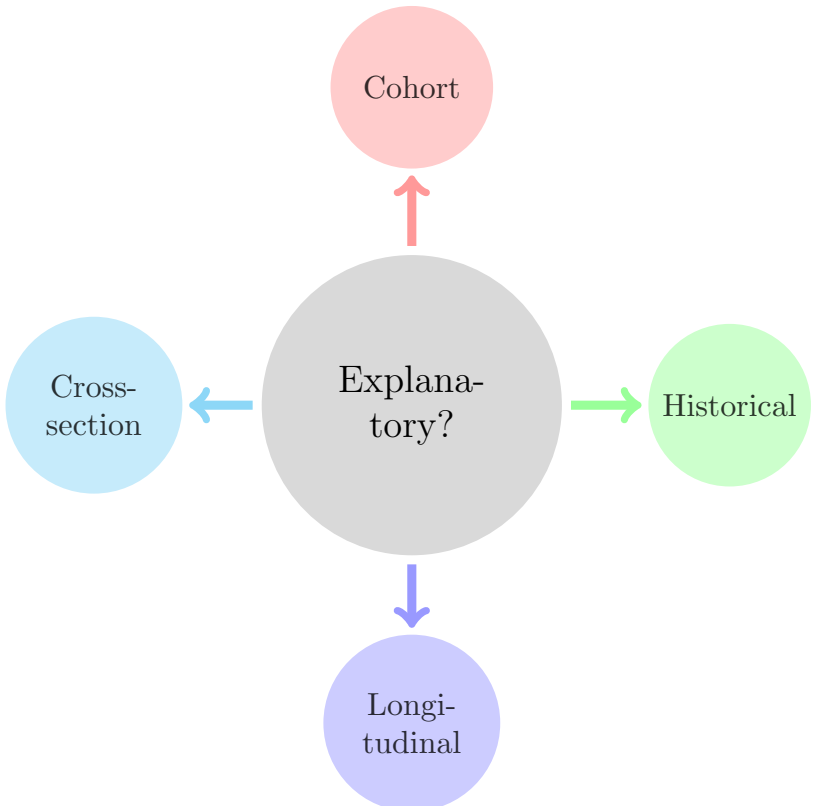
# Select Organization: exploratory



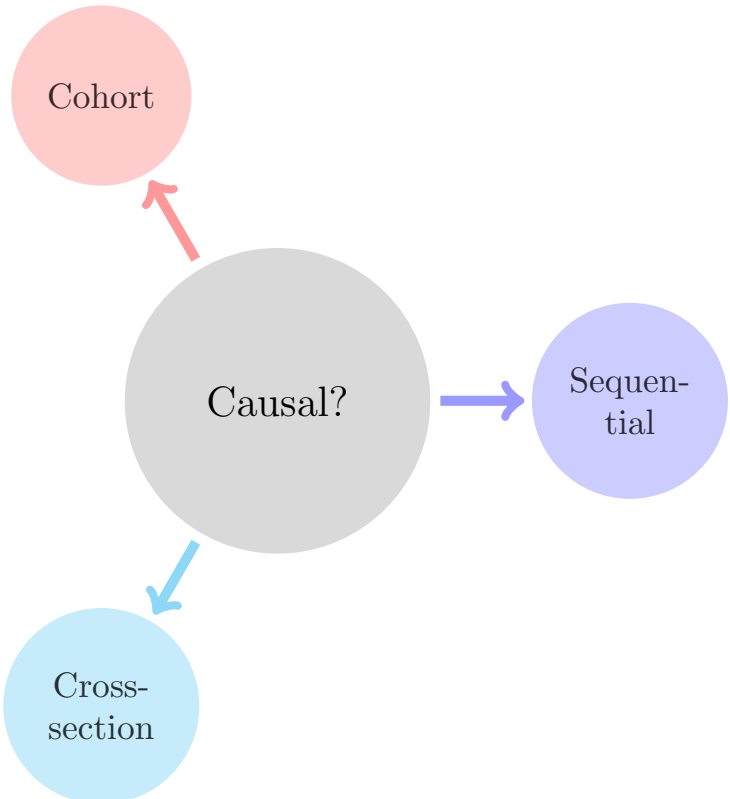
# Select Organization: descriptive



# Select Organization: explanatory



# Select Organization: causal



# Example

Beecham & Noll, “What motivates software engineers working in global software development?”[4]

1. Problem: *Software engineer motivation*
2. Purpose: *Explanatory*
3. RQ: *What motivates software engineers working in a global environment?*
4. Method: *Open ended survey*
5. Organization: *Cohort* (GSD vs. others)

[4] Sarah Beecham and John Noll, “What motivates software engineers working in global software development?” Proceedings of the International Conference on Product-Focused Software Process Improvement”, Bolzano, Italy, 2015

# Summary

- There are many ways to investigate a problem.
- Choice of approach depends on
  - maturity of problem;
  - question being asked;
  - resources available.
- *Any* research involving human subjects *must* have approval from the University Research Ethics Board.