

# Avoiding biases in empirical research

CS-E5200 Design project

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4 February 2019

# Definition



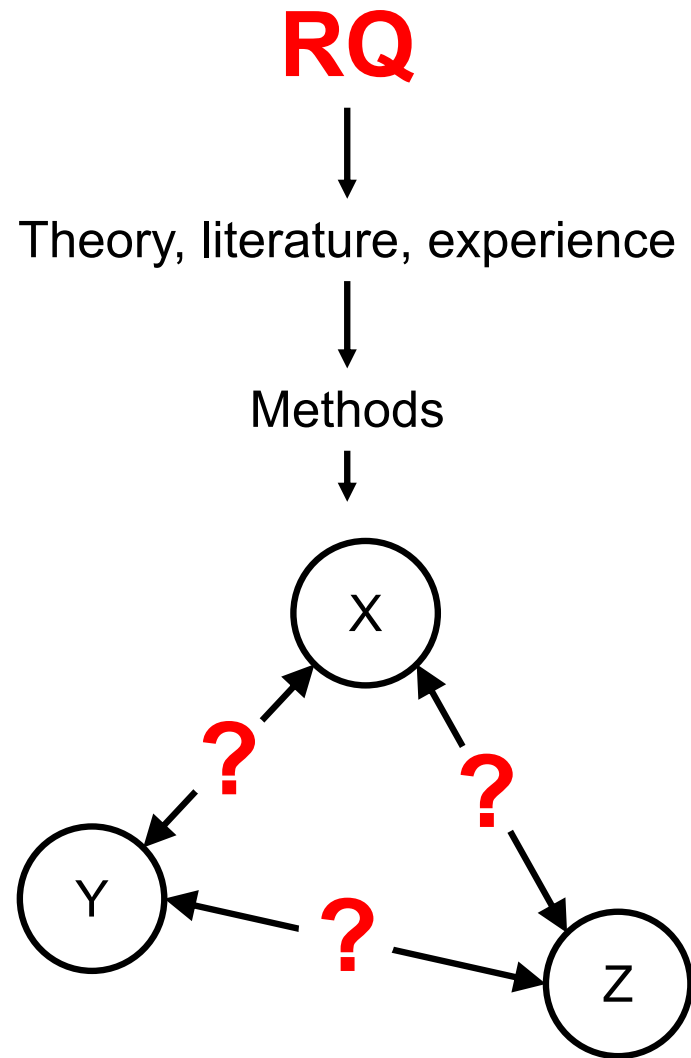
The function of a **research design** is to ensure that the evidence obtained enables us to answer the initial question as unambiguously as possible.

1. Research  
question

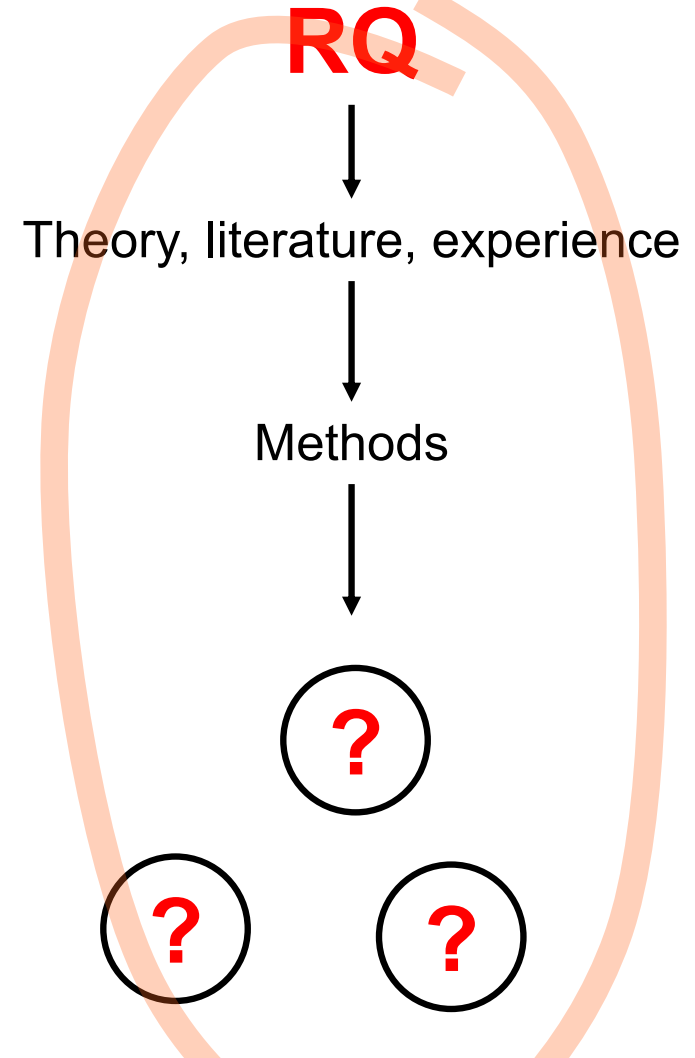


2. Method

# “Bringing order to chaos”



Relationships between elements

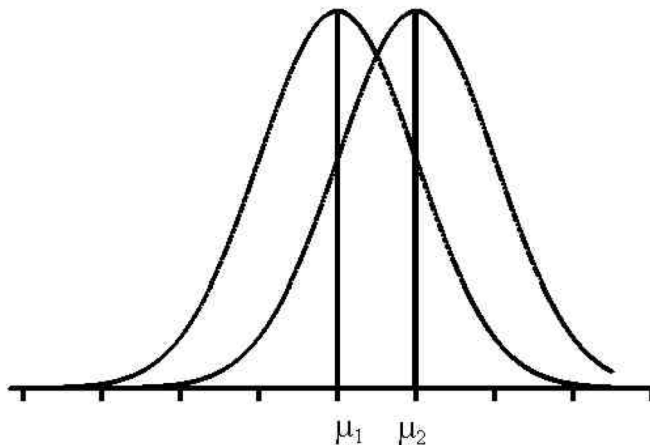


Identifying the elements

# What are we aiming for?

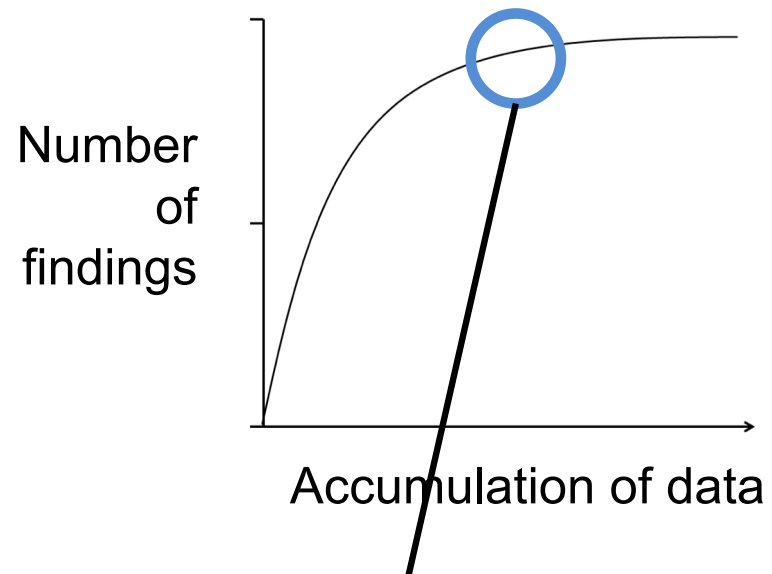
## Quantitative research:

Statistically significant differences between conditions



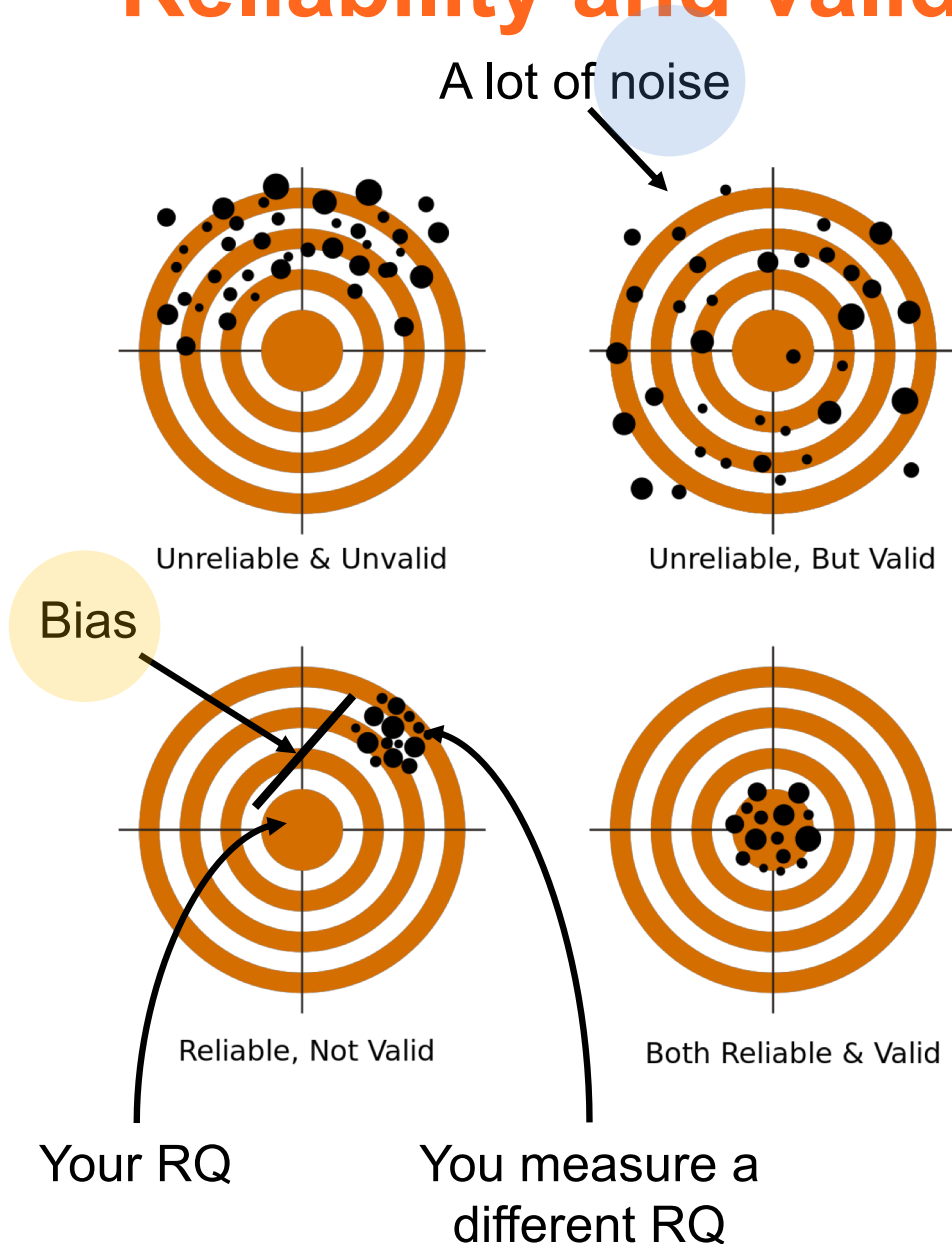
## Qualitative research:

Saturation of observations



Point of saturation: When new data does not increase your understanding

# Reliability and validity of a method



Validity:

= method measures the intended RQ

~ Bias

Reliability:

= method measures the RQ with good detail

~ Noise

Both criteria should be met in a good method

# Sub-categories of validity

## Internal validity

Have the methods been used correctly?

Ask only such RQs for which methods exist, and apply those methods correctly

## External validity

Do the findings generalize to the general population?

Use representative users in your studies

## Construct validity

Do the constructs represent what the researcher intends to study?

Triangulate your constructs and avoid inventing new measures

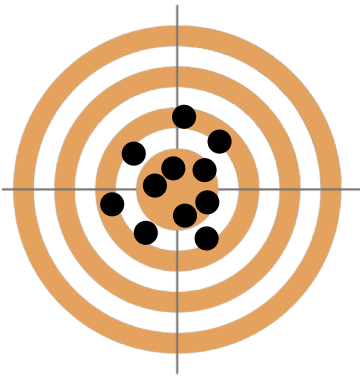
## Ecological validity

Does the study investigate a phenomenon that is relevant also “in real life”?

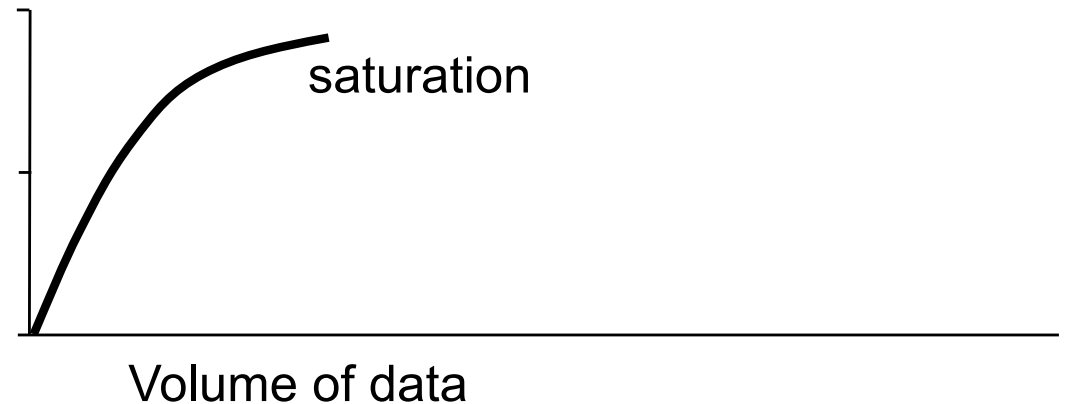
Before the study, go through its research design with expert users

# Why open-endedness should be minimized?

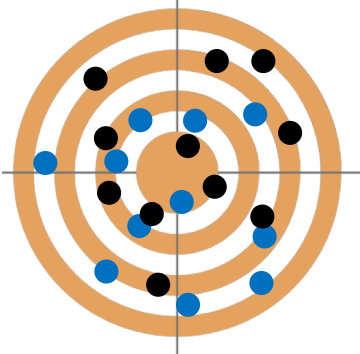
Tightly  
scoped  
research:



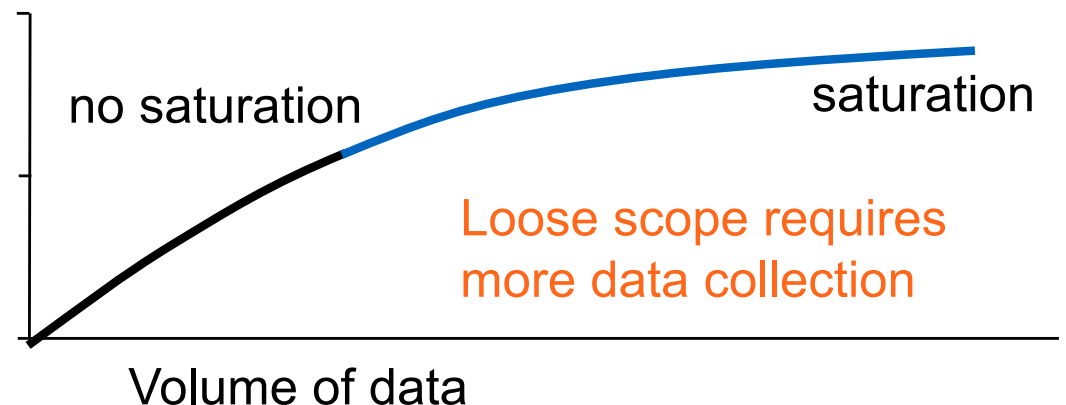
Number  
of  
findings



Loosely  
scoped  
research:



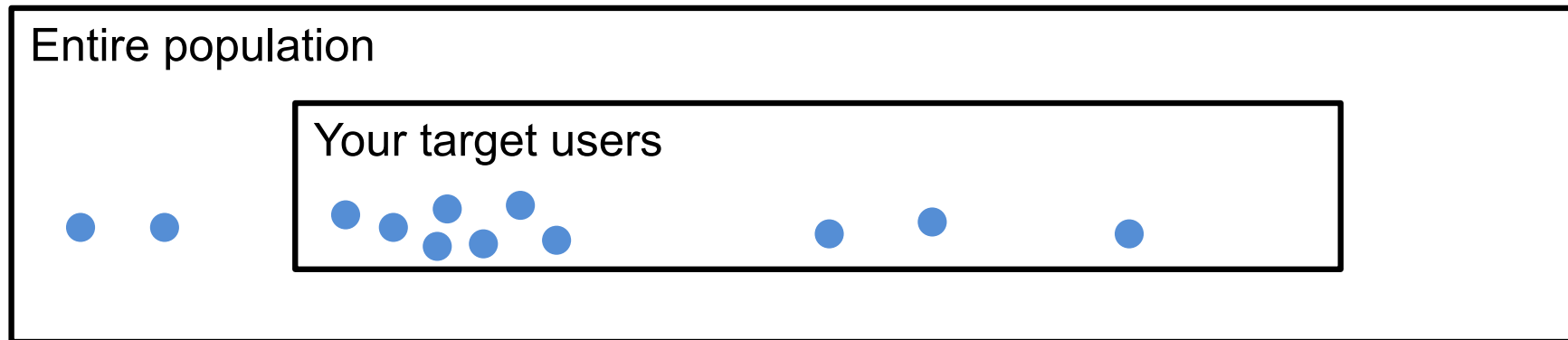
Number  
of  
findings



Typical result of  
excessive open-  
endedness

# Reliability and validity in data collection

Who are your target users (your “sampling frame”)?



If you study these people, what reliability and validity problems does your method have?



# Different sampling (recruitment) strategies

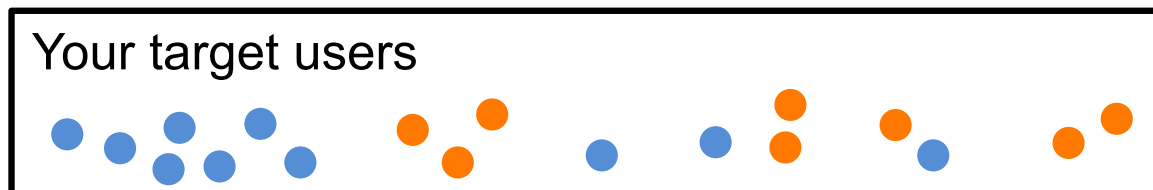
## Random sampling

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

Random sampling is possible only in research on non-humans or by governmental institutions

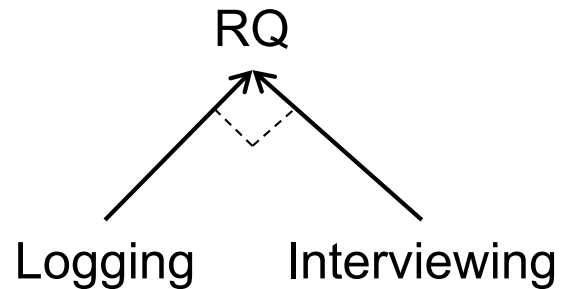
## Convenience sampling

Studying people who you have a good access to



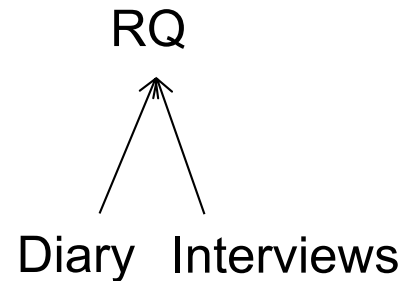
# The benefits of multiple methods

Triangulation:



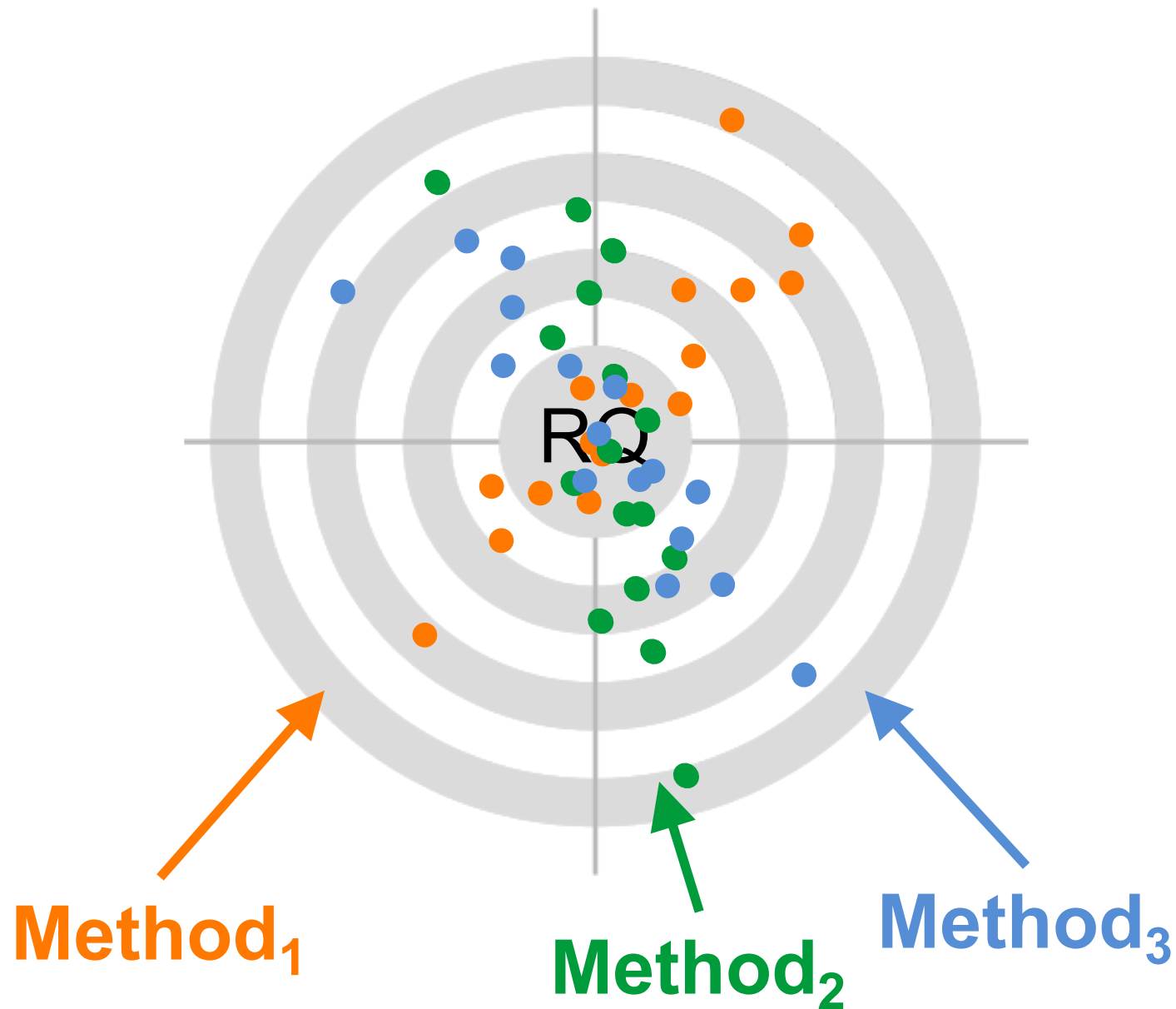
**Improves validity**

Redundancy:

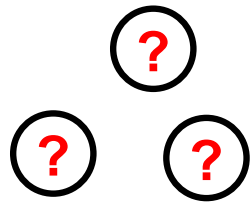


**Improves reliability**

# Operationalization with several methods



# Two research approaches



## Hypothesis induction:

When you are searching for possible patterns

Proceeds from data to theories and hypotheses

Philosophy: inductive and abductive inferencing  
(from data to patterns or from data to speculative possibilities – “it could be this way”)

## Hypothesis evaluation:

When you have an educated guess about the pattern, and you want to verify it

Can also be a comparison:  $a$  vs  $b$

Proceeds from theories to data

Philosophy: falsification (trying to disprove the hypothesis, to see if it really holds)

“I think that  $p$ !  
but am I right?”

# Summary

Aim for high reliability and high validity

Perfect methods are always impossible, but it is beneficial to be able to choose where you are willing to compromise

Use many methods to reach triangulation and to have redundancy