SOCIAL RESEARCH METHODS

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Lecture for Bachelor Students

What this course is all about

Social

Human behavior and experience, social realities

Research

Understanding the truth. We assume, there is a truth out there

Methods

Vehicles or ways to systematically get to the truth based on evidence

About this Course

Combination of lecture, exercises during class and students' studies

In groups of two to three, students will conduct own studies to answer own research questions

Students support each other across groups (peer support)

Regular attendance and contribution will be extremely helpful

Students' evaluation will be based on both presentation (50%) and a final report (50%)

Final presentation will last 10 minutes and will take place in the very last session

Throughout the course professor acts as a coach and enabler, not as boss. Students are responsible.

All slides used during the course are available in printed and PDF-format

Recommended book (helpful but not required): Bryman, A. (2015). Social Research Methods. Oxford.

Learning Objectives

After having finished this course successfully you will …

understand all major **terms and concepts** related to social research methods including elementary statistics

be able to **design and conduct simple studies** based on own research questions and hypotheses

be able to **critically reflect** on studies and study results presented by others

have realized social research methods being **fascinating and fun** (at least sometimes)

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Social Research Methods

Introduction

Example of an empirical evidence reported

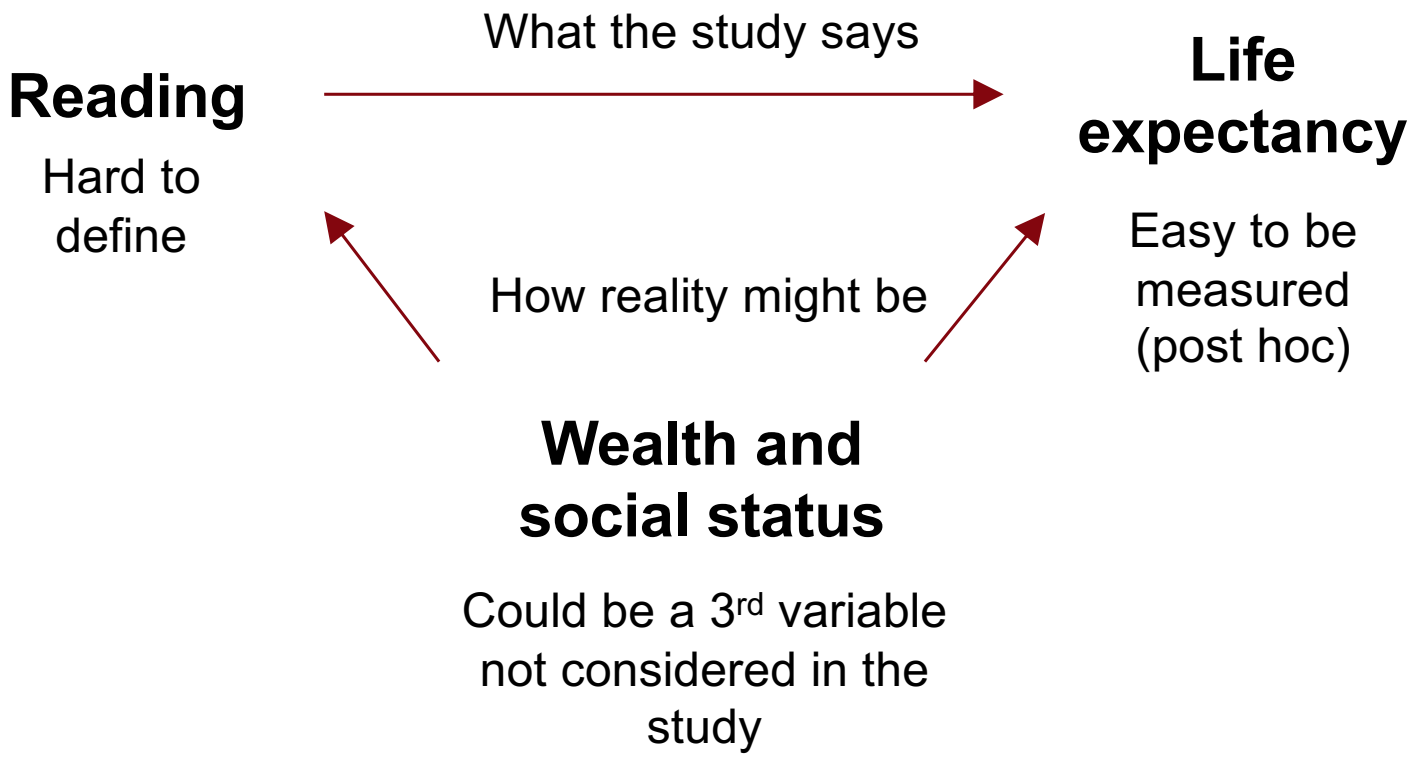
People who read live longer

People using the internet extensively show higher probability to suffer from depression

Unemployment leads to lower life expectancy

Regular caffeine consumption negatively effects sexual potency of men

People who read live longer. Really?



Do not easily rely on every evidence reported in the media

In public media you'll find many evidences proposing various simple causes and effects

Even if they appears as being scientific you should always challenge the research methods applied

Knowledge about (social) research methods are needed to evaluate the validity of evidences reported

What are the variables being considered in a given study and what was the underlying theory?

How where the variables really measured or manipulated?

What was the sample of the study? Was it representative?

Given the research design, can we assume there is a direct cause and effect?

Review of Research Report Example

Briefly walk through the research report handed out by the professor. Just take 10-15 minutes to read it.

In your group, please discuss the following questions:

What is the study reported all about? Just gain a rough understanding. You do not need to understand the report in detail.

What are the main building blocks of this report? How is it structured? Write down everything you detect.

From what you see, how does this report differ from an article published in a newspaper? List all characteristics you detect.

Would you consider this report as rather boring or exciting? On which basis do you make your judgement?

Imagine you'd be required to write a report like this. What would you consider as your most critical challenges?

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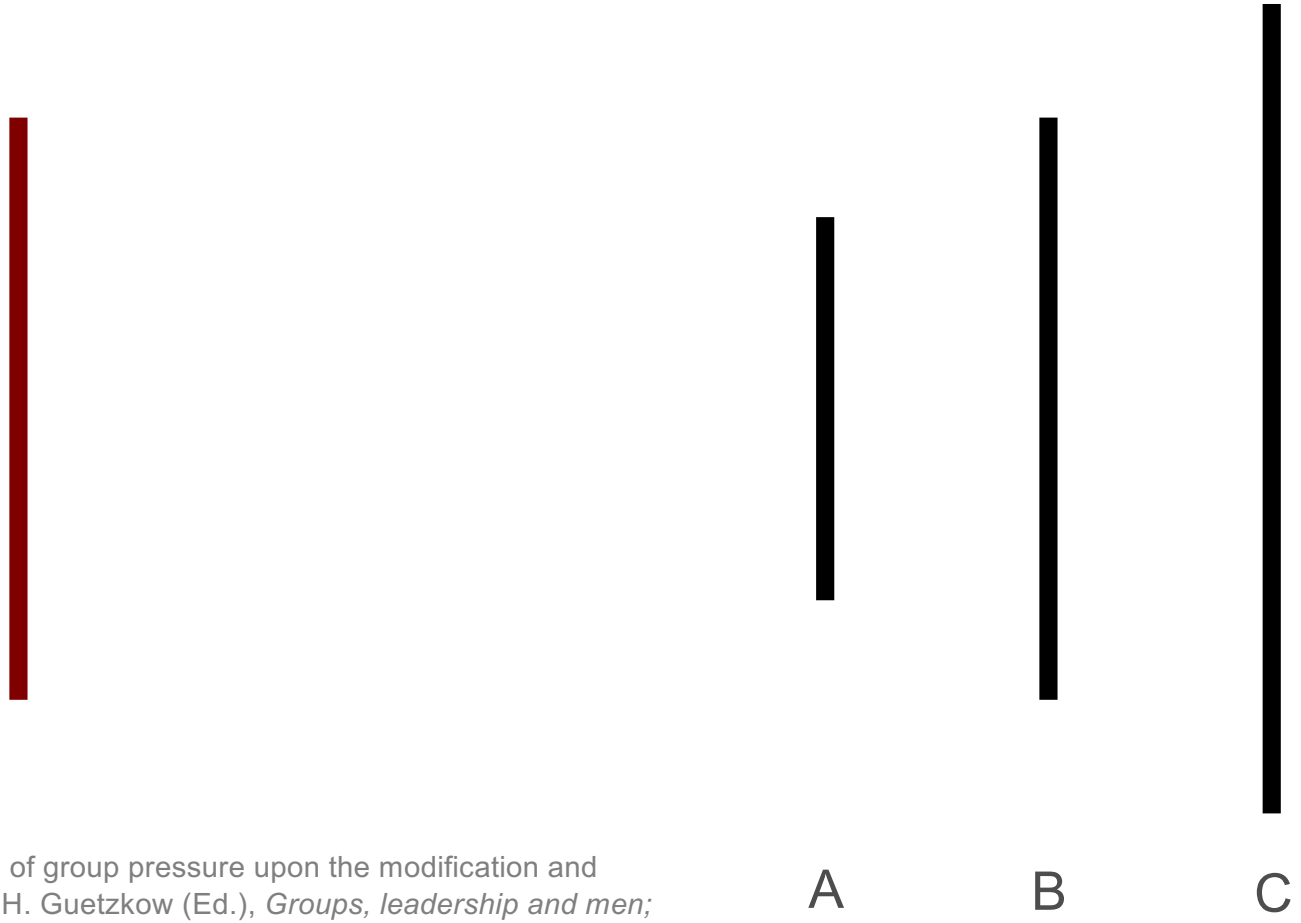
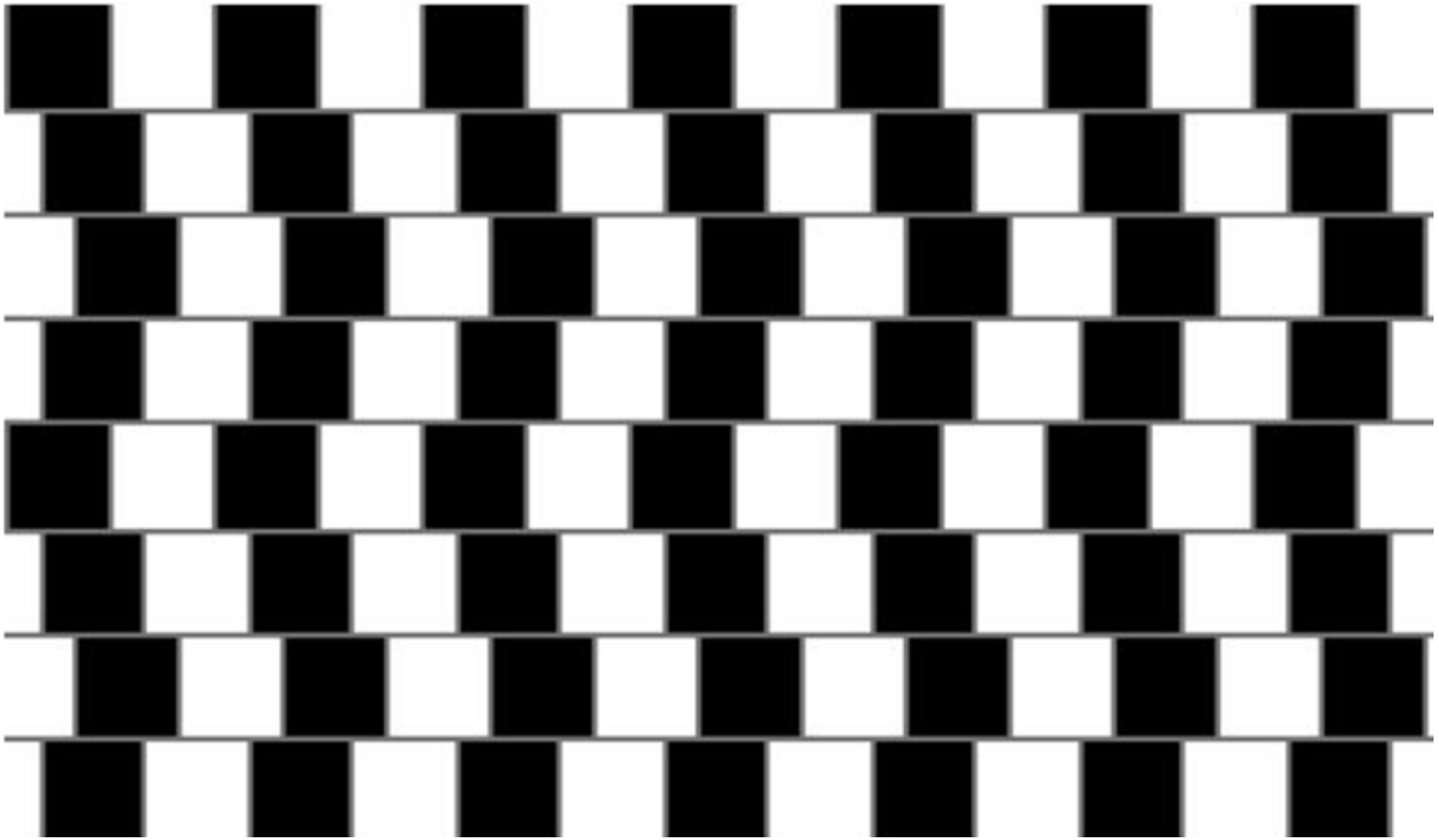
Scientific Research

Asch's Experiment on Majority Influence



Asch, S. E. (1951). Effects of group pressure upon the modification and distortion of judgments. In H. Guetzkow (Ed.), *Groups, leadership and men; research in human relations* (p. 177–190). Carnegie Press.

Optical Illiusion



Monty Hall Problem

1	2	3

Healthy and sick Tissue

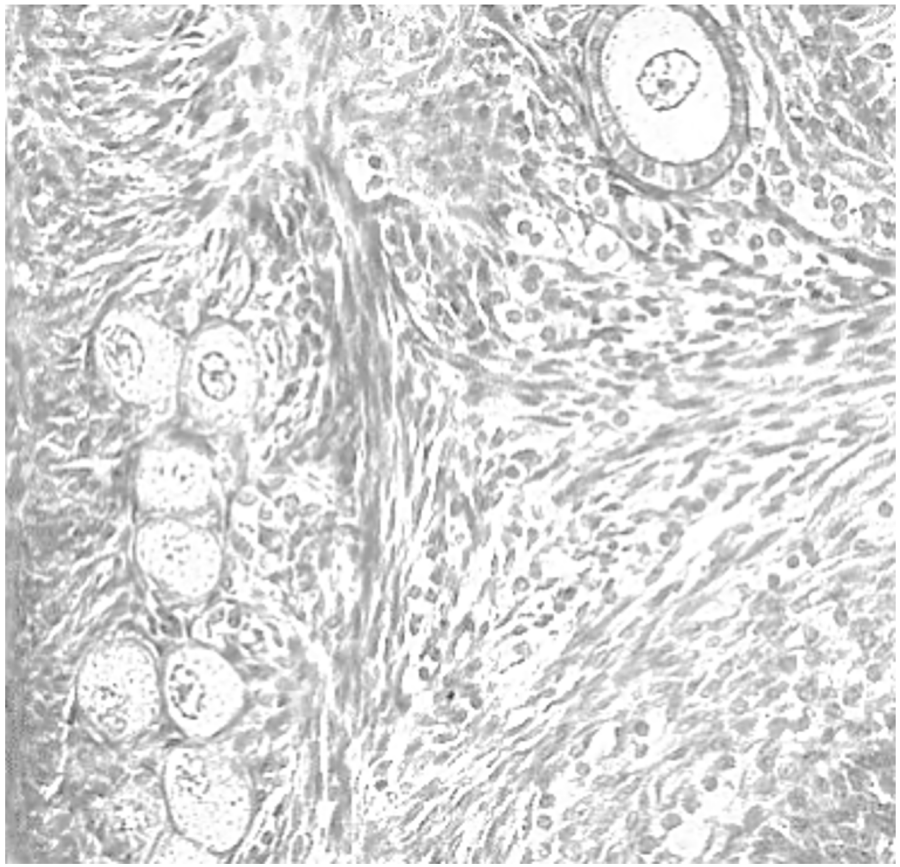
Two subjects where separately presented with pictures of human tissue

They have to find the difference between healthy and sick tissue

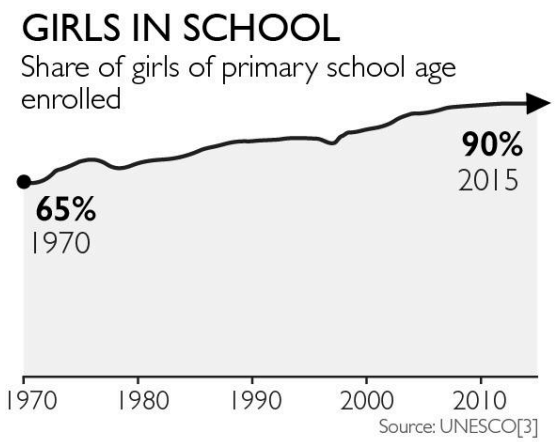
A gets random feedback, **B** gets valid feedback (so, **B** can learn)

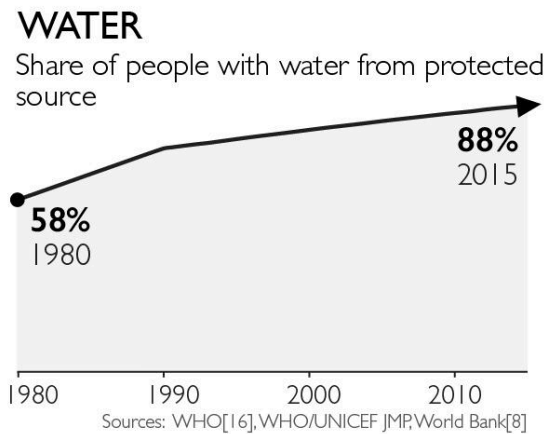
Both present their insights to a group of students

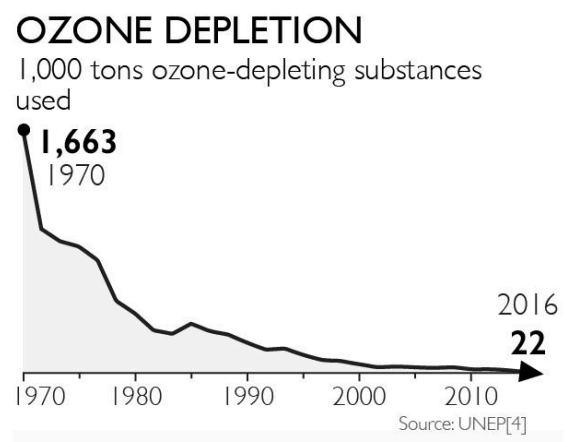
Who has a better clue, **A** or **B**?

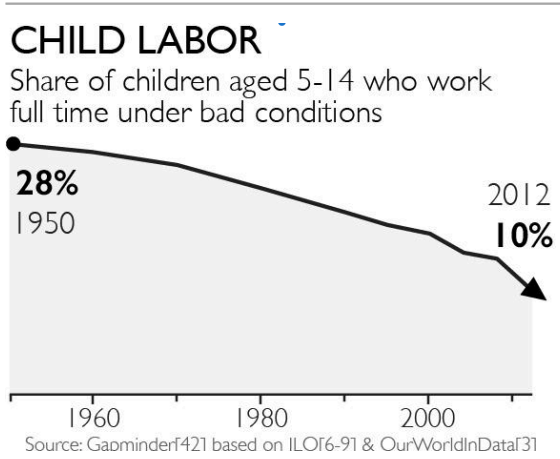


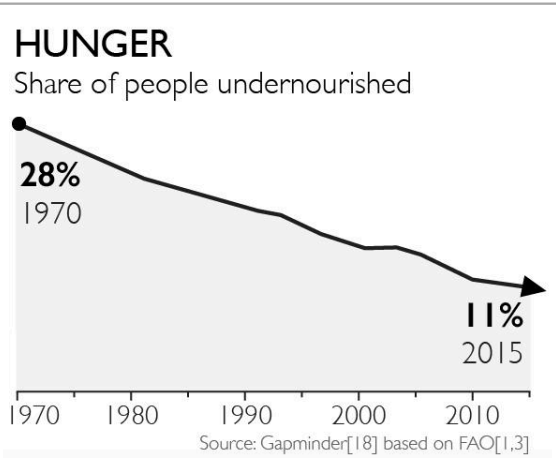
Is the world getting better or worse?

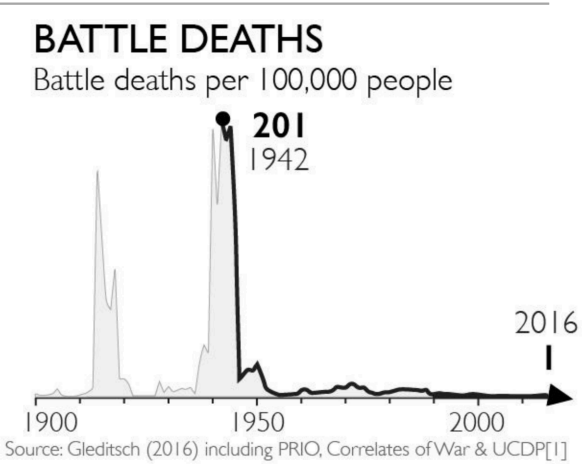










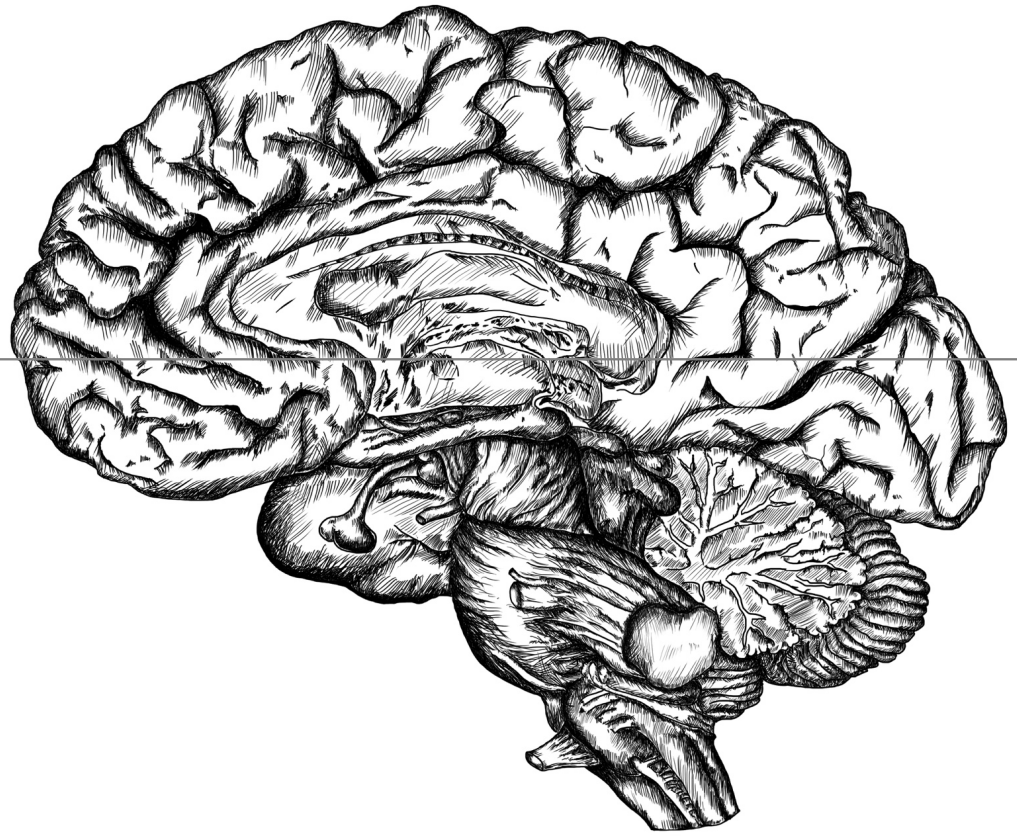


FINISHED FILES ARE THE
RESULT OF YEARS OF SCIENTIFIC
STUDY COMBINED WITH
THE EXPERIENCE OF YEARS

Intuition and Emotions versus rational Cognition

rationale layer

intuitive layer



Cognition versus Intuition

Intuition	Cognition
Old structures, ease, fear, lust, reflexes, anger, first impression, spontaneous reactions, reward, aggression, escape, emotions, subconscious, speed, survival, Freud's Es	New structures, slow thinking, problem solving, empathy, language, empathy, intelligence, prudence, memory, new learning, active reflection, awareness, coping, creativity, Freud's superego **Science belongs to this domain**

Human limitations and the need for scientific research

People's individual under-standing of reality is heavily affected by their social environment

Human senses are not created to see the ultimate truth. They might lead to illusions

Human logic in many cases is too weak to understand what's true or not. We rather tend to feel than think

Human cognition typically is more about being efficient than about being reliable. We tend to reduce the complexity of the world

Human beings by nature are biased in seeing the truth by using the senses and cognition

Good scientific research

Objectivity. Entire research process must be independent from the researcher. It's not about the researcher – it's about the truth

Systematic. All research activities are done in a structured (not random or spontaneous) and conscious manner

Repeatable. A study must be replicable (fully controlled) by other researchers in exactly the same way

Generalizability. Research must lead to result being generalizable to entire population

Theory. Research must lead to a theory or test a theory. At the end it's all about theories.

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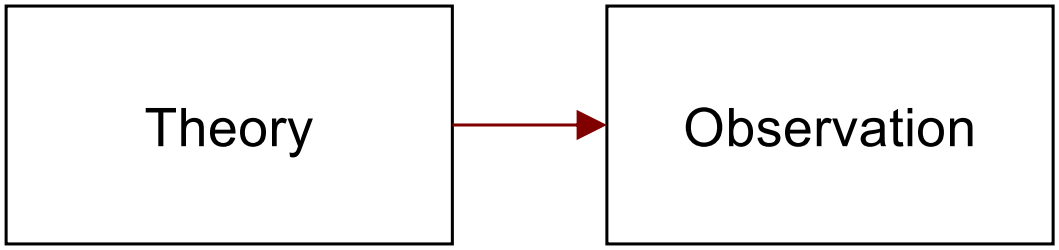
Social Research Methods

Research Question and Hypothesis

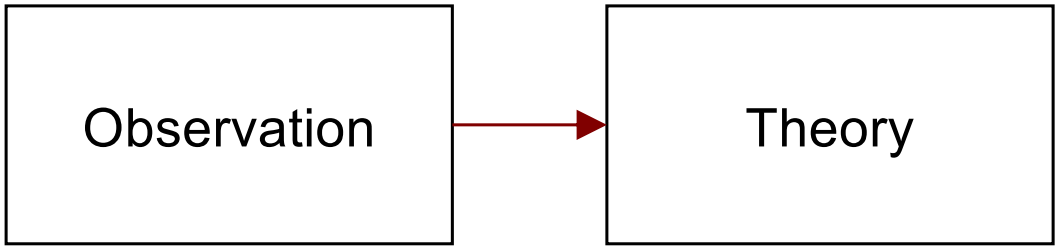
Deduction versus Induction

Deductive approach



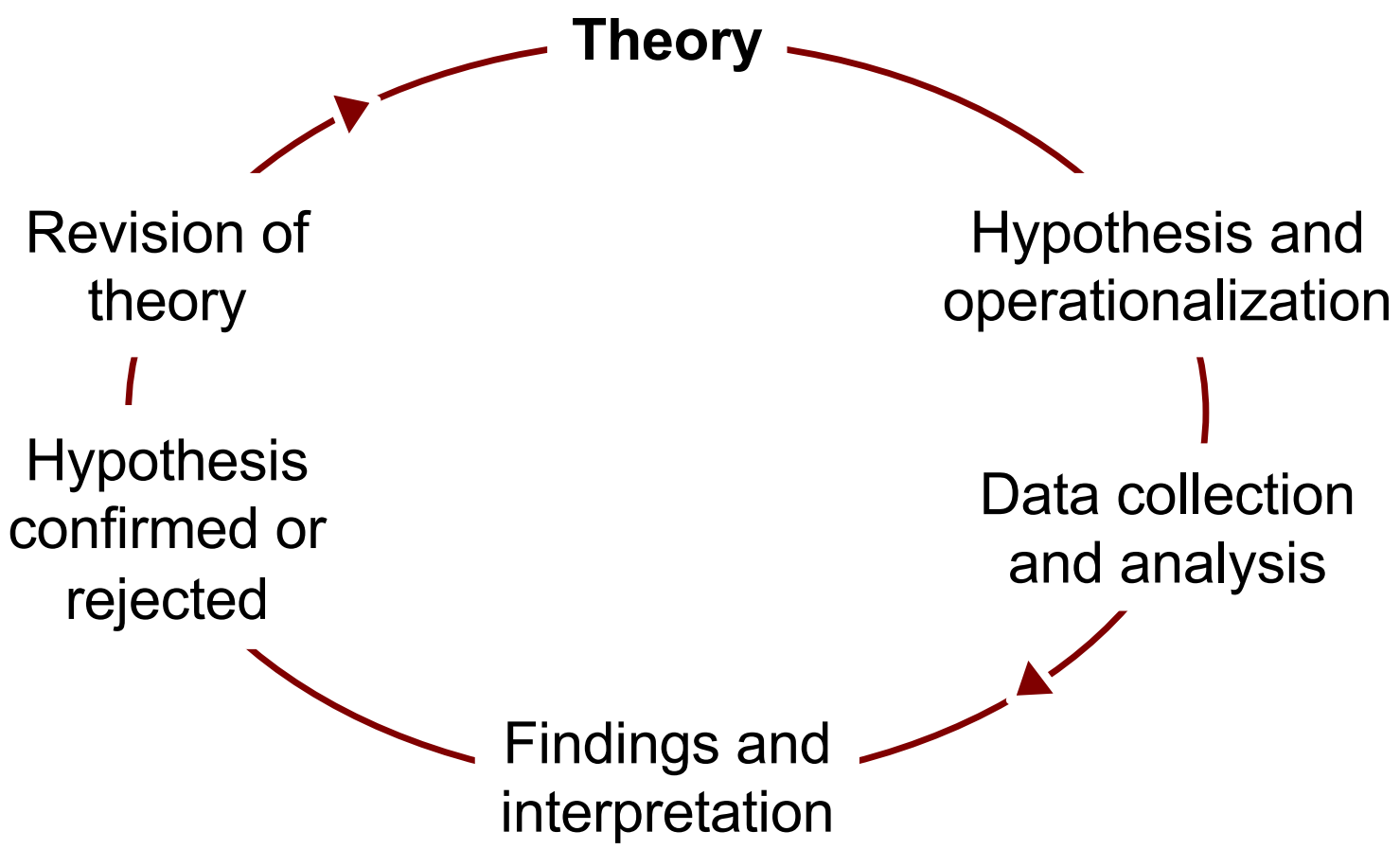
Hypotheses are drawn from a pre-defined theory and tested against quantitative observation and empirical findings (positivism)

Inductive approach



Systematic (qualitative) observations and empirical findings are used to infer hypotheses and theories

Deductive Research Cycle



Example of a theory | Social loafing

Max **Ringelmann** has shown that people in groups reduce their individual efforts

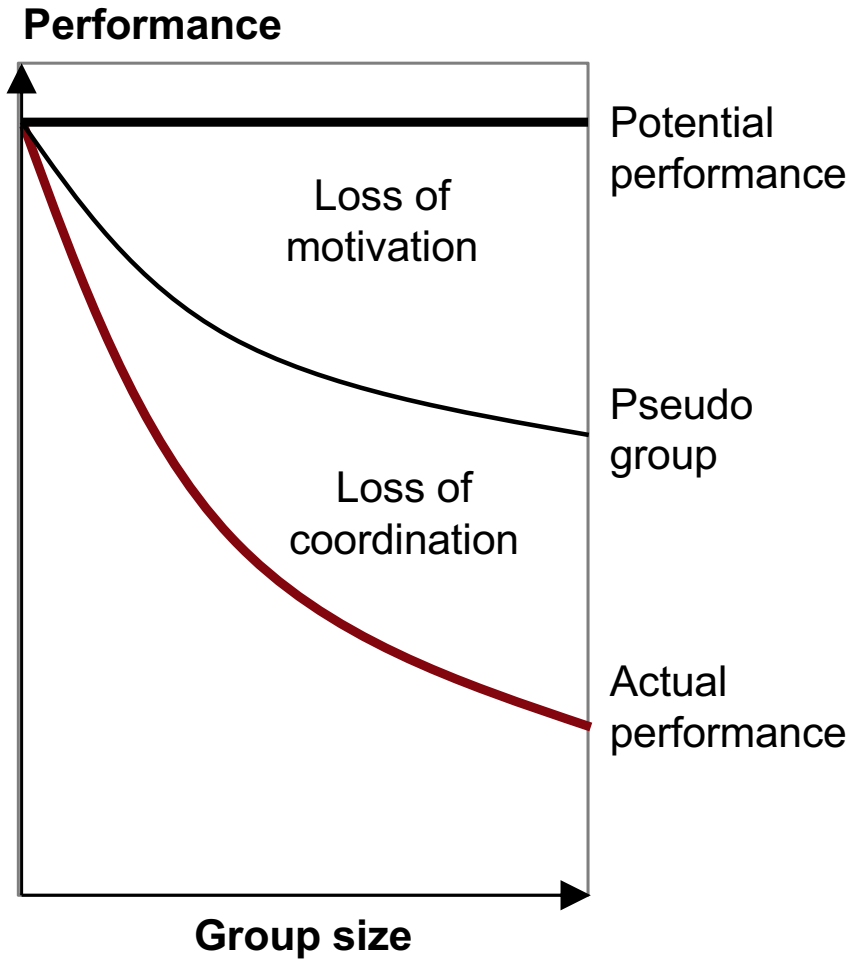
These effects can be observed primarily in **additive tasks**

Loss of motivation is due to lower motivation (free rider effect)

Pseudo groups measure the performance of individuals when they mistakenly believe there is a group

Free-rider effects can be prevented by performance **transparency**

Loss of coordination results from uncoordinated efforts



Operationalization (Example)

Theory
What you want to proof

Groups of various sizes jointly pull a robe (pseudo group)

Measurement of the individual performance

Operationalization
What you actually do as part of your research in terms of manipulation or measurement

Hypothesis

Hypotheses are the building blocks of any theory

They assume (causal) relationship between (at least) two variables

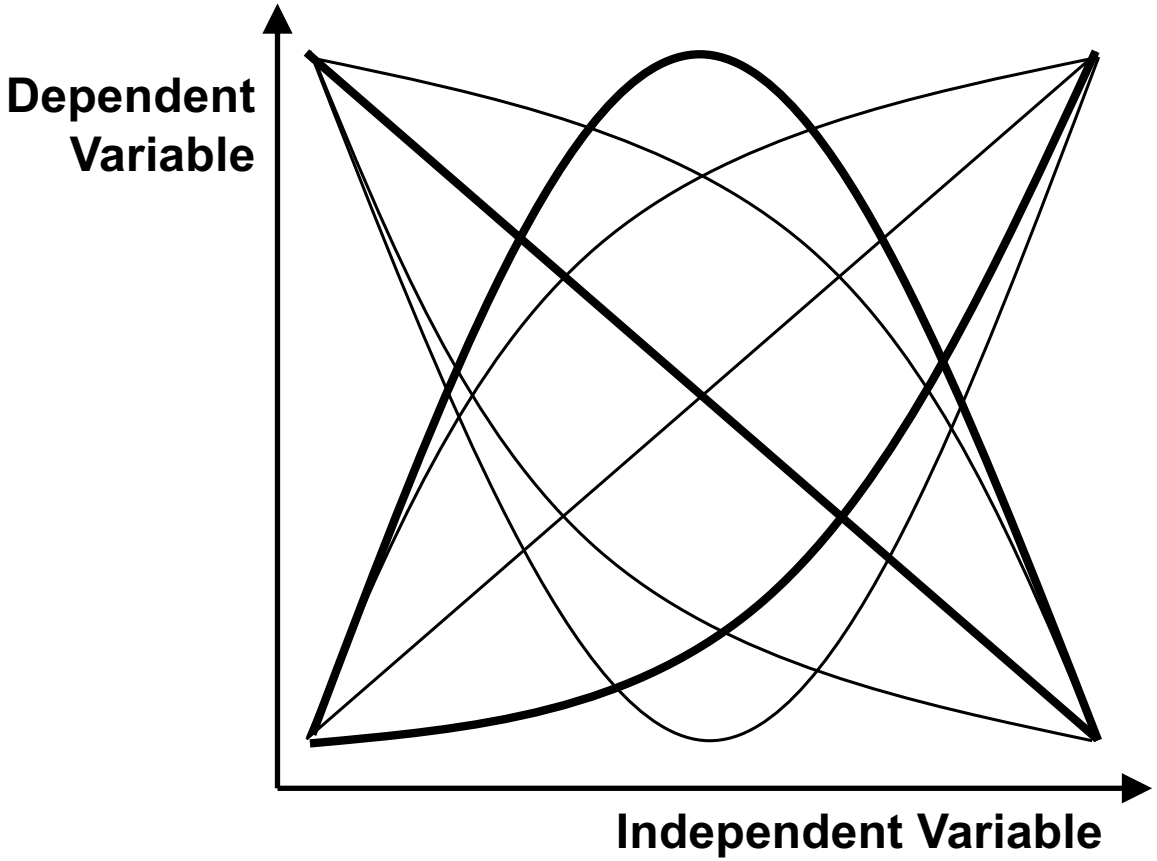
The independent variable (IV) has a direct (causal) effect on the dependent variable (DV)

If X_{IV}, then Y_{DV}. The more X_{IV}, the more/less Y_{DV}

Relationship must not be linear

Independent variable IV → **Dependent variable DV**

Potential relationships between IV and DV

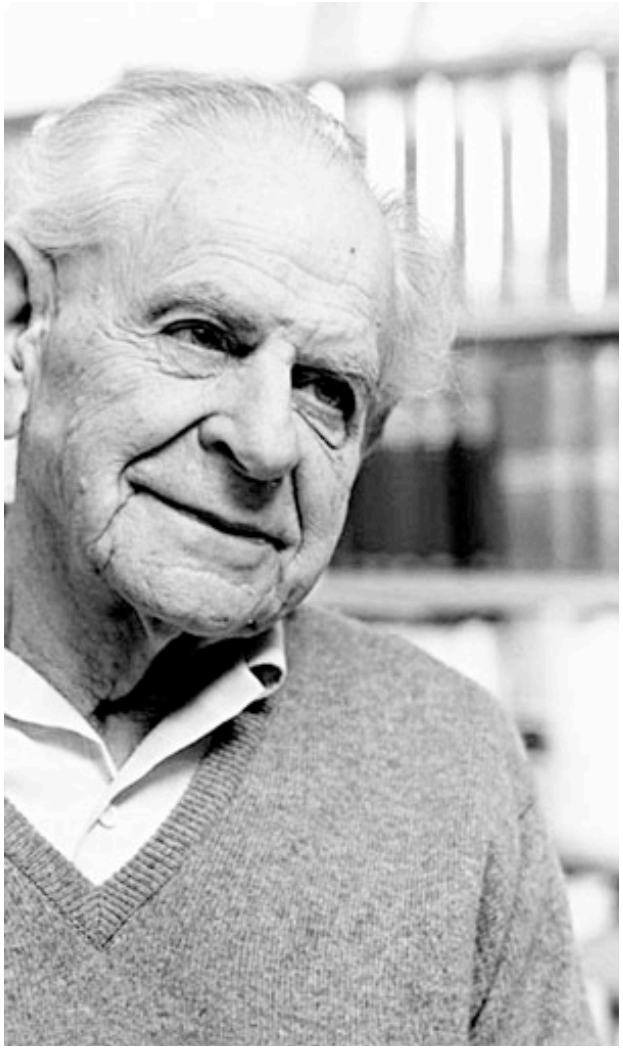


Relationships between IV and DV can show all kind of forms

They could be …

- Linear/non-linear
- Positive/negative
- U-shaped/reversed u-shaped
- Exponential/logarithmic

Critical rationalism

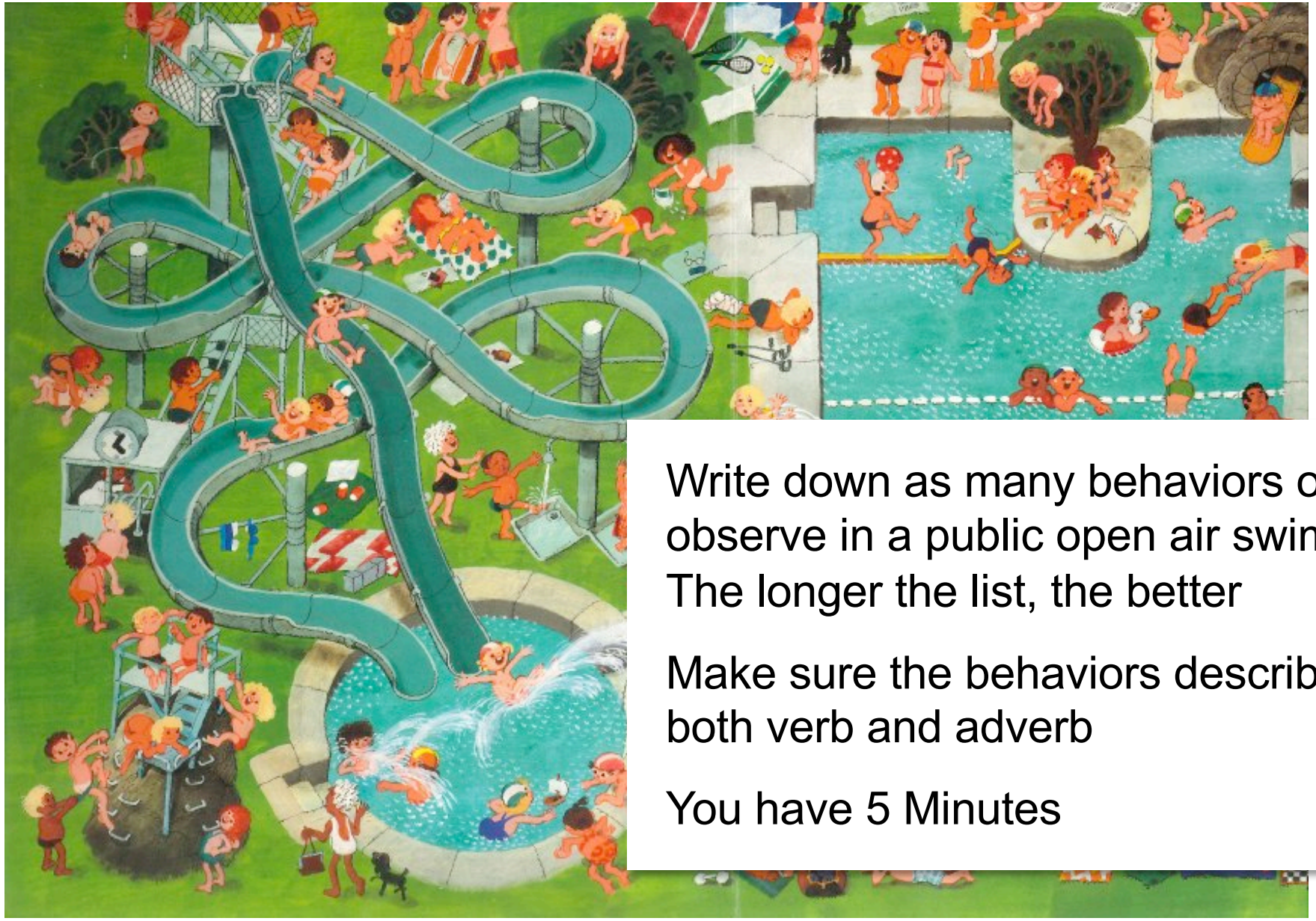


An **epistemological** view on how science is supposed to work (Conjectures and Refutations, Logik der Forschung, by **Karl Popper**, 1934)

The pitfall of **induction** and **positivism**: evidence will never be able to proof a hypothesis being ultimately true

Empirical evidence is only supposed to reject an hypothesis (**falsification**)

Popper recommends the creation if **bold hypothesis** (kühne These), that could be rejected



Write down as many behaviors one might observe in a public open air swimming pool. The longer the list, the better

Make sure the behaviors describe include both verb and adverb

You have 5 Minutes

Nine Rules for your Research Question Definition

Everything is allowed. Really. Your study must not relate to business

Your hypothesis assumes a **relation** between an independent and dependent variable

Your research question should be about **human** behaviour (not of animals, plants, economies etc.)

Do not put yourself or others in an **embarrassing** or **dangerous** situation

Your research question must be **special**. Be curious and creative!

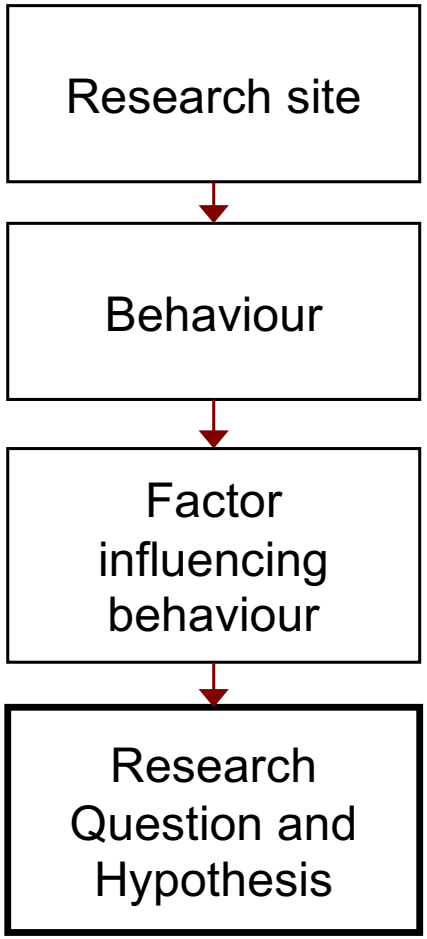
Make sure others will find your research question kind of **interesting** and cool. Do not bore others!

Avoid playing an **active part** in your research setting. Better keep a distance to your subjects

Be aware of the limitations of your **resources**. Data collection should be doable over the course of a single afternoon.

Avoid independent variables like **gender** and **age**. Your study might turn out to be boring

Steps to define your Research Question



Define an environment or setting where you want to observe/measure human behaviour (e.g. bar, campus, shop, street)

Identify any kind of human behaviour and related concepts you want to explain (dependent variable)

Think about measurable factors (independent variable) that might influence the behaviour/concept, you want to observe/measure

Note: There is an endless variety of potential research questions. Better do not stick to your very first idea. There probably is a better one. Get inspired by visiting multiple research sites.

Write your research proposal

On a single page, your written **research proposal** should pointedly provide clear answers to the following questions:

What is your **independent variable**, what your **dependent variable** both on **theoretical** and **operational** level?

What is your **hypothesis** and why do you belief your hypothesis is supposed to be true (**theoretical explanation**)?

How do you either **manipulate** or **measure** your **independent variable**? Which method do you intend to use?

How will you **measure** your **dependent variable**? Which method will you apply?

Why do you think, your research question will be considered as being **relevant** and **new?**

What are relevant **references**, directly related to the topic?

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Social Research Methods

Measurement

Concepts

Job satisfaction • motivation • ambition • cognitive intelligence • leadership culture • customer satisfaction • consumer preferences • health • social status • power • happiness • stress • empathy • group cohesion • friendship • optimism • purchasing power • temperature • weight • political sentiment • attitude

From a scientific perspective we assume concepts to be there, although we have never seen them. Concepts are used to explain and predict the behaviour of individuals and groups.

The case of consumer satisfaction as an intangible concept

In marketing research their is the idea of **consumer satisfaction**

You can‘t see consumer satisfaction. You only could see indicators

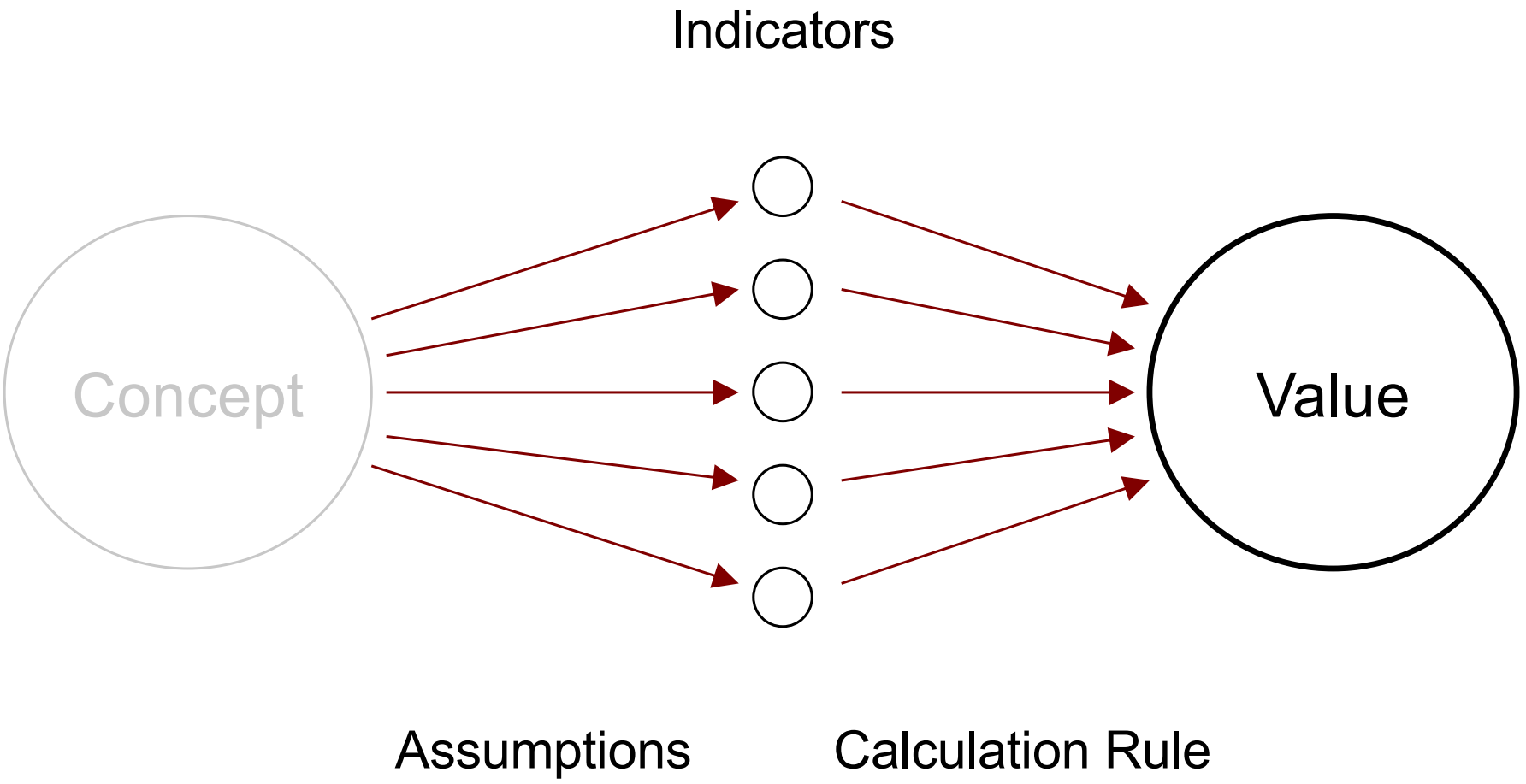
We do not even know, whether consumer satisfaction really exists

Consumer satisfaction seems to explain consumer behaviour (e.g. brand loyalty, recommendations)

If there is something like a consumer satisfaction …

- where is it located in the brain?
- does consumer satisfaction relate to a single factor or to multiple factors?
- how many consumer satisfactions do people have?
- is consumer satisfaction stable over time?

Making Concepts visible through Indicators



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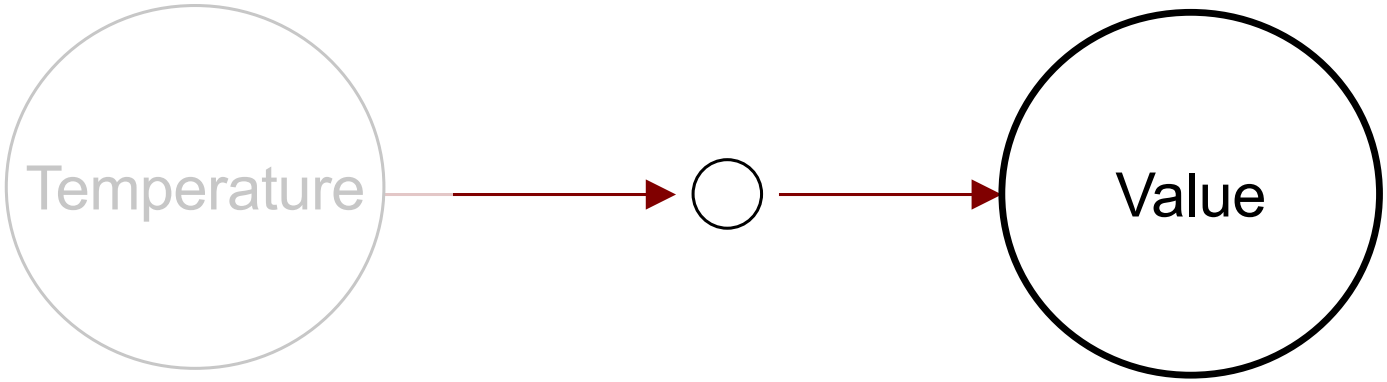


Assumptions related to measurement

You always apply underlying **assumptions** when measuring something

This idea is especially relevant when measuring **intangible** concepts (like in social research)

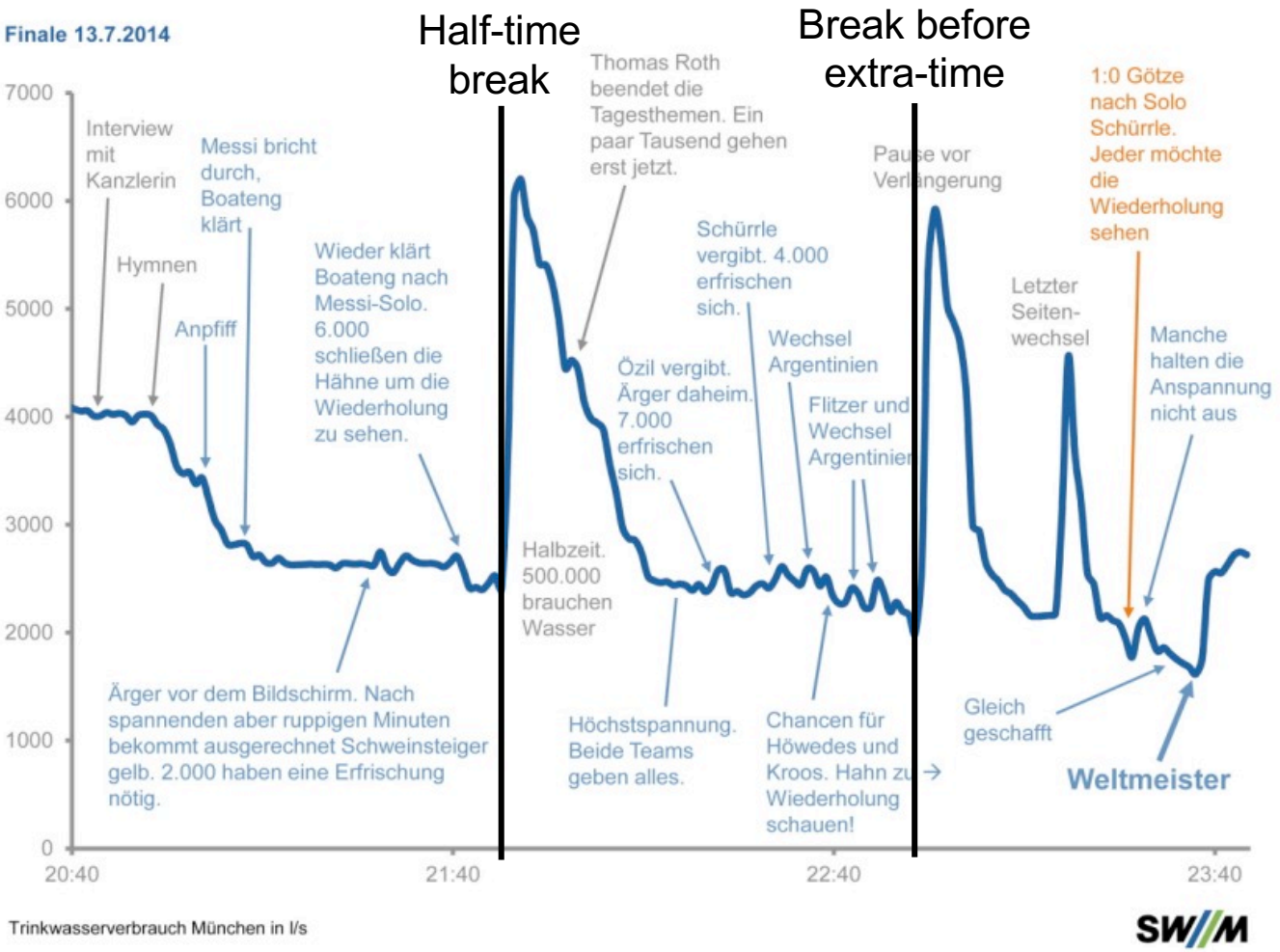
Therefore, measuring something already requires a **theoretical understanding** of the concept being measured

The measurement method is as **valid** as the underlying assumptions are true

Reactivity. In social research the subjects often react to the measurement itself (e.g. social desirability)

Therefore, **non-reactive** measurement is often a good idea

Non-reactive Measurement of TV Switching Frequency during the 2014 Final



Non-reactive measurement refers to ways of operationalization where subjects are not aware of being observed and thus might not react to the measurement itself

The assumption of this measure: The more people watching a TV program the more people will visit the bathroom at a break or at the end and thus consume water

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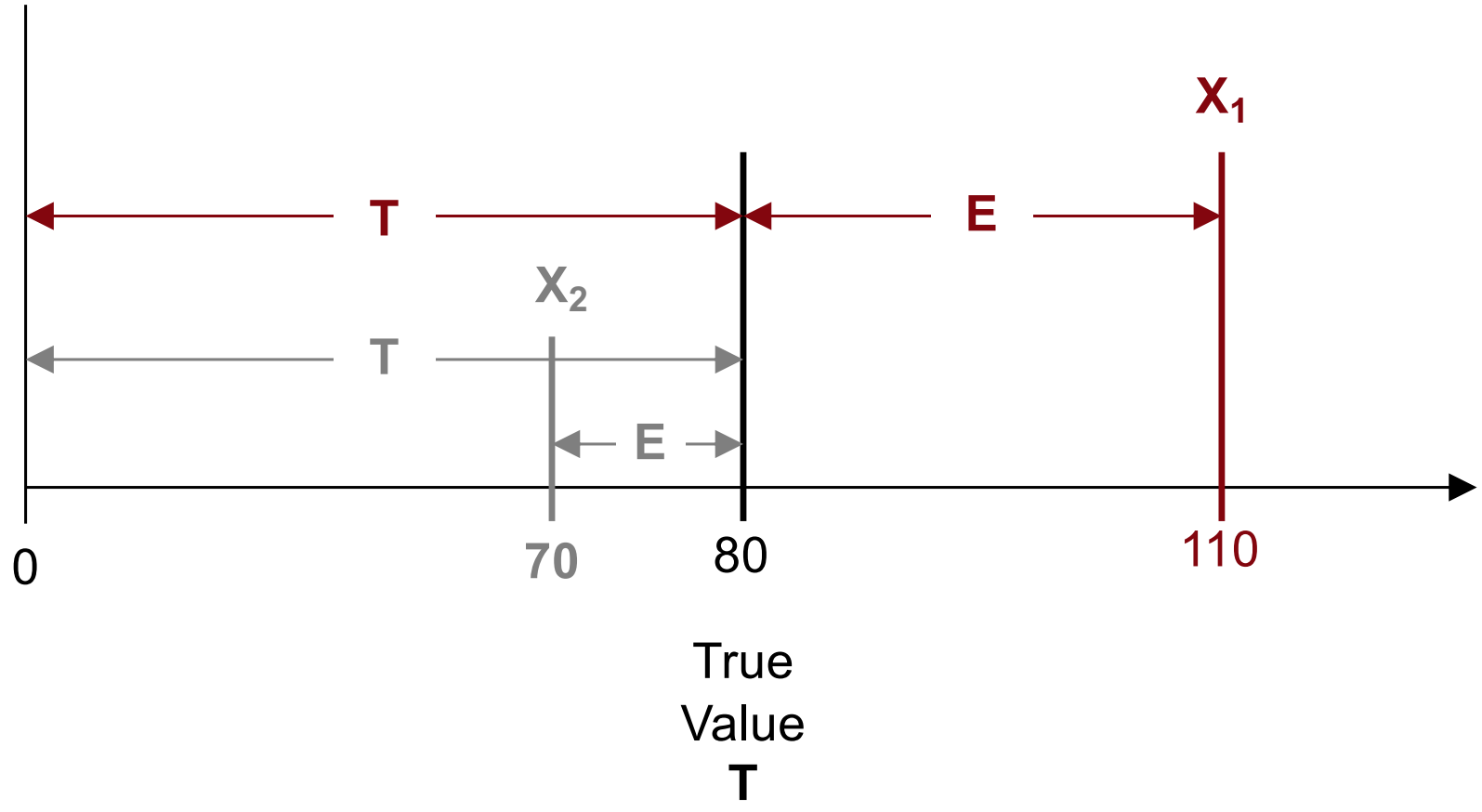
Social Research Methods

Testing

X = T + E



Classical Test Theory

While the bias is common for all, respondents the random error is randomly distributed around the true value (average E = 0)

Bias refers to a systematic error

If we assume the bias to be zero the average X is equal the true value. X = T

As a consequence, multiple measures of the same condition leads to valid results (error will be zeroed out)

$$X = T + E$$

X … Measured value

T … True Value

E … Error (Random + Bias)

Practical implications of classic test theory

The average estimation of multiple raters leads to a more precise outcome than an individual rating (see the example of Francis Galton)

In most tests multiple indicators (items, questions etc.) are used to measure one single dimension or variable (e.g. intelligence, personality)

Most teachers rely on multiple exercises as part of a written exam

Even though multiple items capture different aspects they all revolve around one and the same theoretical concept

Therefore, item-total-correlation and internal consistency are important ideas

Correlation | Simple Example

There is the idea, **money** (wealth) being related to **happiness**

IV: Money (M) available on a monthly basis

DV: Happiness (H) on a scale from 0 (completely unhappy) to 10 (totally happy)

You may ask 23 people to give response to both variables

You'll receive a simple table then, containing two columns for N=23 subjects

M	H
200	6
400	4
500	5
200	2
300	4
200	5
50	0
1200	8
700	6
300	5
500	2
800	9
100	3
300	7
400	7
800	6
200	3
600	4
600	10
300	5
100	1
500	8

You may use **Excel** as a tool and the formula CORREL

Correlation in this example is r = **.64**

The result shows, there is a decent (not perfect) positive and linear relationship between M and H

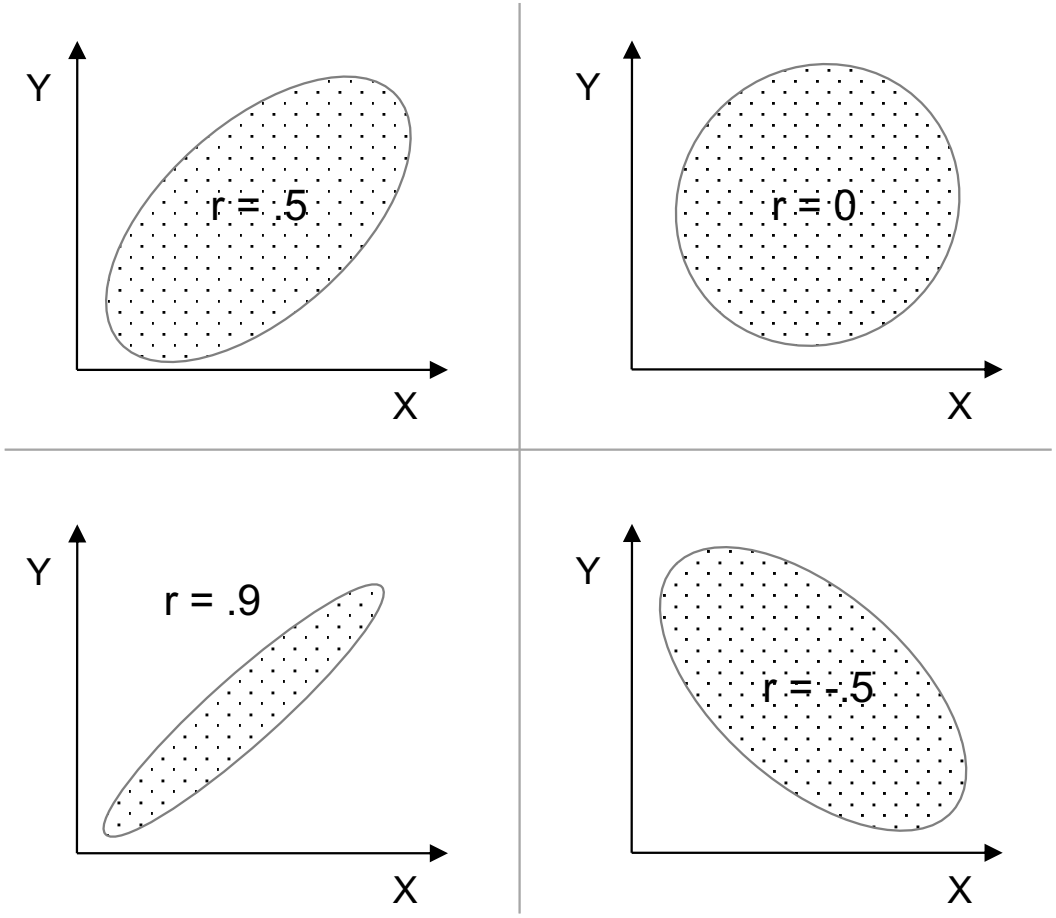
Still, you don't know whether M affects H or vice versa

Correlation (Pearson‘s r)

Correlation (r) reflects **linear** relationship between two variables (X and Y)

It can vary between **-1** (negative perfect relationship) and **+1** (positive perfect relationship)

Correlation of **0** indicates no relationship at all



Item-Total-Correlation

Subject	Item 1	Item 2	Item 3	Item 4	Total Score
1	1	3	5	1	10
2	4	5	2	3	14
3	3	2	5	4	14
4	4	5	1	4	14
5	4	4	5	2	15
6	2	4	4	4	14
7	4	3	1	4	12
8	3	4	5	4	16
9	3	2	3	1	9
10	4	3	1	2	10
11	3	5	5	4	17
12	5	3	2	2	12
13	3	4	1	5	13
14	2	2	2	2	8

Estimating Test-Reliability

	ITC
Do you love to dance?	**.68**
Are you at almost every party in town?	**.81**
Do you enjoy meeting new people?	**.78**
Do you make new friends easily?	**.73**
Do you like pizza?	**.18**
Do you like to small-talk?	**.86**
Do you think others like you?	**.71**
Cronbach‘s Alpha	**.78**

Item-Total-Correlation (ITC) is equal the correlation of the total score with a single item. It indicates to what extend a single item goes along with all other items.

Cronbach’s Alpha is an indicator for internal consistency. Do all items relate to the same concept being measured (whatever the concept might be)?

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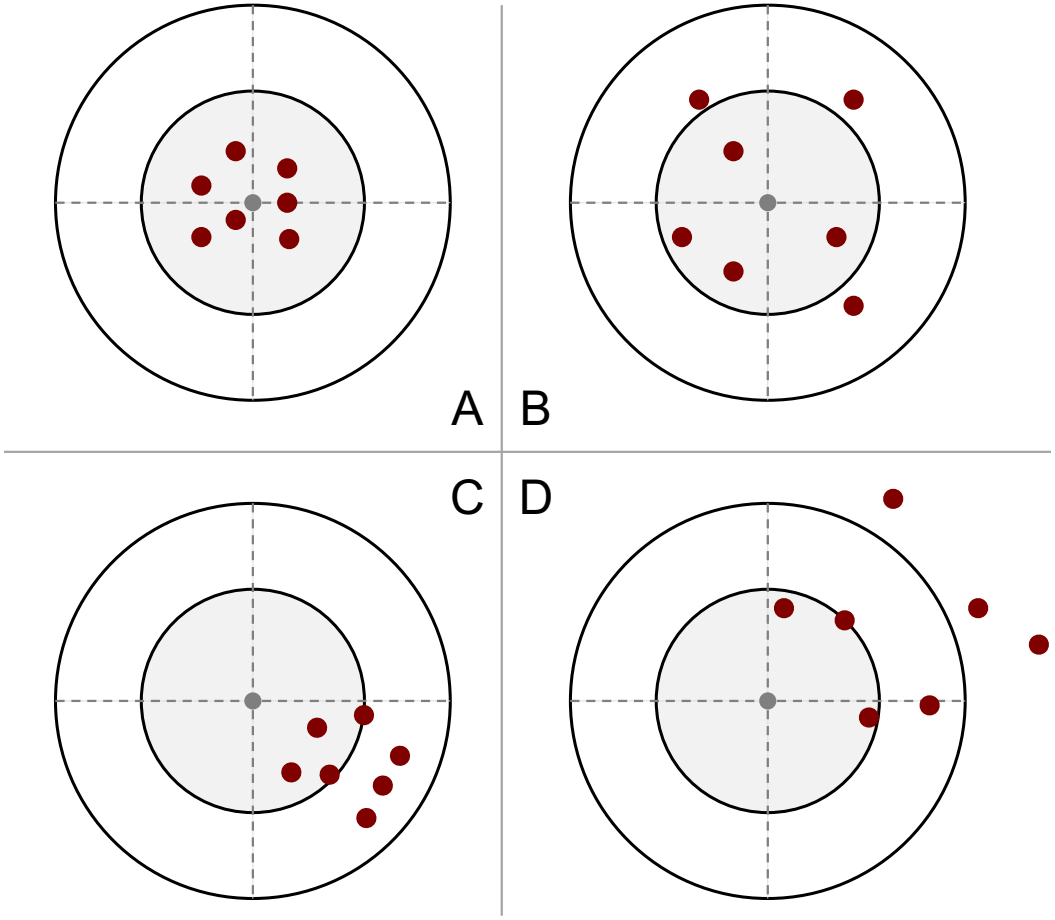
Validity, Reliability and Objectivity

Validity, Reliability and Objectivity

Validity. Does the instrument really measure what it is supposed to measure? (A,B)

Reliability. Will repeated observations of the same subjects lead to same results? (A,C)

Objectivity. The extend to which the measurement is independent from the one doing the measurement



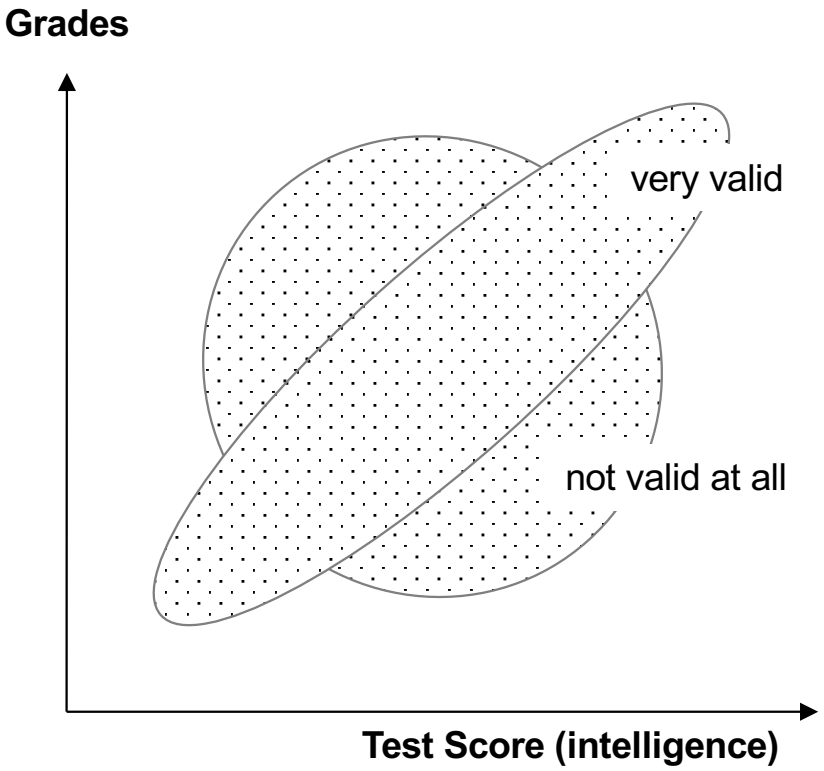
Validity | Example

Intelligence is supposed to predict performance in school

Intelligence may be measured with a kind of intelligence test

To evaluate validity of this particular test, the relation between **test score** and **school grades** is being calculated

In case of high validity the **correlation** between test score and school grades should be high



Reliability | Example

The dimension **Agreeableness** (one factor of the Big Five Personality Model) is supposed to be measured

It is assumed, personality is stable and does not change over time

A group a subjects has been tested at one time (**test**) and again after a couple of weeks (**retest**)

In case of the test being reliable (precise, accurate) the test-scores per person should not change

To estimate reliability a simple **correlation** between test and retest will be calculated

Note, reliability of a test could be independent from its validity but not vice versa

Objectivity | Example

Two **researchers** independently observe children in the schoolyard evaluation social interaction and integration

All children are observed individually leading to individual behavioural scores reflecting individual social behaviour

As a result there are two scores for each children, one provided by observer 1 and one by observer 2

Objectivity means, the variance of scores relate to the difference of the children and not to the difference of the observers

Objectivity means, both observers independently come to the same evaluation per children

In case of high objectivity the **correlation** of the pairwise evaluations should be high

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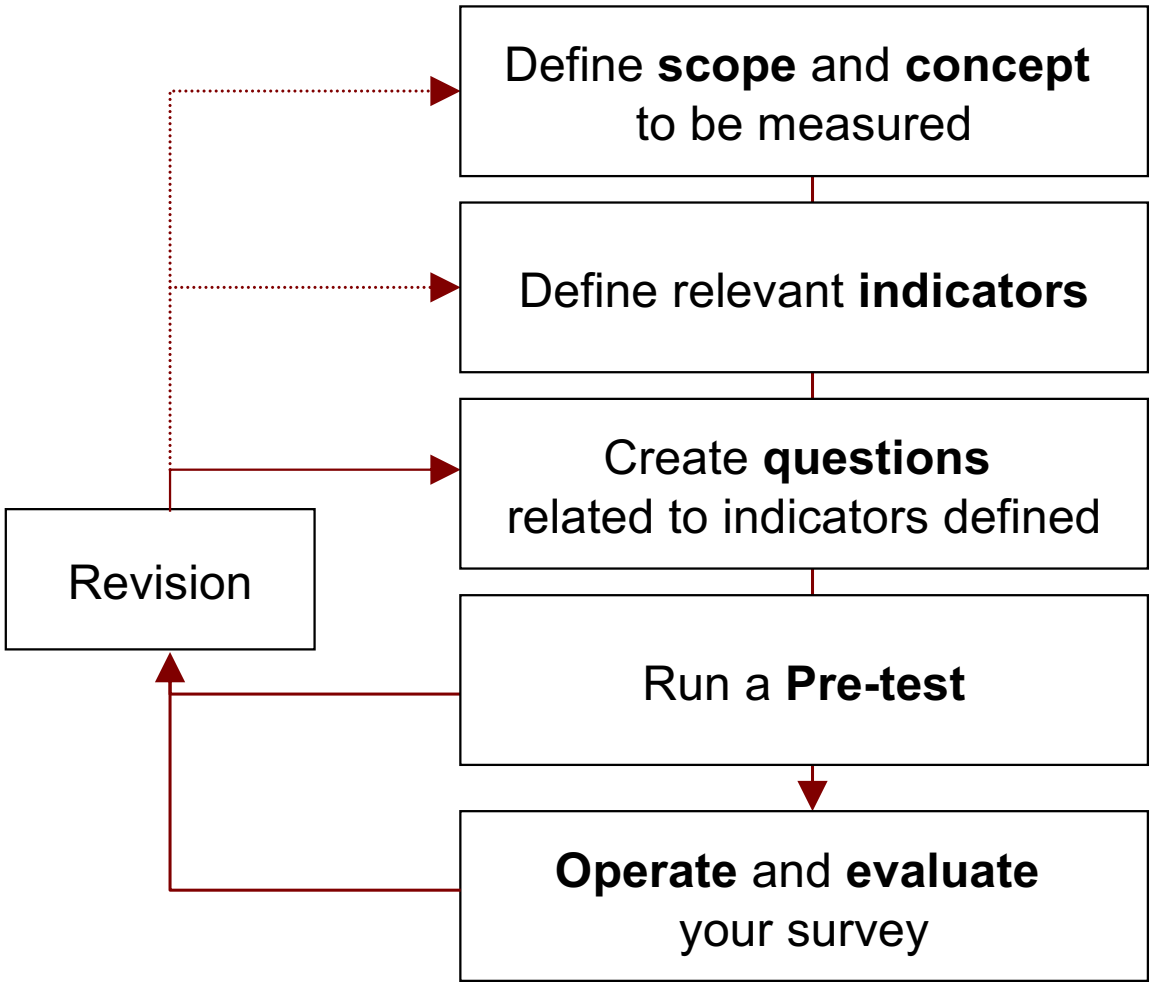
Asking Questions

Dimensions of different Survey Types

Oral Interview	Self-administered Questionnaire
Qualitative	Quantitative
Group	Individual
Un-structured (open)	Structured

Questionnaire Development Process



What is your questionnaire all about (and what not)? What is your concept, you want to measure?

What are the criteria, aspects, factors related to the concept you want to measure?

Now (not earlier) formulate questions and options, that precisely reflect the indicators following practical rules

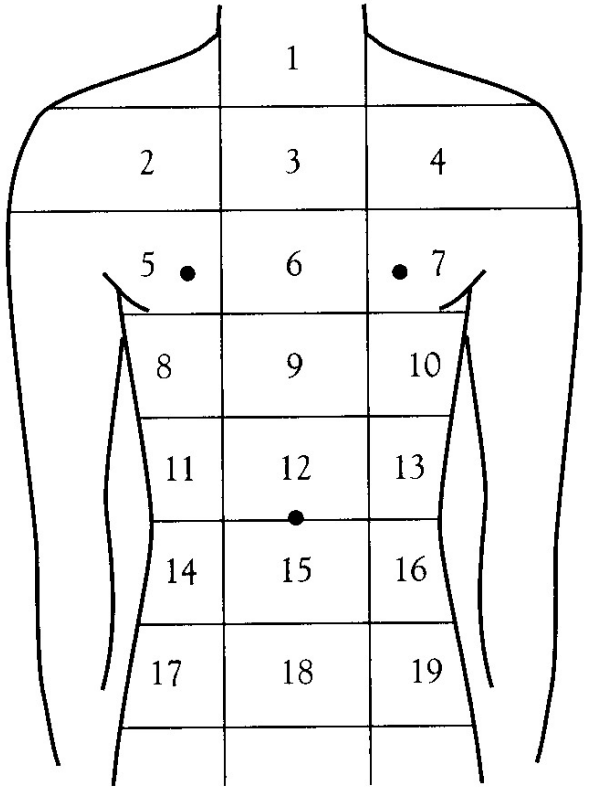
Do a pre-test with a small sample of respondents. “If you don’t have the resource to do a pre-test don’t do the study

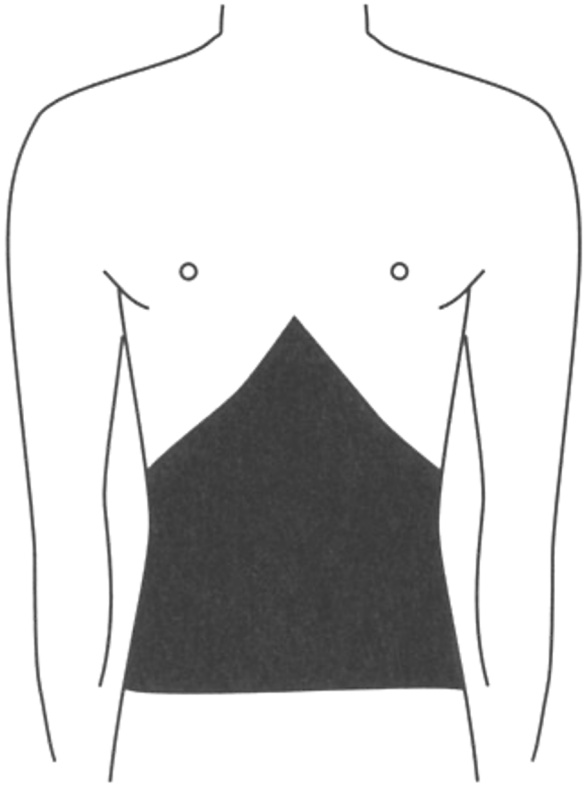
Collect data and analyse response rate, consistency, reliability, item-total-correlation (see testing)

Survey Specification

Variable	Filter	Inhalt	Frage	Optionen (Kodierung)	Format
01 GSCHLT		Geschlecht	Was ist Ihr Geschlecht?	weiblich (1) männlich (2) transgender (3)	Multiple Choice (einmal)
02 INSTA1		Instagram Nutzung	Sind Sie auf Instagram?	Ja (1) Nein (0)	ja/nein
03 INSTA2	02(1)	# Follower auf Instagram	Wie viele Follower haben Sie auf Instagram ungefähr?	Offenes Feld	Eingabe einer Zahl
04 BZHG		Aktueller Status der Beziehung	Wie ist Ihr aktueller Beziehungsstatus?	Ich bin zur Zeit Single (1) Ich bin seit WENIGER als sechs Wochen in einer festen Beziehung (2) Ich bin seit MEHR als sechs Wochen in einer festen Beziehung (3) Ich habe gerade etwas Lockeres am Laufen (4)	Multiple Choice (einmal)
05 PIZZA		Pizza-komposition	Wenn Sie eine Pizza bestellen, wählen Sie dann immer dieselbe Belegung?	ja (1) eher ja (2) teils-teils (3) eher nein (4) nein (5)	
06 BUDGET		Geld frei verfügbar	Wie viel Geld steht Ihnen pro Monat zur freien Verfügung (nach Miete, Fahrtkosten und Verpflegung)?	Offenes Feld	Eingabe einer Zahl

What is Abdomen?





Source: Sudman, Bradburn & Schwarz (1996). Thinking about Answers

Does the learning environment support the achievement of your learning objectives?*

What is „learning environment“? What does relate to this concept, what not? Where does it start? Where does it end? How can any environment support anything? What would this concretely mean? Do you have a personal example?

What are your learning objectives? Anyway, what is a learning objective? What does it mean to achieve a learning objective? What do you think of, when reading this question? What must be, to respond with a clear „yes“ on this one?

* Question taken from a questionnaire used for evaluating lectures at a university

Questions being used during a Pre-test

Paraphrasing. Repeat the question in your own words

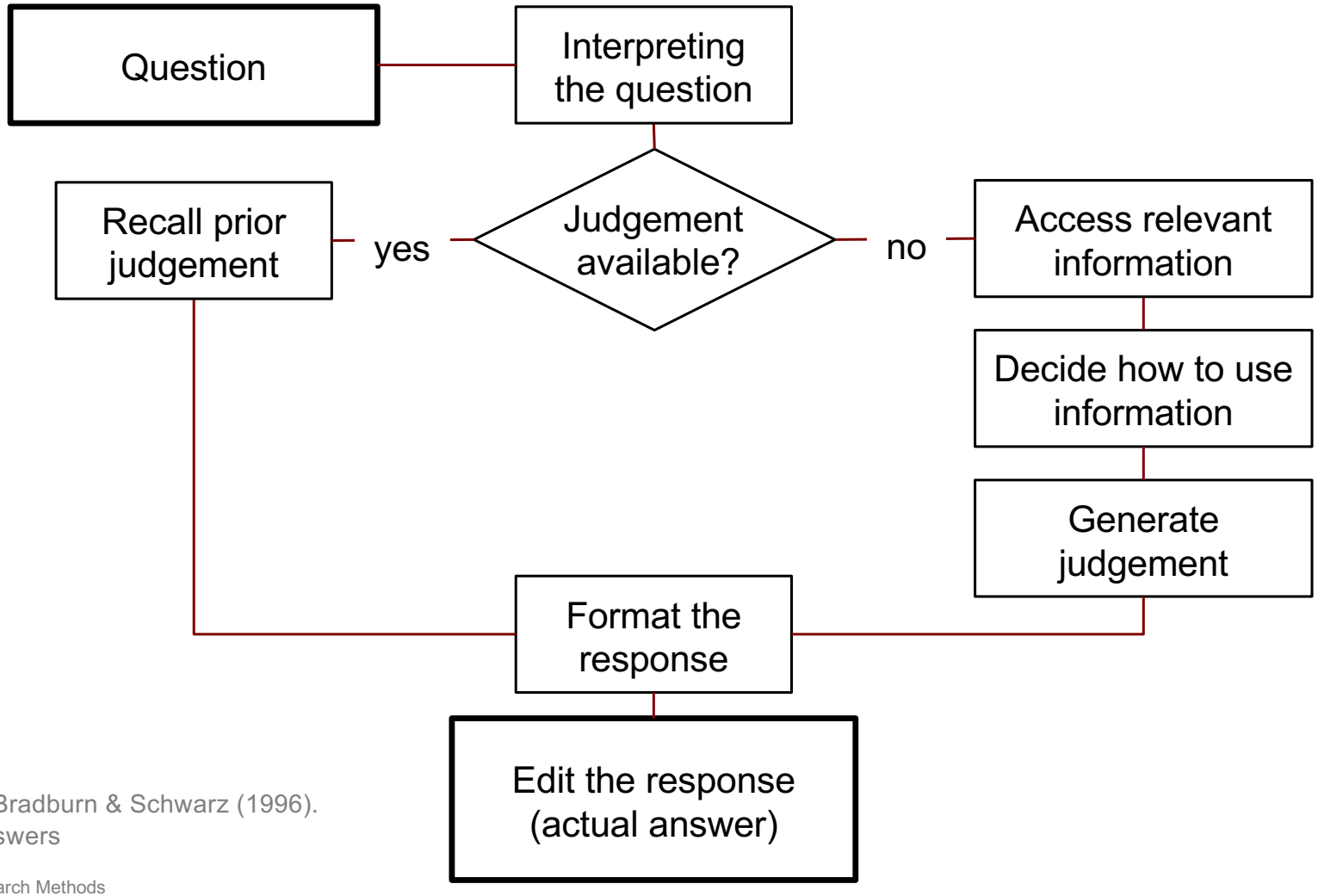
Interpreting. What do you think this question is all about?

Anchoring. What needs to be so that you would answer this question with a “yes”

Thinking loud. When hearing this question, what comes to your mind? When answering the question, what are you aware of?

Giving examples. Give a concrete example of a situation that relates to the meaning of this question.

Thinking about answers (the cognitive view)



Source: Sudman, Bradburn & Schwarz (1996). Thinking about Answers

Context (Sequence) Effects

Overall, how satisfied are you with your life? Over the course of the last 8 weeks how many rendezvous did you have?	$r_{(1,2)} = \mathbf{-.12}$
Over the course of the last 8 weeks how many rendezvous did you have? Overall, how satisfied are you with your life?	$r_{(1,2)} = \mathbf{.66}$

Source: Strack, Martin und Schwarz (1987)

Contrast Effect

Effect of Categories

Version 1		Version 2		
< 2½ hours	**62 %**	< ½ hours	7 %	
2½ - 3 hours	23 %	½ - 1 hours	18 %	
3 - 3½ hours	8 %	1 - 1½ hours	26 %	**84 %**
3½ - 4 hours	5 %	1½ - 2 hours	15 %	
4 - 4½ hours	2 %	2 - 2½ hours	18 %	
> 4½ hours	0 %	> 2½ hours	16 %	

Source: Schwarz, Hippler, Deutsch & Strack (1989)

Find the mistake

Last year I went on vacation

In your eyes, do people who bear much responsibility at work deserve higher salaries compared those who bear less responsibility?

The library of the HFU really rocks (agree .. disagree)

In the canteen I like the food and the physical setting

Would you prefer working in an hierarchical organizational setting?

I would never disagree with a ban of plastic bags

Is the speed of this lecture appropriate? (yes .. no)

I'm satisfied with the learning environment of this lecture (agree .. disagree)

Given the current and future market conditions in your industry, are there any field, topics or concerns that significantly matter with regards to the future competitiveness of your company? (question to CEOs)

What is your opinion on public transportation usage? (positive .. negative)

Good survey questions …

- relate to pre-defined indicators
- are relevant with regard to the research question
- are short and allow short answers
- are as specific as possible
- focus on one aspect only
- relate to things that could be recalled easily
- avoid double negative
- use daily (no technical, professional) terms
- have a consistent polarity
- have complete options to choose from
- do not use slang
- relate to precise time reference
- are not suggestive (end with a question mark)
- catch the respondent's attention

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Social Research Methods

Systematic Observation and Content Analysis

Examples of observation in some classic social psychological studies

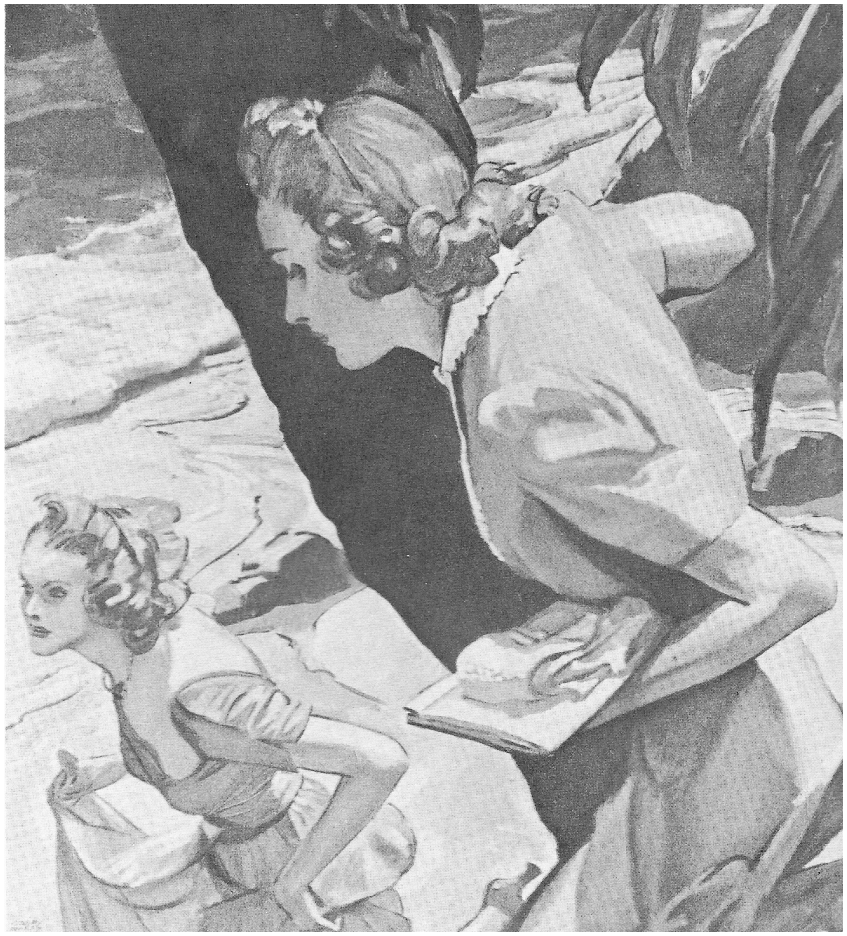
When Prophecy fails	Stanford Prison Experiment	Robbers Cave Experiment	Milgram Experiment
Leon Festinger	Philip Zimbardo	Muzafer Sherif	Stanley Milgram
Cult (Seekers), that believed in the end of the world on Dec 21, 1954 at 12pm	Students being assigned to roles of guard or prisoner in an improvised prison	18 male youth on a summer camp, temporarily split into two groups	Teacher-learner-scenario, where teacher triggers electroshocks to learner
Cognitive Dissonance	Roles and power	Group identity, ingroup/outgroup	Obedience to authority
Festinger, L., Riecken, H. W., & Schachter, S. (1956). When prophecy fails. University of Minnesota Press	Haney, C., Banks, C., & Zimbardo, P. (1973). Interpersonal dynamics in a simulated prison. International Journal of Criminology & Penology, 1(1), 69–97.	Sherif, M., Harvey, O. J., White, B. J., Hood, W. R., & Sherif, C. W. (1961). Intergroup conflict and cooperation: The Robbers Cave experiment (Vol. 10). Norman, OK: University Book Exchange.	Milgram, S. (1974). Obedience to Authority: An Experimental View. New York: Harper and Row, Publishers, Inc..

Types of Observation

Open	Subjects are aware of being observed and being part of a study	Subjects are **not** aware of being observed or being part of a study	**Hidden**
Participant	Researcher actively interacts or communications with subject within the research setting	Researcher is separated from subjects, no interaction, no communication	**Non-participant**
Field	Observation is done in a natural setting that would exist even without the study	Observation is done in an artificial (protected and controlled) setting designed for the purpose of the study	**Laboratory**

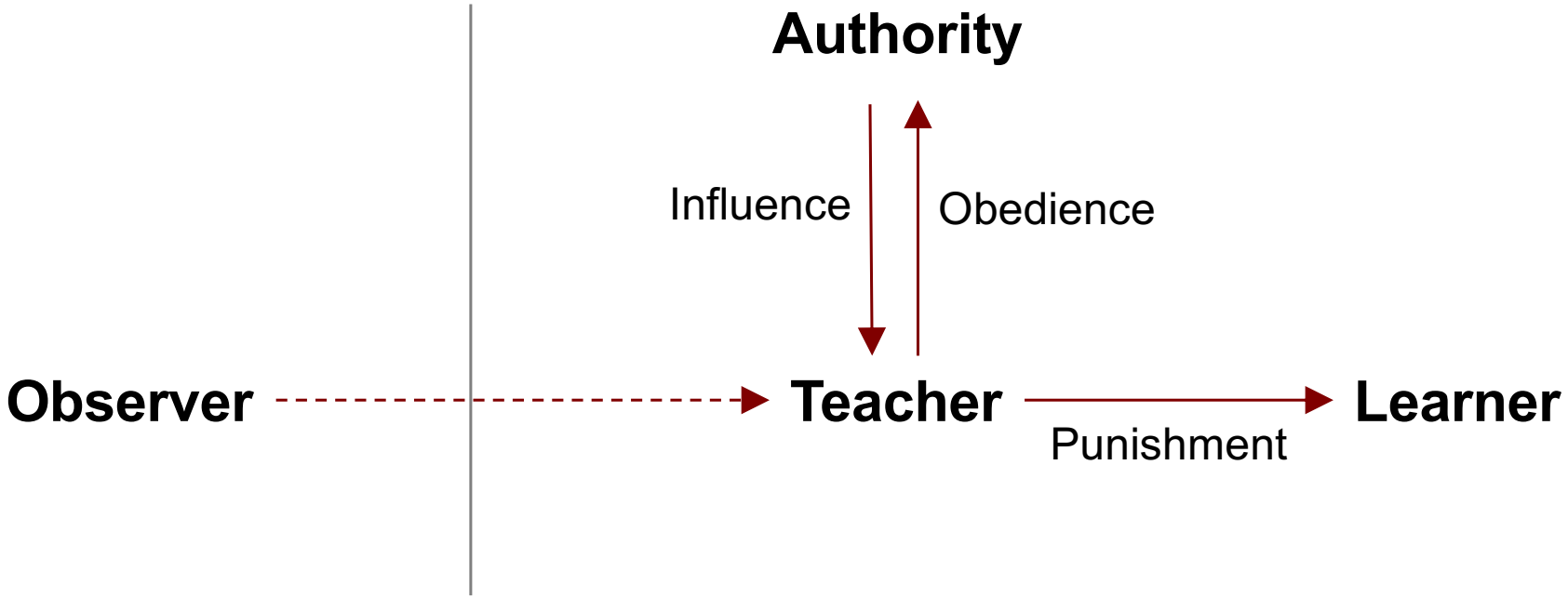
When describing your method you might say something like: “A hidden non-participating observation in the field has been conducted”.

What do you see?



Source: Murray H. A. (1943). Thematic Apperception Test manual. Harvard University Press.

The Milgram Experiment



What is the observer supposed to look at?

What might be precise criteria for your observation?

Challenges with Systematic Observation

Against our human nature **avoid interpreting** while observing the behaviour of others

You primarily see what you are **expecting** to see (according to your hypothesis and knowledge)

Be perfectly clear about what kind of **behavioural patterns** you might observe and classify

Observation requires a **quick** although **precise** classification of human behaviour

Inter-rater-reliability. Different researchers must come to same conclusion when observing independently

Don’t be surprised by the immense **variety** of human behaviour especially in the (uncontrollable) field

Avoid biased **reactivity** especially when doing a participating observation (you cannot not affect others)

Content Analysis (few examples)

Research Question Concept and Target	Source of Content
How do large corporations in Germany position themselves as employer? (Employer Brand)	Career website content
How do children in the age of 10-14 see their future? (Optimism of children)	School essays about “My future”
What is the relevance of Human Capital (“most important asset”) at large corporations?	Annual reports Fortune 500
Is there a relation between employees’ office plants and the nature of their jobs?	Office plants

Exercise: How “cool” are these websites?

1	Develop your **coding system**	Define five verifiable criteria in groups of two, that reflect “being cool” in relation to career websites. On this basis, develop a system that allows you to classify a web page on the scale from 0 to 10 (the higher the value, the “cooler”)
2	Make your **judgements**	Use your previously developed coding system to assess 12 different career websites being presented (1 minute per page). Note: Please make your judgements independently (not in group).
3	Check **inter-rater-reliability**	Calculate your inter-rater-reliability (equal to objectivity in that case) in order to asses the quality of your coding system. Do this by correlating the individual judgements in your group.

CAREER AT H&M

AVAILABLE POSITIONS | WORKING AT H&M | STUDENT | SIGN IN

Search

Search for career opportunities

Category | Region | City | Type

PLACE OF POSSIBLE

Sustainability IS POSSIBLE

HELLO STUDENTS

CONNECT WITH H&M ON LINKEDIN

FAQ

Coding Scheme

Criterion	Career Page 1	2	3	4	5	6	7	8	9	10	11	12
Total												

Coding: 2 = Criterion fully applies, 1 = partly applies, 0 = does not apply

How to conduct systematic observation or content analysis

Clearly **define**, what you want to observe or analyse. Focus on relevant theoretical concepts and criteria. What are behavioural pattern, words etc. you look at?

Prepare **examples** or **prototypes** for what you're supposed to observe/analyse

Have a structured and formal **coding system** (table, form or guide) you may use during data collection

Always have **multiple** observers or analysts, at least in groups of two

Check **interrater-reliability** (Objectivity). Train and improve the coding system until you reach a solid level of reliability (> .7)

Train the usage of you coding system with others and run first trials

In case of observation have a **debrief** with the subjects. Further commend may improve interpreting behaviour

Prototypes | Example of observing the intensity of social interaction of kids (in a school yard)

Level 1	Level 2	Level 3	Level 4	Level 5
No interaction, isolation	**Limited interaction**	**Normal interaction intensity**	**Intense interaction**	**Intense and very active interaction**
Subject stands alone, makes no effort to interact, isolated over the whole period of time observed, talking to nobody	Subject is alone most of the time of observation, is approached by one or more people, no active approach to others	Subject interacts with one or a few people most of the time, rarely alone	Subject interacts with a few people, changing counterparts, active/passive approach of others	Subjects interacts with many different people, never alone, actively approaches others

All content included in the description of the different prototypes relate to previously defined, general indicators

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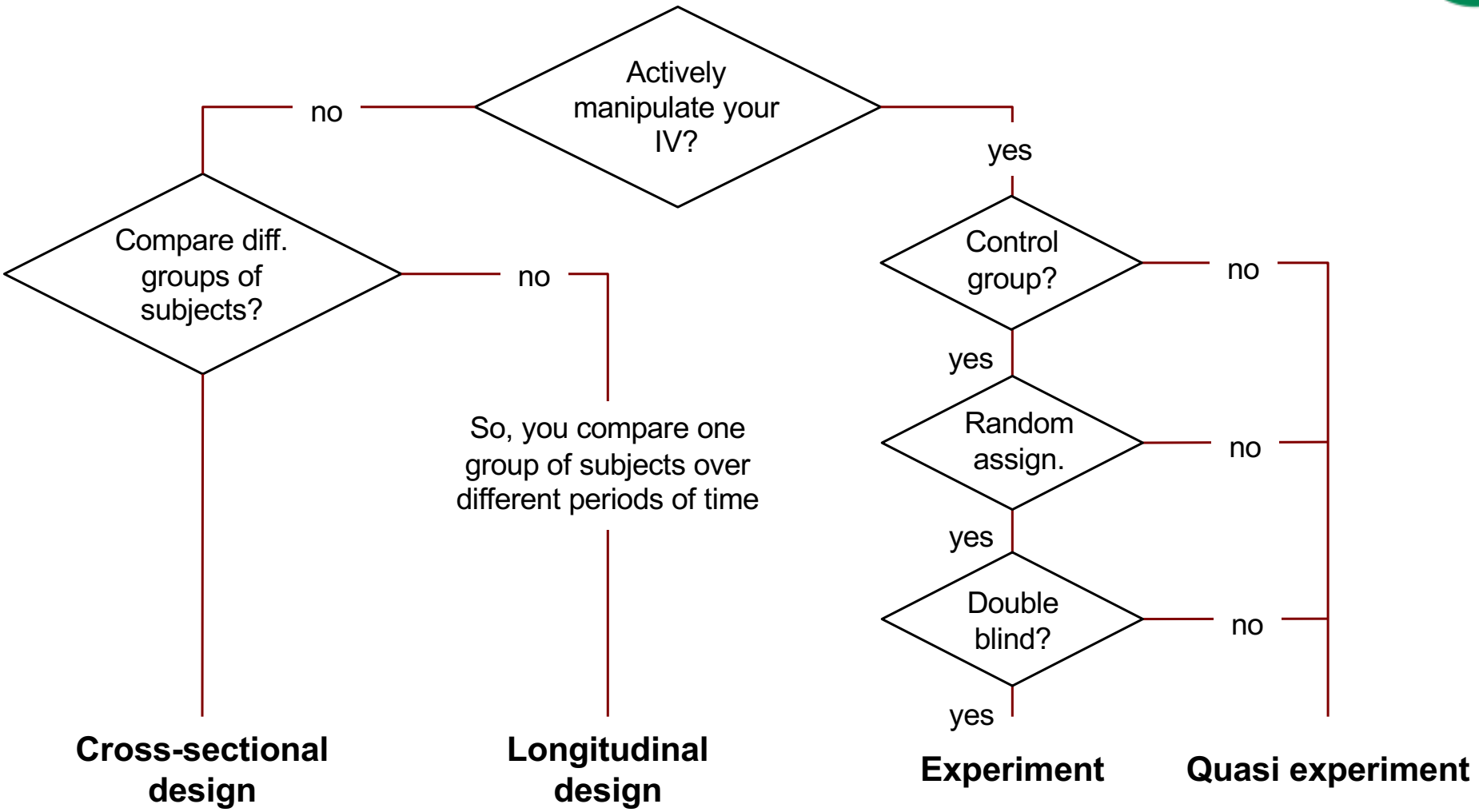
Social Research Methods

Research Design

What is your Research Design?



(Quasi) Experimental Designs

Pretest posttest design
(one group only)

O_1 X O_2

Repeated treatment design
(one group only)

O_1 X O_2 X O_3

Posttest only design

X_1 O
X_2 O
X_3 O

(True) Experimental design

O_1 X O_2
O_1 O_2

Random assignment,
double blind

Observation

E**X**perimental
Treatment

Source: Cook & Campbell (1979). Quasi-Experimentation

True Experimental Designs

The **independent variable** (experimental treatment X) is actively **manipulated** by the researcher

All other variables and potential factors affecting the dependent variable are **held constant**

At least two groups are formed, an **experimental group** and a **control group**

The subjects are **randomly assigned** to experimental and control groups

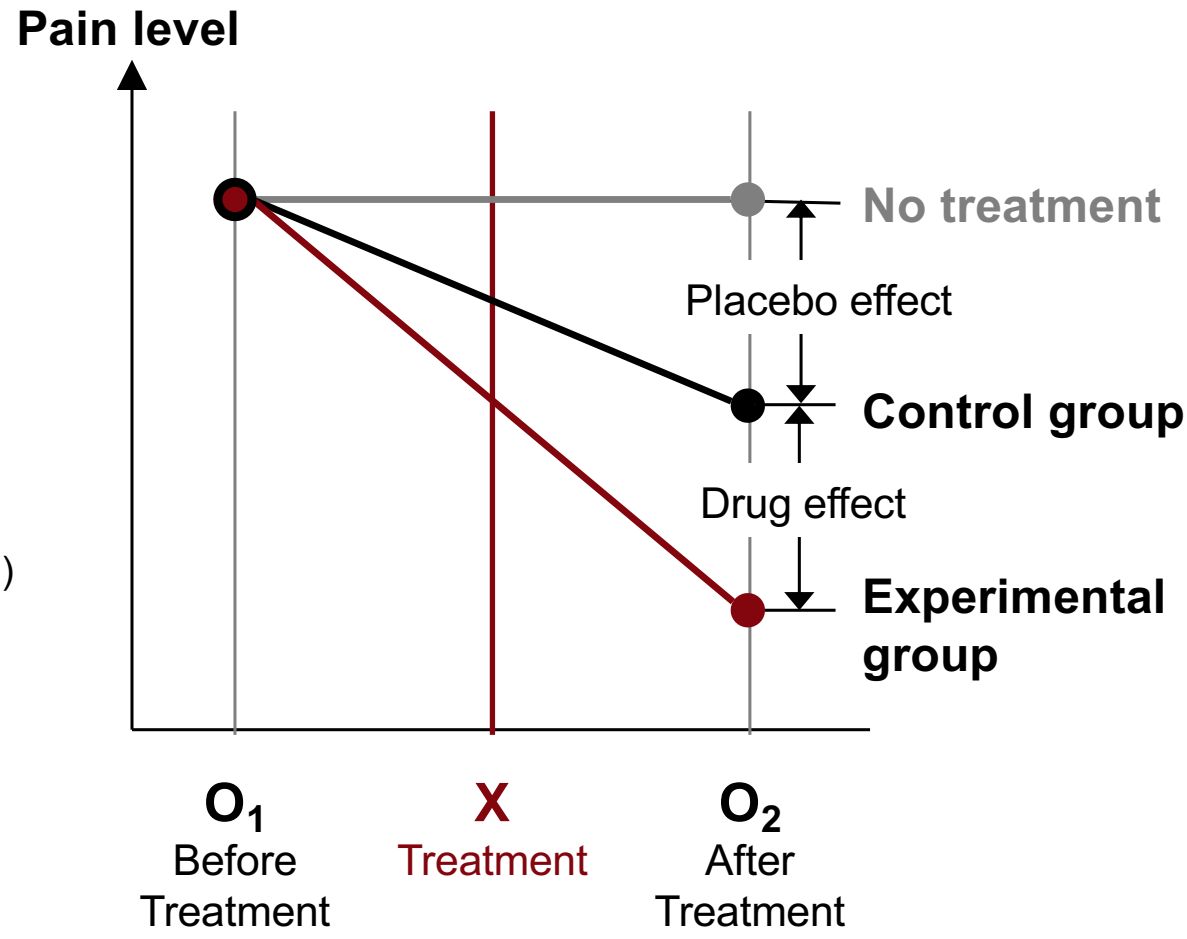
Double blind. The researcher is not aware of the assignment of the subjects (if subject is not aware of its assignment we name it “blind”)

True Experiment | Example of expected outcomes

A specific new drug is supposed to heal chronic pain. Its **effectiveness** will be proofed in a real **experiment**

Pain level is measured through subjects' own estimation on a pain scale
(1 = no pain at all, 10 = worst possible pain)

There is an **experimental group** receiving the new drug and a **control group** receiving a placebo.



Correlation is not equal causality

Internal validity refers to the extend to which the independent variable (**A**) causally effects the dependent variable (**B**)

A correlation between variable **A** and **B**, this does not necessarily mean, that **A** is causing **B** (causality)

Threats to internal validity describe alternative explanations for relations found on a statistical basis

A → **B**

A directly effects B (hypothesis about causality)

A ← **B**

B directly effects A (inversed causality)

A ← **C** → **B**

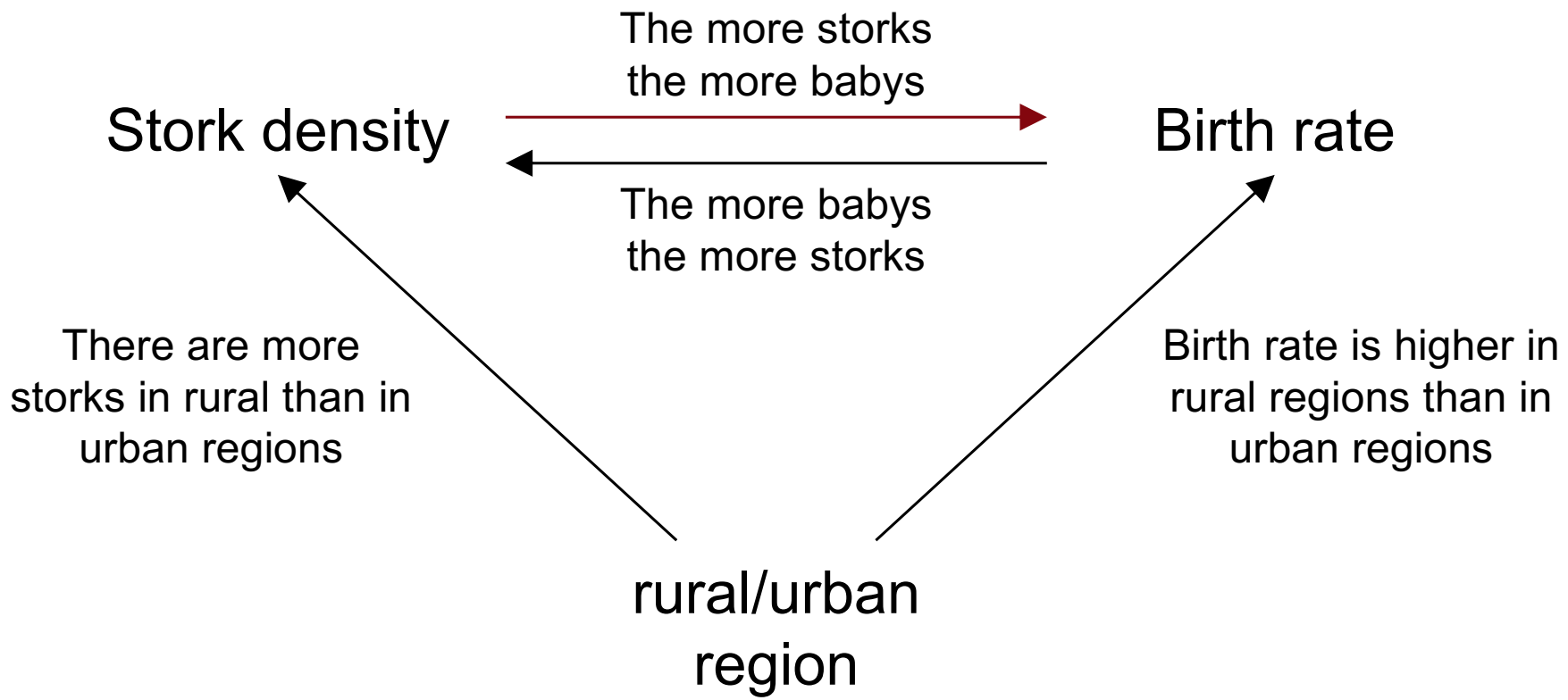
The **third variable** (C) effects both A and B. There is no direct relationship between A and B

A → **C** → **B**

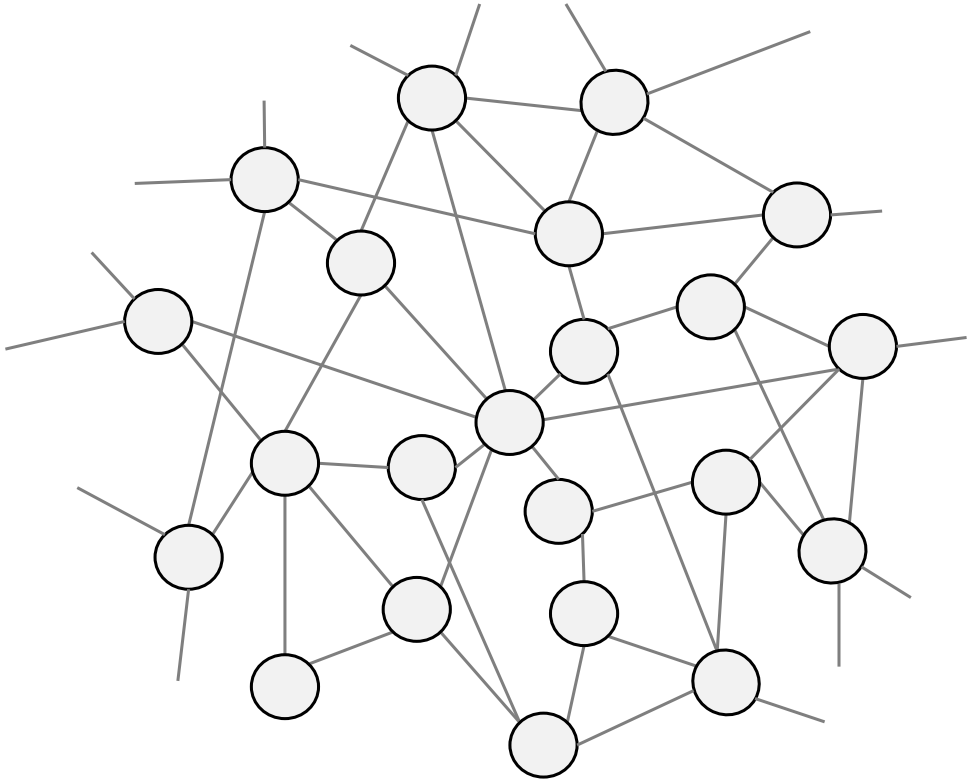
A effects C. C (mediator) in turn effects B. There is no direct relationship between A and B

Storks do not bring babies

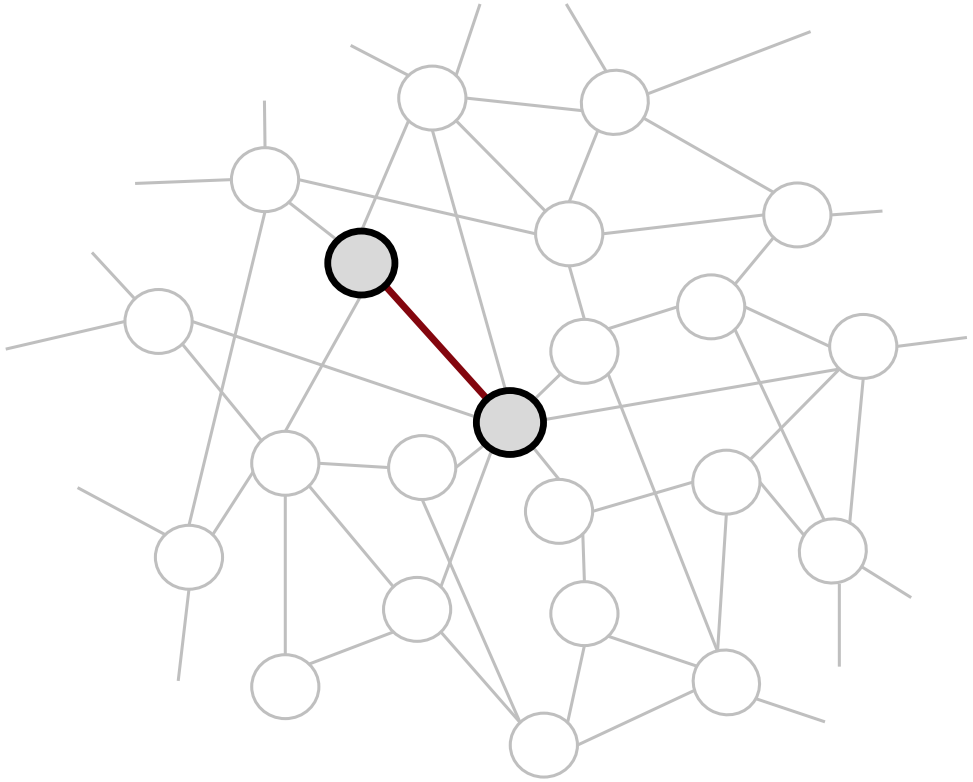
There is actually a robust statistical correlation between **stork density** in regions and the **birth rate** within the regions



The truth is incredibly complicated



How the **truth** really is



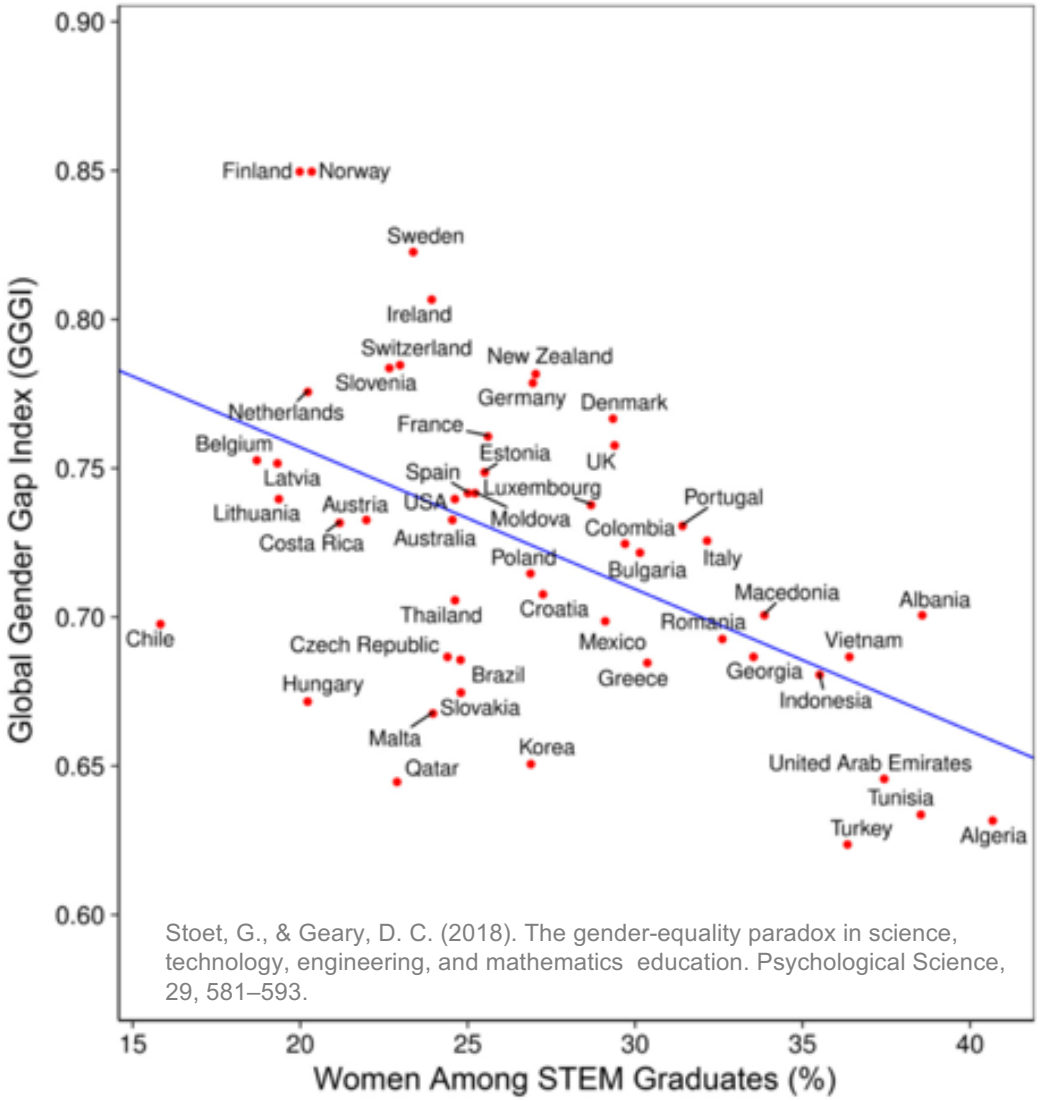
How you look at it in your little **study**

Gender-Equality-Paradox

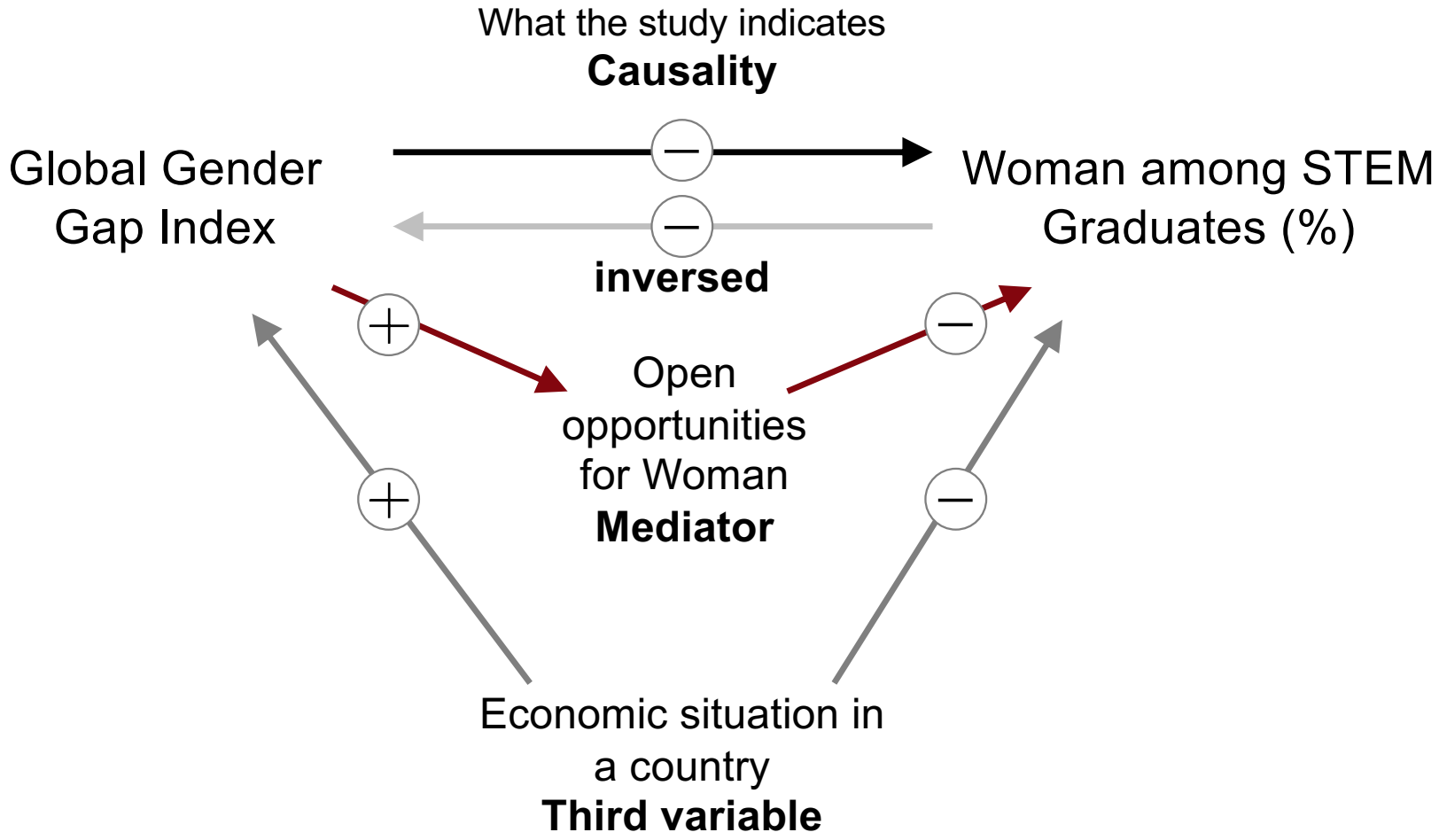
Global Gender Gap Index (GGGI) refers to a country‘s extend to which women having equal opportunities in society, work, politics etc.

STEM refers to professions in the area of Science, Technology, Engineering, Mathematics

There is a **correlation** between GGGI and Woman among STEM Graduates of **-.47**



Gender-Equality-Paradox



Threats to Internal Validity in Quasi-Experimentation

History. Event which takes place between the pre-test and the post-test

Instrumentation. Change of the instrument

Statistical regression. Extreme values tend towards the mean at a later observation

Selection. Difference between the kinds of people in different groups

Mortality. Subjects drop out over the course of the study

Maturation. Subjects naturally change due to age, learning etc.

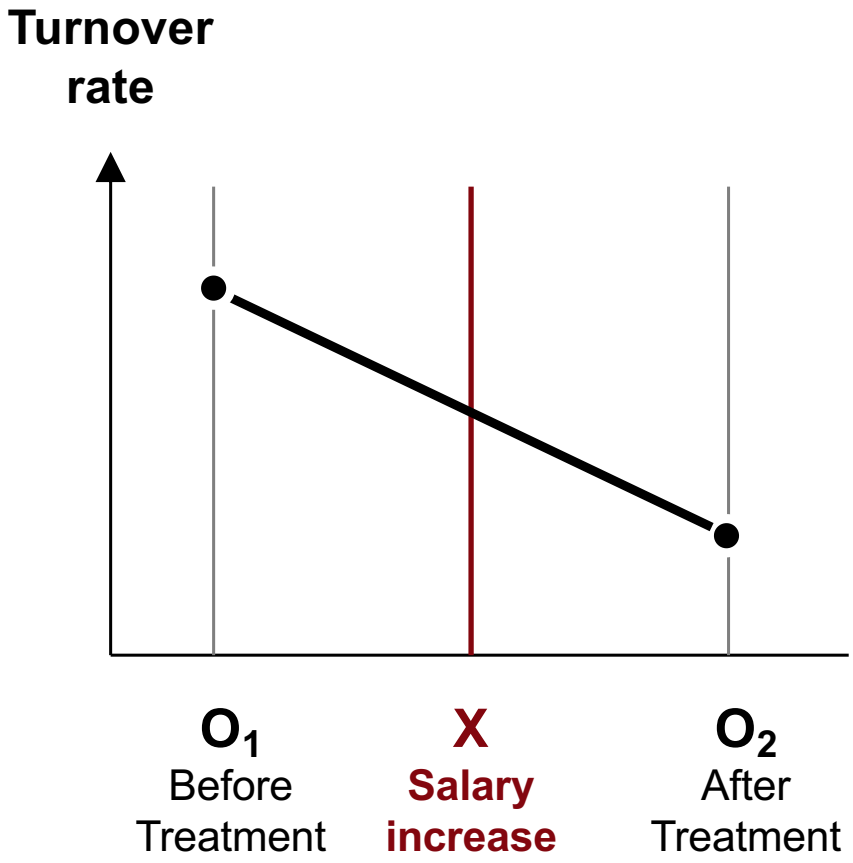
Source: Cook & Campbell (1979). Quasi-Experimentation

History as a threat to internal validity | example

After **base pay** (IV, X) has been increased for all employees **turnover rate** (DV) went down

A **pretest posttest design** (one group only) has been applied

History. Maybe something else (e.g. labour market condition, economic situation) changed between O_1 and O_2.

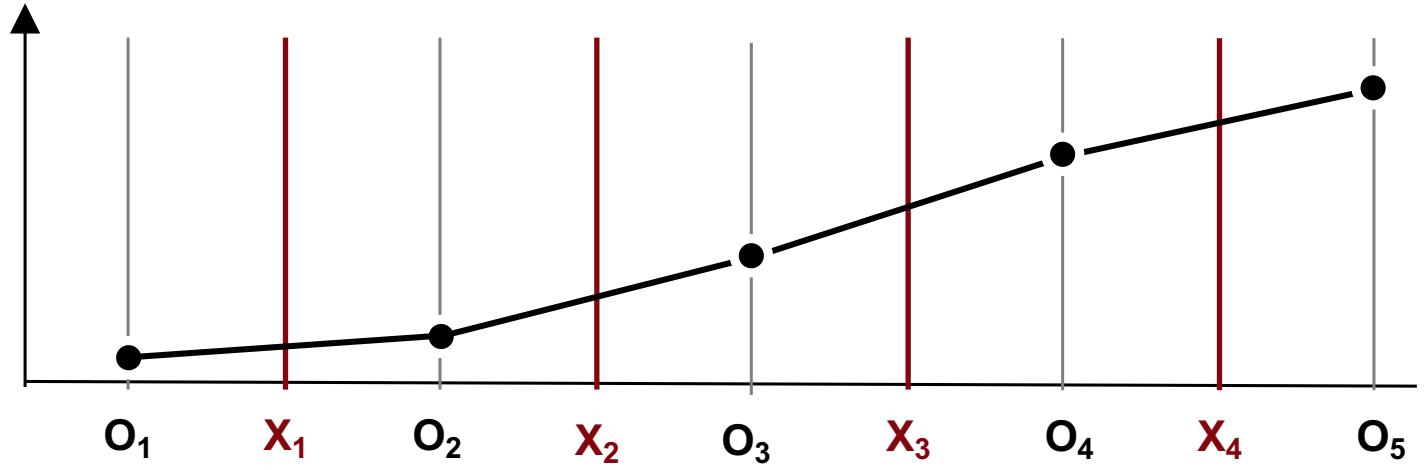


Instrumentation as a threat to internal validity | example

Subjects attend several (4) sessions to **train cognitive capabilities** (IV, X_1 to X_4). In the beginning and after every X **intelligence** was measured (O_1 to O_5). Results indicate, that intelligence could be trained

Repeated treatment design (one group only)

Instrumentation. Subject did increase their ability to deal with the particular nature of intelligence test exercises (reactivity), but not their intelligence as such

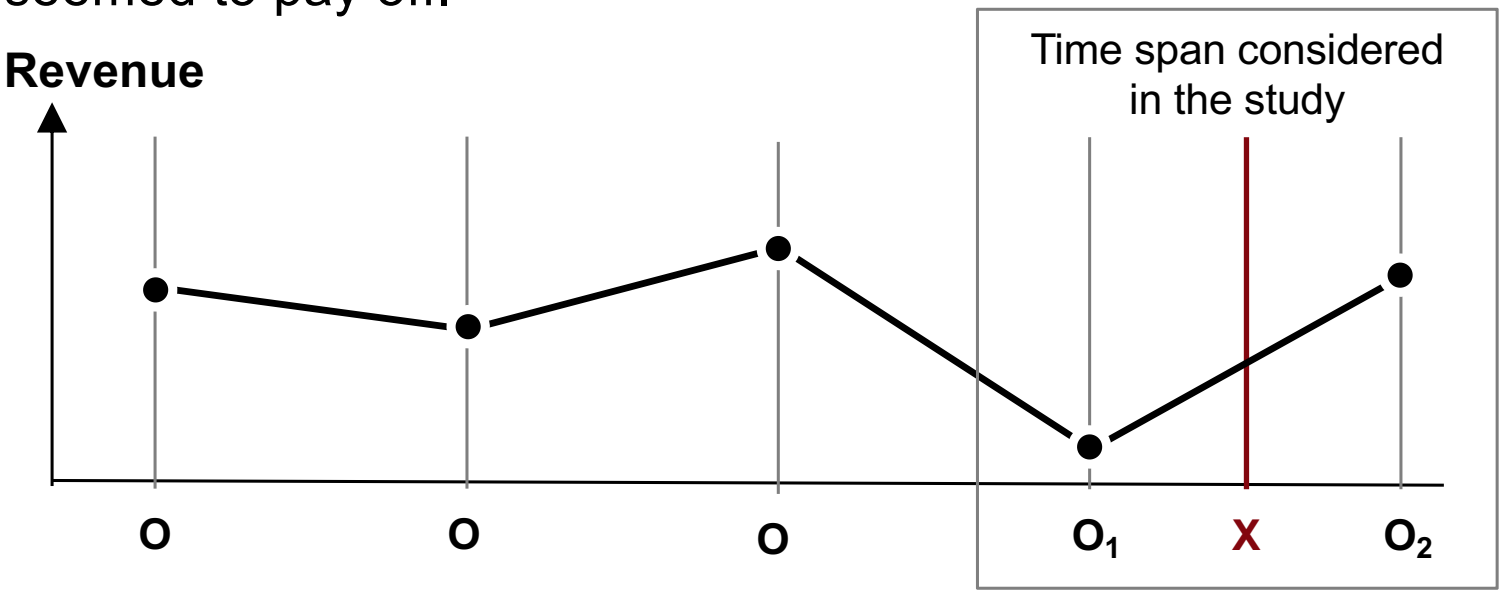


Regression as a threat to internal validity | example

At a specific time (O_1) **revenue** related to a product (DV) has been extremely low. As a consequence **marketing efforts** (IV, X) were increased. As a consequence revenue went up again. The efforts seemed to pay off.

Pretest posttest design

Statistical regression. The marketing efforts didn't make a difference. Revenue just went back to normal as part of its natural variation over time



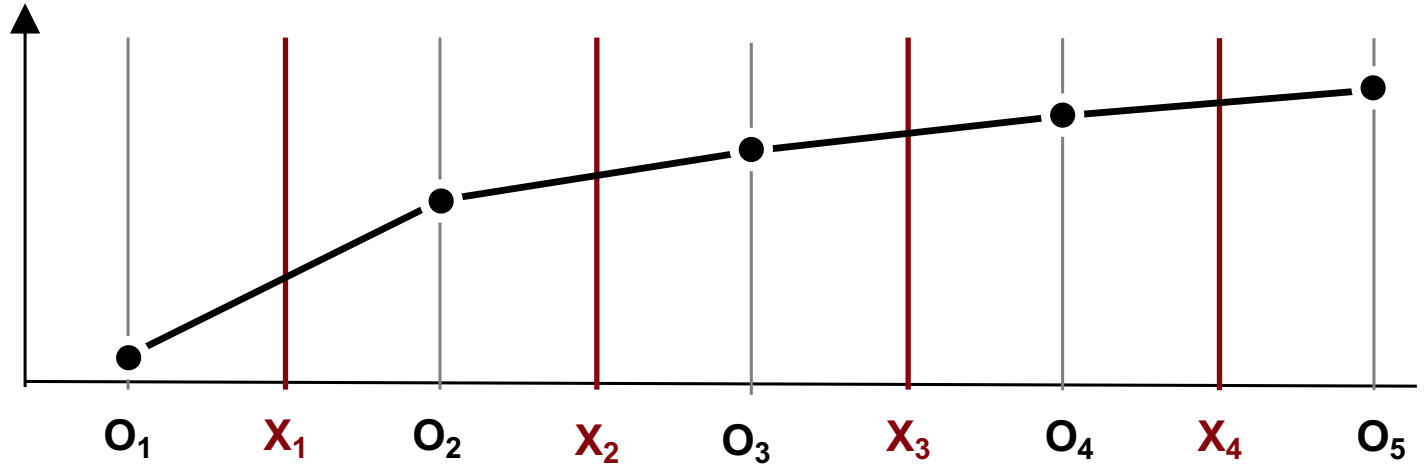
Instrumentation as a threat to internal validity | example

A group of students where engaged in a kind of **student motivation program** (IV, X, 4 sessions, 1 per semester). Results show an increase of **motivation** (DV, tested) over time.

Repeated treatment design (one group only)

Mortality. Over time the unmotivated students left the program. The motivated ones remained.

Motivation to study

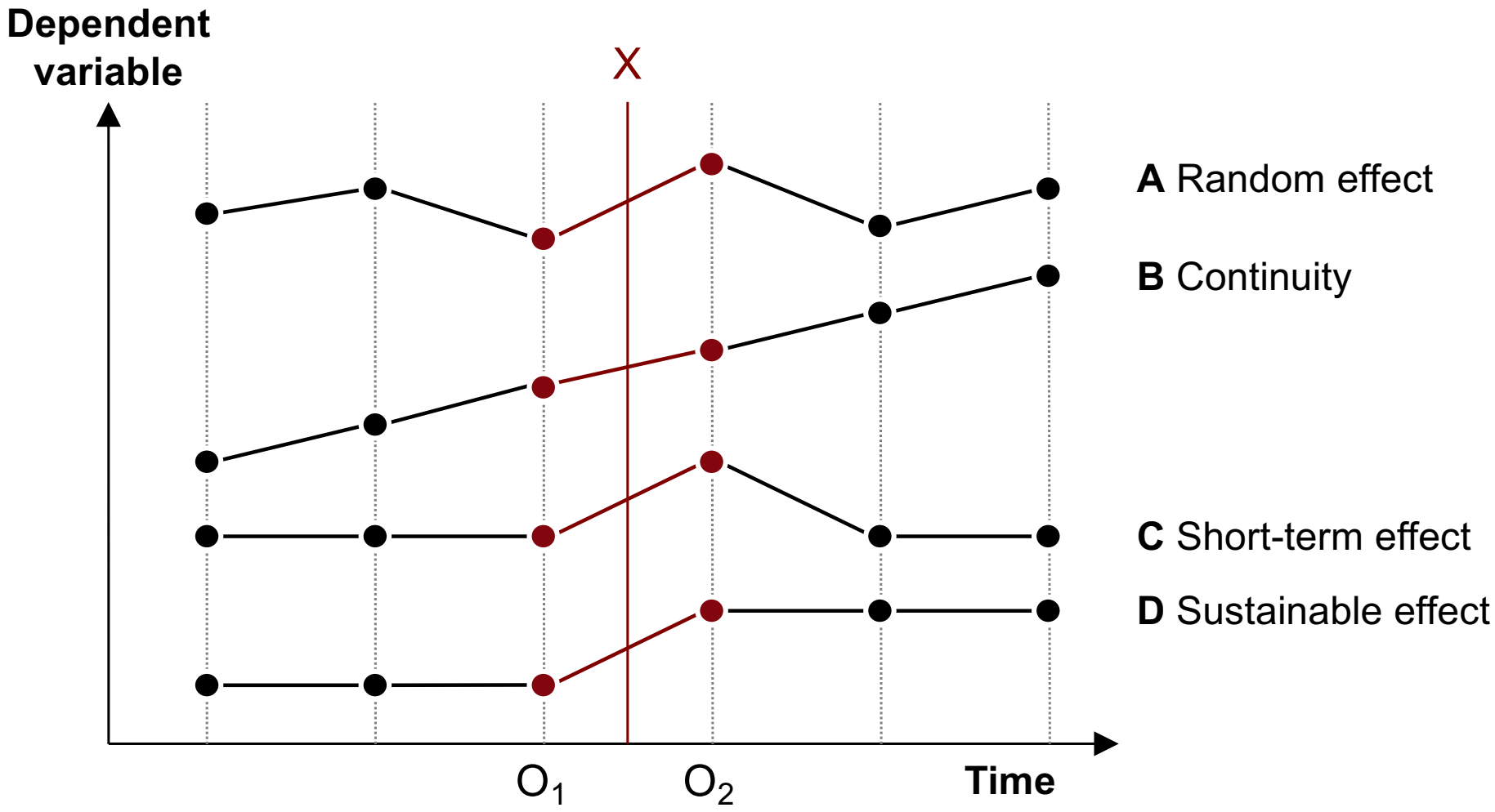


Selection as a threat to internal validity | example

Within three different shifts a variation of **shopfloor management** (IV) has been implemented: none (X_1), voluntary (X_2) and mandatory (X_3). Results show the best **quality** outcome (DV) in X2.

Selection. Differences in quality are not due to X but due to the already existing differences of shift characteristics and their people

True or false effects of an experimental treatment



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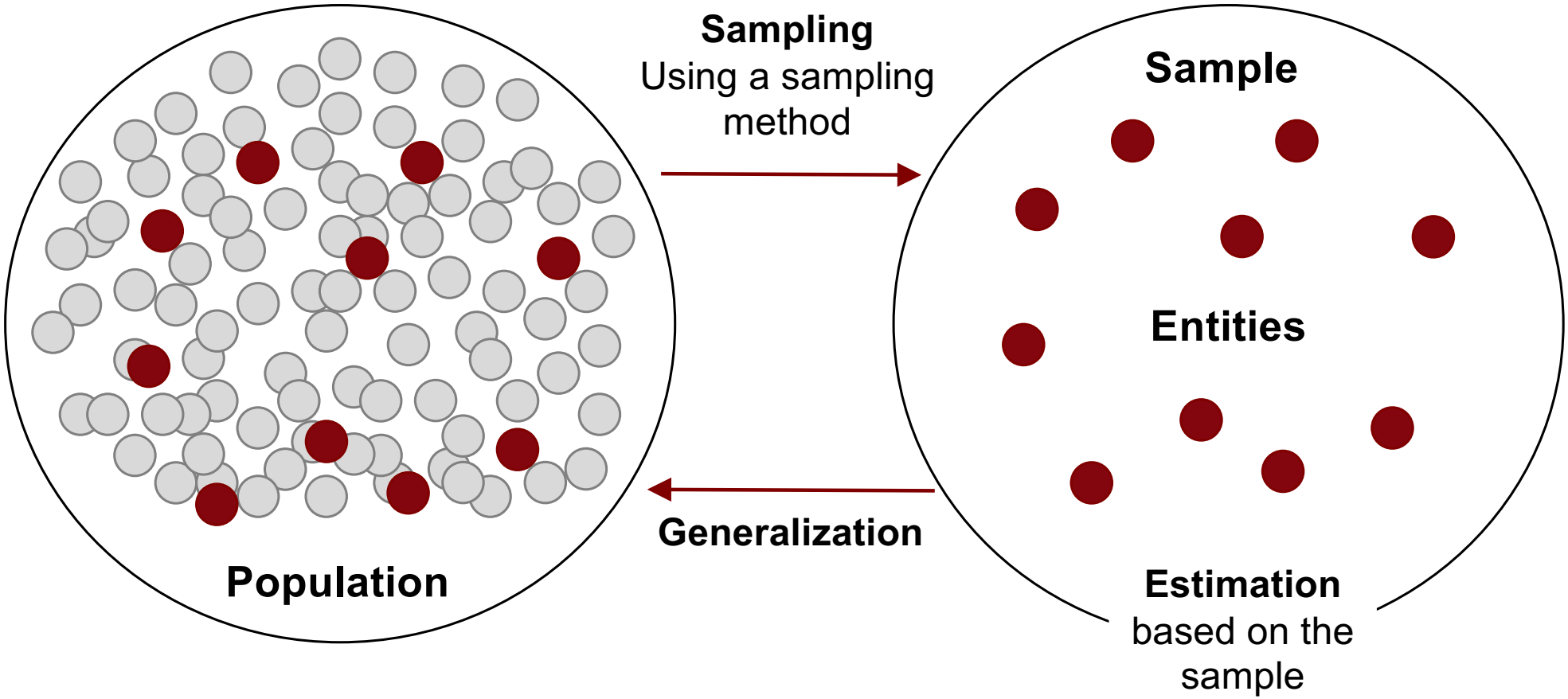
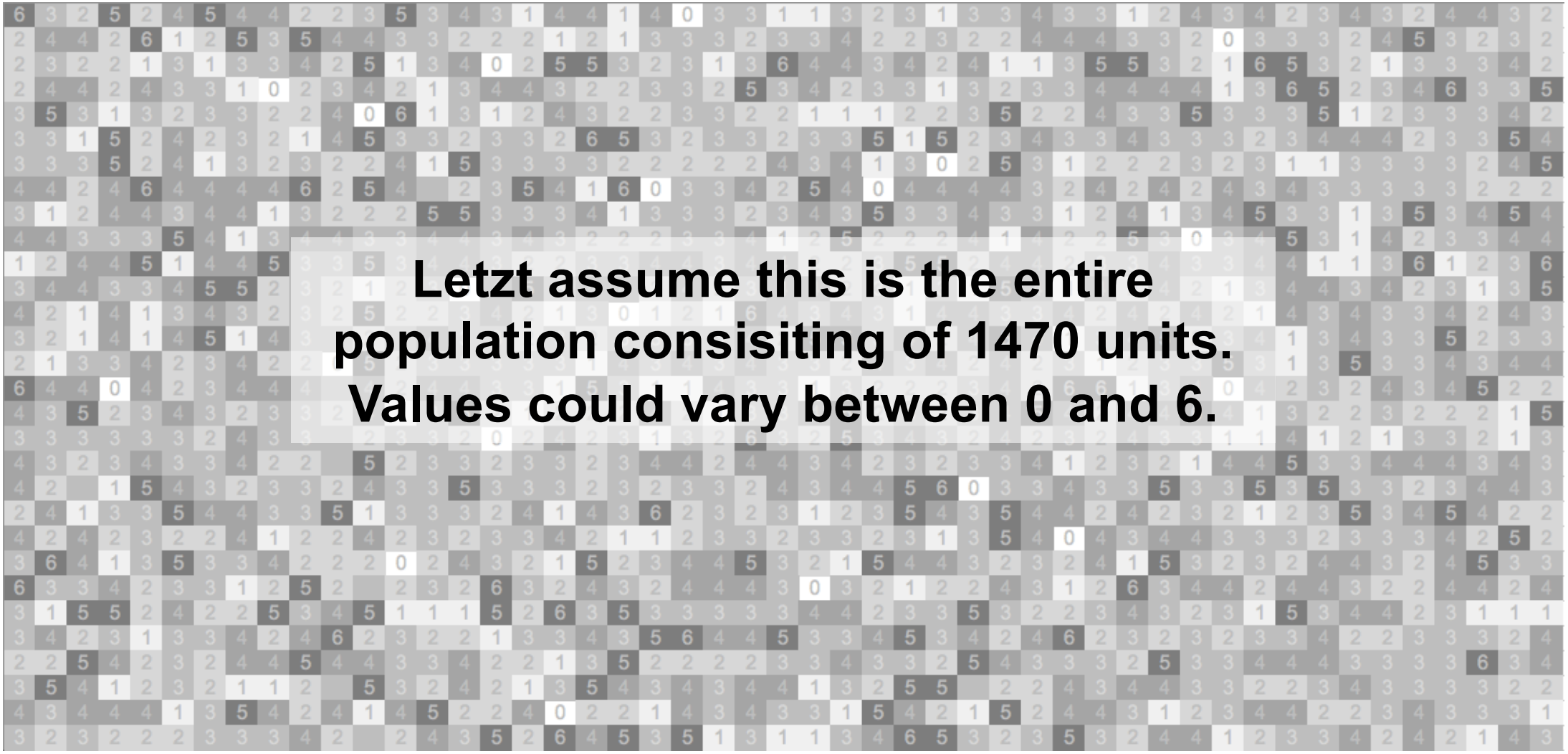
Social Research Methods

Sampling

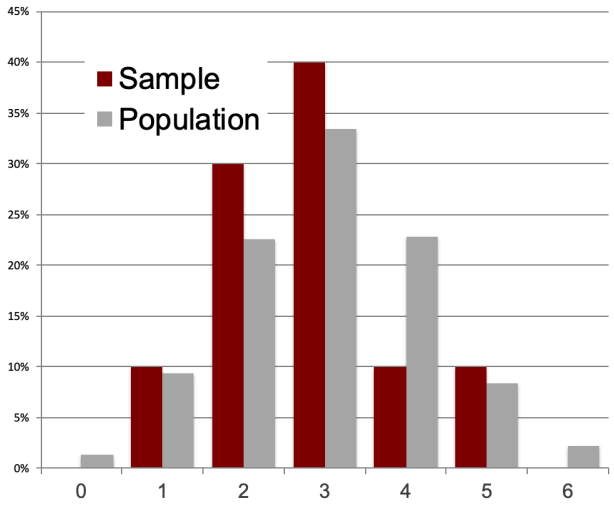
The fundamental idea of sampling



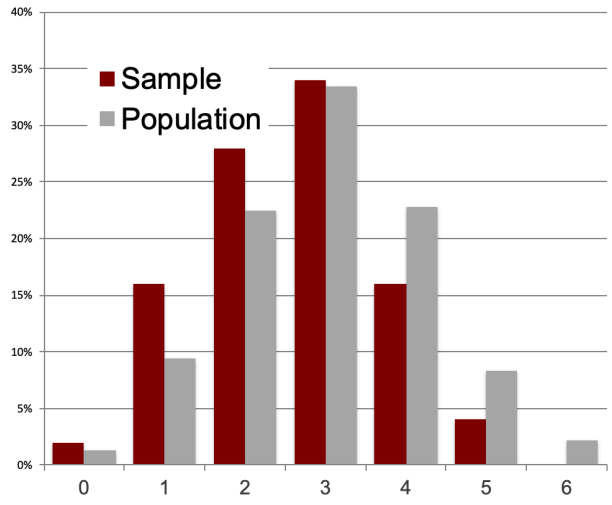
What's the average value?



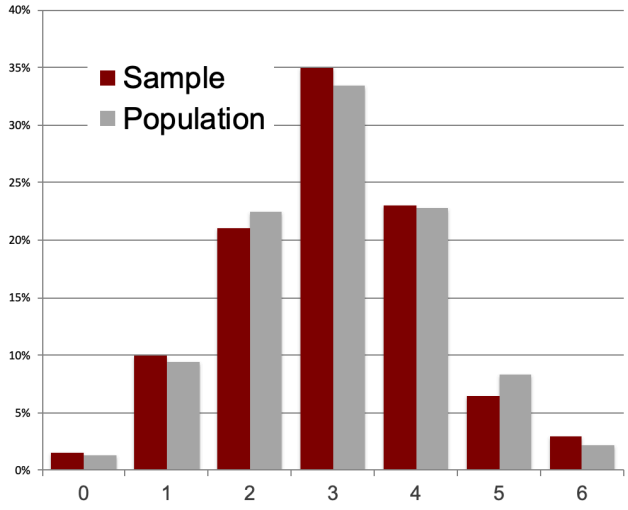
Estimation based on a sample



Sample Size		Mean	
Absolute:	20	Sample:	2,80
Relative:	1%	Population:	3,01
		Error:	**-0,21**



Sample Size		Mean	
Absolute:	50	Sample:	2,58
Relative:	3%	Population:	3,01
		Error:	**-0,43**



Sample Size		Mean	
Absolute:	200	Sample:	3,00
Relative:	13%	Population:	3,01
		Error:	**-0,01**

Sampling error refers to the difference between the estimation based on the sample and the real value in the entire population

Population and entities

What is your **population**?	Who are your **entities**?
On whom or what you want to generalize in the end	The actual nature of the subjects, units in your study
All human beings, all woman, all countries, all students, all Germans, all universities, all car drivers etc.	Individuals, groups, companies, countries, economies, rats, dogs etc.
The sample is supposed to represent your population	Every single entity must be identifiable, which in field studies is often not easy

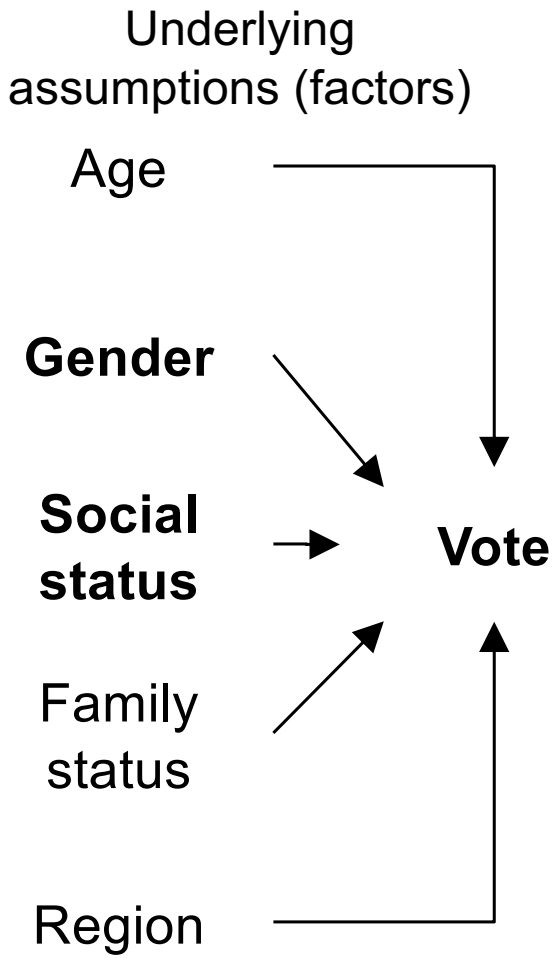
Probability Sample

Simple random sample	Most simple and best form to select a sample. Each unit has an equal probability to be selected. Hard to be done in practices.
Stratified random sample	After having stratified a sample a simple random sample is taken from each strata (e. g. from each faculty a proportional number of units is selected)
Multi-stage cluster sampling	Randomly choosing clusters and then randomly choosing subjects or smaller clusters from each cluster. This can evolve in multiple steps (stages).
PPS-sample probability proportional to size	Probability of a unit to be selected is equal to its size (e. g. when selecting companies as sample units)

Non-Probability Sample

Convenience (ad hoc) sample	Selecting a sample simply based on accessibility and availability of units at a given time at a given place (the most simple method in practice)
Snowball sampling	The researcher makes initial contact to a group of subjects and reaches out to more subjects with the help of the initially selected ones
Quota sampling	Generating a sample that reflects the population in terms of the relative proportions of units in different relevant categories

Quota Sampling | Example of predicting voting behavior



Mirror population (structural composition) based on relevant factors Sample size: 500		**Male** 50%	**Female** 50%	
Upper Class	10%	**25**	**25**	50
Middle Class	70%	**175**	**175**	350
Lower Class	20%	**50**	**50**	100
		250	250	**500**

Sample Size

The higher the **absolute** (not necessarily the relative) sample size the lower the sampling error

The higher the **distribution** (heterogeneity) of a parameter within a population the higher the sampling error

There are **statistical methods** (kind of complicated and rarely used in daily practice) to calculate the right sample size

In practice the determination of sample size is primarily a matter of **resources** (time and costs)

Non-responses might be more critical than the mere amount of respondents, especially when non-responding relates to the concept being measured.

Non-response | a simple case

You want to run a study supposed to measure people's happiness in their romantic relation

To reach as many subjects as possible you go for a snowball-sample on social media

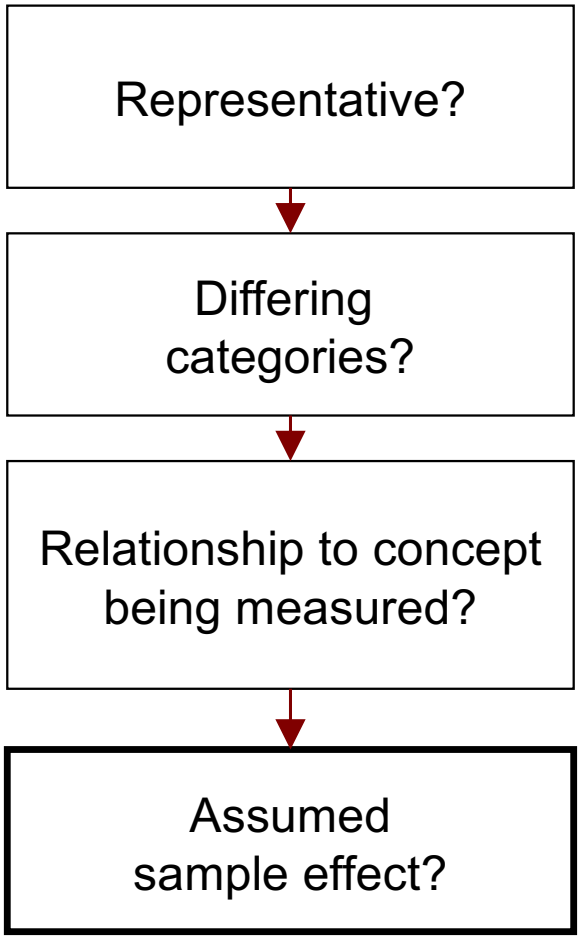
You simple share a link and invite respondents to share the link too

There is strong evidence about people being less active on social media when being happy in their romantic relation

So, people who are happy will show lower willingness to respond to your survey

As a consequence you will underestimate people's happiness because you mainly reach the unhappy ones

Sampling Error and Sampling Effect



Is the sample representative compared to the overall population on which the results are supposed to be generalized?

What are the categories or characteristics on which the sample differs from all units of the population?

Is there a theoretical evidence about these categories being related to the measured concept? If yes, what can be assumed about this relation in terms of direction and extend?

Based on the outcomes of the above mentioned points, what sample effects could be assumed?

Sampling effect | A simple case of election forecast

In the old times election forecast in the US have been conducted by simply calling a random sample on the phone

Not everyone had a phone, only the middle and upper class

This still must not matter.

Remember, most psychological studies have been conducted using rats or students as subjects

However, there might be a relation between social class and political orientation

Now, this seems to really matter

We know, there is a tendency of the middle/upper class to vote for the democrats

As a consequence, the results for the democrats will be over-estimated

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Social Research Methods

Elementary Statistics

Raw Data Matrix

Variables are represented by different columns

Subjects are represented by different lines

SBJ	V1	V2_1	V2_2	V2_3	V2_4	X2
1	0	3	3	2	2	10
2	1	4	2	3	3	12
3	1	3	2	3	2	10
4	0	2	3	2	2	9
5	1	3	2	4	3	12
6	0	2	4	5		
7	0	4	5	1	1	11
8	1	5	4	3	5	17
9	0	4	5		1	
10	1	5	1	4	4	14

The first line shows shortened names of the variables

There are figures only (no text or signs)

Data Preparation

Exclusion of **non-valid values**	Values, that obviously can't be real. Wrong kinds of responses
Identification and exclusion of **outliers**	$X > Q_3 + 1.5 \times IQR$ (Interquartile Range) $X < Q_1 - 1.5 \times IQR$
Z transformation	$Z = (X - \overline{X})/SD$ Mean: 0, Standard Deviation (SD): 1
Changing **polarity** of responses	$X_{new} = (X_{min} + X_{max}) - X_{original}$ X_{min}/X_{max} .. lowest/highest possible value
Calculation of **indices**	Sum or mean of all values related to an index per unit (when all values are valid)

Type of Variables

Level	Description	Examples	Univariate Statistics
Nominal	Values show no order. They are all on same level, discrete, categorical	Brands, names, colour, study, postal code, profession	With these types of variables you mainly can calculate **frequencies**
Ordinal	Values show an order, can be ranked. Intervals cannot be assumed to be equal	Employer ranking, ranking in sports	
Interval	Intervals, differences of values make sense and can be reasonably interpreted	Temperature, school grades, Likert-scales	With these types of variables you can run **mostly all kinds of statistics**
Ratio	There is a natural zero point. Quota can be calculated and reasonably interpreted	Size, prize, costs, length, weight	
Dichotomous	Variables with two possible categories only	Gender, pregnancy, questions with yes/no-response	

Are grades on ordinal or interval level?

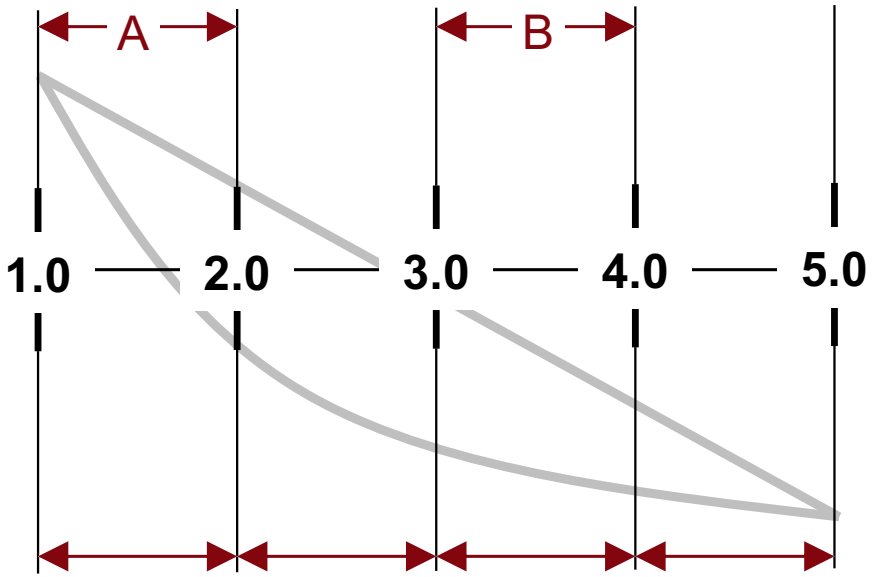
Grades* are on higher level than just **nominal** since there is a direction from very good to not passed (5.0)

Whether grades are on **ordinal** or even **interval** level depends on the interpretation of the differences (intervals) between values

In practice we assume grades to be on interval level since we calculate **averages**

Grades are not on **ratio** level. We would never say, 4.0 is half or double as good/bad as 2.0

Ordinal if interval A is different from interval B



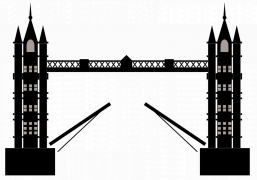
Interval if all differences (intervals) are equal

*) The example shown here relates to german grading sysem where 1.0 is excellent (best possible grade) and 5.0 not passed

Temperature is on interval level

Rome **30°**

Paris **20°**



London **10°**

Berlin **0°**

Temperature is at least on **ordinal** level. In Paris it is warmer than in London

It is at least **interval**. The difference between Rome and Paris is equal to the difference between London and Berlin

It is not on **ratio** level. We couldn‘t say, the temperature in Paris is double as high as the temperature in London since 0 is not a real zero point.

Elementary Statistics Overview

Central tendency	**Arithmetic mean**	Sum of all values divided by the number of values (average)
	Median	The mid-point in a distribution of values
	Modal	The most frequent value in a distribution
Dispersion	**Standard deviation**	Variation around the mean (root mean square)
	Quartile	Lower/upper 25% and middle point (median) of a distribution
Frequency	**Absolute Frequency**	Absolute amount of values in a given category
	Relative Frequency	Frequency in a category divided by total number of values
	Cumulative frequency	Frequency in a category plus the sum of all values so far
Relationship	**Contingency table**	Combined relative frequencies of multiple variables
	Correlation	Linear relationship of two variables (Person's r)

Elementary Statistics Overview

Fictitious results on the question asked in an employee survey:
Would you recommend a friend to work in our company?

Option	Code i	f_i	relative f_i	rel. $f(\%)_i$	f_{ci}	rel. $f(\%)_{ci}$	$i \times f_i$
yes	1	5	0.09	9	5	9	5
mainly yes	2	23	0.42	42	28	51	46
partly-partly	3	17	0.31	31	45	82	51
mainly no	4	8	0.15	15	53	96	32
no	5	2	0.04	4	55	100	10
total		**55**	**1**	**100**			**144**

Frequency (f), cumulative (c)

Mean = 2.62

Standard Deviation = 0.97

Standard Deviation Calculation

1
Calculate the mean of all values (total mean)

2
Substract mean from each value

3
Multiply the outcomes of step 2 by themselves

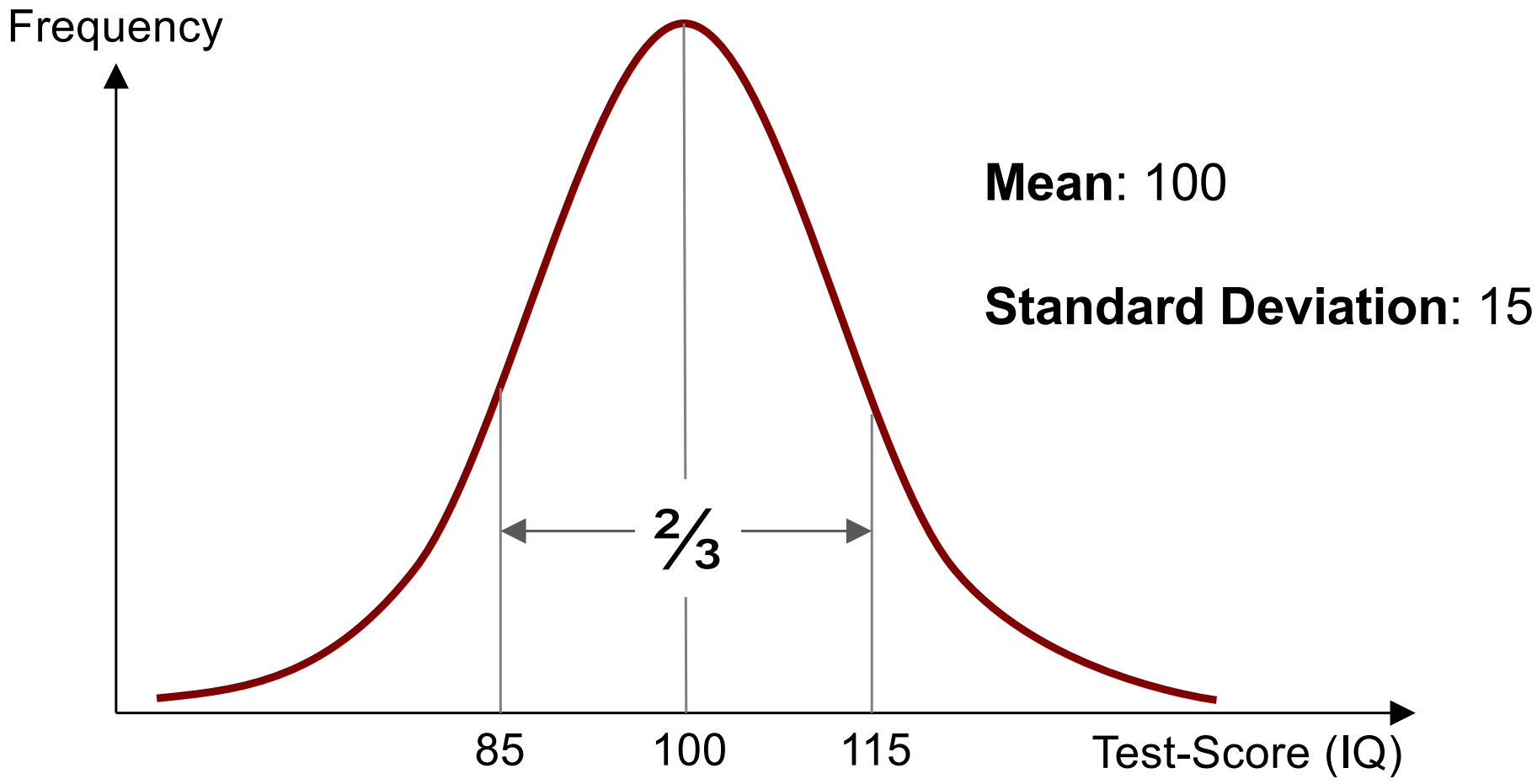
4
Sum up all outcomes of step 3

$$s = \sqrt{\frac{\sum (x - \bar{x})^2}{n}}$$

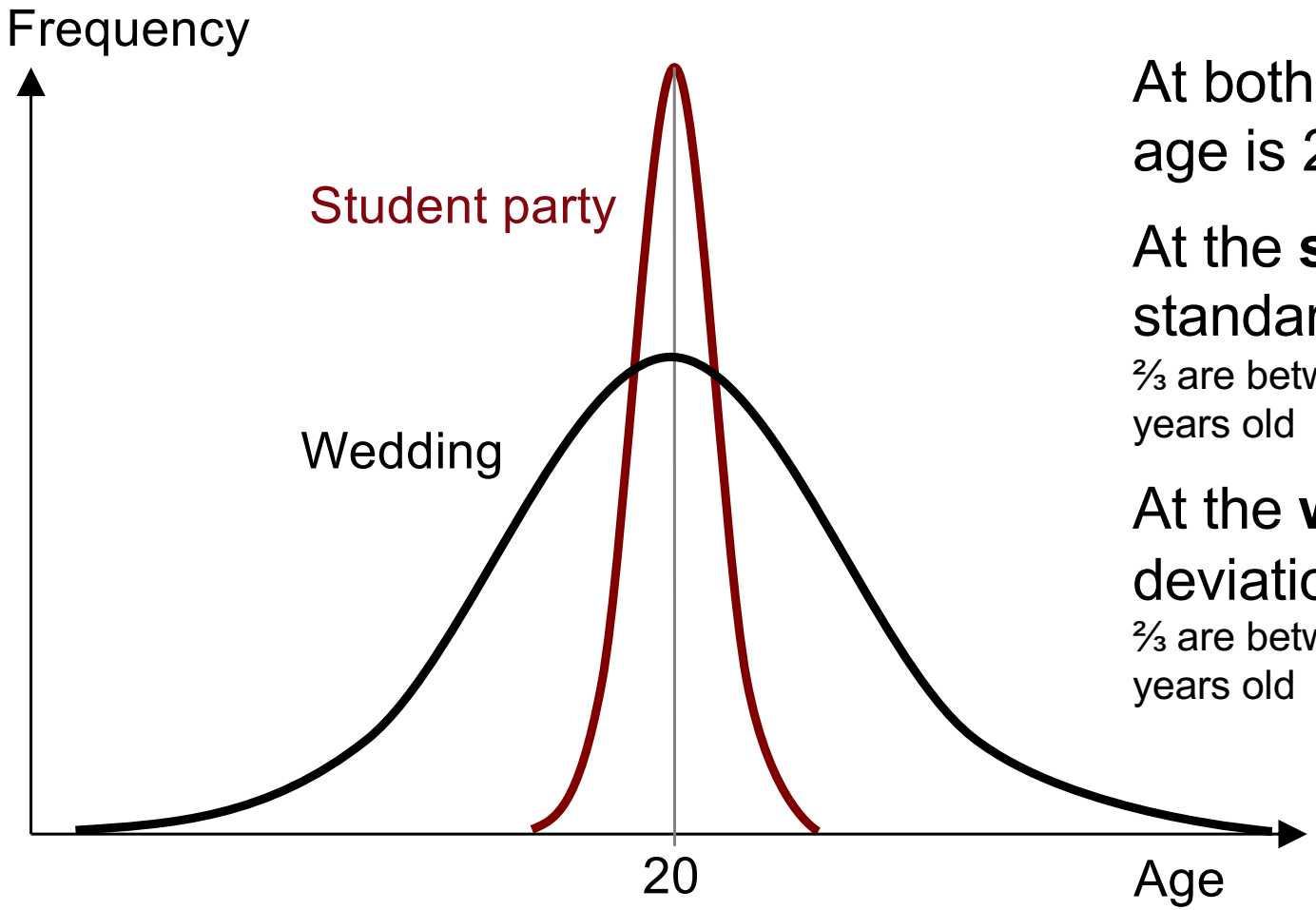
5
Divide outcome of step 4 by total number of values

6
Take the outcome of step 5 and calculate its square root

Normal distribution (Example IQ)



Standard deviation | Student party versus wedding



At both parties the average age is 20.

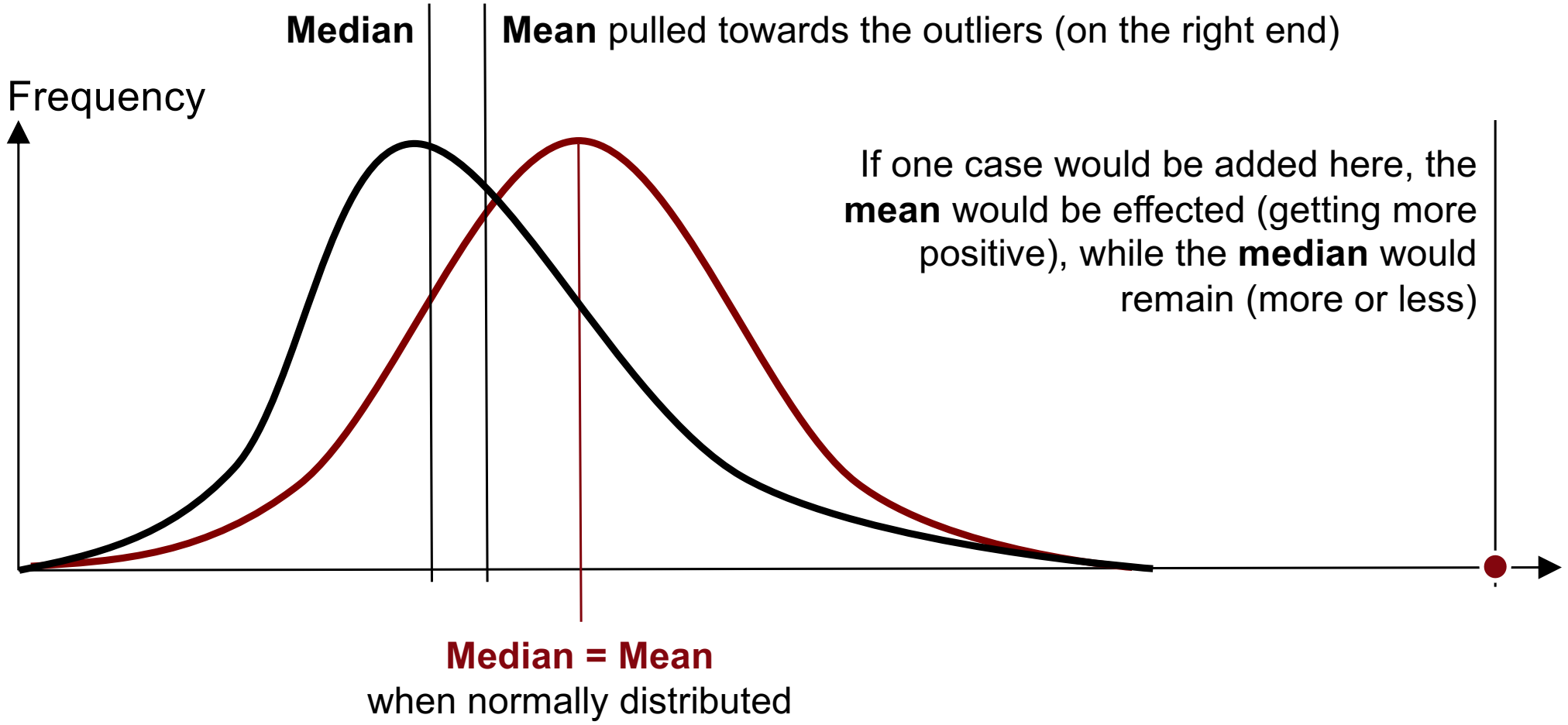
At the **student party** standard deviation is **2**.

⅔ are between 18 (20-2) and 22 (20+2) years old

At the **wedding** standard deviation is **15**.

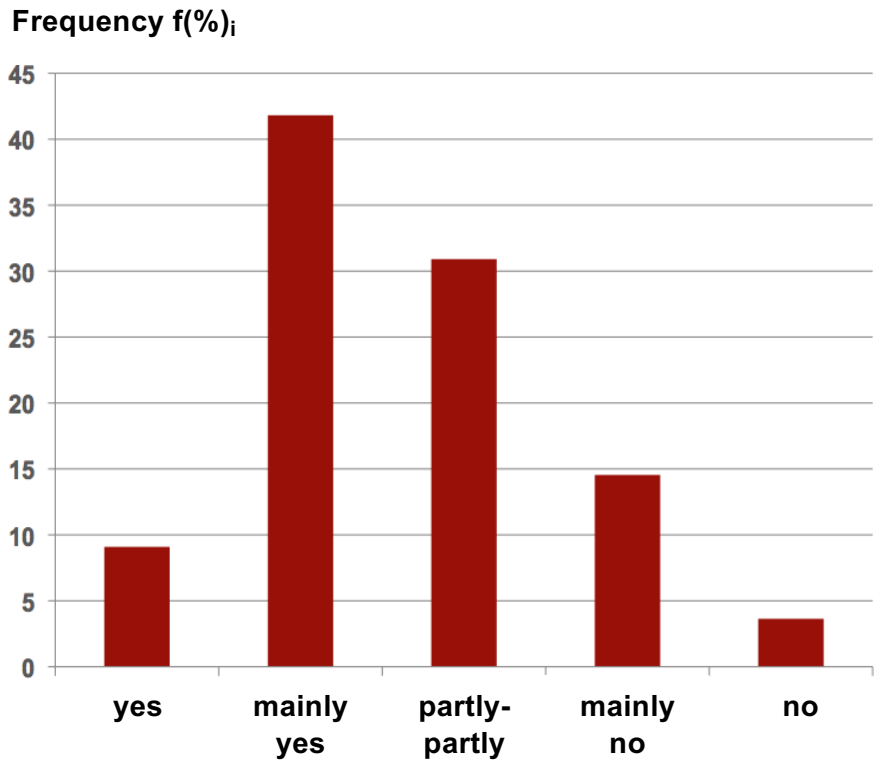
⅔ are between 5 (20-15) and 35 (20+15) years old

Median versus mean



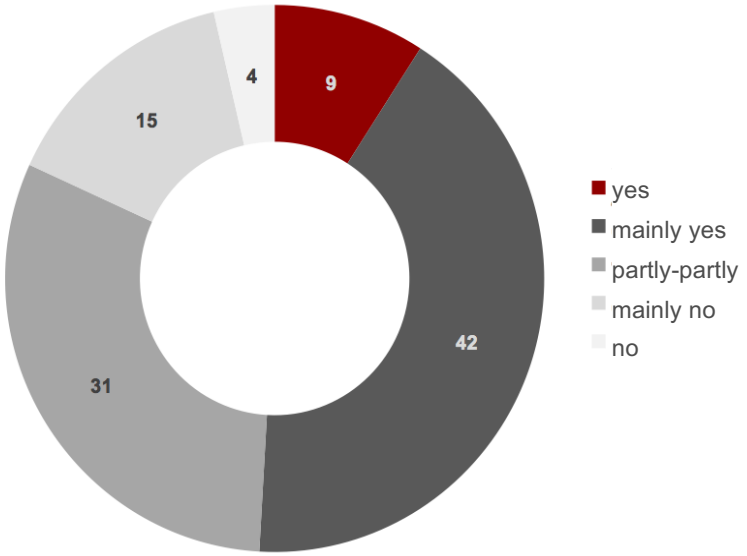
Diagrams (univariate)

Histogram

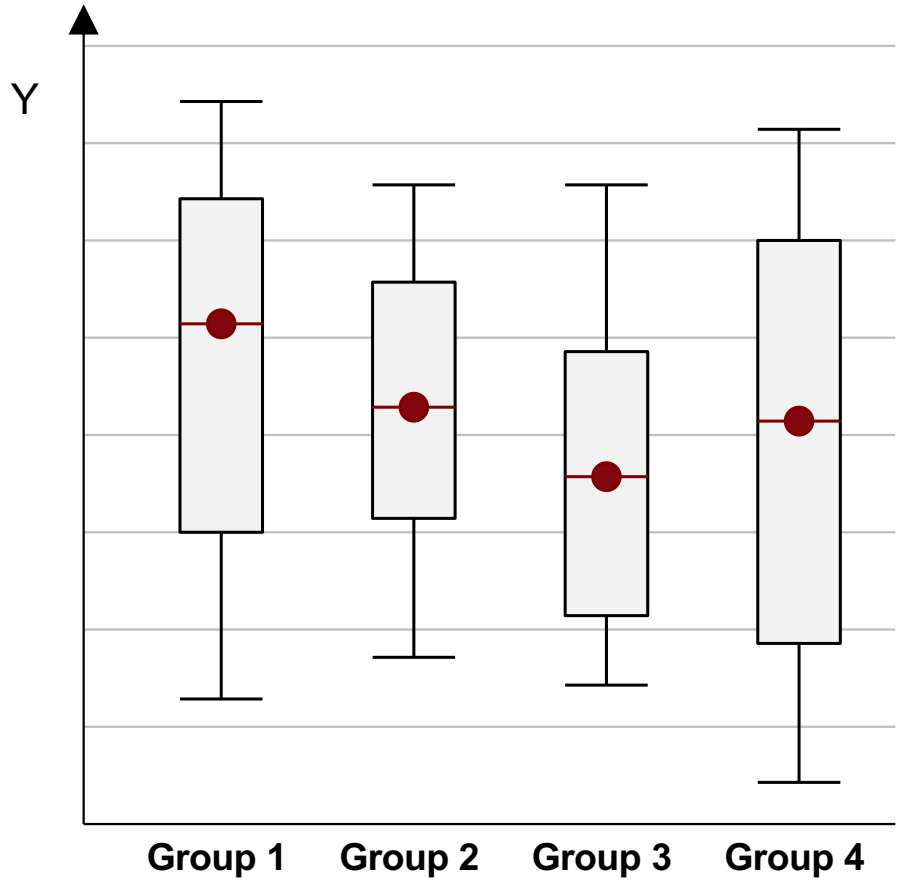


Ring chart

similar to pie chart. Only appropriate with relative frequencies



Box Whisker Diagram (Plot)



Most extreme upper value

Upper (3rd) quartile

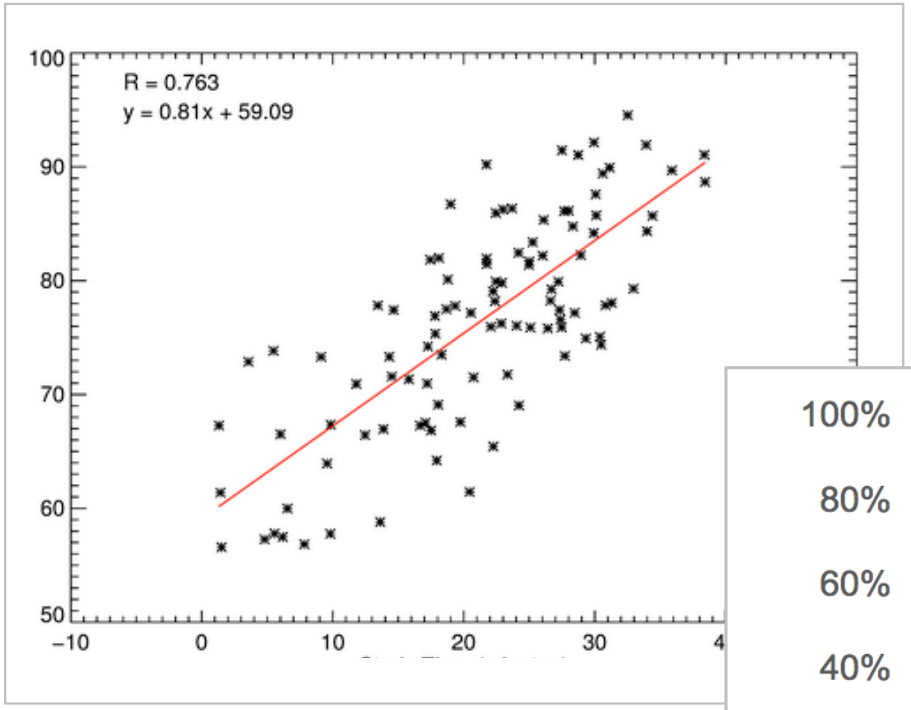
Median (2nd quartile)

Lower (1st) quartile

Most extreme lower value

Relationship

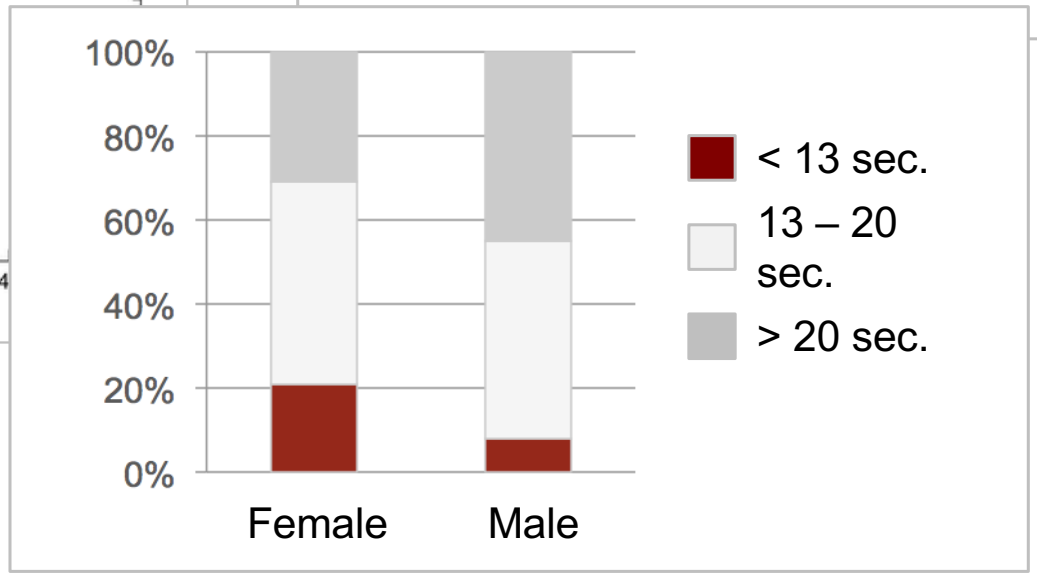
Scatter Diagram (plot)



Contingency Table

Parking speed	Gender: Female (%)	Gender: Male (%)
< 13 sec.	21	8
13 – 20 sec.	48	47
> 20 sec.	31	45

Stacked Bar-Chart



Mean Comparison Example 1

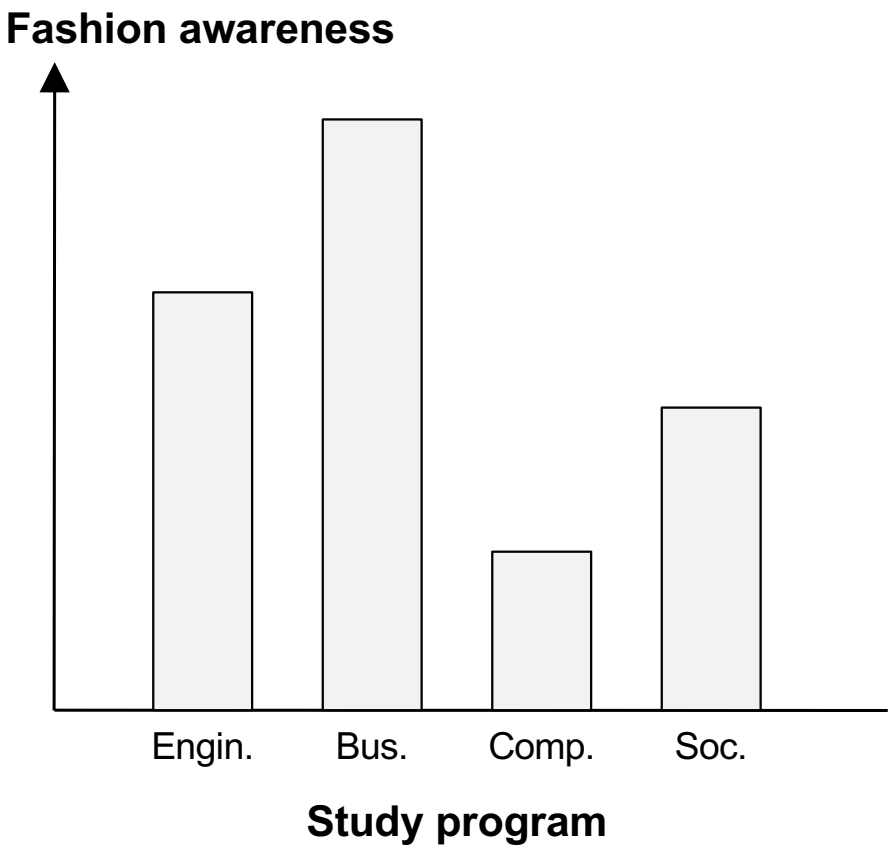
In a quasi-experiment it was investigated how the consumption of alcohol affects the reaction time (measured with the falling-stick-technique).

Reactivity was measured in four cycles. Between the measurements, a specific amount of alcohol was given to the subjects.

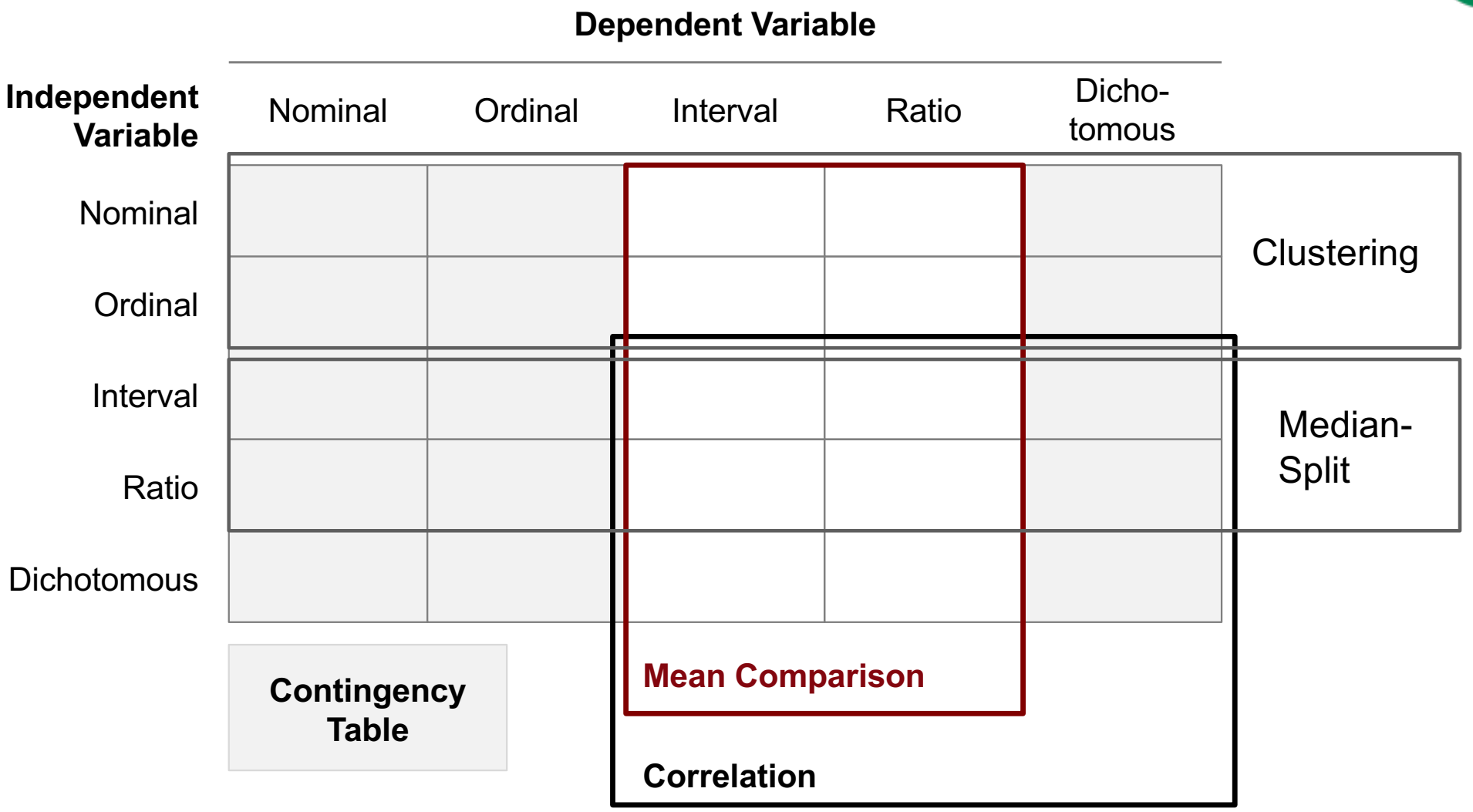
Mean Comparison Example 2

Through a self-administered questionnaire the fashion awareness of students of different study programs was examined.

On the basis of the answers, an index value was calculated for each participant that reflects his/her fashion awareness.



Relationship



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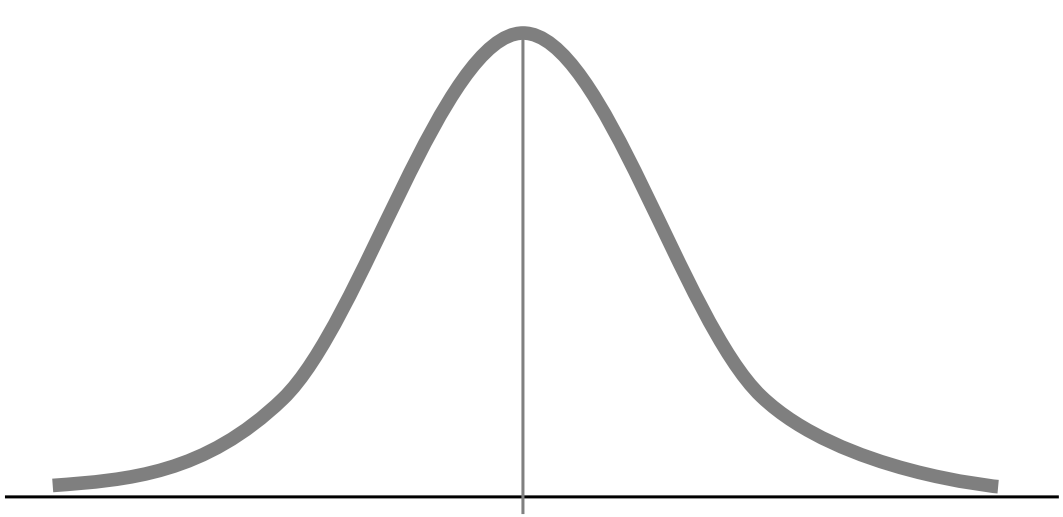
Social Research Methods

Inferential Statistics

We have n, $\bar{x}$ and s to estimate μ and σ of our population N

What we don‘t know

Population
Population size **N**

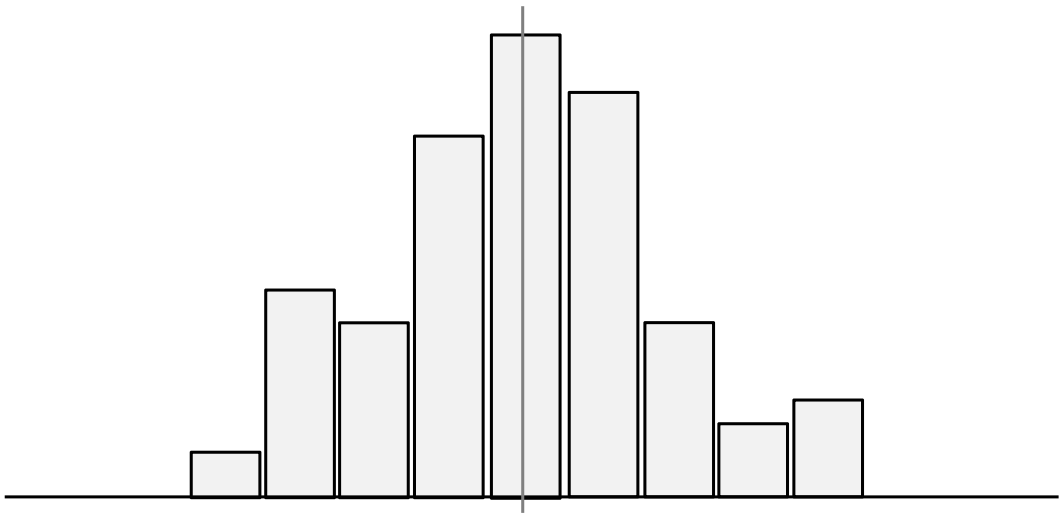


Population mean $\boldsymbol{\mu}$ (mu)

Standard Deviation of **Population** $\boldsymbol{\sigma}$ (sigma)

What we have/know

Sample
Sample size **n**



Sample mean $\bar{\boldsymbol{x}}$ (x bar)

Standard Deviation of **Sample** $\boldsymbol{s}$.

Statistics is about estimation

Sample mean as an estimator for the **population** mean

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$$

$$\bar{x} = \mu$$

Standard deviation of **population**

$$\sigma = \sqrt{\frac{\sum_{i=1}^{N}(x_i - \mu)^2}{N}}$$

Variance

$$\sigma^2$$

Standard deviation of **sample** as an estimator of standard deviation of the **population**

$$s = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}}$$

A little simulation on standard deviation

n = 20	Standard Deviation		n = 8	Standard Deviation	
mean	σ (N)	s (n-1)	mean	σ (N)	s (n-1)
3.05	0.86	0.89	3.63	1.49	1.60
2.60	1.16	1.19	2.75	1.09	1.16
3.15	1.31	1.35	2.50	0.71	0.76
3.15	1.19	1.23	3.63	0.99	1.06
2.55	1.24	1.28	3.00	1.00	1.07
3.00	1.22	1.26	3.06	0.90	0.93
2.80	0.87	0.89	3.13	0.86	0.89
3.05	1.20	1.23	2.63	1.11	1.15
2.85	1.15	1.18	3.00	1.06	1.10
3.10	1.09	1.12	3.00	1.22	1.26
2.93	1.13	1.16	3.03	1.04	1.10

True mean μ **= 3.01**; true standard deviation σ **= 1.22**

Z-Transformation

You can transform any distribution of x into a **z distribution**, where the **mean** of z is **0** and the **standard deviation** of z is **1**

$$z_i = \frac{x_i - \bar{x}}{s}$$

z_i ... z-transformed value of x_i
x_i ... value in the sample
$\bar{x}$ … mean of sample
s … standard deviation of sample

Through a z transformation values and distributions become **comparable**

Independent from what you measure (height, weight, length, personality, grades etc.) you will always receive the **same** distribution

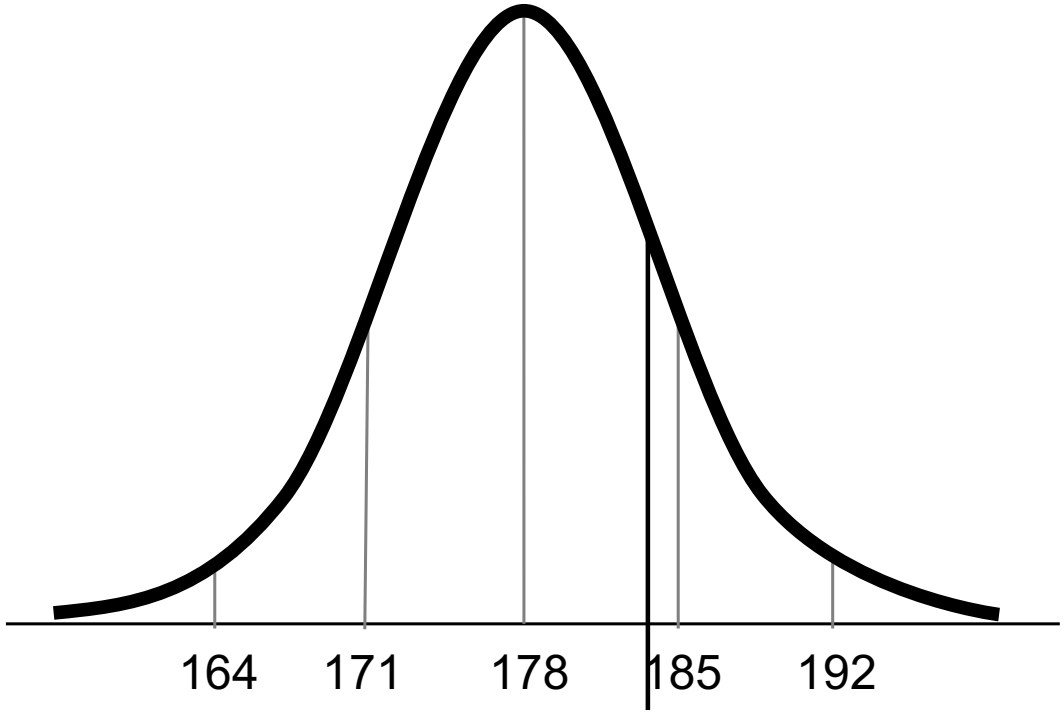
In the end you just look how many standard deviations a value is away from the mean (0)

Z-Transformation | Example

	Original Values			Z-Transformed Values		
	High Jump inches	**100 m Race** seconds	**Shot-put** feet	**High Jump**	**100 m Race** reversed	**Shot-put**
1	312	16	23.0	-0.20	0.00	-0.37
2	335	15	18.4	0.37	0.45	-1.40
3	292	17	27.6	-0.69	-0.45	0.66
4	274	19	23.0	-1.13	-1.36	-0.37
5	307	14	27.6	-0.32	0.91	0.66
6	358	15	23.0	0.93	0.45	-0.37
7	330	14	18.4	0.24	0.91	-1.40
8	249	17	23.0	-1.74	-0.45	-0.37
9	274	19	18.4	-1.13	-1.36	-1.40
10	295	20	23.0	-0.61	-1.81	-0.37
11	333	12	27.6	0.32	1.81	0.66
12	378	15	32.2	1.42	0.45	1.69
13	401	14	27.6	1.98	0.91	0.66
14	343	17	32.2	0.56	-0.45	1.69
s	**40.8**	**2.2**	**4.5**	**1**	**1**	**1**
mean	**320.1**	**16.0**	**24,6**	**0**	**0**	**0**

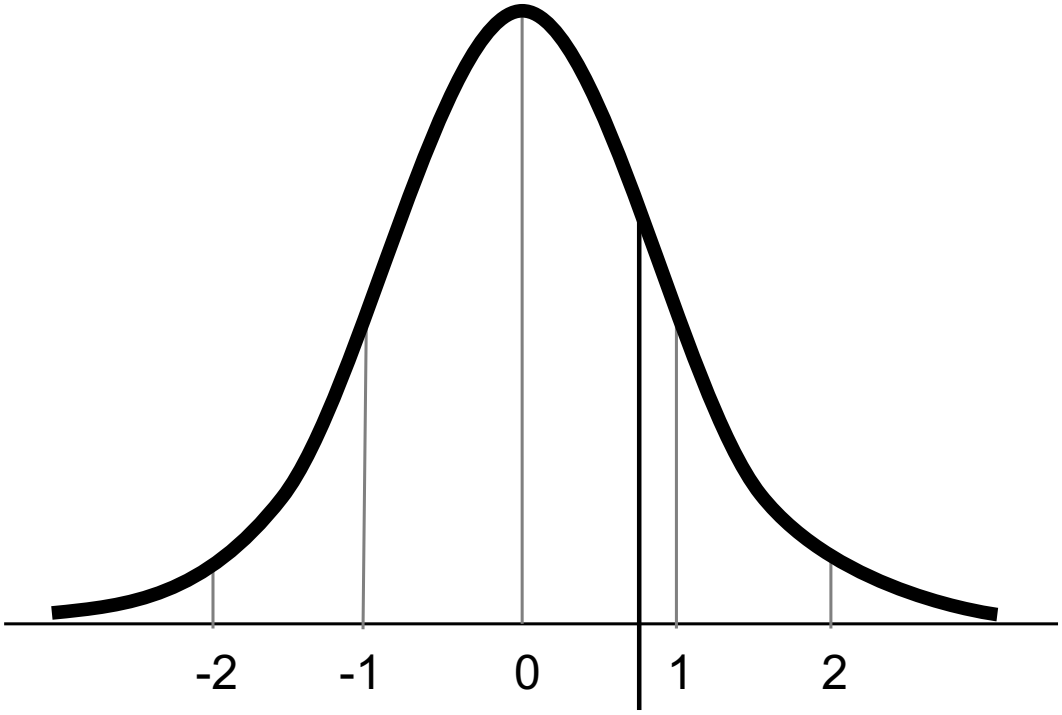
Z-Transformation | Example

Mean height of men in Germany is 178 cm. Standard deviation is 7 cm



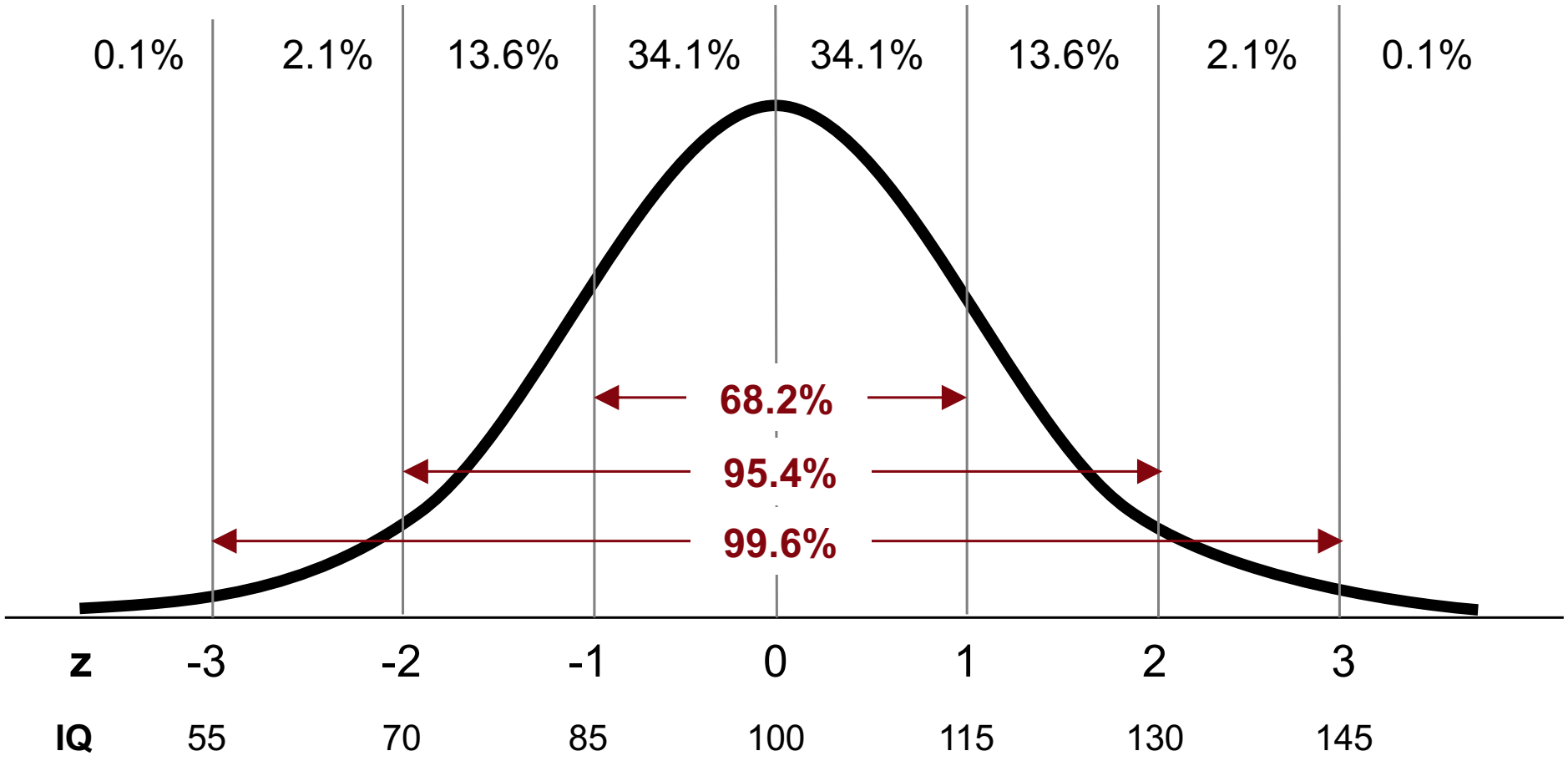
My height **x**: **184**

Z transformed distribution



My height **z**: **0.86**

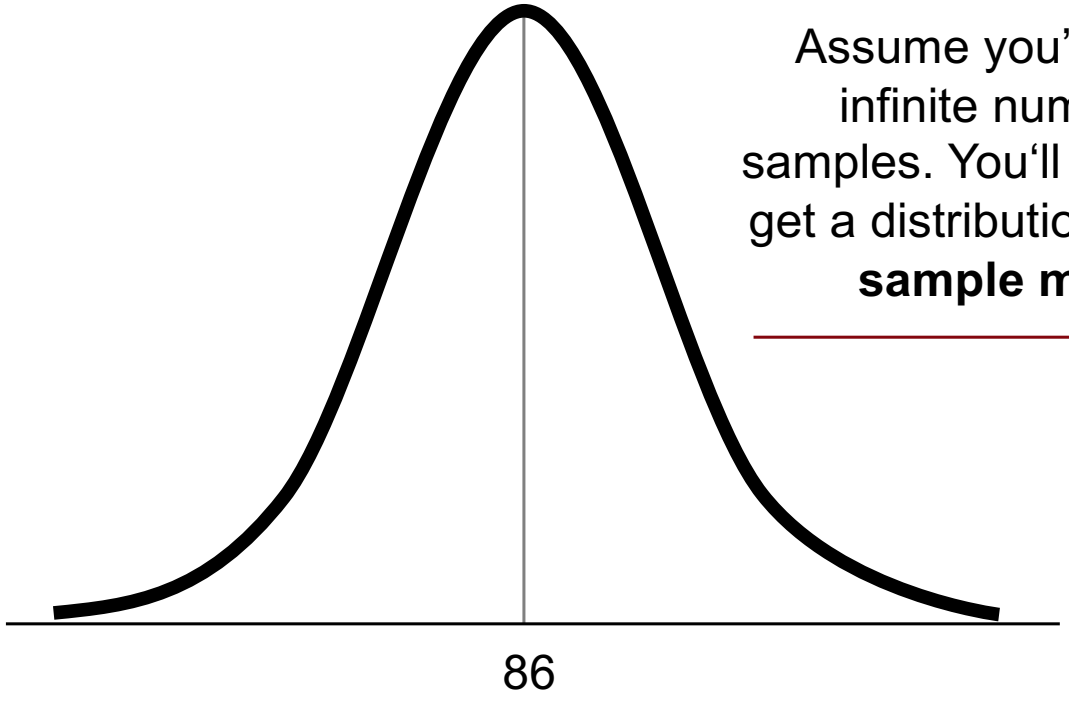
Z distribution



Sample distribution and sample mean distribution

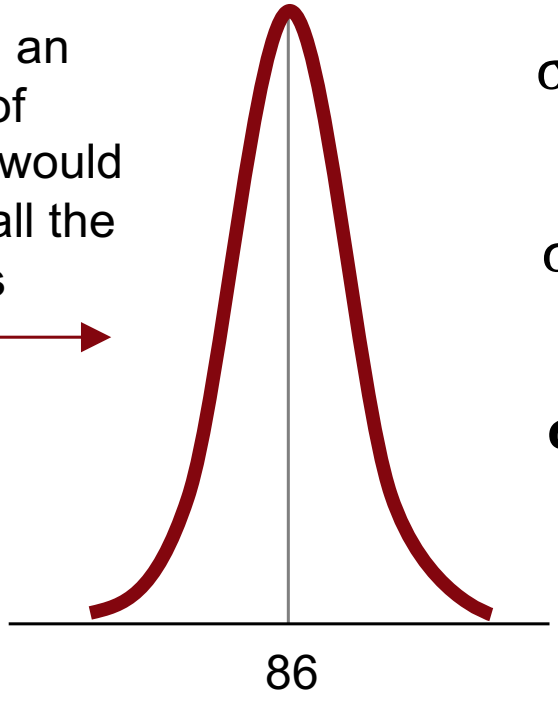
The actual **sample** distribution

$\bar{x}$ = 86, s = 18, n = 100



Assume you'd pull an infinite number of samples. You'll then would get a distribution of all the **sample means**

The estimated distribution of all **sample means**



$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$$

$$\sigma_{\bar{x}} = \frac{18}{\sqrt{100}}$$

$$\boldsymbol{\sigma_{\bar{x}} = 1.8}$$

$\boldsymbol{\sigma_{\bar{x}}}$ … Standard deviation of sample means

Alpha error and beta error

Decision	Actually: H_0 is true	Actually: H_0 is not true
Accept H_0	Correct decision	Beta error Type II
Reject H_0	**Alpha error** **Type I**	Correct decision

The **p-value** refers to the probability (p) of the **alpha error**. Significant when **p < 0.05** (5%). Very significant when **p < 0.01** (1%)

Null hypothesis and alternative hypothesis

In a company sales representative generate 1,000 Euro revenue per day on average. 30 employees, who attended a sales training generate revenue of 1,100 Euro per day. Standard deviation of sales is 250 Euro.

Can we surely say, this training has an effect on sales?

H_0: The training has no effect on sales. $\mu_{\text{not trained}} = \mu_{\text{trained}}$

H_1: The training has an effect on sales. $\mu_{\text{not trained}} \neq \mu_{\text{trained}}$

How probable is it to find a difference of 100 Euro per day even though H_0 is assumed to be true?

H_0 .. Null hypothesis; H_1 .. Alternative hypothesis

Testing significance

First, we calculate the standard deviation of sample means

Standard deviation of sales = 250 Euro, n = 30

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{250}{\sqrt{30}} = 45.6$$

Mean of sample (assuming H_0 is true) = 1,000 Euro, which is a good estimate of the population mean μ.

How probable is it to have 1,100 Euro sales when 1,000 is true?

To understand this, the mean sales of trained sales reps will be transformed (standardized) into a z-score:

$$z = \frac{\bar{x}_{\text{trained}} - \mu}{\sigma_{\bar{x}}}$$

$$z = \frac{1{,}100 - 1{,}000}{45.6} = \mathbf{2.19}$$

Probability of z = 2.19 is less than 5% (see the z distribution)

We can therefore reject H_0

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Social Research Methods

Analysis of Variance (ANOVA)

Analysis of variance

Analysis of variance is supposed to test significance when **comparing means**

ANOVA refers to analysis of variance, when there is one independent variable (IV, could be nominal) and one dependent variable (DV, at least interval)

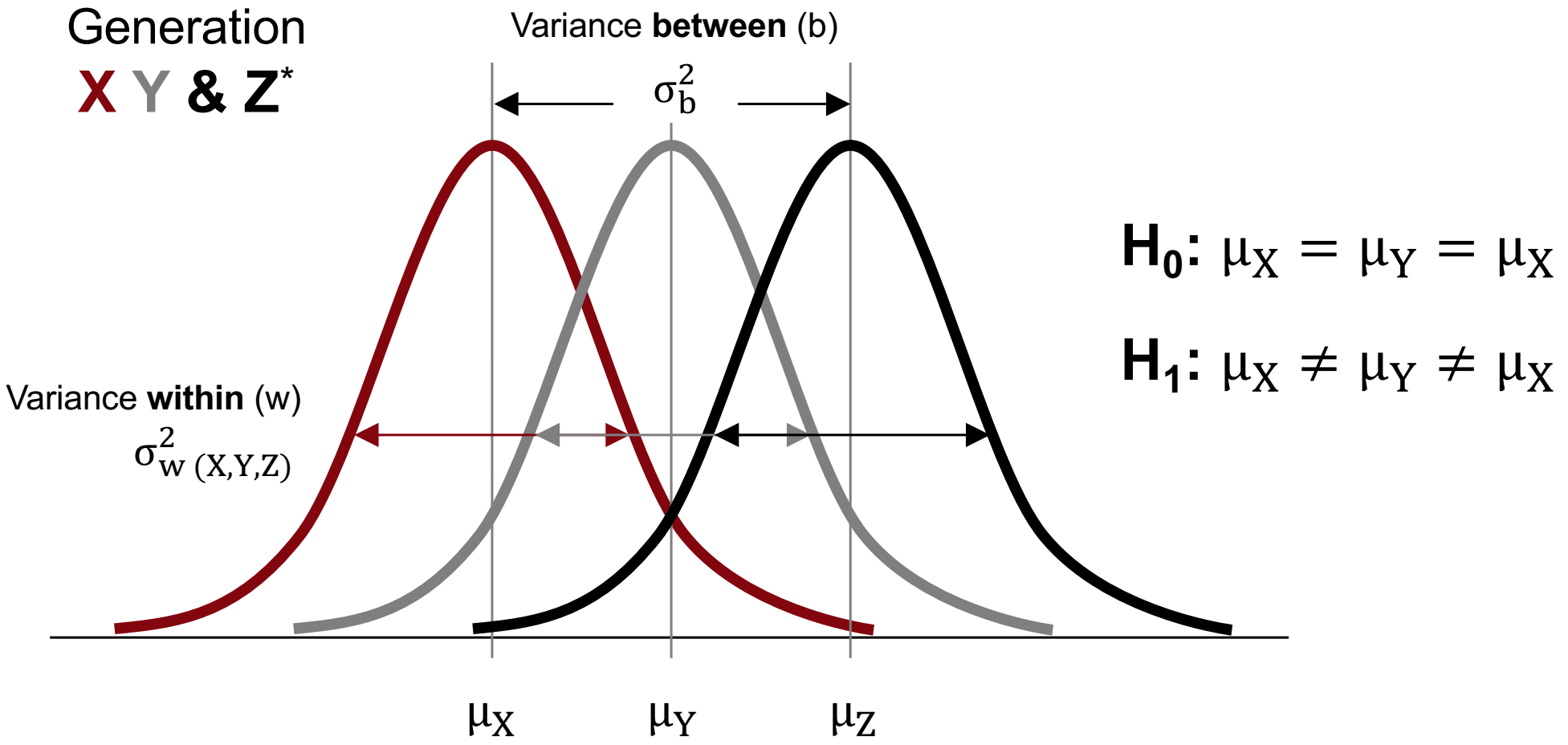
ANOVA is the perfect statistical method in case of **experimental designs**

ANOVA focuses on the **differences** between groups

The interpretation of of any **relation** between IV and DV must be based on the different group means

MANOVA refers to analysis of variance, when there are more than one IV or DV

Comparison of different generations



$\mathbf{H_0}$: $\mu_X = \mu_Y = \mu_X$

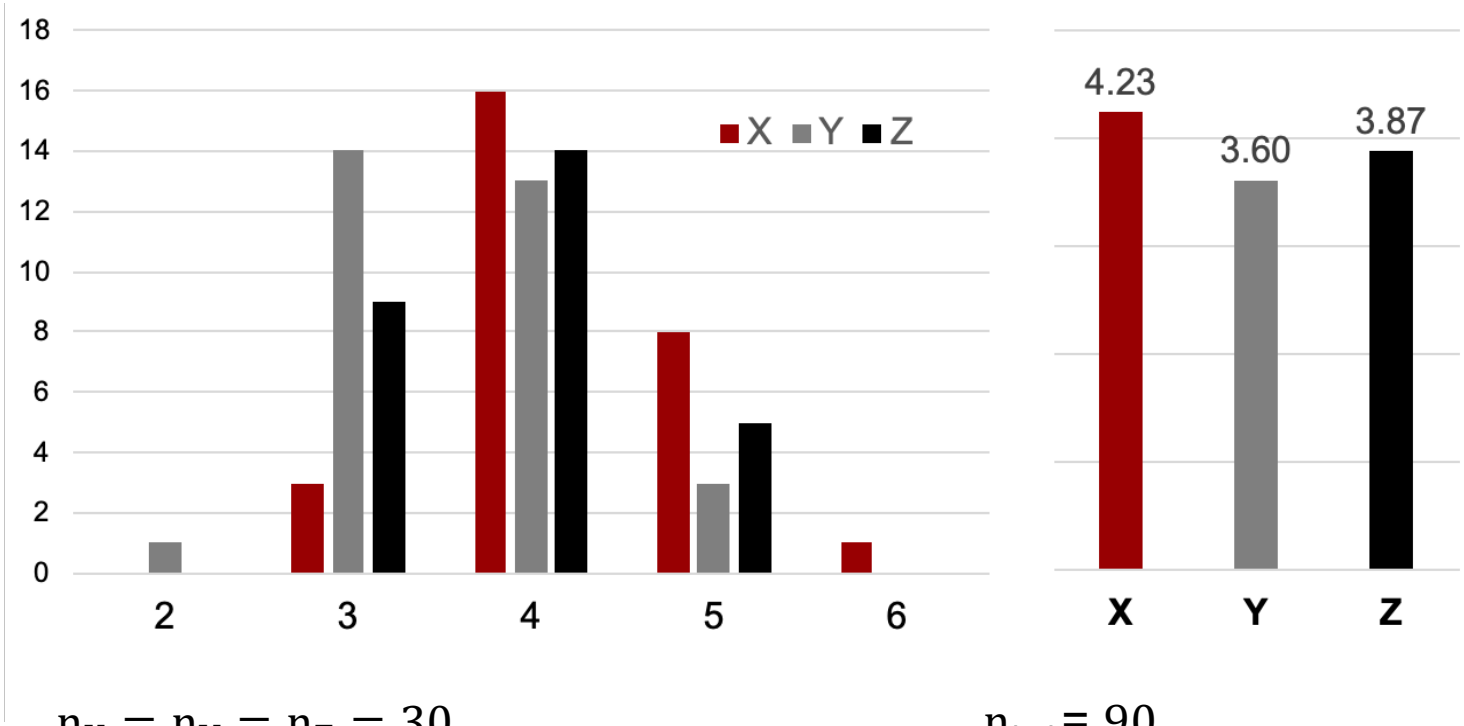
$\mathbf{H_1}$: $\mu_X \neq \mu_Y \neq \mu_X$

Generation X (born 1965-1979), Y (born 1980-1994), Z (born 1995-2015)

Comparison of different generations

i	X	Y	Z
1	4	5	3
2	4	3	3
3	5	3	5
4	4	3	4
5	4	4	3
6	5	3	4
7	4	4	3
8	4	4	4
9	5	3	5
10	4	4	4
11	4	3	3
12	5	3	3
13	3	4	3
14	3	3	4
15	4	3	4
16	4	5	5
17	4	3	4
18	4	4	5
19	4	3	4
20	4	4	4
21	5	3	5
22	4	4	4
23	4	4	5
24	4	4	3
25	5	4	4
26	5	4	4
27	4	4	3
28	6	5	4
29	3	2	3
30	5	3	4
Mean	**4.23**	**3.60**	**3.87**

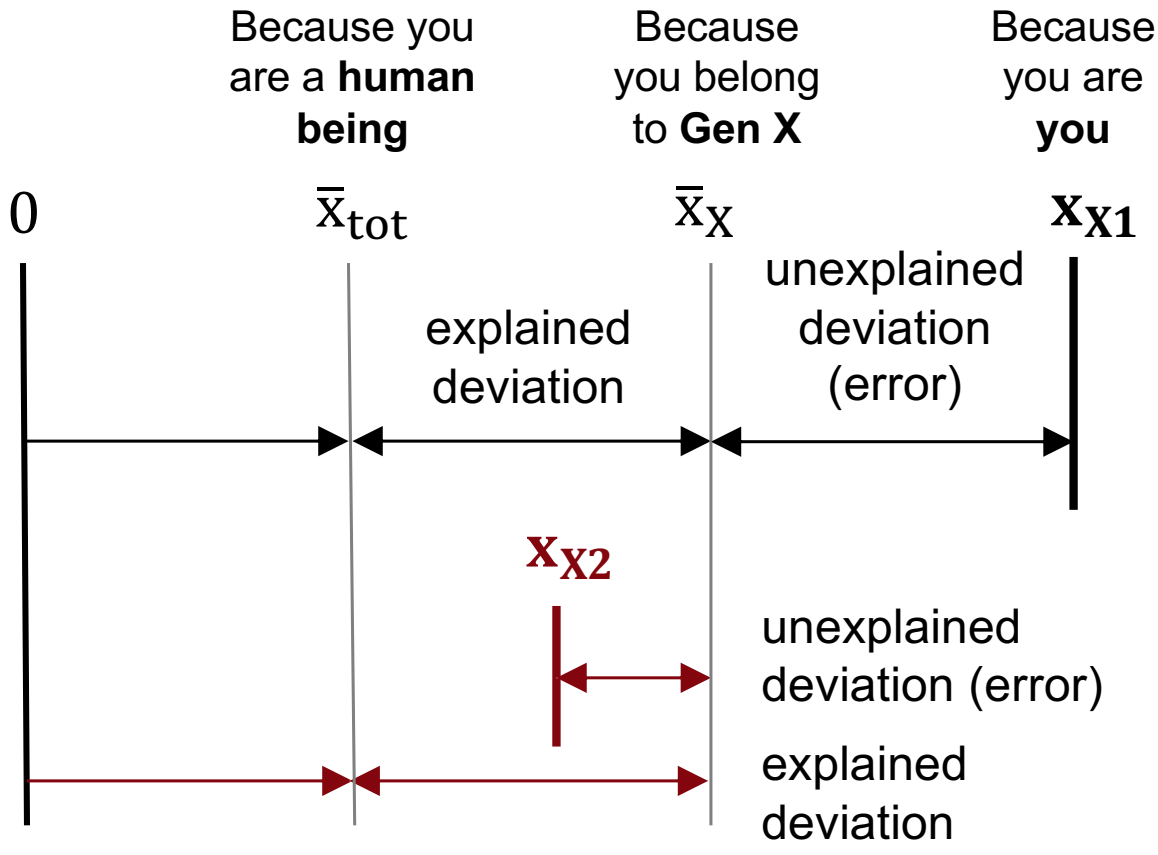
In your career, how many different jobs do you intent to have? Question in a fictitious survey



$n_X = n_Y = n_Z = 30$ $\quad n_{tot} = 90$

$\bar{x}_X = 4.23$ $\quad \bar{x}_Y = 3.60$ $\quad \bar{x}_Z = 3.87$ $\quad \bar{x}_{tot} = 3.90$

Sum of Squares | $SS_{tot} = SS_b + SS_w$



G .. Groups; **n** .. sample size within group
b .. between groups; **w** .. within groups

total deviation

$$SS_{tot} = \sum_{g=1}^{G} \sum_{i=1}^{n} (x_{gi} - \bar{x}_{tot})^2$$

explained deviation

$$SS_b = \sum_{g=1}^{G} n(\bar{x}_g - \bar{x}_{tot})^2$$

unexplained deviation (error)

$$SS_w = \sum_{g=1}^{G} \sum_{i=1}^{n} (x_{gi} - \bar{x}_g)^2$$

Sum of Squares | $SS_{tot} = SS_b + SS_w$

i	Gen (g)	x_{gi}	$\bar{x}_{tot}$	$\bar{x}_g$	SS_{tot}	SS_b	SS_w
		A	*B*	*C*	$(A-B)^2$	$(C-B)^2$	$(A-C)^2$
1	X	**4**	3.90	4.23	**0.01**	**0.11**	**0.05**
2	X	**4**	3.90	4.23	**0.01**	**0.11**	**0.05**
...	...	**...**	...	...	**...**	**...**	**...**
30	X	**5**	3.90	4.23	**1.21**	**0.11**	**0.59**
1	Y	**5**	3.90	3.60	**1.21**	**0.09**	**1.96**
2	Y	**3**	3.90	3.60	**0.81**	**0.09**	**0.36**
...	...	**...**	...	...	**...**	**...**	**...**
30	Y	**3**	3.90	3.60	**0.81**	**0.09**	**0.36**
1	Z	**3**	3.90	3.87	**0.81**	**0.00**	**0.75**
2	Z	**3**	3.90	3.87	**0.81**	**0.00**	**0.75**
...	...	**...**	...	...	**...**	**...**	**...**
30	Z	**4**	3.90	3.87	**0.01**	**0.00**	**0.02**
				Sum:	**50.10**	**6.07**	**44.03**

Variance within and between

Based on the sum of square you can calculate the **variance**

Applied to our case, this leads to the following:

Total variance

$$s^2_{tot} = \frac{SS_{tot}}{G * n - 1}$$

$$s^2_{tot} = \frac{50.10}{3 * 30 - 1} = \mathbf{0.85}$$

Variance **between** groups

$$s^2_b = \frac{SS_b}{G - 1}$$

$$s^2_b = \frac{6.02}{3 - 1} = \mathbf{3.03}$$

Variance **within** groups (error)

$$s^2_w = \frac{SS_w}{G(n - 1)}$$

$$s^2_w = \frac{44.03}{3(30 - 1)} = \mathbf{0.77}$$

We now calculate the so-called **F-value:** $F = \frac{s_b^2}{s_w^2}$

which in the present case is: $F = \frac{3.03}{0.77} = \mathbf{3.93}$

Degrees of freedom in the counter $\mathbf{df_b}$: **2** $(G - 1)$

Degrees of freedom in the denominator $\mathbf{df_w}$: **57** $(G(n - 1))$

We accept probability of error to reject the H_0: **5%** ($p < .05$)

The empirical F-value (3.93) is **higher** than the theoretical one reported in published F-value-tables, which is **3.15**.

So, we can **reject the H_0**. Probability of differences in group means just happening by chance is less than 5%

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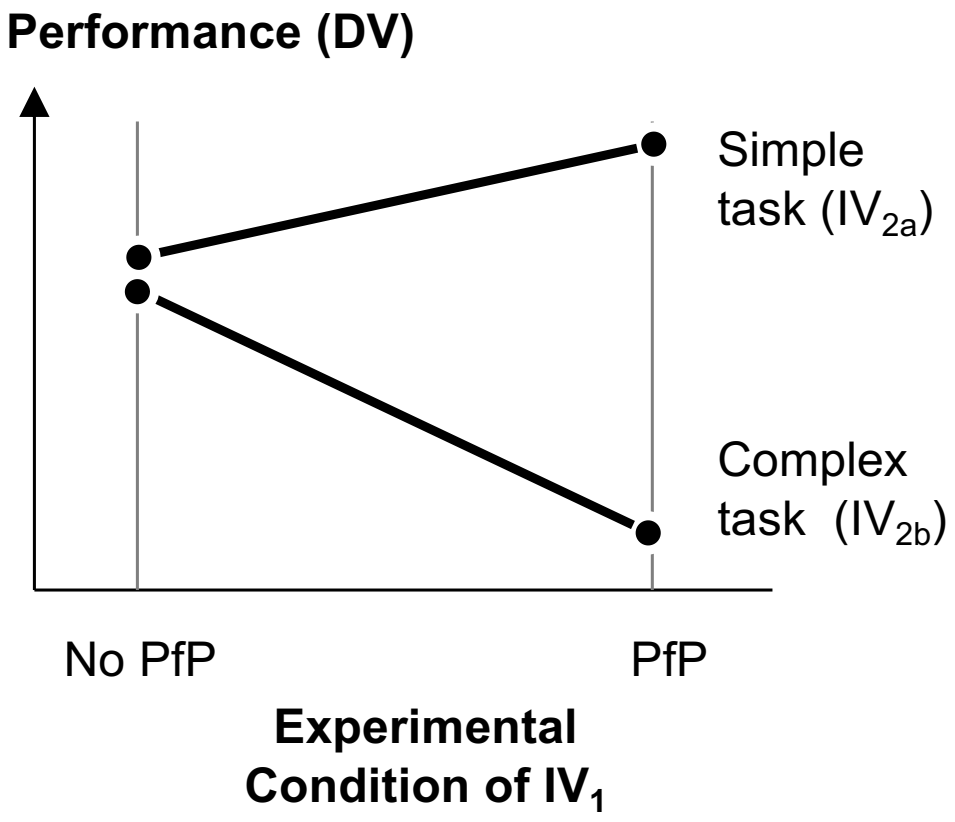
MANOVA

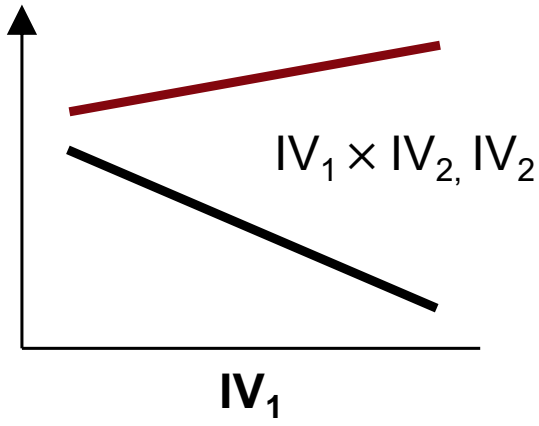
A typical **two-way** design, where MANOVA might be used includes **two IV and one DV**

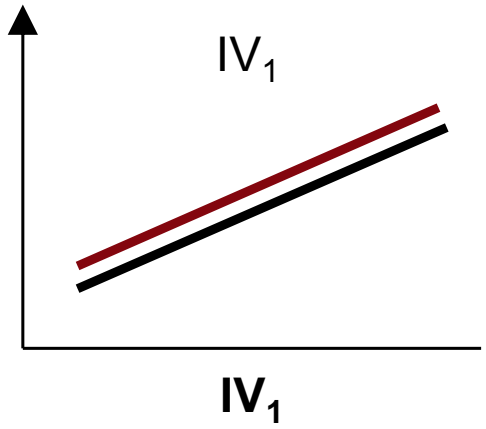
Example: How does pay for performance (PfP, IV_1) influence performance (DV) depending on the complexity of the task (IV_2)?

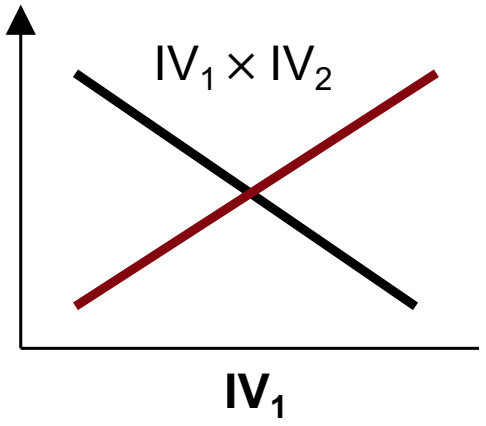
Beside individual effects of both DV there might be an **interaction** of the two

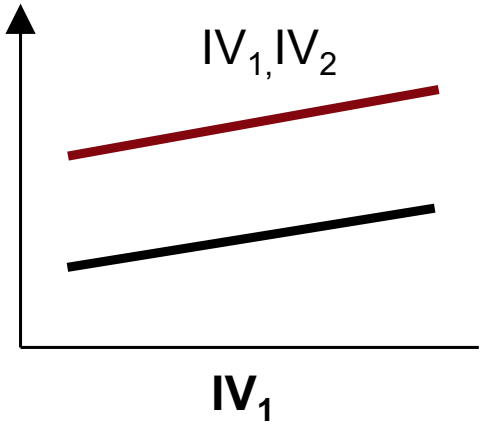


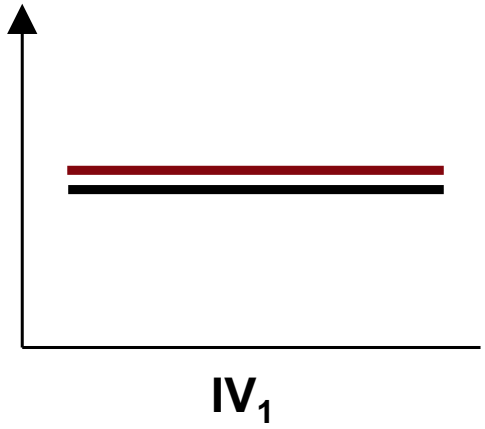
Single effects and interaction











Two-way analysis of variance

$$SS_{tot} = SS_{IV1} + SS_{IV2} + SS_{IV1 \times IV2} + SS_{w\,(Error)}$$

Source	Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	5525.200	5	1105.040	61.190	.000
IV1	29.400	1	29.400	1.628	**.207**
IV2	5328.100	2	2664.050	147.517	**.000**
IV1 × IV2	167.700	2	83.850	4.643	**.014**
Error	975.200	54	18.059		
Corrected Total	6500.400	59			

Example provided by SPSS Statistics, IBM Corporations

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Reporting and Presenting

Final Report - Formalities

Please read my guide **How to write a Term Paper or Thesis**. There, you'll find all technical details regarding formats, style, citation etc.

There is no rule about the required length of a report. Really. However, it must include all aspects of a professional report

You are requested to upload your report in a PDF-format on MS Teams in the **Reports** channel by the end of the official examination phase. No printed version is needed

Structure of the Final Report

Title page and **index**

Abstract. A very short summary of your paper

Introduction. What is your research all about? Why is it relevant? Give a brief outlook on the report.

Theory. What is your hypothesis and why do you belief it is valid? Has there been any previous scientific insights to be considered?

Methods. Explain your research method with regards to (1) data collection, (2) research design and (3) sampling

Results. Plain statistical results

Discussion. Do your results support your hypothesis? What are your major points of criticism regarding your research methods?

Conclusion. So what? Provide a short hindsight summary (nothing new here)

References. List all references (correctly) used in the report.

Appendix. Data collection tool (questionnaire or specification, coding scheme etc.), raw data matrix)

Contact details of the **authors**

Academic writing

Have clear **structure** that follows scientific conventions

Always write in the **third person**. There is no “I” or “we” in the paper

The writing style is as **factual** as possible instead of provoking, funny, personal or emotional

Ensure **simplicity** and **clarity** throughout the paper

Always **refer to** the **figures**, which the reader is supposed focus on at a given position in your paper. All figures and tables are numbered and headlined

Use **figures** only, when they are **relevant** for the reader to understand your argumentation. They are not there to brighten up your paper

Use **citation rules** correctly and consistently. Anyway, you are free to choose any citation rule

Refer to **academic sources** only

Use **quotations** only, when you have to

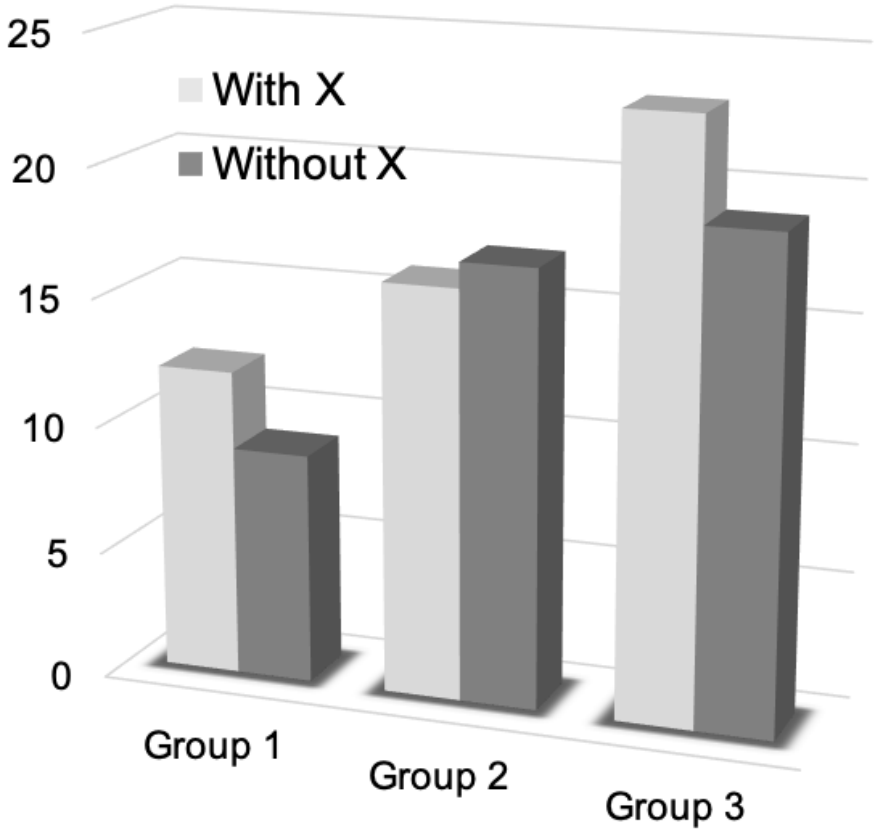
Never copy and paste from other sources. It’s illegal and we name it **plagiarism**

Does and Don’ts

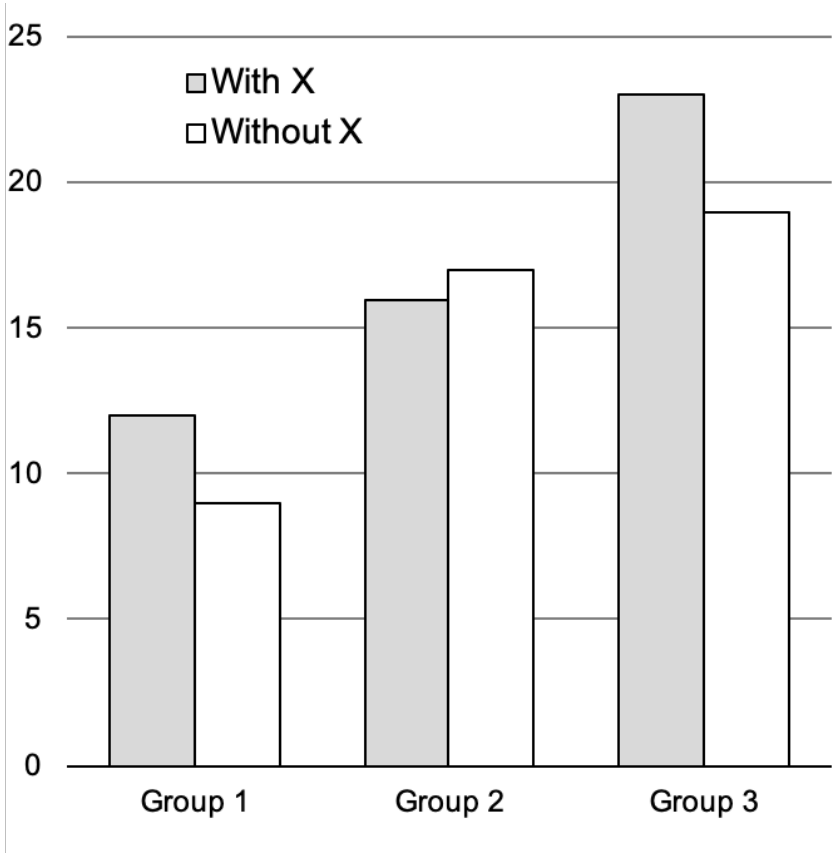
You never do this	You better do this
We have conducted an experiment …	An experiment has been conducted
All describtive statistics are shown here: [figure]	All descriptive statistics are shown in figure X. [show figure X] Descriptive analyses (see figure X) show a … [show figure X]
2. Heading AAA 2.1 Heading BBB 3. Heading CCC	2. Heading XXX 2.1 Heading YYY 2.2 Heading ZZZ
Unfortunately the results do not support the hypothesis …	The results do not support the hypothesis …

Your graphs

… don‘t look like this.



They look like this



Your Result Presentation

While your report must be serious your presentation could be quite **entertaining**

Typically your presentation includes the following **slides**:
(1) Title with names of presenters (2) research question and hypothesis (3) theory (4) research methods used (5) statistical results (graphical killer-slide) (6) brief discussion and conclusion

You are free to use as many slides as you want. Use **PowerPoint**.

Your presentation will lasts **10 minutes**. Not longer!

Please upload your presentation in a PPT-format on MS Teams in the Presentation-channel latest by **12.00 pm the day before presentation**

Please use a **sound name** of your presentation-file indicating its content. It will make my life easier

During presentation day all files will be available on my laptop (I use a MacBook). Pointer will be available

The sequence of all presentations will be random

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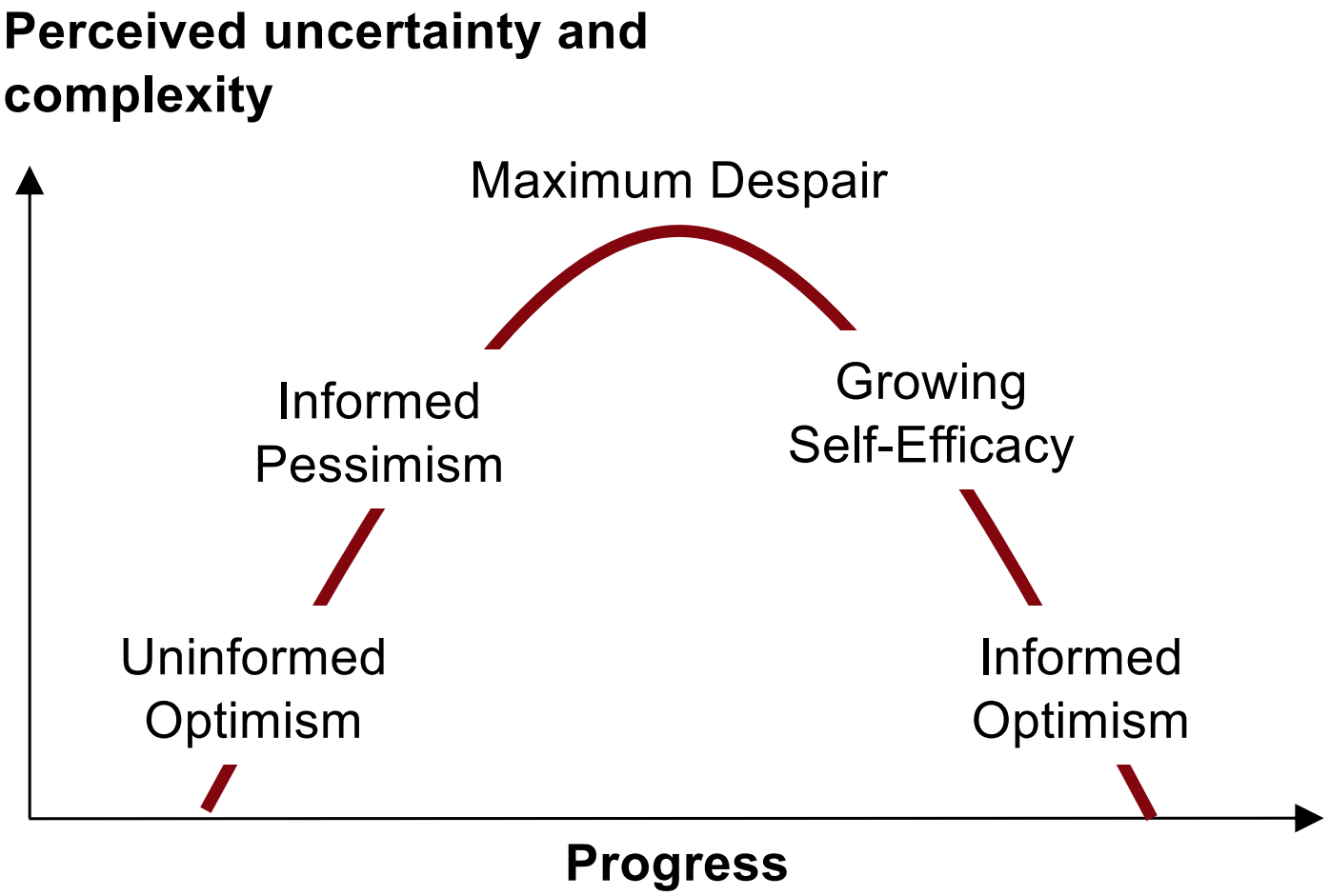
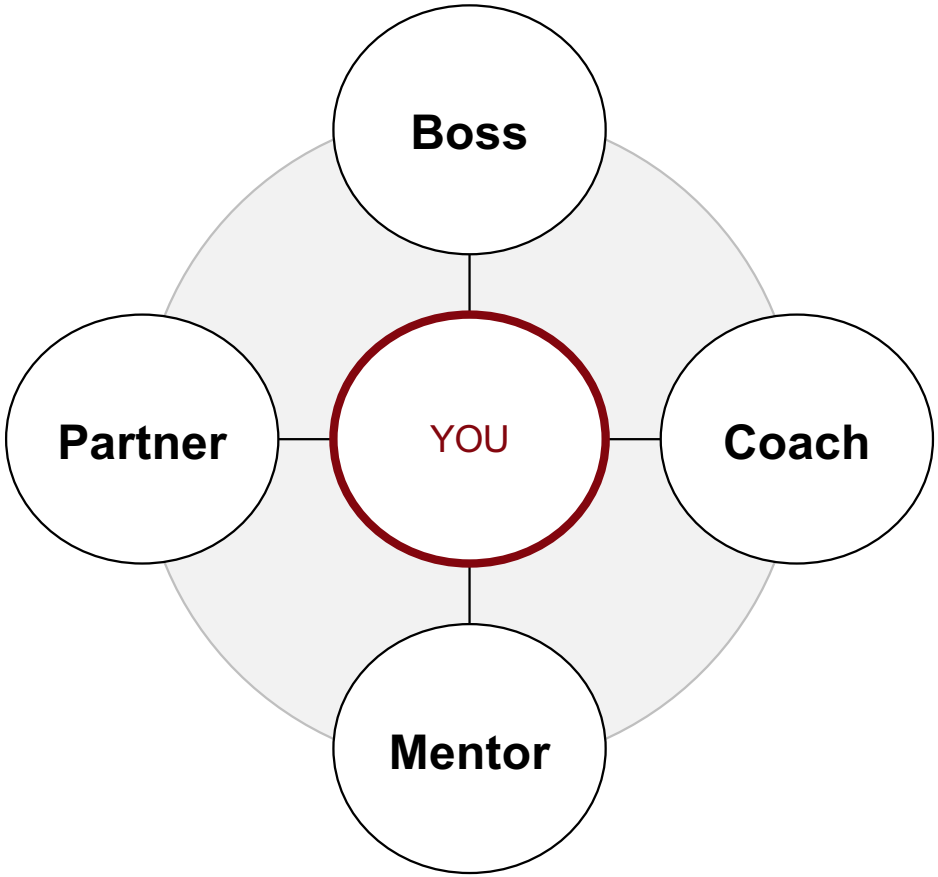
The Psychology of Writing a Thesis

How you will experience your thesis



Be clear about the role of your supervisor



Fachlicher und formaler Einfluss des Betreuers

Intensität der Anweisungen und Instruktionen

Modus der Zusammenarbeit und Kommunikation

Wechselseitiger Beitrag zum Ergebnis und Erfolg

- Do not overestimate what you could achieve in a short period of time

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Appendix

Questions for your Orientation (1 of 2)

What is your **independent variable** and what is your **dependent variable**?

What is our **hypothesis** and why do you believe it is valid (**theoretical justification**)?

Why do you believe your hypothesis is **relevant, special** or at least **interesting**?

Which of the two variables will be **measured** and which one will be **manipulated**?

On which **level** are your measured variables (nominal, ordinal, interval, ration)?

Overall, how do you **operationalize** your hypothesis and variables?

Which type of **data collection** method do you use?

Can you exclude any **reactivity** effects related to your measurement method used?

Questions for your Orientation (2 of 2)

How do you assess the **validity, reliability and objectivity** of your data collection methods?

What kind of **research design** do you apply?

What threats on **internal validity** could result from the chosen research design?

What is your total **population** on which the results are supposed to be generalized and who are your **entities**?

What is your **sampling methods** and which **sampling effects/errors** might derive from it?

How do you graphically present your **statistical results**?

Do your results statistically **confirm** your hypothesis?

Overall, what are your key points of **criticism** with regards to your chosen methods?

Recommended Literatur

Bryman, A. (2015). Social Research Methods. Oxford

Cook, T. D., & Campbell, D. T. (1979). Quasi-Experimentation. Design & Analysis Issues for Field Settings. Houghton Mifflin.

Diekmann, A. (2007). Empirische Sozialforschung. Grundlagen, Methoden, Anwendungen. Rowohlt.

Gadenne, V. (1984). Theorie und Erfahrung in der psychologischen Forschung. Mohr

Saunders, M. , Lewis P., & Thornhill, A. (2009). Research Methods for Business Students. Prentice Hall

Sudman, S., Bradburn, N. M., & Schwarz, N. (1996). Thinking About Answers: The Application of Cognitive Processes to Survey Methodology. Wiley

Excel Formula

Statistics	English	Deutsch
Mean	AVERAGE(..)	MITTELWERT(..)
Mean (specific categories)	AVERAGEIF(..)	MITTELWERTWENN(..)
Median	MEDIAN(..)	MEDIAN(..)
Modal	MODE(..)	MODALWERT(..)
Standard Deviation (Population)	STDEVP(..)	STABWN(..)
Standard Deviation (Sample)	STDEV(..)	STABW(..)
Correlation	CORREL(..;..)	KORREL(..;..)
Frequencies	FREQUENCY(..;..)	HÄUFIGKEIT(..;..)
Frequency (spec. value)	COUNTIF(..)	ZÄHLENWENN(..;..)
Sum	SUM(..)	SUMME(..)
Square root	SQRT(..)	WURZEL(..)

Exercises Elementary Statistics

1. Stepwise calculate standard deviation for variable **BUDGET** without using the excel function STDEVP (as indicated on slide 39 in the handout)

2. Run a so called z transformation based on variable **INSTA2**.

3. Change polarity of variable **PIZZA**.

4. Calculate the mean, median, modal value, standard deviation, absolute and relative frequency based on Variable **PIZZA**. Draw a pie chart based on relative frequencies. Draw a bar chart based on cumulative (relative) frequencies

Exercises Elementary Statistics

5. Calculate an index value **FTNSSX** based on variables **FTNSS01** to **FTNSS12.** Define reasonable categories on which you can calculate absolute frequencies. Draw a histogram.

6. Compare group means of variable **FTNSSX** based on group variable **BZHG**. Draw a bar or line chart to visualize mean comparison.

7. Calculate an index value **AMBTNX** based on variable **AMBTN01** to **AMBTN06** and calculate all sorts of descriptive statistics.

8. Calculate correlation between variable **AMBTNX** and **FTNSSX.**