

Recognising Research: Approaches & Designs

Introduction to Study Skills & Research Methods (HL10040)

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Lecture Outline:

- The Research Process
- The Research Design Continuum
- Experimental Designs
- Sampling Methods
- Scientific Reasoning
- Quantitative & Qualitative Research Strategies.



What is Research?

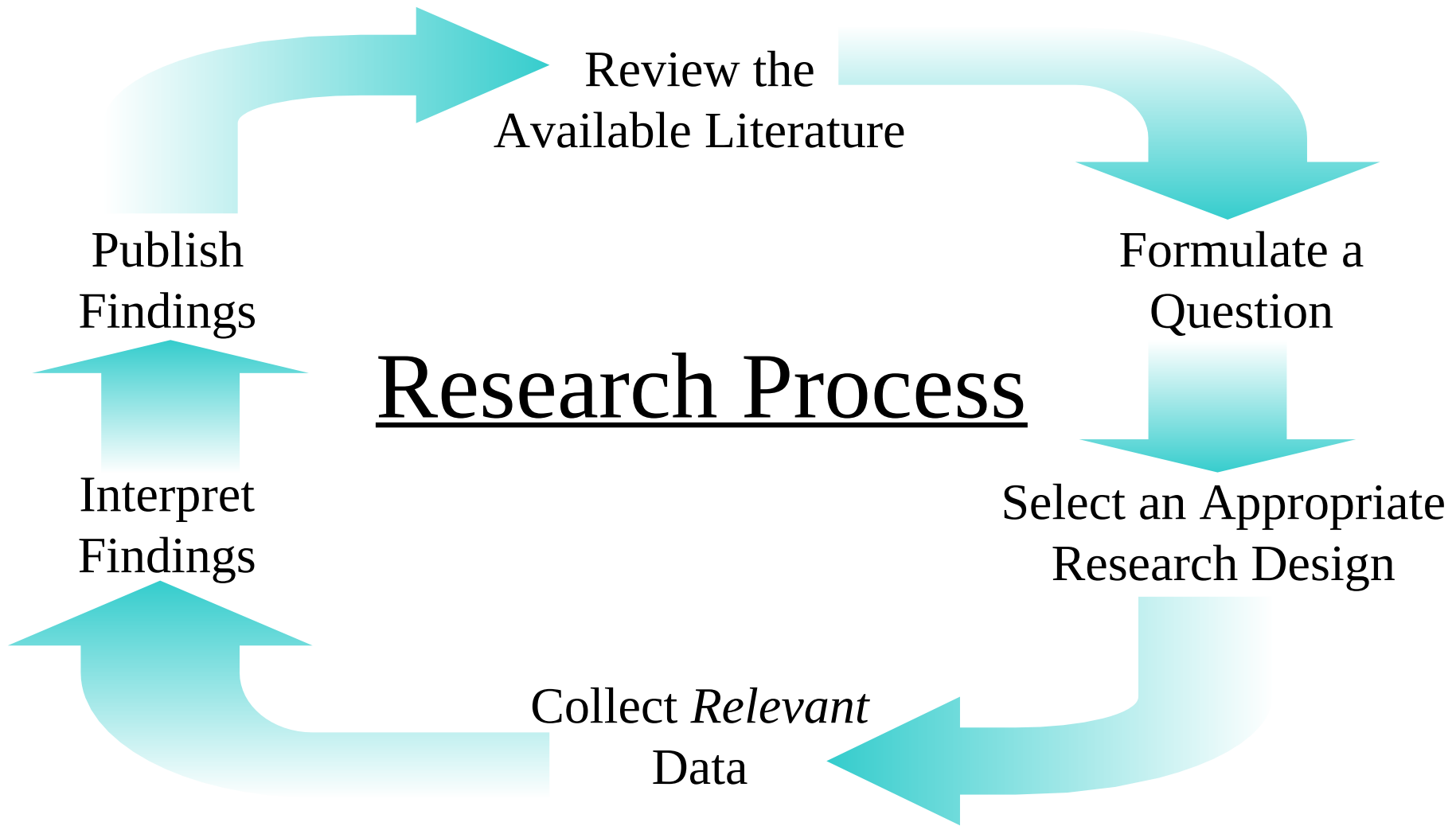
- A systematic means of problem solving (Tuckman 1978)
- 5 key characteristics:



What is Research?

1. Systematic – research process
2. Logical – induction/deduction
3. Empirical – evidence based
4. Reductive – generalisation
5. Replicable – methodology.





Research Continuum

Reductionism



Research Continuum

Basic

- Theoretical?
- More Invasive?
- Laboratory Based?
- Tightly Controlled?
- Lacks External Validity?
- Focus on Mechanism
- More Reductionist

Internal Validity?

Applied

- Quick Answers?
- Less Invasive?
- Field Based?
- Loosely Controlled?
- Externally Valid?
- Focus on Effect
- Less Reductionist.



Research Continuum



e.g.

➤ Does Caffeine Ingestion
Improve Athletic
Performance?



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Research Continuum

Basic

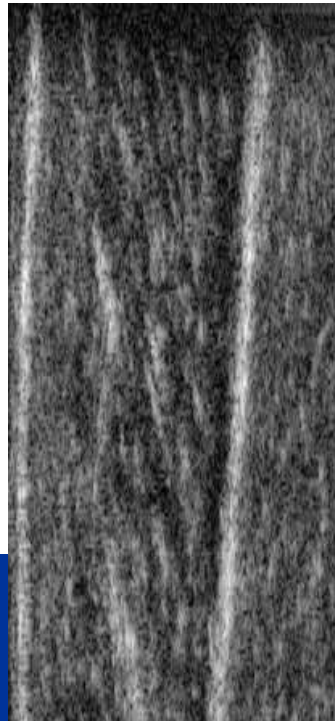
e.g.

- Does Caffeine Ingestion Improve Ca^{2+} binding with troponin?
- Would this Facilitate Acto-Myosin Coupling?
- Would this aid contraction?

Applied

e.g.

- Does Caffeine Ingestion Improve Athletic Performance?



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Research Continuum

Basic

e.g.

➤ Does Caffeine Ingestion Inhibit Glycogen Phosphorylase?

➤ Does Caffeine Ingestion Increase Lipid Metabolism?

➤ -Would this Spare Endogenous Glycogen?

Applied

e.g.

➤ Does Caffeine Ingestion Improve Athletic Performance?



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Research Continuum

Basic

Applied

e.g.

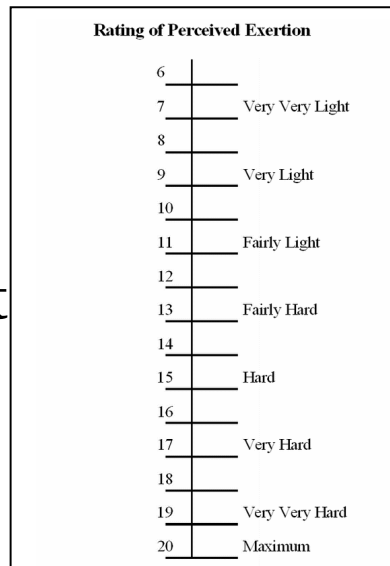
➤ Does Caffeine Ingestion Stimulate the CNS?

-Would this Increase Motor Unit Recruitment

-Would this Reduce Perceived Effort?

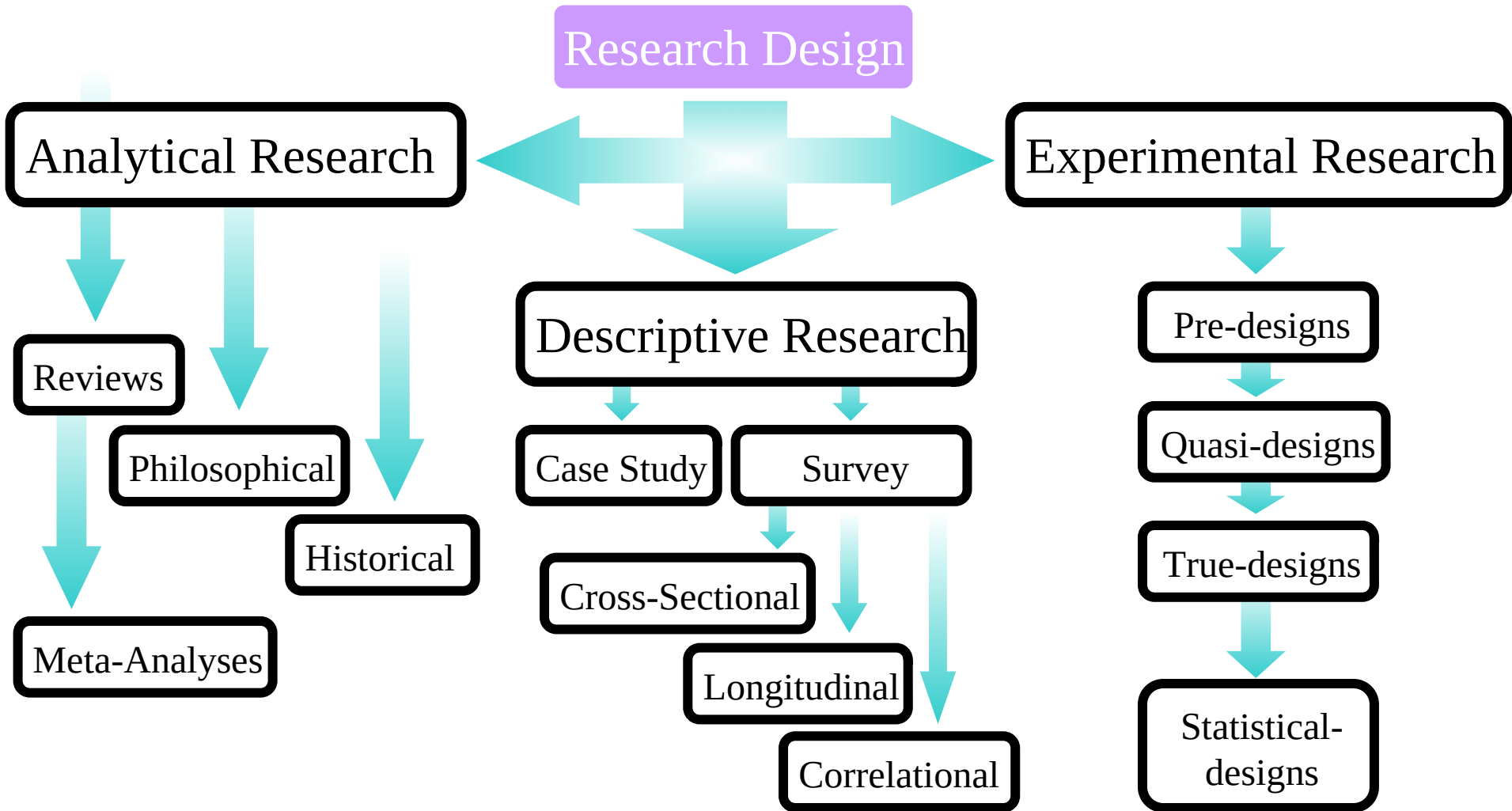
e.g.

➤ Does Caffeine Ingestion Improve Athletic Performance?



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Research Design Continuum



Analytical Research

- Reviews
 - A critical account of present understanding
 - A meta-analysis is a quantitative method of review
- Historical Research
 - Accessing both primary (e.g. witnesses) or secondary (e.g. literature) sources to document past events
- Philosophical Research
 - Organising existing evidence into a comprehensive theoretical model



Descriptive Research

- Case Study
 - Accrual of detailed information from an *individual*
- Survey
 - Cross-sectional: Status of a various groups at a given point in time
 - Longitudinal: Status of a given group at various points in time
 - Correlational: Relationships between variables



Refutable?



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Correlational Evidence

- When variable X increases, variable Y also increases
- So, does X increase Y?
 - or does Y increase X?
- Alternatively, does Z increase both X and Y?

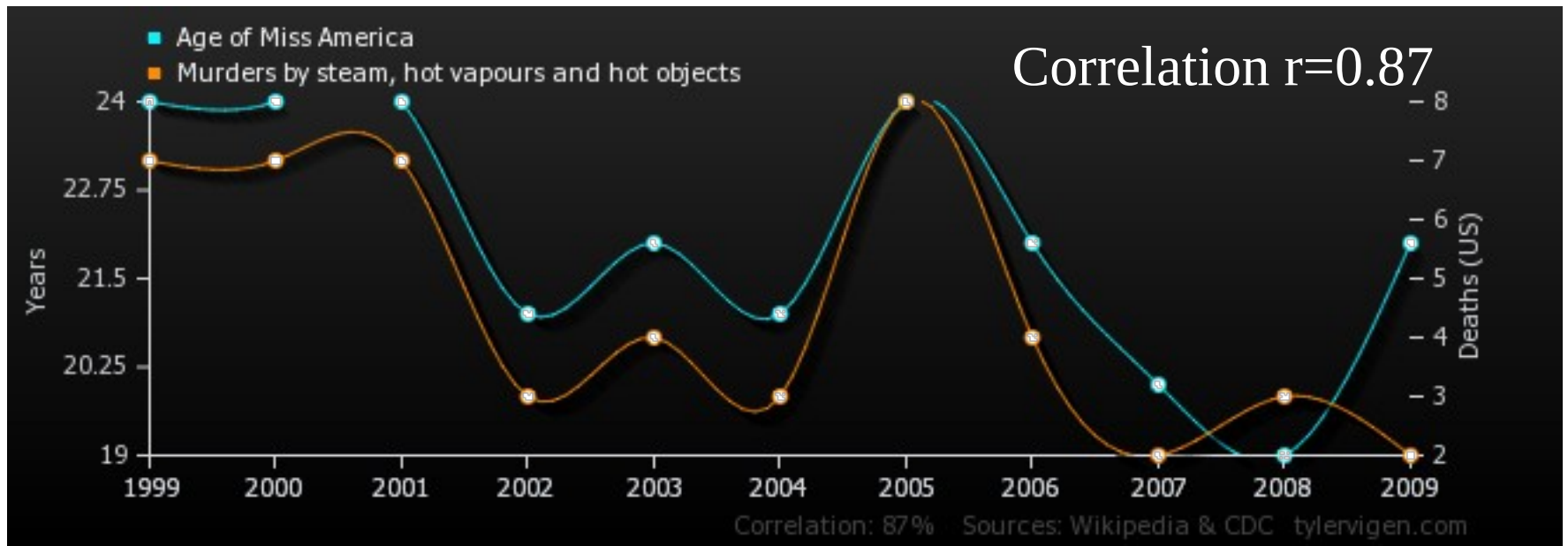
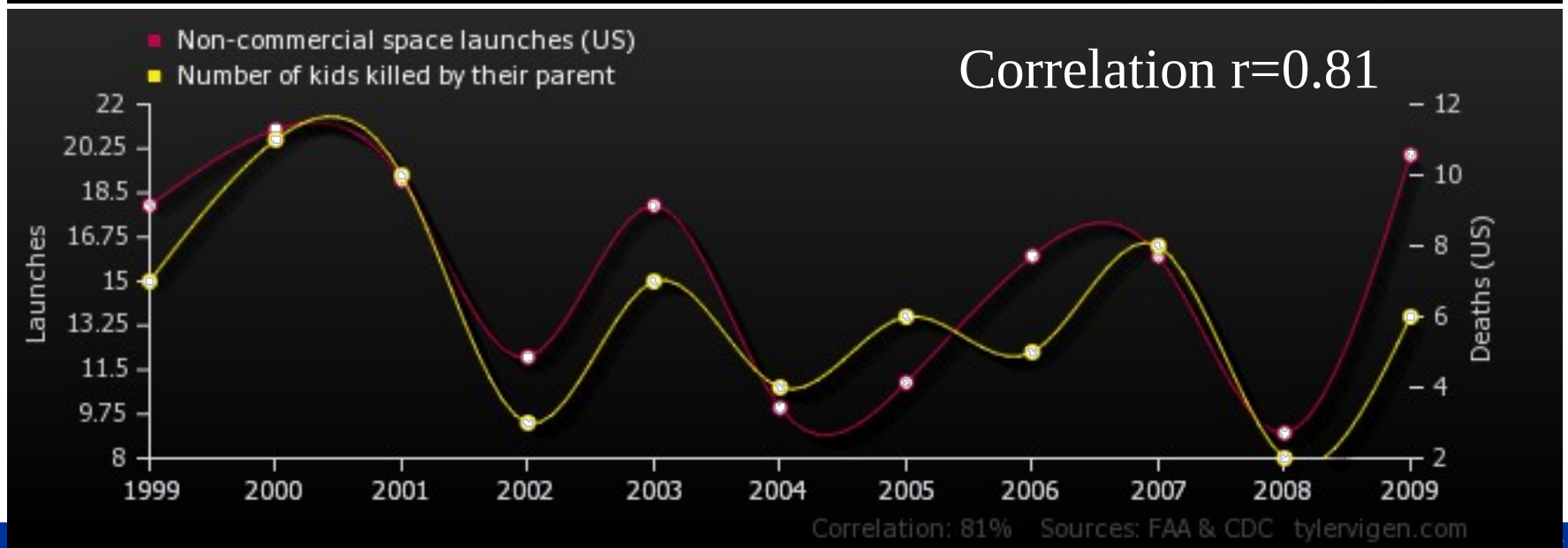


Correlations do not infer Causality
(and vice versa?)

See inapt use of language: Brown et al (2013)
i.e. always Read Primary Lit (inc. actual data)!



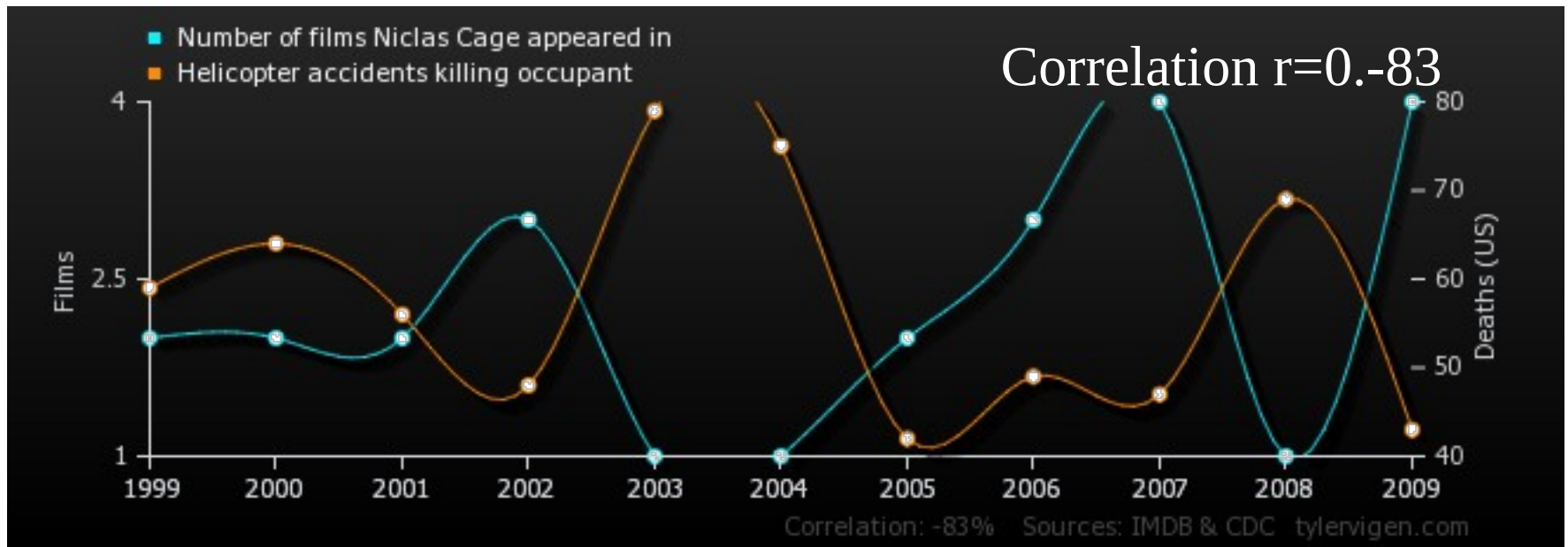
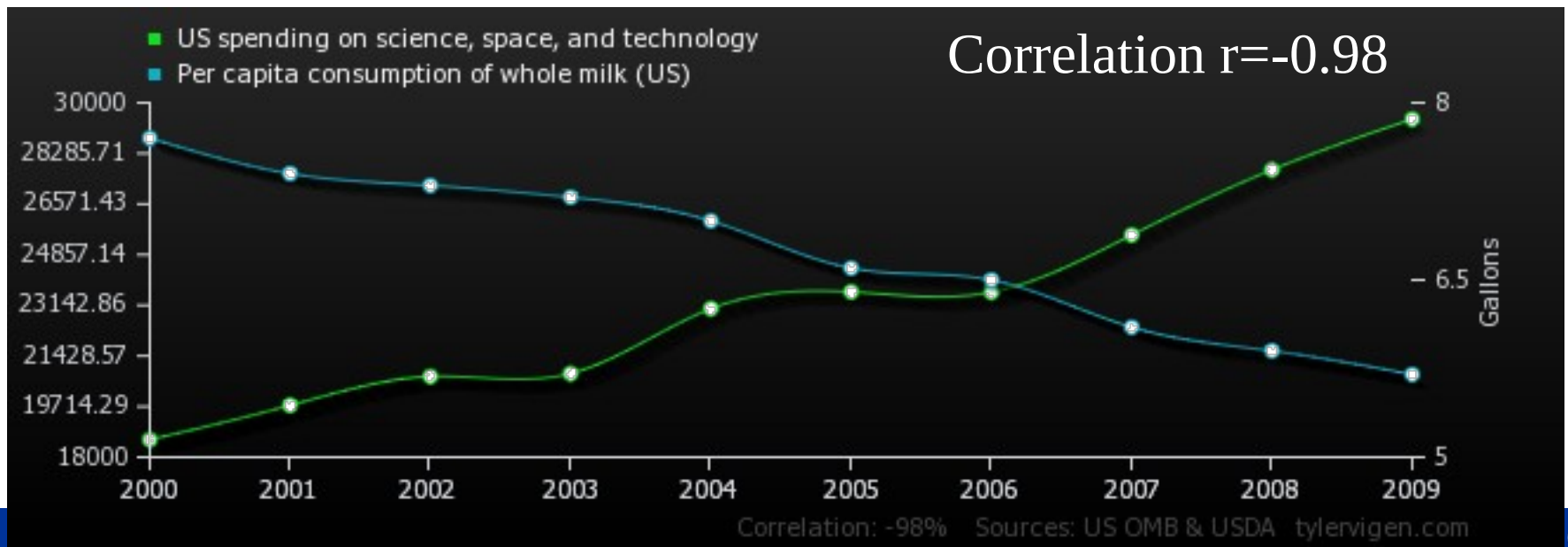
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Experimental Research

- Experimental research involves a direct assessment of how one variable influences another
- This allows the establishment of causality
- All extraneous variables must be held constant while a single variable is manipulated and the effect measured
- Definition of variables:

Independent Variable = this variable is the ‘cause’



Experimental Research

- Experimental research involves a direct assessment of how one variable influences another
- This allows the establishment of causality
- All extraneous variables must be held constant while a single variable is manipulated and the effect measured
- Definition of variables:

Independent Variable = can be manipulated or allowed to vary



Experimental Research

- Experimental research involves a direct assessment of how one variable influences another
- This allows the establishment of causality
- All extraneous variables must be held constant while a single variable is manipulated and the effect measured
- Definition of variables:

Independent Variable = also known as the predictor variable



Experimental Research

- Experimental research involves a direct assessment of how one variable influences another
- This allows the establishment of causality
- All extraneous variables must be held constant while a single variable is manipulated and the effect measured
- Definition of variables:

Dependent Variable = this variable is the ‘**effect**’



Experimental Research

- Experimental research involves a direct assessment of how one variable influences another
- This allows the establishment of causality
- All extraneous variables must be held constant while a single variable is manipulated and the effect measured
- Definition of variables:

Dependent Variable = should only vary in response to the IV



Experimental Research

- Experimental research involves a direct assessment of how one variable influences another
- This allows the establishment of causality
- All extraneous variables must be held constant while a single variable is manipulated and the effect measured
- Definition of variables:

Dependent Variable = also known as the criterion variable



Experimental Research

- Experimental research involves a direct assessment of how one variable influences another
- This allows the establishment of causality
- All extraneous variables must be held constant while a single variable is manipulated and the effect measured
- Definition of variables:

Law of the single variable:

there will always be uncontrollable influences



Experimental Research

- Experimental research involves a direct assessment of how one variable influences another
- This allows the establishment of causality
- All extraneous variables must be held constant while a single variable is manipulated and the effect measured
- Definition of variables:

Extraneous Variables = must be controlled to isolate the effect of the IV on the DV



Experimental Research

- Experimental research involves a direct assessment of how one variable influences another
- This allows the establishment of causality
- All extraneous variables must be held constant while a single variable is manipulated and the effect measured
- Definition of variables:

Confounding Variables = extraneous variables which have co-varied with the IV



Experimental Designs

- Pre-Experimental
- Quasi-Experimental
- True-Experimental

Key:

– R = random assignment for equivalent groups



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Random Group Assignment

List 20 individuals

All to be assigned to treatment (T) or placebo (P)

Group 1: toss a coin for each individual

Group 2: ‘think-up’ a list that seems random.



Experimental Designs

- Pre-Experimental
- Quasi-Experimental
- True-Experimental ...or via repeated measures design, matched pairs design or matched groups design

Key:

- R = random assignment for equivalent groups
- $O_{1,2...}$ = observation of group x (recording of DV)
- $O_{a,b...}$ = observation of group y (recording of DV)
- T = treatment (IV)
- P = placebo (IV).



Experimental Designs

- Pre-Experimental
- Quasi-Experimental
- True-Experimental

Question:



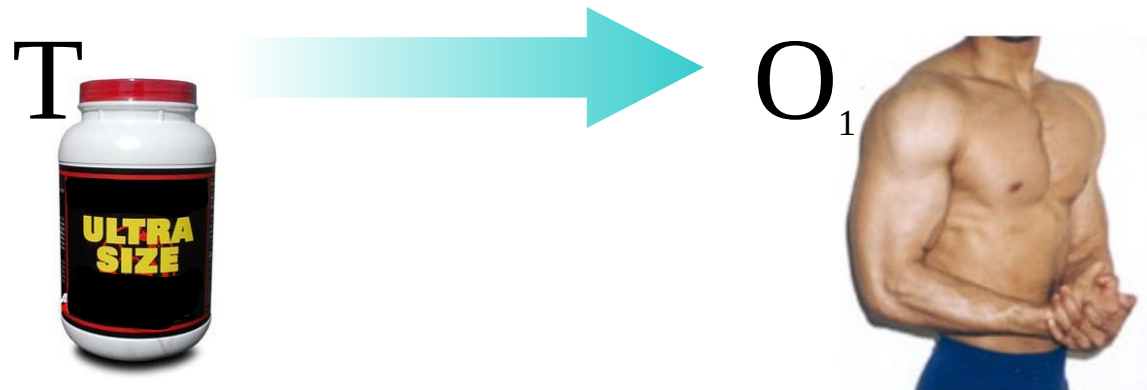
“Does protein supplementation increase muscle hypertrophy?”



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Pre-Experimental Designs

One Shot Study



Pre-Experimental Designs

One Group Pre-test Post-test

O_1



T

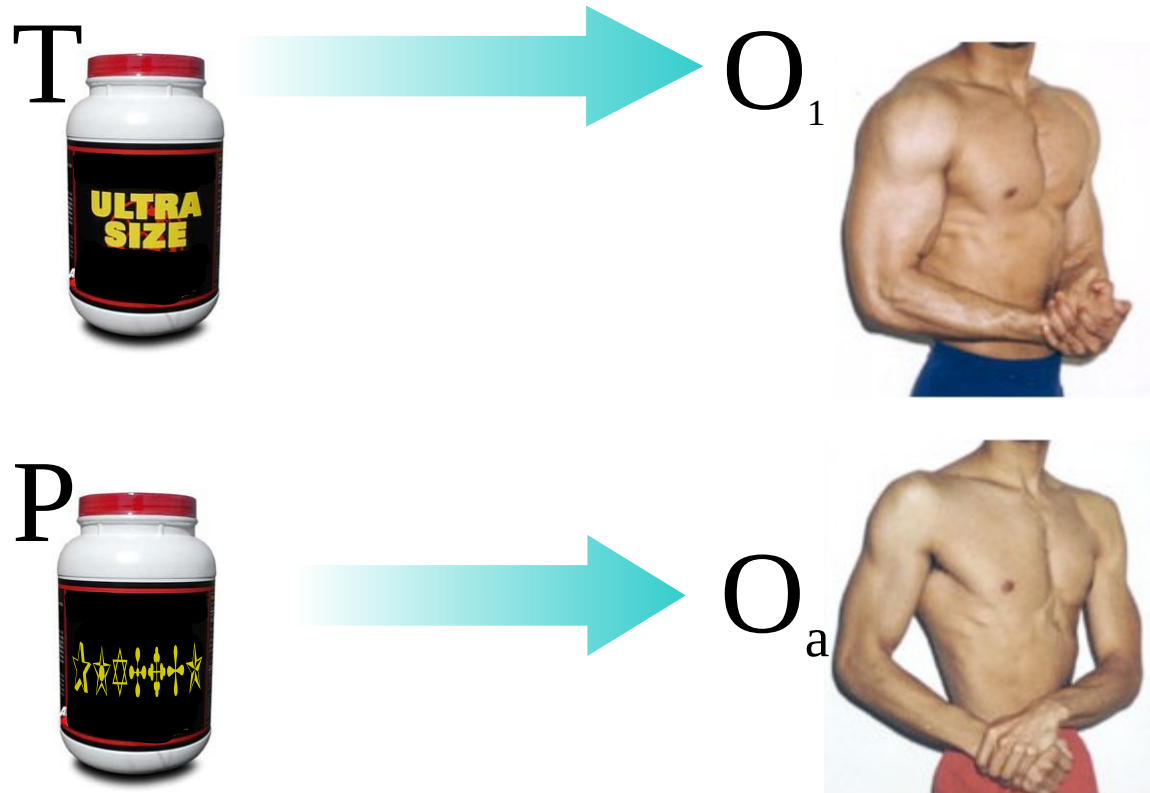


O_2



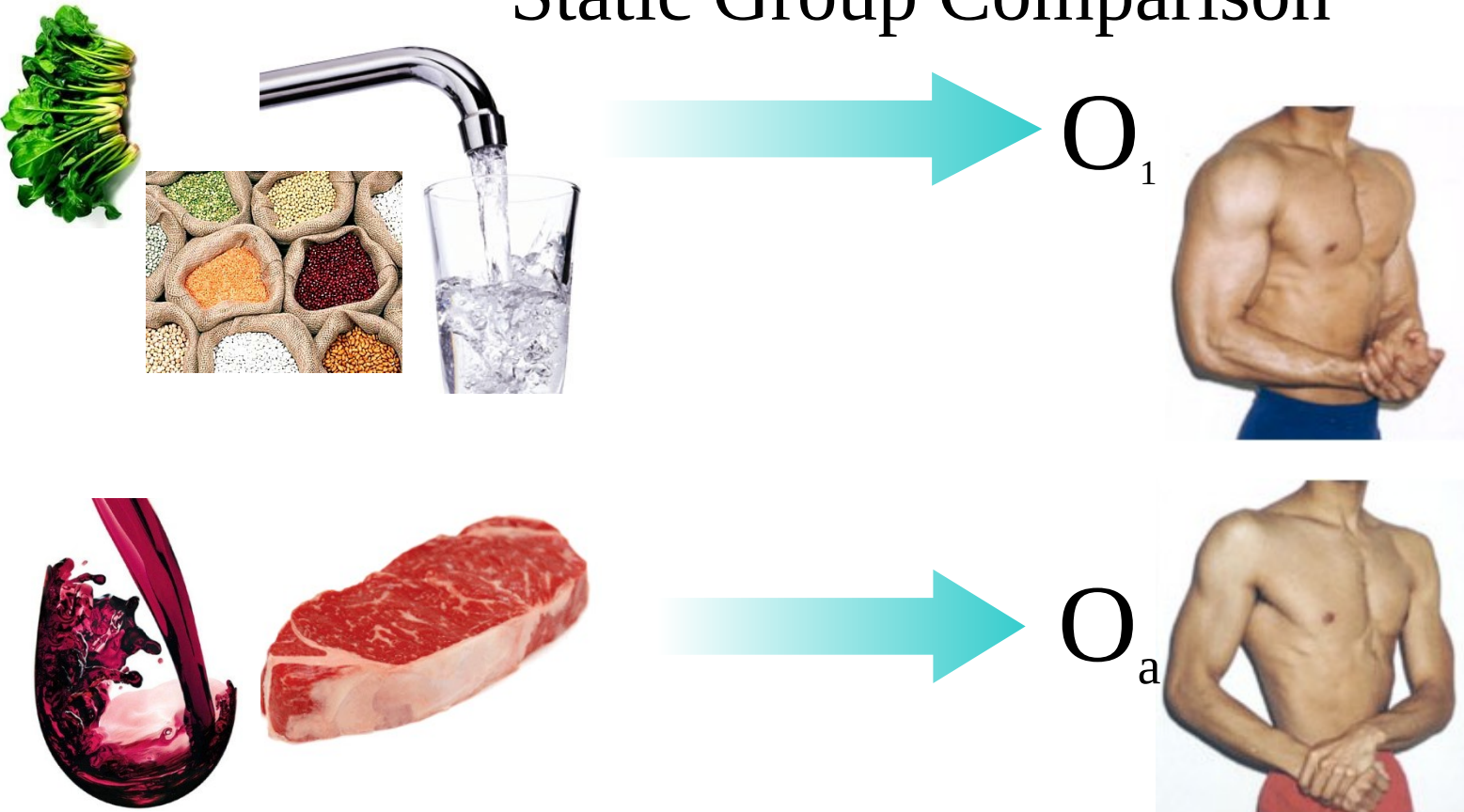
Pre-Experimental Designs

Static Group Comparison



Pre-Experimental Designs

Static Group Comparison



Daniel 1:8



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Quasi-Experimental Designs

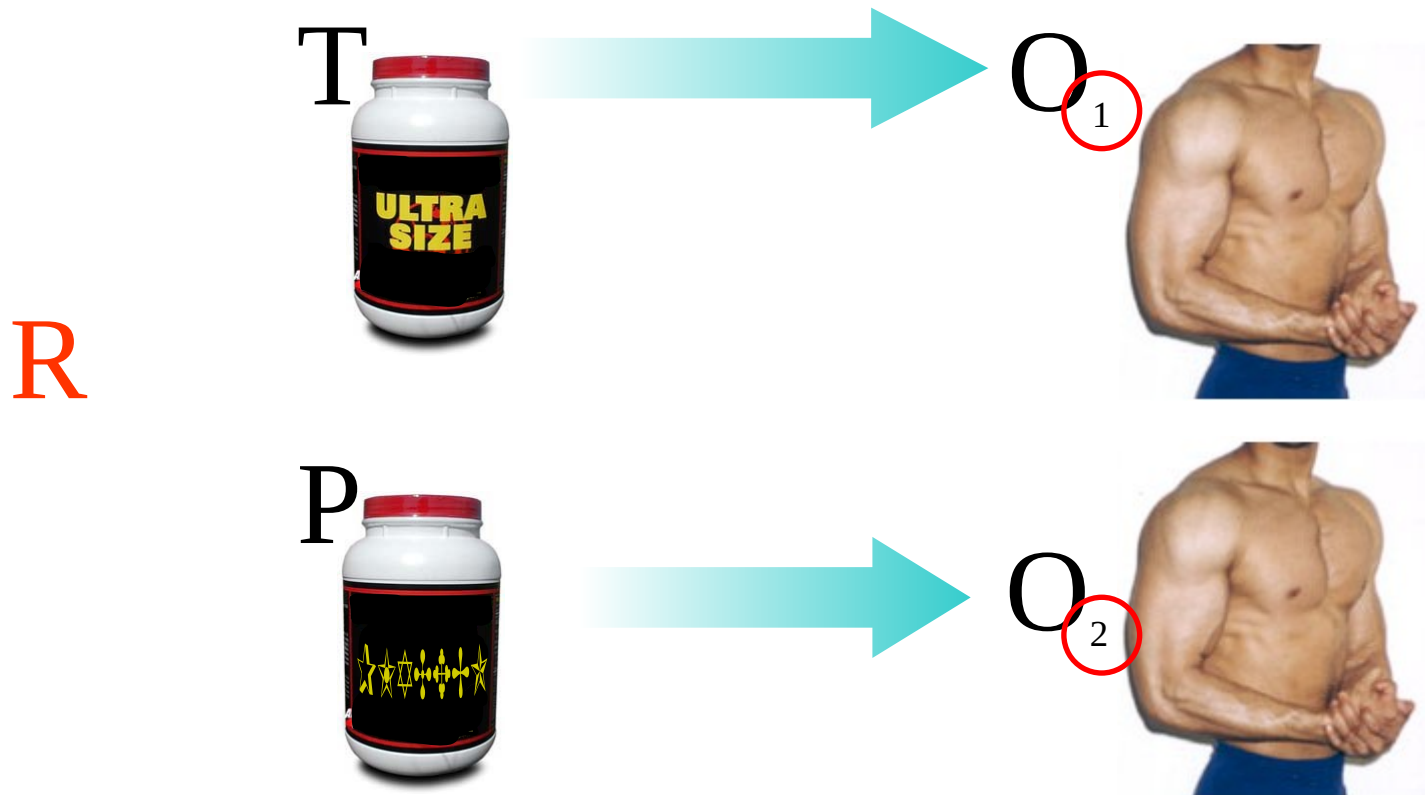
Time series



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True-Experimental Designs

Randomised Group Comparison



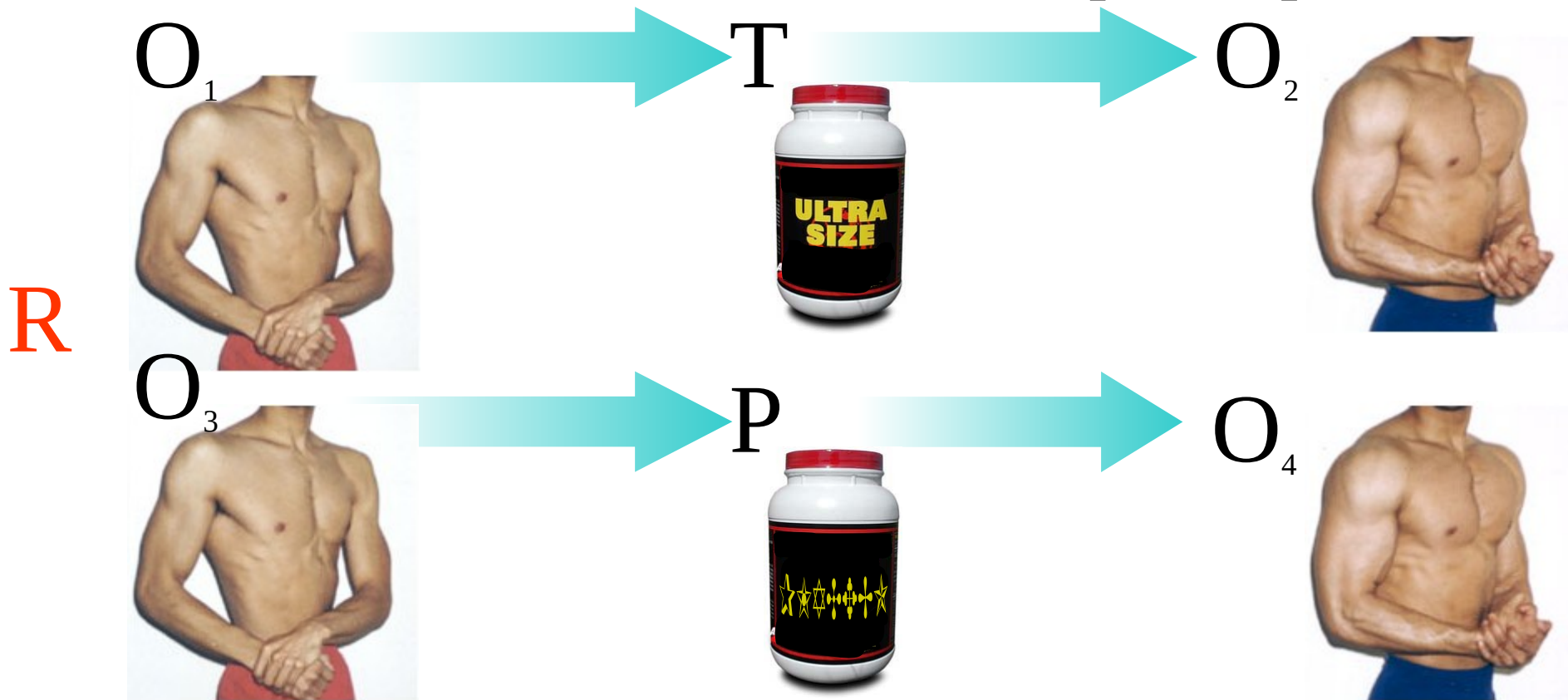
Earliest recorded example of random group allocation as recent as 1928 (Forsetlund *et al.* 2007)



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True-Experimental Designs

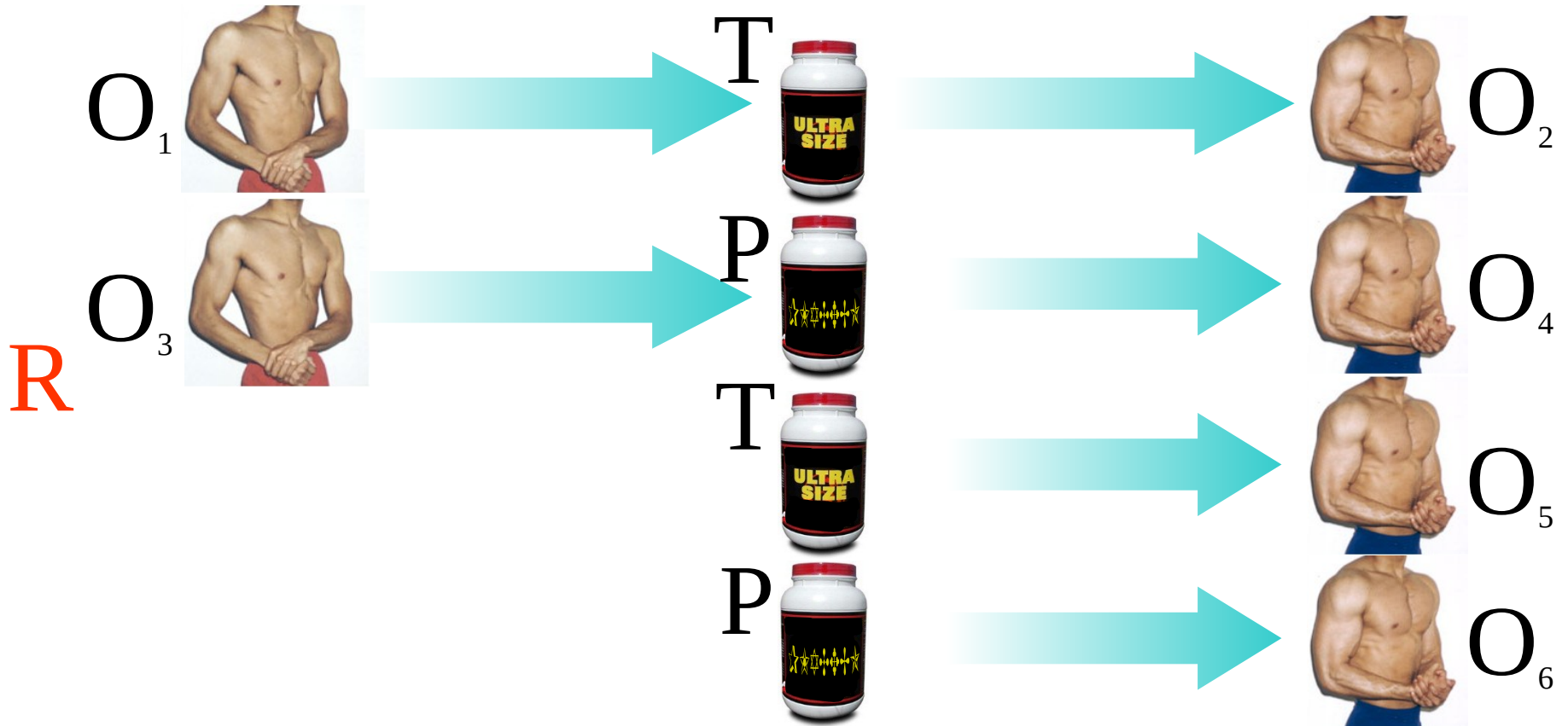
Pre-test Post-test Randomised Group Comparison



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True-Experimental Designs

Solomon Four-Group Design

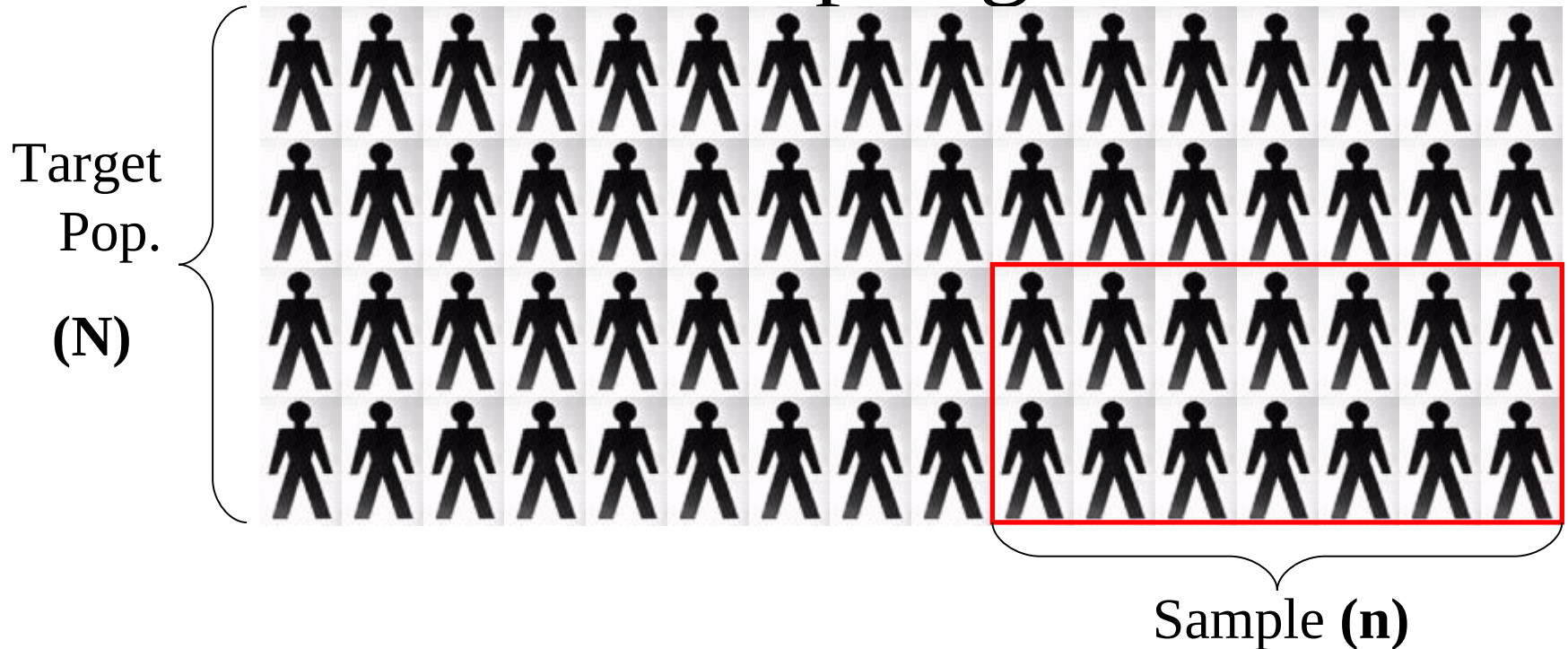


Sampling

- Split into research teams
- Each person take a 'sample' of Smarties
- Each group record the total number of Smarties and the number of red Smarties



Sampling



- Effective Sampling produces a $\mathbf{n}$ which is representative of $\mathbf{N}$
- Note: $\mathbf{n}$ is only ever representative of the $\mathbf{N}$ it was drawn from, i.e. not necessarily the general population.

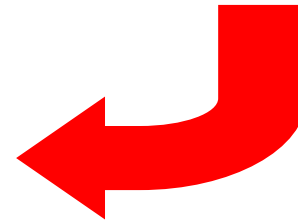


Sampling



↑ ↑ ↑
The dependent variable can be
generalised from n to N

↓
Statistics



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Sampling Methods

- Random- All members of N have an equal chance of selection

e.g. 

- Stage- Randomly select a group, then take sample

e.g. 

- Cluster- Select a natural group to sample from

e.g. local community



Sampling Methods

- Stratified- identify strata and sample accordingly

i.e. **Global Pop.**

♀ = 51%

♂ = 49%

Sample (n=100)

♀ = 51

♂ = 49

- Systematic- e.g. every fourth person *but* starting at a random point
- Opportunity- sample a convenient group

Avoid Researchers!



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Scientific Reasoning (Logic)

Quantitative?

Confirmation of a theory from
your own observations



General
Theory

Deductive Reasoning

Inductive Reasoning

Specific
Observation

Formation of a theory grounded
in your own observations

Qualitative?



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Quantitative versus Qualitative

Quantitative Research Strategy

- Investigation aims to assess a pre-stated theory (Deductive Reasoning)
- Often involves hypothesis testing
- Attempts to minimise the influence of the researcher on the outcome
- Quantitative data infers statistics
- Data collection therefore requires 'closed' responses

Qualitative Research Strategy

- Investigation aims to create a novel theory (Inductive Reasoning)
- Researcher becomes an inherent part of the study - *ethnography*
- Qualitative data infers complex statements or opinions
- Data collection therefore permits 'open' responses



Choice of Research Strategy...

- Based on:
 - Epistemology (How should we be attempting to assess knowledge?)
 - Positivism = explain a phenomena
 - Interpretivism = understand a phenomena
 - Ontology (Does the data exist in a tangible or an intangible form?)
 - Objectivism = explain independent external outcomes
 - Constructionism = understand how social factors interact



Choice of Research Strategy...

- Study in the natural sciences often requires a *positivistic epistemology* and an *objectivistic ontology*
- Study in the social sciences often requires an *interpretive epistemology* and a *constructionist ontology*
- *However*, it is occasionally possible to combine these strategies by coding qualitative data quantitatively (i.e. Athlete = 1 ; Non-Athlete = 2)



Selected Reading

- Thomas J. R. & Nelson J. K. (2005) Research Methods in Physical Activity, 5th edition. Champaign, Illinois: Human Kinetics
- Berg K. E. & Latin R. W. (2008) Essentials of Research Methods in Health, Physical Education, Exercise Science, and Recreation, 3rd edition. Maryland: Lippincott Williams & Wilkins



Where's my quid?

- You need £100 for a night out
- You max out your overdraft for £50 and I lend you £50

MONIES OWED: £50 (JB) + £50 (bank) = £100

- You only spent £97, so had £3 change
- You put £1 back in your account and gave me £1 back

MONIES OWED: £49 (JB) + £49 (bank) = £98

...plus you have your £1 = £99

Where's the extra quid gone?



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