



COMP320

RESEARCH PRACTICE

Research Philosophies and Putting them into Practice

Objectives for Today

After this session, you should be able to:

- **Explain** what 'computing' research is
- **Discuss** the main characteristics of different research philosophies
- **Recognize** the challenges associated with different forms of reasoning
- **Analyze how** research methods are justified through underpinning philosophy

Objectives for Today

Why bother reviewing philosophy?

- Helps you reflect upon and sharpen your thinking about the nature of knowledge and how it is constructed
- Provides a framework that underpins your activity as a scientist in your chosen field, helping you to make decisions about your work
- Shapes your engagement with the work of others
- Prepares you to better articulate the justification for your choice of research method

Objectives for Today

1. Research

2. Research Philosophy

- On the Philosophy of Science
- Characteristics of Research Philosophies
- Ontologies
- Epistemologies
- Axiology

3. Methods of Reasoning and Inference

- Deductive
- Inductive
- Abductive

4. Well-Known Research Philosophies

- Positivism vs Interpretivism



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Research

Understanding the Path to
Discovery

What Is Research?

What do you understand by the term
'research'?

What distinguishes business and
management research from research more
generally?

Group Activity

In groups of 4-6:

- Discuss some potential answers to these questions with your peers (5 minutes)
- Sketch how you see research (5 minutes)
- Explain your sketch to the other groups (5 minutes)

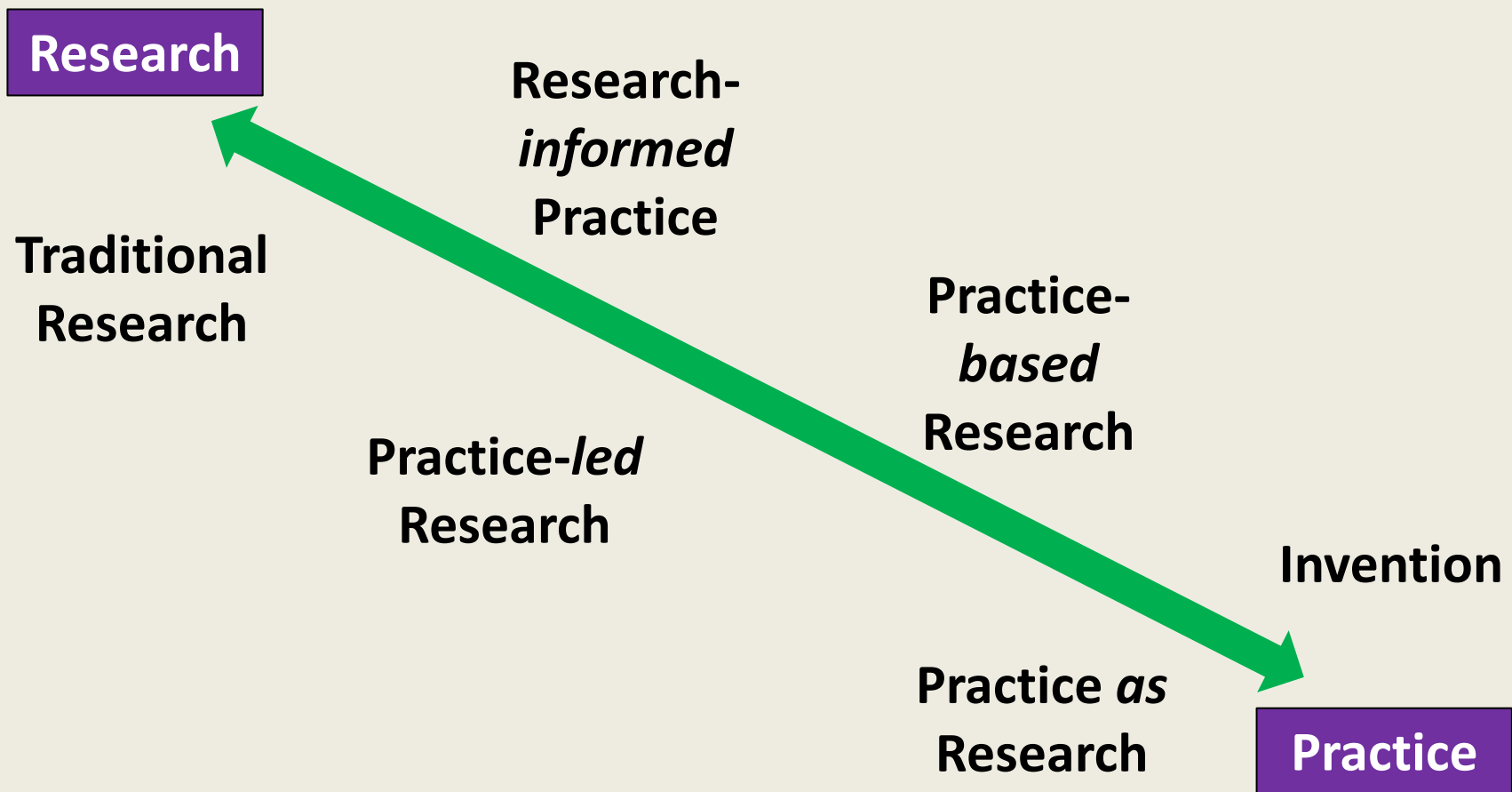
What is Computing Research?

A **systematic** inquiry, the objective of which is to provide information to **solve technical problems*** with **computational** solutions.

- Trans-disciplinary --- computers are used in nearly every field.
- Engages both with theory and practice
- Used in every area of computing for games:
 - **Algorithms:** collision detection, AI techniques, distributed systems
 - **Development Practice:** software engineering techniques, dev strategies
 - **Effects:** perception of quality, technology-design relation, software psychology

** any problem or opportunity that requires insight about technology or social effect of technology*

What is Computing Research?



What is Computing Research?



What is Good Research?

Standards of the scientific method:

1. Purpose clearly defined
 - Any statement of the decision or problem should include its scope, its limitations, and the precise meanings of all words and terms.
2. Research process detailed
 - Research procedures used should be described in sufficient detail to permit another researcher to repeat the research
3. Research design thoroughly planned
 - Sampling, data collection procedures, experimental controls etc. planned.
4. Limitations clearly stated
 - Report, with complete honesty, any flaws in procedural design, and estimate their effect on the research findings. There is no such thing as a perfect research design!
5. High ethical standards applied
 - Safeguard against causing mental or physical harm to participants and that makes data integrity a first priority should be valued highly.

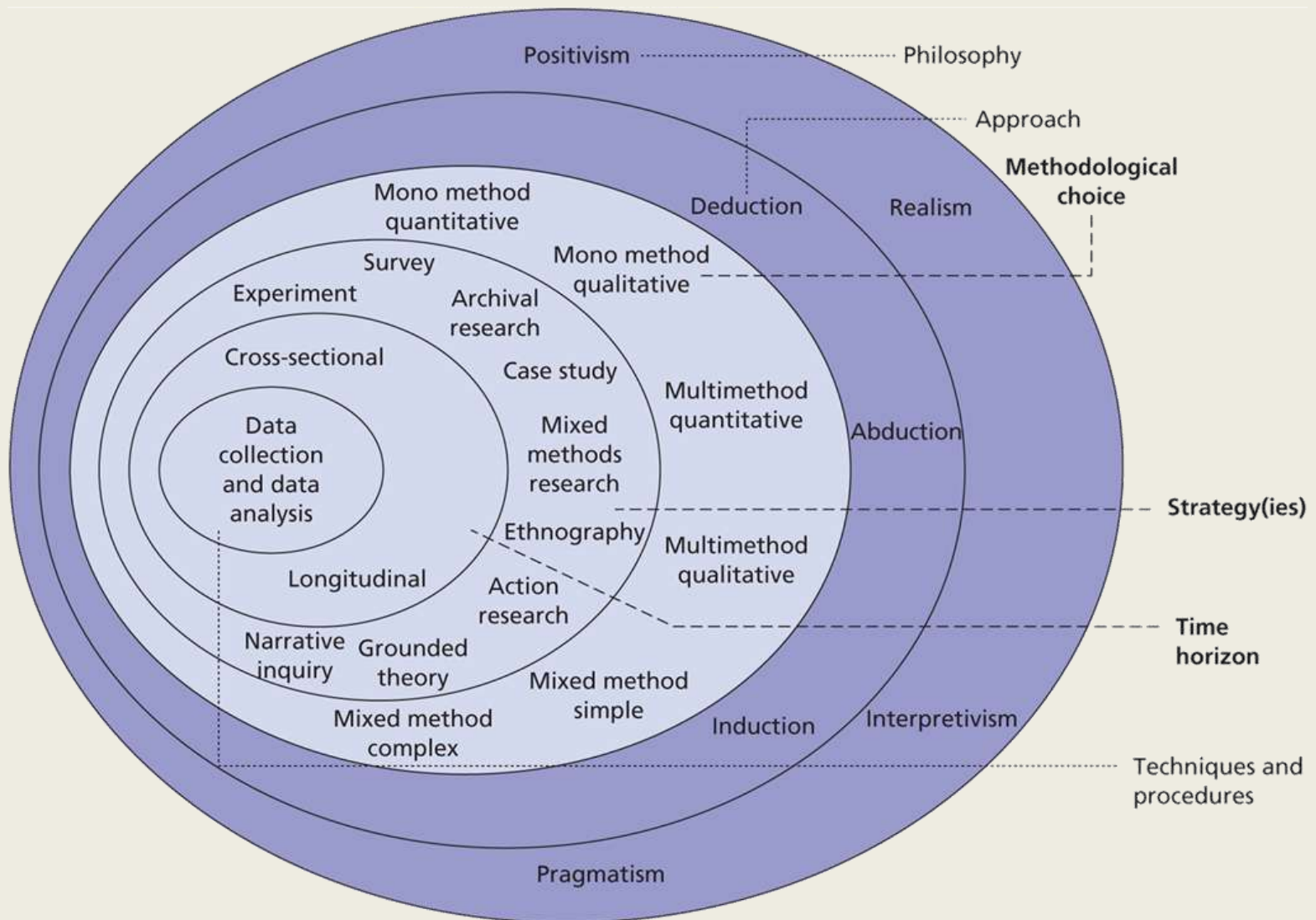
What is Good Research?

Standards of the scientific method:

6. Adequate analysis for decision maker's needs
 - Analysis is sound and claims are based on the evidence
7. Findings presented unambiguously
 - Use restrained, clear and precise language. Other researchers should be able to replicate the findings.
8. Conclusions justified
 - Conclusions should be limited to those for which the data provide an adequate basis. Don't over-interpret or over-generalise.
9. Researcher's experience reflected
 - The researcher is experienced, has a good reputation in the research field and is a person of integrity.

Research Philosophy

What is 'knowledge'?



What is Research Philosophy?

An overarching term relating to the development of knowledge and the nature of that knowledge.

What is Research Philosophy?

- All research is based on assumptions about how the world is and how we can best come to understand it
- These assumptions (and practical considerations) will guide our research strategy and methods
- One research question, different approaches and choices.
- There are many philosophies – none is 'better' than the other...

Characteristics of Research Philosophies

- **Ontology** – your view of the nature of reality; assumptions on what the world is and how the world works
- **Epistemology** – your view of the nature of knowledge; beliefs on what constitutes knowledge and acceptable evidence
- **Axiology** – your view of value; the purpose of research; role of researchers; how researchers should conduct themselves to add value
- **Reasoning** – the way in which researchers make sense of things and infer conclusions

Ontology

- What constitutes reality?
- How can we understand existence?
- “facts are facts” – there is a truth
- “people are people” – truth is complex and relative to individuals
- “we all observe the same objective reality”
- “reality is transient and socially constructed”

Epistemology

- What constitutes valid knowledge?
- How can we obtain valid knowledge?
- “empiricism - observation and evidence”
- “rationalism - reasoning by debate”
- “constructivism – from experience”

Epistemology

- What constitutes valid knowledge?
- How can we obtain valid knowledge?
- “results must be replicated by others”
- “depth and individual variation is valid”

Epistemology

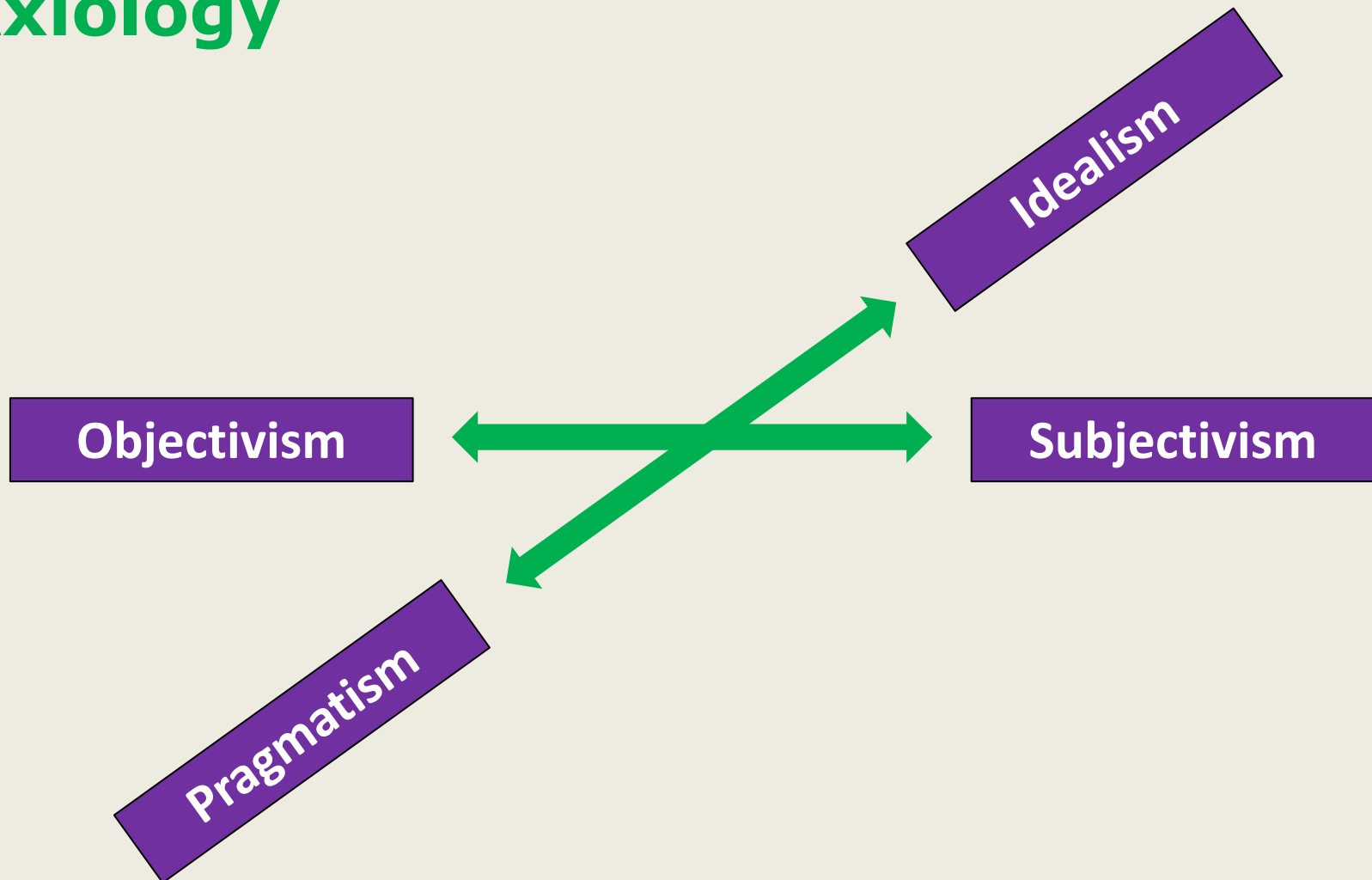
- What constitutes valid knowledge?
- How can we obtain valid knowledge?
- “only has value if potentially falsifiable”
- “justifiable beliefs count as knowledge”

Axiology

The study of the nature of value and valuation:

- Pragmatics --- research justified by the current needs of a society, change shape to do what works best on the ground
- Idealism --- research activity guided by ideology and foundational principles, follow principles (particularly those from the enlightenment)
- Objectivism --- researchers should distance themselves from their work as undue interference compromises the value of the work
- Subjectivism --- all contributions have value, they offer unique perspectives and wisdom, no matter their muddiness

Axiology



Activity: What Are Your Thoughts?

- In pairs:
 - Focus on your own field and discipline*
 - Discuss your ontological beliefs
 - Discuss your epistemological beliefs
 - Discuss your axiological beliefs
 - Come to some choice and justification.
 - You will then present your thoughts to the class
- You have:
- 5 minutes to reflect
 - 10 minutes to discuss and take notes
 - 1 minute each to present

*recall the distinction we made last week

Methods of Reasoning

How 'do we know' what we know?

Methods of Reasoning

- How do you draw conclusions?
- When do you use theory?
- Are you starting with a theory?
- Are you finishing with a theory?

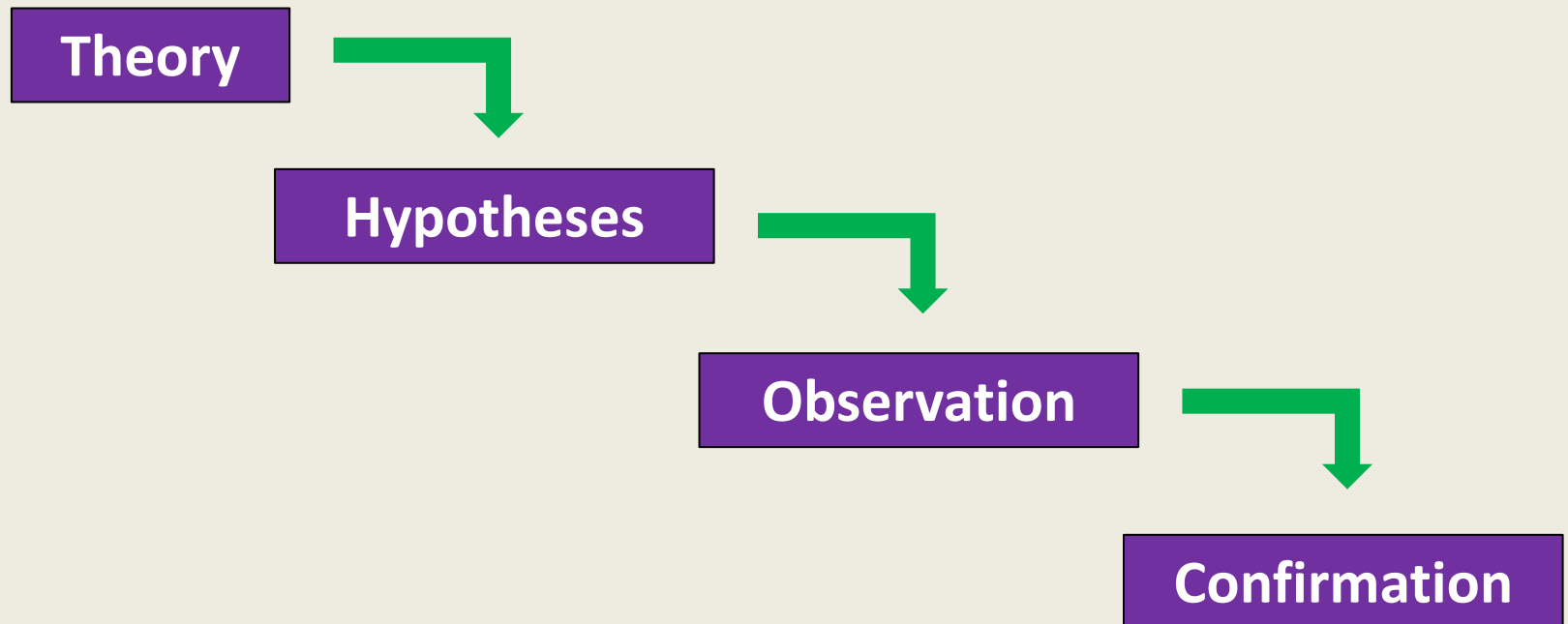
1. Deduction
2. Induction
3. Abduction

Deduction

- Conclusions follow necessarily from the stated premises:
 - Premise 1: All humans are mortal.
 - Premise 2: Socrates is a human.
 - Conclusion: Socrates is mortal.
- Deduction is generally an inference by reasoning from the general to the specific.
- The reasoning in this argument is valid, because when premises, 1 and 2, are true then the conclusion, 3, cannot be false.

Deduction

- Theories are developed and a research strategy designed to assess hypotheses:



Deduction

- Falsificationism is based on deductive reasoning
 - H: All swans are white
 - O: I observe a black swan
 - Conclusion: H is false

Deduction

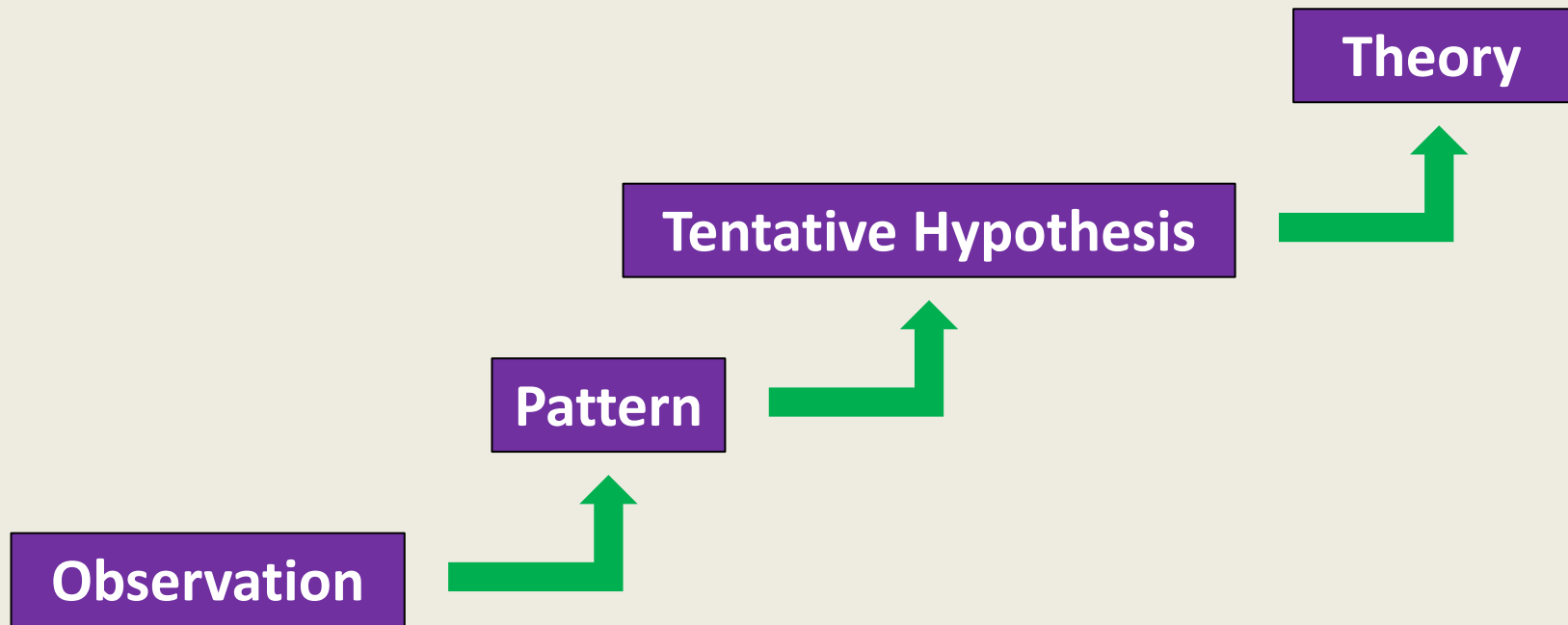
- Falsificationism is based on deductive reasoning
 - H: All swans are white
 - O: I observe a black swan
 - Conclusion: H is false
- **Is this conclusion correct?**

Induction

- Conclusions, either specifically or generally, are made based on previous observation(s).
 - Premise 1: The Sun has risen in the east today
 - Premise 2: The Sun has risen in the east today
 - Conclusion: The Sun will rise in the east *tomorrow*
- Induction is generally an inference by reasoning from the specific to the general
- The truth of the premises does not guarantee the truth of the conclusion.

Induction

Data are collected and theories are developed as a result of the analysis:



Induction

- Inductivism is based on inductive reasoning:
 - O1: Iron is magnetic
 - O2: Nickel is magnetic
 - O3: Cobalt is magnetic
 - Conclusion: All metals are magnetic

Induction

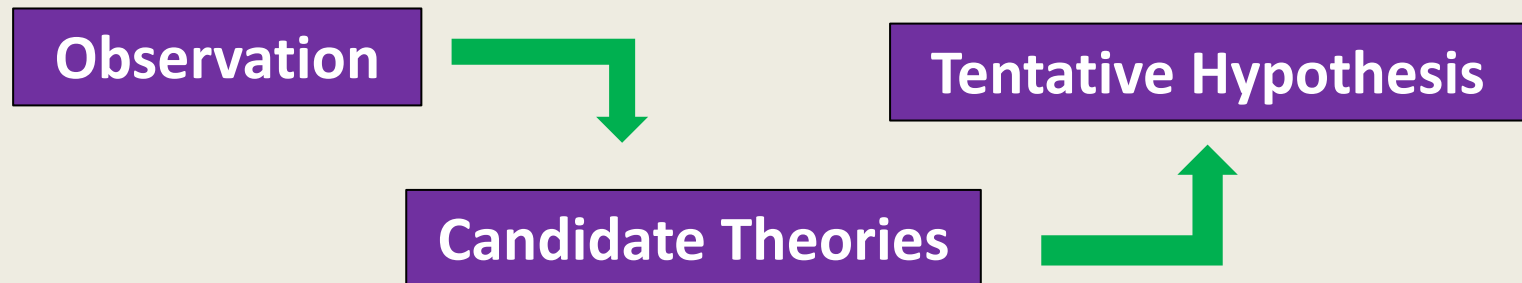
- Inductivism is based on inductive reasoning:
 - O1: Iron is magnetic
 - O2: Nickel is magnetic
 - O3: Cobalt is magnetic
 - Conclusion: All metals are magnetic
- **Is this conclusion correct?**

Abduction

- Use theory and argument to determine the best conclusion from premises
 - Premise 1: The lawn is wet
 - Theory: If it rained, then it would be unsurprising that the lawn is wet
 - Conclusion: It rained
- Abduction is generally inference by selecting the most probable conclusion
- The truth of the premise and the theory does not guarantee the truth of the conclusion, such that they are “sufficient but not always necessary”

Abduction

- Data are collected and the most probable theory is selected:



Abduction

- Diagnosis is often based on abductive reasoning, such that the best explanation is selected based on available evidence
 - Premise: The child has a fever
 - Premise: It is winter
 - Theory: It would be unsurprising for the child to have a cold if they have a fever in winter
 - Conclusion: The child has a cold

Abduction

- Diagnosis is often based on abductive reasoning, such that the best explanation is selected based on available evidence
 - Premise: The child has a fever
 - Premise: It is winter
 - Theory: It would be unsurprising for the child to have a cold if they have a fever in winter
 - Conclusion: The child has a cold
- **Is this conclusion correct?**

Reasoning

Inductivism

- Derive conclusions from observation
- Use evidence to create new theory
- Specific to general

Falsification

- Derive conclusions from observation
- Use evidence to falsify existing theory
- General to specific

Activity: What Are Your Thoughts?

- In pairs or small groups:
 - Unpack the research method that you might deploy *in your particular study*
 - Discuss the approach(es) to reasoning that you might deploy as part of that method
 - Try to identify how this aligns with the philosophies discussed earlier
 - Share your thoughts to the class
- You have:
- 5 minutes to reflect
 - 10 minutes to discuss and take notes
 - 1 minute each to present



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Well-Known Research Philosophies

Who knows what?

What is Research Philosophy?

There are four well-known research philosophies:

1. Positivism
2. Interpretivism
3. Realism
4. Pragmatism

We will compare positivism and interpretivism.
Review the other two independently.

Positivism

- Origin in natural sciences
- Only observable phenomena lead to credible data
- Use existing theory to formulate hypothesis

Positivism

- Collect data
- Test hypothesis based on statistical analysis of data
- Confirm or reject hypothesis
- For example, two different researchers looking into the merger of two firms will arrive at the same conclusions, and a single explanation can be given.

Positivism

- **Key Principles:**

1. The world exists externally and is viewed objectively
2. Research is value-free
 - 'Facts are facts' – no influence from us
3. The researcher is independent, taking the role of an objective analyst.

- **Assumptions**

1. The world is observed by collecting objective facts.
2. The world consists of simple elements to which it can be reduced.

Interpretivism

- Can the social aspects of **computing for games** and **technology** be explained with the 'law-like' propositions of positivists?
- Every technical interaction or situation, or associated social phenomenon is complex, and unique!
- A situation which is a function of circumstances and individuals at a particular time, seen from the point of view of the individuals.
- Research is done among people by people: 'social actors'

Interpretivism

- **Key Principles:**

1. the social world is constructed and is given meaning subjectively by people
2. the researcher is part of what is observed
3. research is driven by interests

- **Assumptions:**

1. The social world is observed by seeing what meanings people give to it and interpreting these meanings from their viewpoint.
2. Social phenomena can only be understood by looking at the totality.

Positivism and Interpretivism

	Positivism	Interpretivism
<i>Basic principles</i>		
View of the world	The world is external and objective	The world is socially constructed and subjective
Involvement of researcher	Researcher is independent	Researcher is part of what is observed and sometimes even actively collaborates
Researcher's influence	Research is value-free	Research is driven by human interests
<i>Assumptions</i>		
What is observed?	Objective, often quantitative, facts	Subjective interpretations of meanings
How is knowledge developed?	Reducing phenomena to simple elements representing general laws	Taking a broad and total view of phenomena to detect explanations beyond the current knowledge

Activity: Mary's Research

- Mary decided to conduct a research project on stress in game studios, focusing on programmers and software defects.

- How would you conduct this research?
- What philosophies inform this choice?

Get into small groups.

You have:

- 5 minutes to reflect
- 10 minutes to discuss and take notes
- 2 minutes each to present

Philosophies and Approaches

Positivist Approach

- Mary started with a hypothesis that higher levels of stress lead to a higher incidence of defects.
- She decided to use a large number of programmers in a company.
- She administered a questionnaire in order to establish their levels of stress as well as static code analysis and git blame to establish points at which defects were introduced into the game.
- She found a strong relationship between levels of stress and the probability of checking a defect into source control.
- She concluded that the data confirmed her hypothesis.

Interpretivist Approach

- Mary interviews a number of key staff. She was interested in their views about possible causes of stress, their strategies to cope with stress at work, and how they viewed the company policies in relation to stress.
- She also holds a focus group where programmers could, confidentially, reflect upon and discuss bugs they had introduced into the codebase, probing whether stress was a factor
- Her data allowed her to make recommendations about possible causes of stress, working practices associated with stress-induced software defection, and how companies could better support their programmers.

- Which is better, which more useful?

Next Week

Prepare for Ed's Session

Task I - Hypotheses

A hypothesis is:

“a supposition or proposed explanation made on the basis of limited evidence as a starting point for further investigation”

It's a provisional answer to your question!

By next week you should:

- Tidy your research question
- Review notes on hypotheses
- Using your research question, devise at least **ONE** hypothesis
- Strive to state hypotheses in a formal way

Task II - Ethics

If you intend to involve people in your research, you **must** obtain ethical clearance.

Even if you don't, you still need your ethics signed-off!

<https://goo.gl/cfbmck>

By next week you should:

- Download and complete a draft of your ethics application form
- Bring it with you to your supervision meeting