Monograph on

INDUCTIVE & DEDUCTIVE RESEARCH APPROACH

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"Well begun is half done"

--Aristotle, quoting an old proverb

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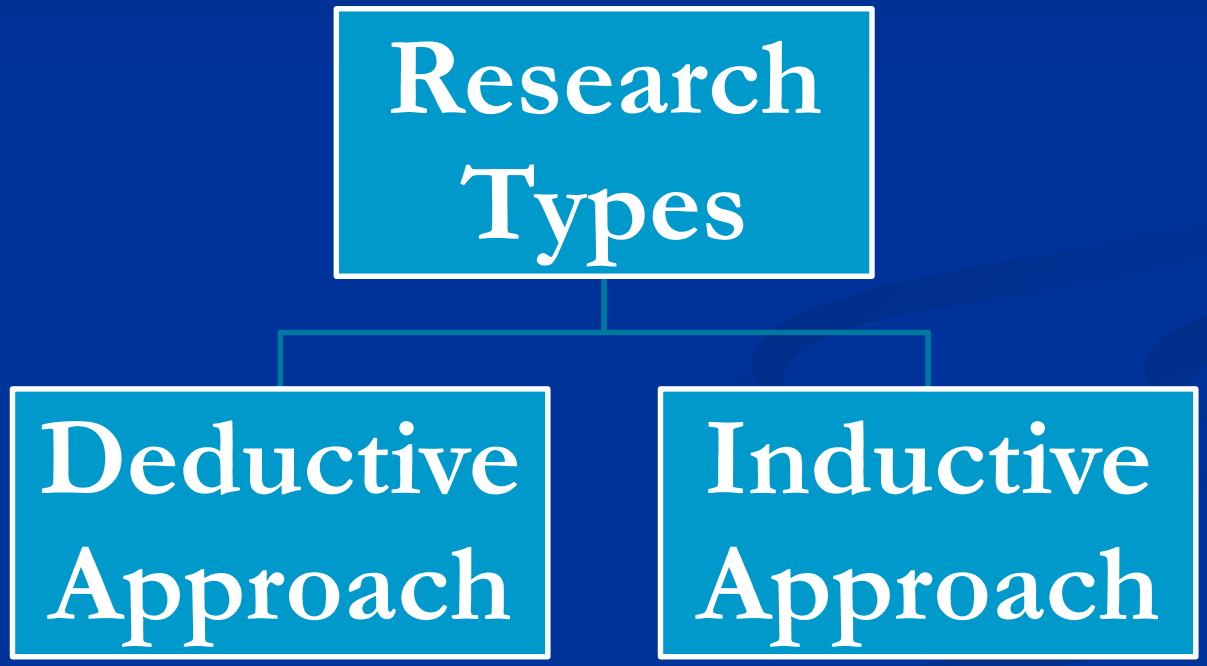
Research Methods

In research, we often refer to the two broad methods of reasoning as the ***deductive*** and ***inductive*** approaches.



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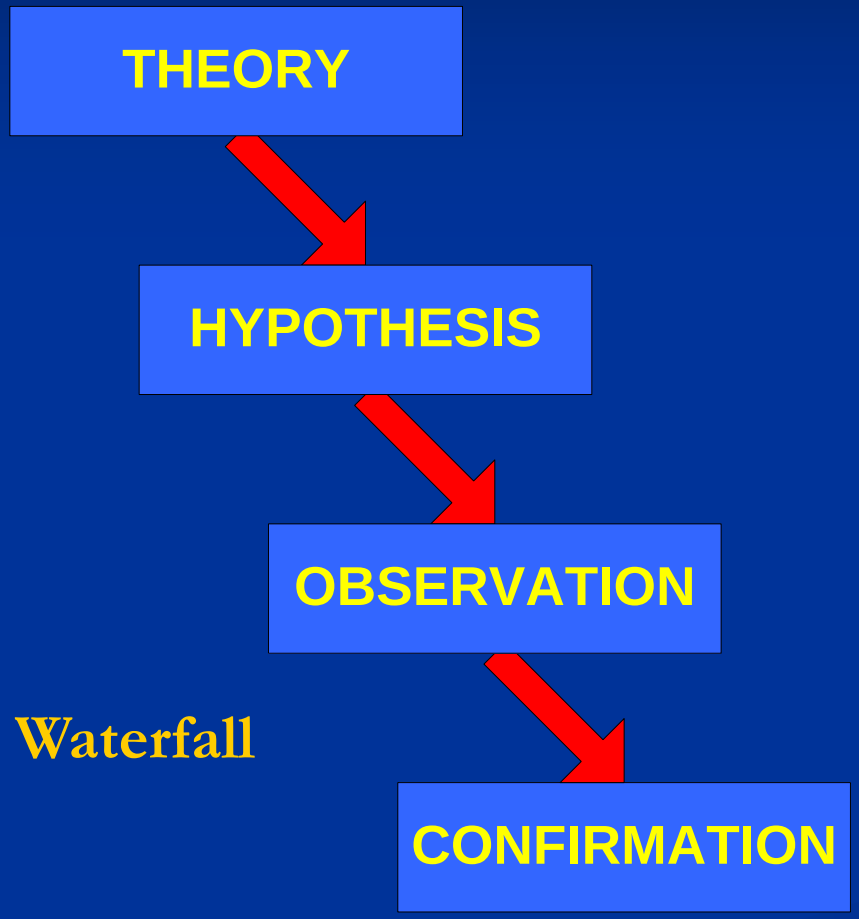
Deductive Research Approach



Waterfall

- Deductive reasoning works from the more general to the more specific.
- Sometimes this is informally called a "top-down" approach.
- Conclusion follows logically from premises (available facts)

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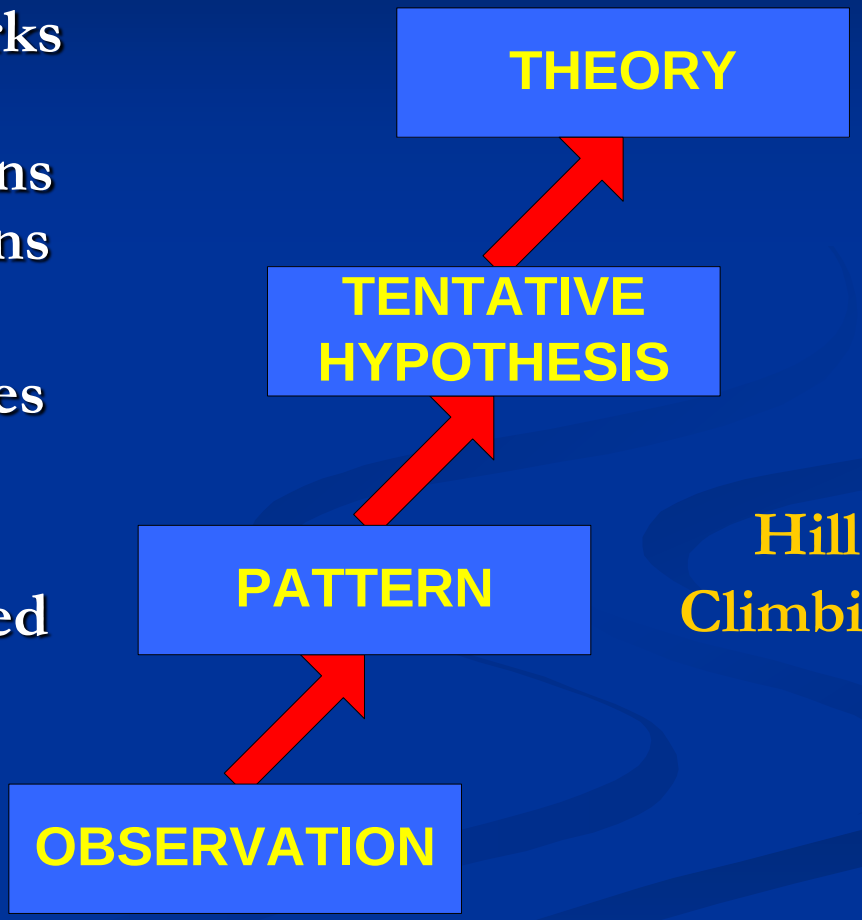
Inductive Research Approach

- Inductive reasoning works the other way, moving from specific observations to broader generalizations and theories.
- Informally, we sometimes call this a "bottom up" approach
- Conclusion is likely based on premises.
- Involves a degree of uncertainty



Hill Climbing

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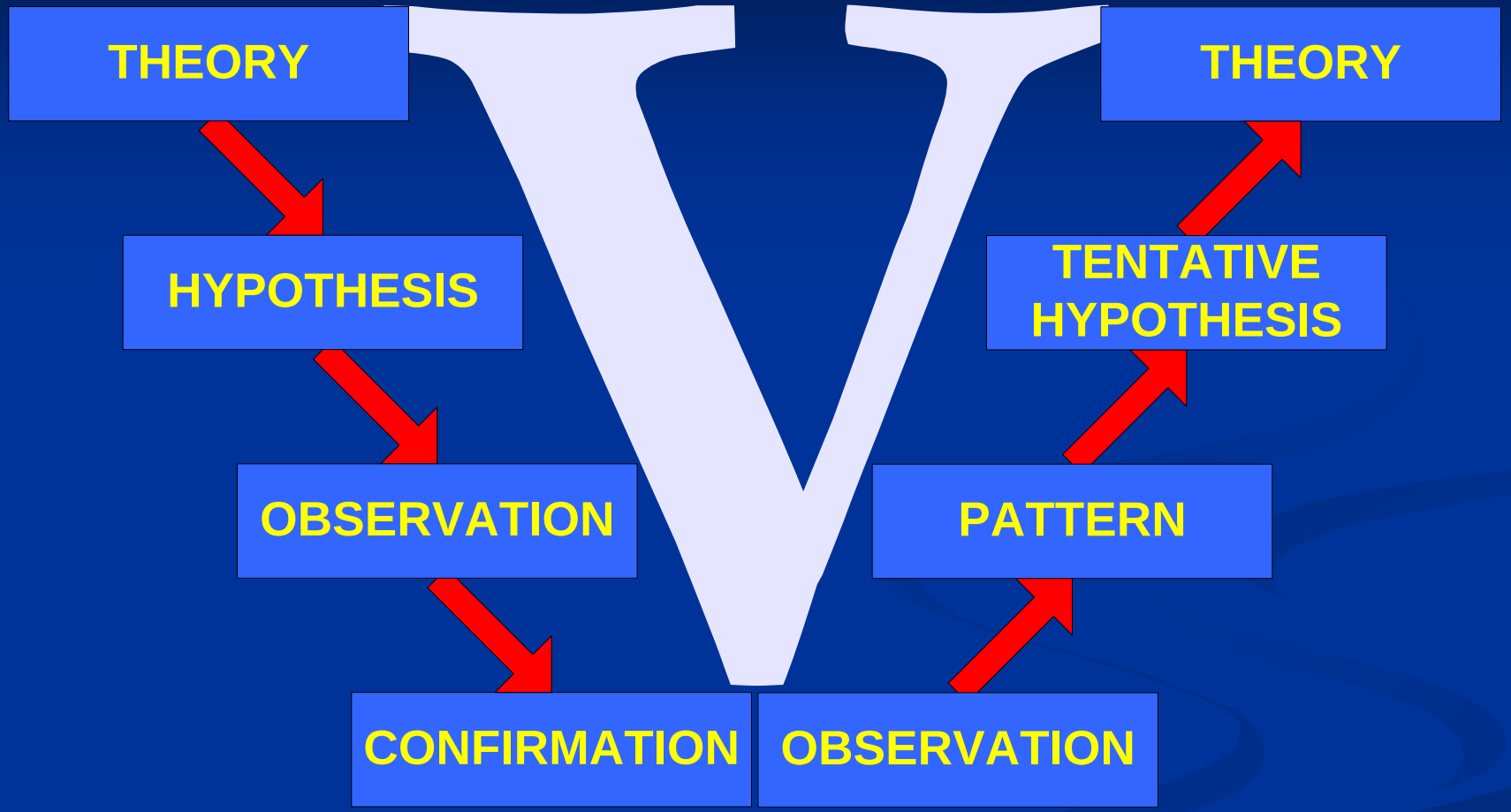
Deductive Vs. Inductive



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Deductive Vs. Inductive

- Induction is usually described as moving from the specific to the general, while deduction begins with the general and ends with the specific.

- Arguments based on laws, rules and accepted principles are generally used for Deductive Reasoning. Observations tend to be used for Inductive Arguments.

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Logical Reasoning and Human Nature

- Historically, many researchers believed that logical reasoning is an essential part of human thought process and this dominates in scientific & Technological research and Development.

- However, humans are not natural logical reasoners

- REFERENCE:

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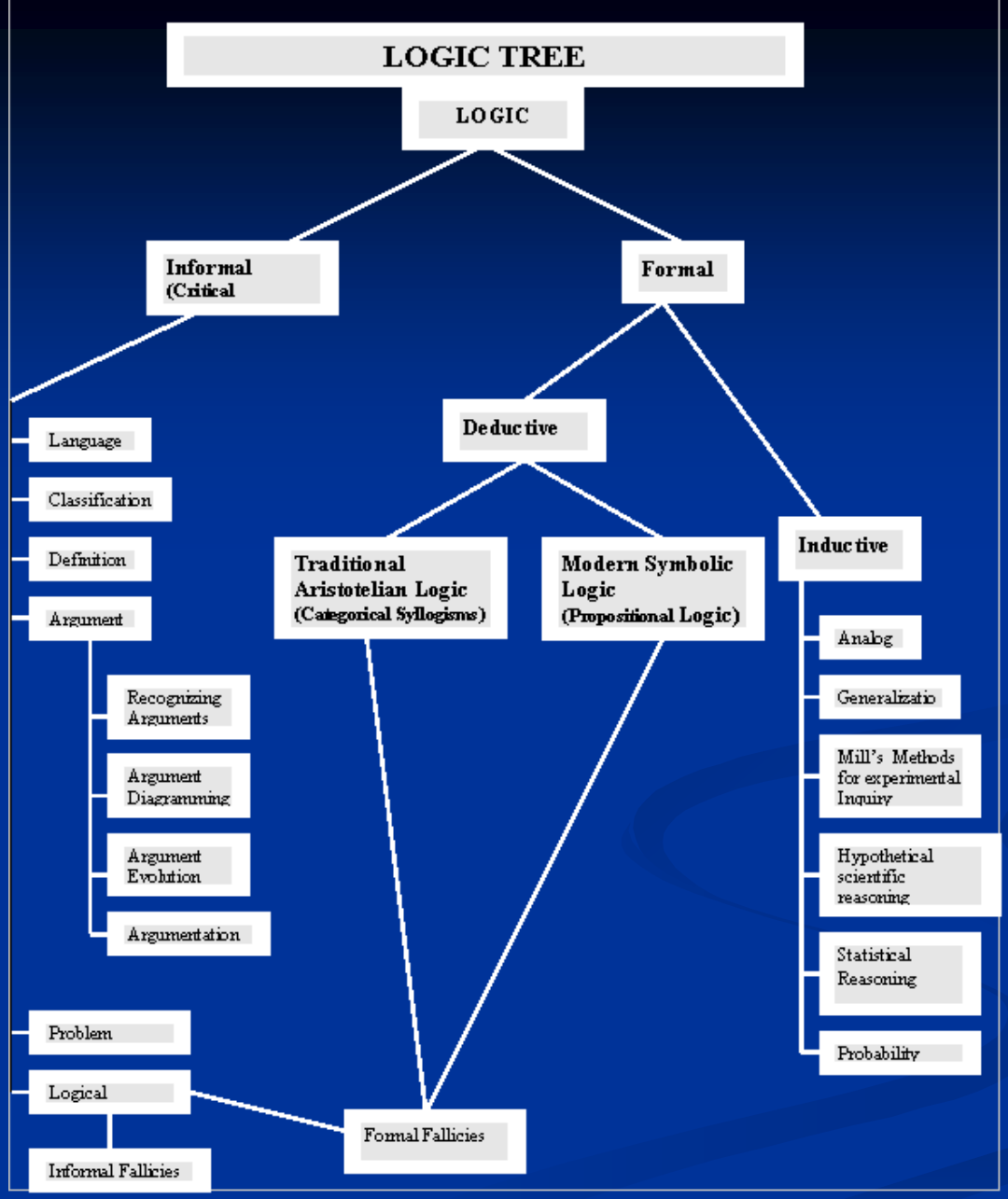

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Reasoning methods and Argumentation

- The main division between forms of reasoning that is made in philosophy is between deductive reasoning and inductive reasoning.

- Formal logic has been described as 'the science of deduction'.

- The study of inductive reasoning is generally carried out within the field known as informal logic or critical thinking.

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Usual[a] distinctions between quantitative and qualitative methods	
Concepts usually associated with quantitative method	Concepts usually associated with qualitative method
Type of reasoning	
Deduction	Induction
Objectivity	Subjectivity
Causation	Meaning
Type of question	
Pre-specified	Open-ended
Outcome-oriented	Process-oriented
Type of analysis	
Numerical estimation	Narrative description
Statistical inference	Constant comparison

[a] The use of the term "usual" is meant to remind readers that these distinctions are not entirely discrete. In fact, there is a spectrum of research that encompasses both methods that, in turn, crosses these traditional demarcations.

http://www.phac-aspc.gc.ca/publicat/cdic-mcc/18-3/d_e.html

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Automated Reasoning

- Logic lends itself to automation.
- A variety of problems can be attacked by representing the problem description and relevant background information as logical axioms and treating problem instances as theorems to be proved.

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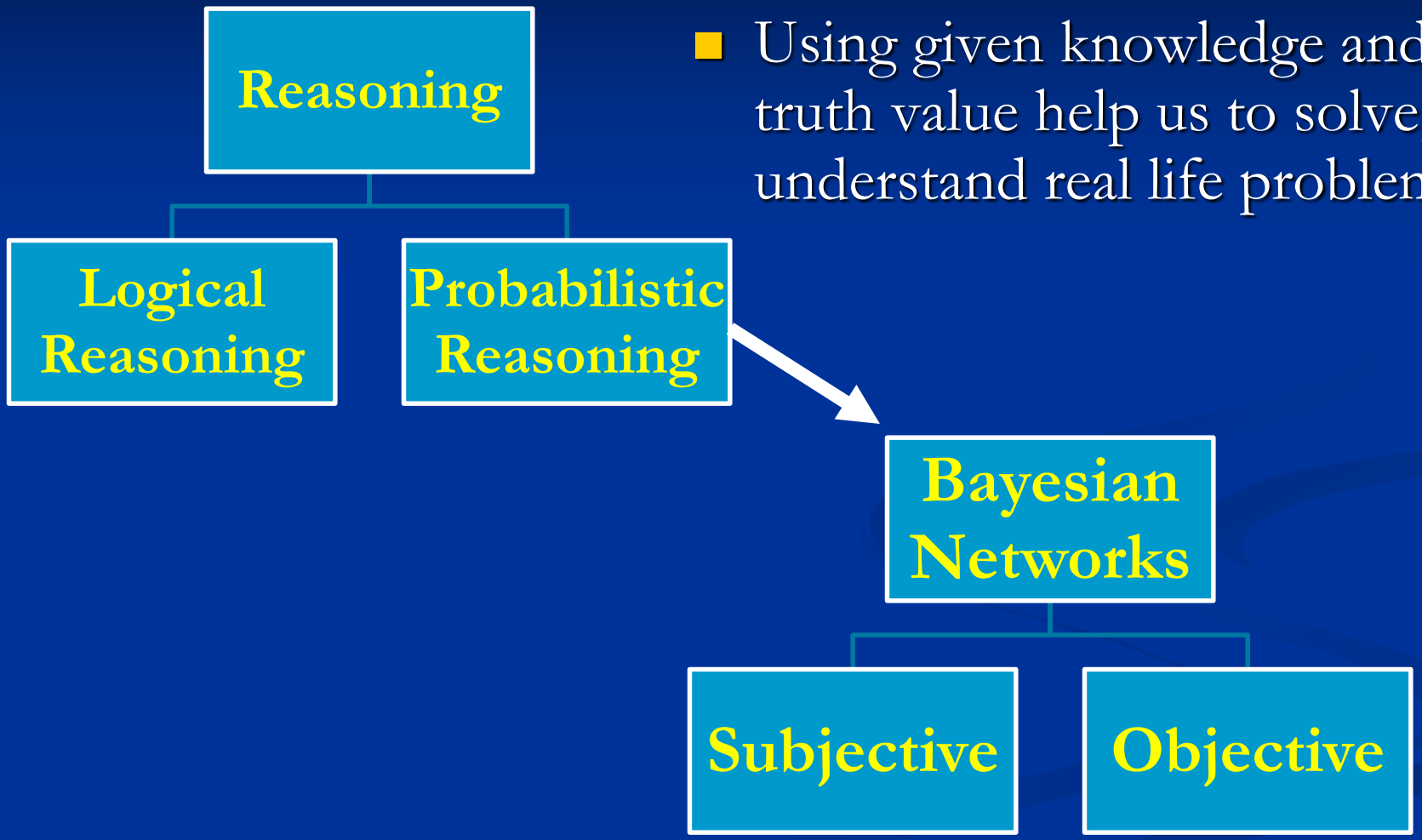
Logic and Reasoning



- Using given knowledge and truth value help us to solve, understand real life problems.

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EXAMPLE

- p: All mathematicians wear glasses
- q: Anyone who wears glasses is an algebraist
- r: All mathematicians are algebraist

$p \wedge q \rightarrow r \equiv (\sim(p \wedge q) \vee r)$

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TRUTH TABLE

Truth Table for the formulae built with the Logical Operators

p	q	r	pΛq	~(pΛq)	~(pΛq)Vr
T	T	T	T	F	T
T	T	F	T	F	F
T	F	T	F	T	T
T	F	F	F	T	T
F	T	T	F	T	T
F	T	F	F	T	T
F	F	T	F	T	T
F	F	F	F	T	T

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- If r is the conclusion, and we know that p and q are true simultaneously then r is valid statement.
- In real life, the statements are true or false, here statement means an atomic statement, thus statements may be simple (atomic) or component. If p, q and r are independent statements, then we need to prove: $p \wedge q \rightarrow r$

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Commitment

Ontological Commitment:

What exists in the world: Language of reasoning (Formal).

Epistemological Commitment

What an intelligent entity believes about the fact.

Believe System: True, False, Unknown, degree of believe, degree believe with ranks (known values)

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Formal Language	Ontology (What exists)	Epistemology
Propositional Logic	facts	True/False /Unknown
Predicate Logic	Facts, objects, relations	True/False /Unknown
Probability Theory	Facts with change	Degree of believe on [0,1]
Temporal Logic	Facts, objects, relation and time	True/False /Unknown

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Fuzzy Logic	Facts with degree of believe	Known interval value
ANN-FL	Facts with degree of believe with learning	Known interval values with improvement in believe
Spatial Logic	Facts, objects, relation, time & Space	True/False /Unknown

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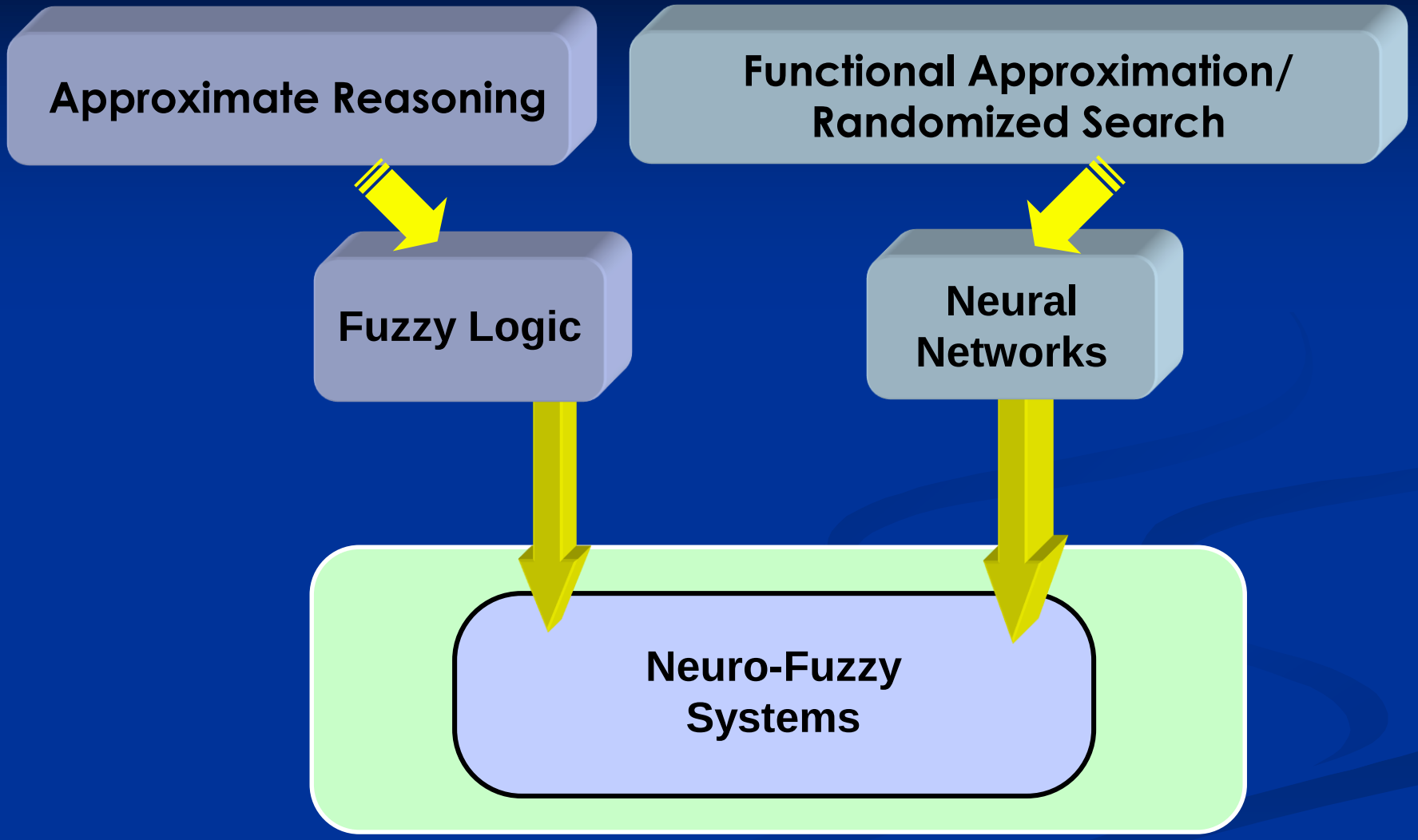
Evolution of Neuro-Fuzzy Logic



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" The whole of science is nothing more than a refinement of everyday thinking".

- Albert Einstein

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- Syed Muhammad Aqil Burney; Tahseen Ahmed Jilani, "A refined fuzzy time series model for stock market forecasting" Elsevier—Science Direct, Physica-A, January 2008 (in press). www.elsevier.com/locate/physa

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