<https://oir.umbc.edu/2013-umbc-data-gallery/>

<https://en.wikipedia.org/wiki/Ray_Solomonoff>

<https://en.wikipedia.org/wiki/Psychophysics>

**Inferences** are steps in [reasoning](https://en.wikipedia.org/wiki/Reasoning) - moving from [premises](https://en.wikipedia.org/wiki/Premise) to [logical consequences](https://en.wikipedia.org/wiki/Logical_consequence)

Rationalism is the belief in innate ideas, reason, and deduction. -> Objective

Deductive logic is sometimes identified with formal logic

Empiricism is the belief in sense perception, induction, and that there are no innate ideas. -> Subjective

An **inductive inference** is one which is likely to be true because of the state of the world

With rationalism, believing in innate ideas means to have ideas before we are born.-for example, through reincarnation. Plato best explains this through his theory of the forms, which is the place where everyone goes and attains knowledge before they are taken back to the “visible world”. Innate ideas can explain why some people are just naturally better at some things than other people are- even if they have had the same experiences.

Rationalists believe that the 5 senses only give you opinions, not reasons.

Deduction is the third characteristic of rationalism, which is to prove something with certainty rather than reason.

empiricists believe that sense perception is the main source of knowledge. John Locke explained this by dividing ideas into 2 parts: 1) simple, and 2) complex. Simple ideas are based only on perception, like color, size, shape, etc. Complex ideas are formed when simple ideas are combined. Another belief of empiricists is that ideas are only acquired through experience, and not through innate ideas. Induction is the final characteristic of empiricists. It is the belief that very few things, if any, can be proven conclusively.

Math is only rational because it’s symbols are axiomatic and its dictionary can be proven deductively… or rather it has aspects that are mathematical, and aspects that are empirical (the same is true of Newtonian mechanics or special relativity, but more obviously so). If we take Euclidean geometry as the science of space, as Greeks understood it, it is an empirical theory that may or may not match observations, and is subject to revision based on them. On the other hand, if we take it as the collection of theorems derivable from Hilbert's axioms (which complete those of Euclid) then it is a purely mathematical theory. This is related to existence of alternative geometries only in the sense that we can not conclude a priori that empirical geometry is Euclidean, because alternatives do exist.  
  
Scepticism is usually associated with the name of [David Hume](https://www.marxists.org/glossary/people/h/u.htm#hume-david)

[Kant](https://www.marxists.org/glossary/people/k/a.htm#kant-immanuel) was himself working towards scepticism in opposition to what he saw as the dogmatism of materialists such as [Diderot](https://www.marxists.org/glossary/people/d/i.htm#diderot-denis) when he was shocked by reading Hume’s scepticism, which seemed to show that science was impossible. Kant shows that scepticism is in fact the most dogmatic of all philosophies, since it asserts, dogmatically, that certainty cannot be attained. Thus Kant sought a *critical* philosophy to overcome the conflict between dogmatism and scepticism and define exactly what *are* the boundaries of knowledge.

Gottfried Leibniz, the great metaphysician, analyzed matter conceptually and reduced it beyond the level of atom, called it “monad” and presented it as immaterial, spiritual elements, underlying matter below the level of atom. In other words, quite ahead of his time and the physics of his age, he divided atom conceptually and broke it up into monads, that is, into immaterial elements, meaning that atom itself (which was believed to be indivisible, and said to be the smallest unit of matter) was discovered by him to be composed of immaterial elements – monads. Thus matter is ultimately composed of immaterial elements below the level of atom. The finding of this metaphysician is corroborated today by modern physics. The discovery of subatomic particlesprotons, neutrons and electrons, which are immaterial elements close to (if not exactly the same as) American Journal of Social Issues & Humanities Vol.1 No.2. (Nov.2011) ©AJSIH Vol.1 No.2. (Nov.2011) 35-49 Ochulor, Apebende, Metuonu | 44 Leibniz‟s monads points to the metaphysical foundation of modern science

Modern science is based on induction which is itself based on a metaphysical foundation as is evident from the principle of causality. This is what emerges clearly from the analysis of the problem of induction by David Hume and Karl Popper. Hume and Popper did not find any empirical foundation of induction precisely because its foundation is metaphysical, not empirical. For instance, there is no empirical proof that the future will be exactly like the past; that future occurrences will be like those of the past. These are apriori, metaphysical features that constitute the foundation of science.

The sciences seek the knowledge of things in their proximate causes. Metaphysics, on the other hand, is the science of things in their ultimate causes, reasons, and principles, acquired by the aid of human reason alone.

At the very root of all scientific knowledge are the ideas of cause, effect, quality, truth, relation, and similar ones. Science can only presuppose the validity of these ideas, consequently robbing them of their objective value, which robs science of the ground upon which it stands.

Kant sees law, duty, and obligation as the very heart of morality, while Hume does not

By “pure” or *a priori* moral philosophy, Kant has in mind a philosophy grounded exclusively on principles that are inherent in and revealed through the operations of reason. According to Kant, morality’s commands are unconditional. We could never discover a principle that commands all rational beings with such absolute authority through a method of empirical moral philosophy. An empirical approach, he argues, can tell us how people do act, but it cannot tell us how we ought to act.

metaphysics can contain empty definitions (ontology) but must show necessary logical truths (aprior) about emprical truths

Hume concretely divided empirical and rational. Kant resolved this.

Synthetic - Emprical. Amplative, adds meaning

Apriori - rational. Necessary and universal

Concept: “A triangle is a shape enclosed by 3 lines”.

Knowledge: The interior angle of a triangle sum to form 180 degrees

Reason Synthetic/Amplative/Empirical: The information is not given from what is given

Reason A priori: This can't be proven empirically but must be rationalized.

QED: Math is both sythetic and apriori. IE. All Metaphysical knowledge is a combination of the two.

Metaphysics discovers nessary universal truths. -> apriori

Metaphysics isnt about empty definitional truths. Amplitive. -> synthetic

Hume - reason is the slave of passion

Categorical imperative - do onto others as you would have done onto you. Treat people like ends not means

Inference vs causal understanding

Information is defined by its meaning. **Meaning** is defined by **perceiver**. An observer “notice or perceive (something) and register it as being significant”.

Perceptions arise from encoding of stimuli. Perception is “the ability to see, hear, or become aware of something through the sense”. A **perciever** “become aware or conscious of (something); come to realize or understand”.

Significant - “having a particular meaning; indicative of something.”

Important - “of great significance or value; likely to have a profound effect on success, survival, or well-being. “

Too many variations of

Neurons = ohm’s law I = v/r. Electric current = voltage / resistence

80 billion in brain - axons - human experience. How?

Deep learning = differentiable layers (incremental improvements) trained with SGD stochastic gradient descent  
188 cognitive biases

Photosynth, phagocytocis, osmosis.

Written in the perspective of the data. We traverse all the factors that contribute to the creation of data and what it means to explore it. From there we try to understand the background and history of data exploration and modern approaches and theory.

Once this understood, we turn write in the perspective of a citizen data scientist. We must define what this means and understand the limits of our assumptions. This persona allows us to create a better model. We then have to break apart the constraints we will be faced with when creating our ideal system.

Reasoning is a consequence of learning.   
Humans do not use QM for thinking but it could be possible with phosphorus

Yann leCun thinks NN will be capable of human reasoning.

Planning is a form of reasoning. Symbols and formal logic are discrete which is incompatible with learning and SGD. Replace symbols with vectors. Replace logic by continuous functions. Which now becomes compatible.

From ml to machine reasoning.

Final product of agi needs to have some grounding in reality weather from sense/body or through vide/ virtual worlds.

Three types of memory. State of cortex - 20, long/short term - hippocampus. Lastly its stored in the synapps. Chain of reasoning needs to access this knowledge and recurssively expound on the experiences.

Optical nerve in 1 eye has 1 million fibers. Pretend the are either on or off. The brain will not learn if you cut create perturbation to the input on/offs. One eye can see 2 to the 1 million possible combinations but only make sense of a fraction of that which is to say humans are not agi. We think we are general because we are general in all the things we understand. We cnt imagin tasks that are outside our comprehension. Heat is the world of things of which we have no idea. any system we have all sorts of variables. Anything not understood is explained as entropy. Entropy is heat.

Teach a machine to replace itself.

Supervised learning works better in nlp then image video processing because it handles uncertainty better.

Art is an extension of philosophy.

exhistentialism

Camus

Kierkegard

Nietzh

Heideger

Sartre

A scientist engaged in a piece of research, say in physics, can attack his problem straight away. He can go at once to the heart of the matter: to the heart, that is, of an organized structure. For a structure of scientific doctrines is already in existence; and with it, a generally accepted problem-situation. This is why he may leave it to others to fit his contribution into the framework of scientific knowledge. The philosopher finds himself in a different position. He does not face an organized structure, but rather something resembling a heap of ruins (though perhaps with treasure buried underneath). He cannot appeal to the fact that there is a generally accepted problem-situation; for that there is no such thing is perhaps the one fact which is generally accepted. Indeed it has by now become a recurrent question in philosophical circles whether philosophy will ever get so far as to pose a genuine problem. Nevertheless there are still some who do believe that philosophy can pose genuine problems about things, and who therefore still hope to get these problems discussed, and to have done with those depressing monologues which now pass for philosophical discussions. And if by chance they find themselves unable to accept any of the existing creeds, all they can do is to begin afresh from the beginning.

* vienna, Autumn 1934.

PART I Introduction to the Logic of Science

1 A Survey of Some Fundamental Problems

1 The Problem of Induction

2 Elimination of Psychologism

3 Deductive Testing of Theories

4 The Problem of Demarcation

5 Experience as a Method

6 Falsifiability as a Criterion of Demarcation

7 The Problem of the ‘Empirical Basis’

8 Scientific Objectivity and Subjective Conviction

3 Theories

12 Causality, Explanation, and the Deduction of Predictions

13 Strict and Numerical Universality

14 Universal Concepts and Individual Concepts

15 Strictly Universal and Existential Statements

16 Theoretical Systems

17 Some Possibilities of Interpreting a System of Axioms

18 Levels of Universality. The Modus Tollens

5 The Problem of the Empirical Basis

25 Perceptual Experiences as Empirical Basis: Psychologism

26 Concerning the So-Called ‘Protocol Sentences’

27 The Objectivity of the Empirical Basis

28 Basic Statements

29 The Relativity of Basic Statements. Resolution of Fries’s Trilemma

30 Theory and Experiment

6 Degrees of Testability

31 A Programme and an Illustration

32 How are Classes of Potential Falsifiers to be Compared?

36 Levels of Universality and Degrees of Precision  
37 Logical Ranges. Notes on the Theory of Measurement

38 Degrees of Testability Compared by Reference to Dimensions  
39 The Dimension of a Set of Curves

7 Simplicity 121 41 Elimination of the Aesthetic and the Pragmatic Concepts of Simplicity 42 The Methodological Problem of Simplicity 43 Simplicity and Degree of Falsifiability 44 Geometrical Shape and Functional Form 45 The Simplicity of Euclidean Geometry 46 Conventionalism and the Concept of Simplicity

8 Probability 133 47 The Problem of Interpreting Probability Statements 48 Subjective and Objective Interpretations 49 The Fundamental Problem of the Theory of Chance 50 The Frequency Theory of von Mises 54 Finite Sequences. Ordinal Selection and Neighbourhood Selection. 57 Infinite Sequences. Hypothetical Estimates of Frequency

58 An Examination of the Axiom of Randomness 59 Chance-Like Sequences. Objective Probability 60 Bernoulli’s Problem 61 The Law of Great Numbers (Bernoulli’s Theorem) 62 Bernoulli’s Theorem and the Interpretation of Probability Statements 63 Bernoulli’s Theorem and the Problem of Convergence contents ix 64 Elimination of the Axiom of Convergence. Solution of the ‘Fundamental Problem of the Theory of Chance’ 65 The Problem of Decidability 66 The Logical Form of Probability Statements 67 A Probabilistic System of Speculative Metaphysics 68 Probability in Physics 69 Law and Chance 70 The Deducibility of Macro Laws from Micro Laws 71 Formally Singular Probability Statements 72 The Theory of Range

9 Some Observations on Quantum Theory 209 73 Heisenberg’s Programme and the Uncertainty Relations 74 A Brief Outline of the Statistical Interpretation of Quantum Theory 75 A Statistical Re-Interpretation of the Uncertainty Formulae 76 An Attempt to Eliminate Metaphysical Elements by Inverting Heisenberg’s Programme; with Applications 77 Decisive Experiments 78 Indeterminist Metaphysics 10 Corroboration, or How a Theory Stands up to Tests 248 79 Concerning the So-Called Verification of Hypotheses 80 The Probability of a Hypothesis and the Probability of Events: Criticism of Probability Logic 81 Inductive Logic and Probability Logic 82 The Positive Theory of Corroboration: How a Hypothesis may ‘Prove its Mettle’ 83 Corroborability, Testability, and Logical Probability 84 Remarks Concerning the Use of the Concepts ‘True’ and ‘Corroborated’ 85 The Path of Science

Language analysts believe that there are no genuine philosophical problems, or that the problems of philosophy, if any, are problems of linguistic usage, or of the meaning of words. I, however, believe that there is at least one philosophical problem in which all thinking men are interested. It is the problem of cosmology: the problem of understanding the world—including ourselves, and our knowledge, as part of the world. All science is cosmology, I believe, and for me the interest of philosophy, no less than of science, lies solely in the contributions which it has made to it. For me, at any rate, both philosophy and science would lose all their attraction if they were to give up that pursuit. Admittedly, understanding the functions of our language is an important part of it; but explaining away our problems as merely linguistic ‘puzzles’ is not.

Language analysts regard themselves as practitioners of a method peculiar to philosophy. I think they are wrong, for I believe in the following thesis. Philosophers are as free as others to use any method in searching for truth. There is no method peculiar to philosophy. A second thesis which I should like to propound here is this. The central problem of epistemology has always been and still is the problem of the growth of knowledge. And the growth of knowledge can be studied best by studying the growth of scientific knowledge. I do not think that the study of the growth of knowledge can be replaced by the study of linguistic usages, or of language systems.

One such reason is the correct belief that **logical paradoxes need the method of linguistic analysis for their solution**, with its famous **distinction between meaningful** (or ‘well-formed’) and **meaningless** linguistic expressions. **This correct belief is then combined with the mistaken belief that the traditional problems of philosophy arise from the attempt to solve philosophical paradoxes whose structure is analogous to that of logical paradoxes, so that the distinction between meaningful and meaningless talk must be of central importance for philosophy also**.

The problem of epistemology may be approached from two sides: (1) as the problem of ordinary or common-sense knowledge, or (2) as the problem of scientific knowledge. Those philosophers who favour the first approach think, rightly, that scientific knowledge can only be an extension of common-sense knowledge, and they also think, wrongly, that common-sense knowledge is the easier of the two to analyse. In this way these philosophers come to replace the ‘new way of ideas’ by an analysis of ordinary language—the language in which common-sense knowledge is formulated. They replace the analysis of vision or preface, 1959 xxi perception or knowledge or belief by the analysis of the phrases ‘I see’ or ‘I perceive’, or ‘I know’, ‘I believe’, ‘I hold that it is probable’; or perhaps by that of the word ‘perhaps’.

Now to those who favour this approach to the theory of knowledge I should reply as follows. Although I agree that scientific knowledge is merely a development of ordinary knowledge or common-sense knowledge, I contend that the most important and most exciting problems of epistemology must remain completely invisible to those who confine themselves to analysing ordinary or common-sense knowledge or its formulation in ordinary language.

E·pis·te·mol·o·gy /əˌpistəˈmäləjē/ *noun*PHILOSOPHY - The theory of knowledge, especially with regard to its methods, validity, and scope. Epistemology is the investigation of what distinguishes justified belief from opinion.

Now to those who favour this approach to the theory of knowledge I should reply as follows. Although I agree that scientific knowledge is merely a development of ordinary knowledge or common-sense knowledge, I contend that the most important and most exciting problems of epistemology must remain completely invisible to those who confine themselves to analysing ordinary or common-sense knowledge or its formulation in ordinary language. I wish to refer here only to one example of the kind of problem I have in mind: the problem of the growth of our knowledge. A little reflection will show that most problems connected with the growth of our knowledge must necessarily transcend any study which is confined to common-sense knowledge as opposed to scientific knowledge. For the most important way in which common-sense knowledge grows is, precisely, by turning into scientific knowledge. Moreover, it seems clear that the growth of scientific knowledge is the most important and interesting case of the growth of knowledge. It should be remembered, in this context, that almost all the problems of traditional epistemology are connected with the problem of the growth of knowledge. I am inclined to say even more: from Plato to Descartes, Leibniz, Kant, Duhem and Poincaré; and from Bacon, Hobbes, and Locke, to Hume, Mill, and Russell, the theory of knowledge was inspired by the hope that it would enable us not only to know more about knowledge, but also to contribute to the advance of knowledge—of scientific knowledge, that is. (The only possible exception to this rule among the great philosophers I can think of is Berkeley.)

Also, it seems to me paradoxical that philosophers who take pride in specializing in the study of ordinary language nevertheless believe that they know enough about cosmology to be sure that it is in essence so different from philosophy that philosophy cannot make any contribution to it. And indeed they are mistaken. For it is a fact that purely metaphysical ideas—and therefore philosophical ideas—have been of the greatest importance for cosmology. From Thales to Einstein, from ancient atomism to Descartes’s speculation about matter, from the speculations of Gilbert and Newton and Leibniz and Boscovic about forces to those of Faraday and Einstein about fields of forces, metaphysical ideas have shown the way

I turn first to those whose chosen method is the construction of artificial models of the language of science. Historically, they too take their departure from the ‘new way of ideas’. They too replace the (pseudo-) psychological method of the old ‘new way’ by linguistic analysis. But perhaps owing to the spiritual consolations offered by the hope for knowledge that is ‘exact’ or ‘precise’ or ‘formalized’, the chosen object of their linguistic analysis is ‘the language of science’ rather than ordinary language. Yet unfortunately there seems to be no such thing as ‘the language of science’. It therefore becomes necessary for them to construct one. However, the construction of a full-scale working model of a language of science—one in which we could operate a real science such as physics—turns out a little difficult in practice; and for this reason we find them engaged in the construction of intricate working models in miniature—of vast systems of minute gadgets. In my opinion, this group of philosophers gets the worst of both worlds. By their method of constructing miniature model languages they miss the most exciting problems of the theory of knowledge— those connected with its advancement. For the intricacy of the outfit bears no relation to its effectiveness, and practically no scientific theory of any interest can be expressed in these vast systems of minutiae. These model languages have no bearing on either science or common sense.

Indeed, the models of ‘the language of science’ which these philosophers construct have nothing to do with the language of modern science. This may be seen from the following remarks which apply to the three most widely known model languages.

The limitations mentioned were imposed upon the model languages simply because otherwise the solutions offered by the authors to their problems would not have worked. This fact can be easily proved, and it has been partly proved by the authors themselves. Nevertheless, they all seem to claim two things: (a) that their methods are, in some sense or other, capable of solving problems of the theory of scientific knowledge, or in other words, that they are applicable to science (while in fact they are applicable with any precision only to discourse of an extremely primitive kind), and (b) that their methods are ‘exact’ or ‘precise’. Clearly these two claims cannot both be upheld.

the method of constructing artificial model languages is incapable of tackling the problems of the growth of our knowledge; and it is even less able to do so than the method of analysing ordinary languages, simply because these model languages are poorer than ordinary languages. It is a result of their poverty that they yield only the most crude and the most misleading model of the growth of knowledge— the model of an accumulating heap of observation statements