# Propositional Logic, Truth Tables, and Epicurus' Objection to "Dialectic"

### Post by “Cassius” of September 5, 2021 at 10:52 AM

Martin has pointed out what appears to be an excellent opportunity to put together a special presentation on Epicurean views of "formal logic" and its relationship to reality. The opportunity comes from our mention in an earlier thread of the following statement by Torquatus in Cicero's On Ends:

sensibus confirmat, id est incorruptis atque integris testibus, si infantes pueri, mutae etiam bestiae paene loquuntur, magistra ac duce natura, nihil esse prosperum nisi voluptatem, nihil asperum nisi dolorem, de quibus neque depravate iudicant neque corrupte, nonne ei maximam gratiam habere debemus qui hac exaudita quasi voce naturae sic eam firme graviterque comprehenderit ut omnes bene sanos in viam placatae, tranquillae, quietae, beatae vitae deduceret? Qui quod tibi parum videtur eruditus, ea causa est quod nullam eruditionem esse duxit nisi quae beatae
72 vitae disciplinam iuvaret. An ille tempus aut in poetis evolvendis, ut ego et Triarius te hortatore facimus, consumeret, in quibus nulla solida utilitas omnisque puerilis est delectatio, aut se, ut Plato, in musicis, geometria, numeris, astris contereret, quae et a falsis initiis profecta vera esse non possunt et si essent vera nihil afferrent quo iucundius, id est quo melius viveremus; — eas ergo artes persequeretur, vivendi artem tantam tamque operosam et perinde fructuosam relinqueret? Non ergo Epicurus ineruditus, sed ii indocti qui quae pueros non didicisse turpe est ea putant usque ad senectutem esse discenda." Quae cum dixisset, "Explicavi," inquit, "sententiam meam et eo quidem consilio, tuum iudicium ut cognoscerem, quae mihi facultas, ut id meo arbitratu facerem, ante hoc tempus numquam est data."





whole discourse relies throughout for confirmation on the unbiased and unimpeachable evidence of the senses; if lisping infants, nay even dumb animals, prompted by Nature's teaching, almost find voice to proclaim that there is no welfare but pleasure, no hardship but pain—and their judgment in these matters is neither sophisticated nor biased—ought we not to feel the greatest gratitude to him who listened to this utterance of Nature's voice, and grasped its import so firmly and so fully that he has guided all sane-minded men into the paths of peace and happiness, calmness and repose? You are pleased to think him uneducated. The reason is that he refused to consider any education worth the name that did not help to school us in happiness.
72 Was he to spend his time, as you encourage Triarius and me to do, in perusing poets, who give us nothing solid and useful, but merely childish amusement? Was he to occupy himself like Plato with music and geometry, arithmetic and astronomy, which starting from false premises cannot be true, and which moreover if they were true would contribute nothing to make our lives pleasanter and therefore better? Was he, I say, to study arts like these, and neglect the master art, so difficult and correspondingly so fruitful, the art of living? No! Epicurus was not uneducated: the real philistines are those who ask us to go on studying till old age the subjects that we ought to be ashamed not to have learnt in boyhood." Thus concluding, he added: "I have explained my own view, but solely with the object of learning what your verdict is. I have never hitherto had a satisfactory opportunity of hearing it."



Again, the thread reference was here, and below is a copy of Martin's post: RE: Issues In The Meaning And Definition of Logic

Quote

"If the premises are false, the conclusion is going to be false."

No.
If the premises are false, the conclusion is not necessarily false.
Otherwise, you could "refute" a true statement by presenting it as the conclusion of false premises.

The truth table of a syllogism looks like this (you can verify by thinking it through line by line):

| A | * | B | ⇒ | C |
|---|---|---|---|---|
| T | T | T | T | T |
| T | T | T | F | F |
| T | F | F | T | T |
| T | F | F | T | F |
| F | F | T | T | T |
| F | F | T | T | F |
| F | F | F | T | T |
| F | F | F | T | F |

You can see from this table that the conclusion may be true if any or both of the premises are false.

One way of stating the issue is that the laws of formal logic in fact do allow a syllogistic construction in which the conclusion is true while one or more premises or false. This is not the way non-experts think that logic works, so it is important that non-experts understand what the experts are asserting, so that they can see that the assertions of formal logic need not be connected with reality -- and for that reason normal people should not infer that formal logic can be used to "disprove reality."

We're going to see if we can put together some reference material that will make this issue easier to understand, and hopefully trace it all the way back to Aristotle if not earlier.

The issue of logic being a tool that can be consistent within itself, and yet not be connected with practical reality, is something that we see come up over and over. It seems to me that this is counterintuitive to the way most non-experts approach the issue of logic, so it will be great to see if we can develop a presentation that will make the issue easier for the average person to understand.

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## Post by “Martin” of September 16, 2021 at 4:54 PM

The part of propositional logic which seems to be most relevant for this discussion on logic is explained in the tutorial

https://www.iit.edu/sites/default/files/2021-02/basic_propositional_logic_workshop.pdf

Please see my additions in the attachment.

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## Post by “Cassius” of September 16, 2021 at 9:20 PM

Martin I have glanced at both the the lit.edu material and your additional notes.

This looks to be a very interesting presentation!

Thinking forward to how you begin the presentation, I do not see anything in the Lit.edu material as to the meaning of the variables that will be used in the tables, and I presume that is one of the central issues that you will be describing in terms of how these operations are not necessarily tied to reality.

Is there a way to summarize or add to the handout picture the nature of this issue? I think you will be very thoroughly explaining how, given the premises of the exercise, the results of formal logic are reached.

So is the issue in the "premises of the exercise" themselves? And how do we start off the presentation emphasizing that aspect, so that we do not get lost in the weeds?

I am reminded of this from Hermotimus:

> Quote
>
> Perhaps an illustration will make my meaning clearer: when one of those audacious poets affirms that there was once a three-headed and six-handed man, if you accept that quietly without questioning its possibility, he will proceed to fill in the picture consistently—six eyes and ears, three voices talking at once, three mouths eating, and thirty fingers instead of our poor ten all told; if he has to fight, three of his hands will have a buckler, wicker targe, or shield apiece, while of the other three one swings an axe, another hurls a spear, and the third wields a sword. It is too late to carp at these details, when they come; they are consistent with the beginning; it was about that that the question ought to have been raised whether it was to be accepted and passed as true. Once grant that, and the rest comes flooding in, irresistible, hardly now susceptible of doubt, because it is consistent and accordant with your initial admissions. That is just your case; your love-yearning would not allow you to look into the facts at each entrance, and so you are dragged on by consistency; it never occurs to you that a thing may be self- consistent and yet false; if a man says twice five is seven, and you take his word for it without checking the sum, he will naturally deduce that four times five is fourteen, and so on *ad libitum*. This is the way that weird geometry proceeds: it sets before beginners certain strange assumptions, and insists on their granting the existence of inconceivable things, such as points having no parts, lines without breadth, and so on, builds on these rotten foundations a superstructure

> equally rotten, and pretends to go on to a demonstration which is true, though it starts from premises which are false.
>
> Just so you, when you have granted the principles of any school, believe in the deductions from them, and take their consistency, false as it is, for a guarantee of truth. Then with some of you, hope travels through, and you die before you have seen the truth and detected your deceivers, while the rest, disillusioned too late, will not turn back for shame: what, confess at their years that they have been abused with toys all this time? so they hold on desperately, putting the best face upon it and making all the converts they can, to have the consolation of good company in their deception; they are well aware that to speak out is to sacrifice the respect and superiority and honor they are accustomed to; so they will not do it if it may be helped, knowing the height from which they will fall to the common level. Just a few are found with the courage to say they were deluded, and warn other aspirants. Meeting such a one, call him a good man, a true and an honest; nay, call him philosopher, if you will; to my mind, the name is his or no one's; the rest either have no knowledge of the truth, though they think they have, or else have knowledge and hide it, shamefaced cowards clinging to reputation.

How do we make that point at the very introduction of the topic?

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## Post by “Martin” of September 17, 2021 at 3:10 AM

A variable in the tutorial (or proposition as I denote it more specific in my additions) is a place holder for a sentence, whereby that sentence needs to be meaningful to the extent that it can be true or false.

Epicurus knew and even Aristotle was aware of that binary logic might be applicable in full only to timeless sentences and those which refer to past events but not to events in the future. If everybody gets a good enough understanding on Monday and there is time left, we can expand the discussion into the pitfalls of applying logic to future events and how quantum logic avoids those pitfalls. It will still take several months until I finish a book from which I hope to gain a deeper understanding and more confidence in applying quantum logic. I know enough to say something about it but a complete stand-alone presentation on quantum logic will have to wait until 2022.

## Post by “Cassius” of September 17, 2021 at 4:53 AM

> Quote from Martin
>
> Epicurus knew and even Aristotle was aware of that binary logic might be applicable in full only to timeless sentences and those which refer to past events but not to events in the future.

YES - that is the issue, and I think it's absolutely critical that people understand that before, during, and after they try to absorb the presentation, because otherwise the problem diagnosed in the Hermotimus excerpt is undetectable.

Do you have any specific references on those two categories (1) timeless sentences (2) future events?

I believe part of what you are referring to must include the Epicurus reference to not being willing to state whether Hermarchus will be alive or dead tomorrow.

And this comment is not directed just to Martin - everyone who is at all interested in this issue needs an understanding of this, so we need to develop means of explaining it that are as memorable as possible.

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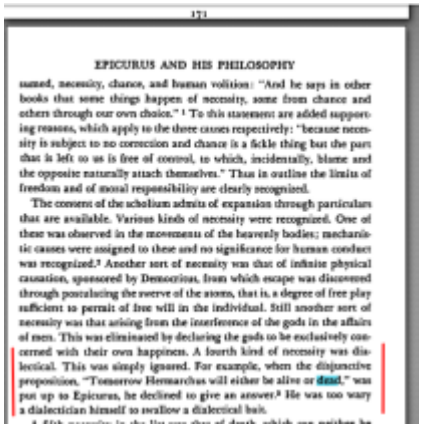
## Post by “Cassius” of September 17, 2021 at 5:13 AM

Examples:

Reference in DeWitt as to the Hermarchus example (however DeWitt is probably wrong in this first one to say Epicurus "ignored" the issue - the reason we have the example is that he was giving the proper response to the problem):

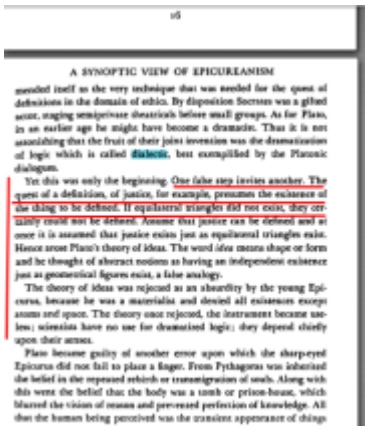


EPICURUS AND HIS PHILOSOPHY

named, necessity, chance, and human volition: "And he says in other books that some things happen of necessity, some from chance and others through our own choice." [1] To this statement are added supporting reasons, which apply to the three causes respectively: "because necessity is subject to no correction and chance is a fickle thing but the part that is left to us is free of control, to which, incidentally, blame and the opposite naturally attach themselves." Thus in outline the limits of freedom and of moral responsibility are clearly recognized.

The content of the scholium admits of expansion through particulars that are available. Various kinds of necessity were recognized. One of these was observed in the movements of the heavenly bodies; mechanistic causes were assigned to these and no significance for human conduct was recognized.[2] Another sort of necessity was that of infinite physical causation, sponsored by Democritus, from which escape was discovered through postulating the swerve of the atoms, that is, a degree of free play sufficient to permit of free will in the individual. Still another sort of necessity was that arising from the interference of the gods in the affairs of men. This was eliminated by declaring the gods to be exclusively concerned with their own happiness. A fourth kind of necessity was dialectical. This was simply ignored. For example, when the disjunctive proposition, "Tomorrow Hermarchus will either be alive or dead," was put up to Epicurus, he declined to give an answer.[3] He was too wary a dialectician himself to swallow a dialectical bait.

Seaching for "dialectic" in EAHP produces a huge number of hits. Here are some of the most on point:



A SYNOPTIC VIEW OF EPICUREANISM

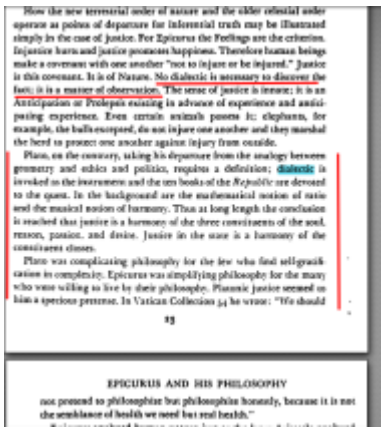
revealed itself as the very technique that was needed for the quest of definitions in the domain of ethics. By disposition Socrates was a gifted actor, staging semiprivate theatricals before small groups. As for Plato, in an earlier age he might have become a dramatist. Thus it is not astonishing that the fruit of their joint invention was the dramatization of logic which is called dialectic, best exemplified by the Platonic dialogues.

Yet this was only the beginning. One false step invites another. The quest of a definition, of justice, for example, presumes the existence of the thing to be defined. If equilateral triangles did not exist, they certainly could not be defined. Assume that justice can be defined and at once it is assumed that justice exists just as equilateral triangles exist. Hence arose Plato's theory of ideas. The word *idea* means shape or form and he thought of abstract notions as having an independent existence just as geometrical figures exist, a false analogy.

The theory of ideas was rejected as an absurdity by the young Epicurus, because he was a materialist and denied all existences except atoms and space. The theory once rejected, the instrument became useless; scientists have no use for dramatized logic; they depend chiefly upon their senses.

Plato became guilty of another error upon which the sharp-eyed Epicurus did not fail to place a finger. From Pythagoras was inherited the belief in the repeated rebirth or transmigration of souls. Along with this went the belief that the body was a tomb or prison-house, which blurred the vision of reason and prevented perfection of knowledge. All that the human being perceived was the transient appearance of things

Another:



How the new terrestrial order of nature and the older celestial order operate as points of departure for inferential truth may be illustrated simply in the case of justice. For Epicurus the Feelings are the criterion. Injustice hurts and justice promotes happiness. Therefore human beings make a covenant with one another "not to injure or be injured." Justice is this covenant. It is of Nature. No dialectic is necessary to discover the fact; it is a matter of observation. The sense of justice is innate; it is an Anticipation or Prolepsis existing in advance of experience and anticipating experience. Even certain animals possess it: elephants, for example, the bulls excepted, do not injure one another and they marshal the herd to protect one another against injury from outside.

Plato, on the contrary, taking his departure from the analogy between geometry and ethics and politics, requires a definition; dialectic is invoked as the instrument and the ten books of the *Republic* are devoted to the quest. In the background are the mathematical notion of ratio and the musical notion of harmony. Thus at long length the conclusion is reached that justice is a harmony of the three constituents of the soul, reason, passion, and desire. Justice in the state is a harmony of the constituent classes.

Plato was complicating philosophy for the few who find self-gratification in complexity. Epicurus was simplifying philosophy for the many who were willing to live by their philosophy. Platonic justice seemed to him a specious pretense. In Vatican Collection 54 he wrote: "We should

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not pretend to philosophize but philosophize honestly, because it is not the semblance of health we need but real health."

Another, as to education:

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THE PAIDEIA FALLACY

No correct understanding either of the schooling of Epicurus or of his later attitude toward education is possible without uncovering and dispelling a fallacy based upon the ambiguity of *paideia*, which means either "education" or "culture." This fallacy is the more regrettable because magnified by modern scholars. There is extant a saying of Epicurus which may be rendered: "To sea with your swift ship, blessed boy, and flee from all education (*paideia*)." [83] To Epicurus this means the Platonic curriculum of education then in vogue, that is, geometry, rhetoric, and dialectic. Ancient detractors, however, exploiting the ambiguity, insisted that it applied to all culture, including the traditional education in music and literature. Plutarch added history and Quintilian echoed the general accusation.[84]

There is a similar saying of Epicurus, which unamended may be rendered as follows: "Bravo, my lad! I congratulate you upon beginning the study of philosophy free of all indiscretion." [85] Plutarch, although unfriendly, makes it clear that the lad was congratulated "because he had kept himself pure by refraining from the studies." [86] What was meant by "the studies" need occasion no perplexity; they were the geometry and arithmetic required by Platonism as prerequisites. Modern scholars, however, fall into the trap baited by the ancients. They amend by substituting the word *paideia*, found in the previous saying, and translating "pure of all culture." One scholar even emends to read "pure of all defilement." [87]

This willful misrepresentation in ancient times and concurrence in

The intellectual grounds for rejecting dialectic were equally fundamental. Epicurus denied categorically each of its four assumptions, first, that reason was the criterion, second, that sensations were undependable, third, that phenomena were shifting and deceptive, and fourth, that the only real and eternal existences were the ideas. The reality of the ideas he denied on the ground that nothing exists except atoms and empty space. In place of reason he declared Nature to furnish criteria of truth and he held the Sensations, supplemented by the Feelings and innate notions (Anticipations), to be direct and immediate contacts with external reality, whether physical or social. Thus dialectic became a superfluity.

The rejection of Plato's teachings is almost total. If the Authorized Doctrines be read item by item it may be observed that almost all are contradictions of Plato, and that it becomes plainly manifest that the writings of Plato occupied the chief place in the youthful studies of Epicurus. The Platonic dialogues were the textbooks of dialectic and in modern parlance would be "required reading."

This almost total rejection does not, on the contrary, preclude extensive borrowing and adaptation on the part of Epicurus. Dialectic by virtue of its dramatic form is committed to a very casual employment of a great variety of analytical tricks and logical devices. If incidentally it





furnishes instruction in logic, this is by a method analogous to the case system in the teaching of law. This casual use of logic is precisely what we find in the writings of Epicurus, and it was this practice that gave superficial justification to Cicero in accusing him of "abolishing definitions and offering no instruction in classifications and in partitions of

philosophies. He proposed to put life into it: "For just as there is no profit in medicine unless it expels the diseases of the body, so there is none in philosophy either unless it expels the malady of the soul." [88] With Democritus himself Epicurus was impatient because of his impiritic skepticism, which to him was a sort of pessimism, paralyzing to action.

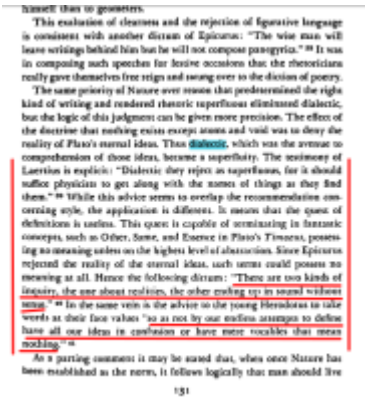
Epicurus is thus seen emerging as a natural pragmatic, impatient of all knowledge that lacks relevance to action. Platonic dialectic was to him a superfluity and consisted in "walking around endlessly and harping upon the question, What is the meaning of 'good'?" [89] At times his zeal becomes truly religious, and his language anticipates the terminology of the New Testament. Of this a specimen is his advice to the young





Pythocles: "From the outset you must believe that no other end is gained from the knowledge of celestial phenomena, whether viewed in their associations [with the astral deities] or by themselves, than peace of soul and an abiding faith." [90] He did not believe in "following the logos" nor in following "knowledge like a sinking star beyond the utmost bound of human thought." The thing of supreme urgency was not knowledge but the happiness of mankind. He called his teachings "true philosophy," but they approximated to a religion. He claimed for himself the title of "sage," but he was really a prophet.

When once Epicurus had discovered himself as a prophet and a pragmatist, a dynamic significance was injected into the analogy between philosophy and medicine. Unlike the Platonists, he was bound to be concerned not only with adolescent males but also with human beings



This exaltation of clearness and the rejection of figurative language is consistent with another dictum of Epicurus: "The wise man will leave writings behind him but he will not compose panegyrics." [88] It was in composing such speeches for festive occasions that the rhetoricians really gave themselves free reign and swung over to the diction of poetry.

The same priority of Nature over reason that predetermined the right kind of writing and rendered rhetoric superfluous eliminated dialectic, but the logic of this judgment can be given more precision. The effect of the doctrine that nothing exists except atoms and void was to deny the reality of Plato's eternal ideas. Thus dialectic, which was the avenue to comprehension of those ideas, became a superfluity. The testimony of Laertius is explicit: "Dialectic they reject as superfluous, for it should suffice physicists to get along with the names of things as they find them." [89] While this advice seems to overlap the recommendation concerning style, the application is different. It means that the quest of definitions is useless. This quest is capable of terminating in fantastic concepts, such as Other, Same, and Essence in Plato's *Timaeus*, possessing no meaning unless on the highest level of abstraction. Since Epicurus rejected the reality of the eternal ideas, such terms could possess no meaning at all. Hence the following dictum: "There are two kinds of inquiry, the one about realities, the other ending up in sound without sense." [90] In the same vein is the advice to the young Herodotus to take words at their face values "so as not by our endless attempts to define have all our ideas in confusion or have mere vocables that mean nothing." [91]

As a parting comment it may be stated that, when once Nature has been established as the norm, it follows logically that man should live

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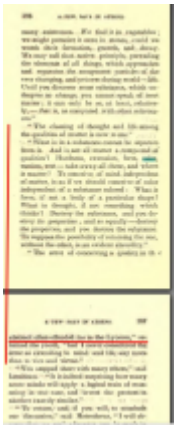
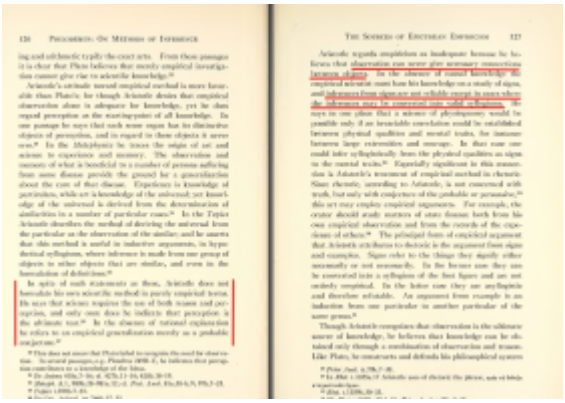
## Post by “Cassius” of September 17, 2021 at 6:00 AM

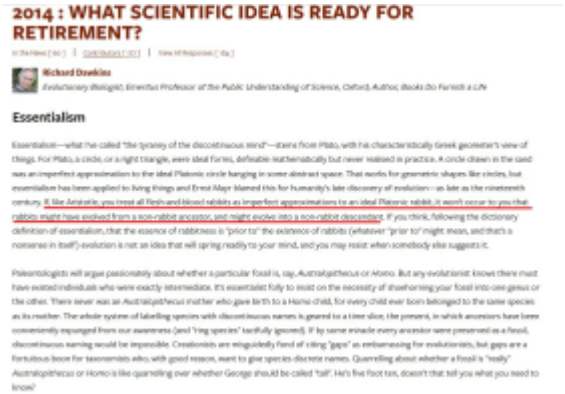
These excerpts from a nearby post are also relevant:



Especially this part from Philip DeLacy as to Philodemus' "On Methods of Inference" -->



The last reference I would throw into this pot is a comment by Richard Dawkins in which he seems to also place Aristotle in Plato's camp:



2014 : WHAT SCIENTIFIC IDEA IS READY FOR RETIREMENT?

Richard Dawkins

Evolutionary Biologist, Emeritus Professor of the Public Understanding of Science, Oxford, Author, Books Do Furnish a Life

Essentialism

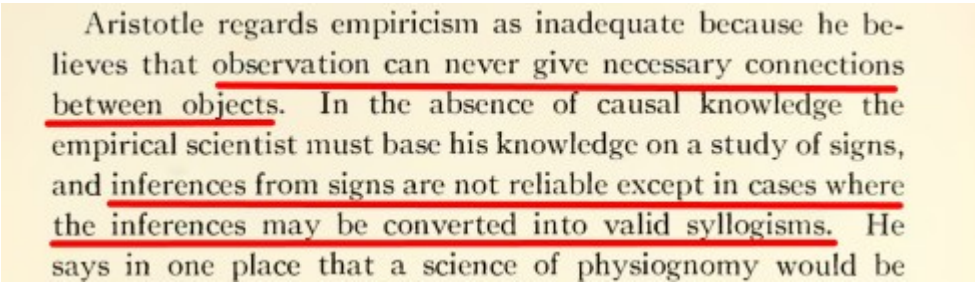
Last excerpt illustrating someone who fell victim to this issue, from Heller's biography "Ayn Rand and the World She Made":

Two years earlier, she had written an inscription in Paterson's copy of The Fountainhead that quoted Roark's tribute to Gail Wynand: "You have been the one encounter in my life that can never be repeated." This was a warm commendation, conveying affection and respect. Yet it also carried a subliminal, elegiac note, one that echoed Roark's mixed sympathies for Wynand. Rand was beginning to think of Paterson as stubborn, even stifling. On first moving to Hollywood, she had traded long, fond letters with Paterson. But by 1943, her side of the correspondence had cooled. In the midst of sisterhood, conflicts had opened a narrow rift between them. God the father was also sore point. Rand had always known that Paterson believed in God, although she also knew that the crotchety individualist did not endorse any organized religion and thought that the Christian morality would one day be replaced by something better. Rand held faith of any kind to be inconsistent with rationality; she particularly despised Christianity, with its insistence on suffering and brotherhood, as "the best possible kindergarten of communism." The women had panted and dodged this issue for years. But in their letters it rose acrimoniously to the surface, with Rand at one point writing that "an omniscient being, by definition, is a totalitarian dictator. Ah, but he won't use his power? Never mind. He has it." The two also conducted a fascinating, though highly charged, argument about the limits of Aristotelian deductive reasoning. Paterson thought that Rand's use of logic, sometimes, resembled the arid arguments put forward by the philosophers Rand most disliked. When such philosophers "had strung some words together, in the form of a syllogism or other logical construction, they thought that [the formulation] had to be so—without asking if the facts which constitute the necessary premises are so," Paterson wrote. Take, for example, the logic of, "All men are mortal; Socrates is a man; therefore Socrates is mortal. That is a good syllogism," she wrote, "but its truth depends on the premises being true—that men are mortal, that Socrates is a man. Logic is an instrument for dealing with whatever you can get into its measure." The older woman thought that God and men were both to some degree immeasurable. She argued that Rand trusted deductive reasoning too much and overvalued matters that reason might identify as being worthy of investigation but that were illogical, or inexplicable, at least for now. Rand thought that the alternative to a morality of reason was "the fist of revelation," and that to hypothesize entities and spheres that the human mind was by its nature inadequate to understand was at best perverse.

## Post by “Cassius” of September 17, 2021 at 6:11 AM

This exercise is helping me see the connection between this "formal logic" problem and the problem of "necessity."

Since Epicurus was rejecting "necessity" in human life, in favor of "free will," then it's logical he would be suspicious of too-broad claims of "necessity" in anything involving human life.



Aristotle regards empiricism as inadequate because he believes that observation can never give necessary connections between objects. In the absence of causal knowledge the empirical scientist must base his knowledge on a study of signs, and inferences from signs are not reliable except in cases where the inferences may be converted into valid syllogisms. He says in one place that a science of physiognomy would be

combine Epicurus' rejection of dialectic with his rejection of "necessity" and it seems to me that you have a pretty sweeping rejection of the reliability of syllogistic logic in virtually every aspect of human affairs. That doesn't mean syllogistic logic isn't reliable in regard to "material" issues, because the letter to Herodotus points out that most things in the universe are as they have been set in motion from the "formation of the world."

So it looks like you end up with both necessity (and formal logic) being useful in most purely non-living affairs, but "free will," and therefore freedom from formal logic, in the affairs of living things with freedom of action.

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## Post by “Martin” of September 18, 2021 at 3:02 AM

> Quote
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> Do you have any specific references on those two categories (1) timeless sentences (2) future events?

Currently, my references are only in German:

Carl Friedrich von Weizsaecker's German original "Aufbau der Physik" of "The Structure of Physics", English edition by Thomas Görnitz, Holger Lyre, Springer Science & Business

Media, 2007, ISBN 1402052359, 9781402052354:

https://books.google.co.th/books/about/The_Structure_of_Physics.html?id=DeexONN0zDgC&source=kp_book

In that book, the book "Quantum logic" from P. Mittelstaedt is referenced. I still have the notes from attending his lectures at University of Cologne about 35 years ago.

Some articles in "Physik Journal".

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## Post by “Cassius” of September 20, 2021 at 3:43 PM

Also directly relevant to our topic tonight is Usener 376:

U376

**Cicero *Academica* II.30.97 (Lucullus):** They will not get Epicurus, who despises and laughs at the whole of dialectic, to admit the validity of a proposition of the form “Hermarchus will either be alive tomorrow or not alive,” while dialecticians demand that every disjunctive proposition of the form “either *x* or not-*x*” is not only valid but even necessary. See how on his guard the man is whom your friends think slow; for “If,” he says, “I admit either of the two to be necessary, it will follow that Hermarchus must either be alive tomorrow or not alive; but as a matter of fact in the nature of things no such necessity exists.” Therefore let the dialecticians, that is, Antiochus and the Stoics, do battle with this philosopher, for he overthrows the whole of dialectic.

**Cicero, *On The Nature of The Gods,* I.25.70 (Cotta speaking):** Epicurus did the same sort of thing in his argument with the logicians. It is an axiom of the traditional logic that in every disjunctive proposition of the form “*X* either is … or is not …” one of the alternatives must be true. He was afraid that if he admitted anything of this sort, then in a proposition such as “Tomorrow Epicurus will either be alive or he will not be alive,” one or the other of the statements would be a *necessary* truth: so to avoid this he denied that there was any logical necessity at all in a disjunction proposition, which is too stupid for words!

**Cicero, *On Fate,* 10.21:** Now here, first of all, if it were my desire to agree with Epicurus and deny that every proposition is either true or false, I would rather accept that blow than agree that all things come about through fate; for the former opinion gives some scope for discussion, but the latter is intolerable. So Chrysippus strains every sinew in order to convince us that every proposition is either true or false. Epicurus is afraid that, if he concedes this, he will have to concede that whatever comes about does so through fate; for if either the assertion or the denial is true from eternity, it will also be certain – and if certain, also necessary. **[cf. *Ibid.,***

**9.19]**

**Potentially Relevant in Addition:**

U380 (this may be a good clue to those categories in which dialectical formal logic is especially to be distrusted:

**Aetius, *Doxography,* I.29.6 [p. 326 Diels] (Plutarch, I.29.2; Stobaeus *Anthology, Physics* 7.9):** Epicurus says that chance is a cause which is uncertain with respect to persons, times, and places.

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## Post by “Cassius” of September 20, 2021 at 5:11 PM

One more from Lucian, similar to Hermotimus, this time from Incaromenippus, An Aerial Expedition. The main relevant part is in bold below but I left text before and after since it is so colorful:

Menippus. Well, a very short survey of life had convinced me of the absurdity and meanness and insecurity that pervade all human objects, such as wealth, office, power. I was filled with contempt for them, realized that to care for them was to lose all chance of what deserved care, and determined to grovel no more, but fix my gaze upon the great All. Here I found my first problem in what wise men call the universal order. I could not tell how it came into being, who made it, what was its beginning, or what its end. But my next step, which was the examination of details, landed me in yet worse perplexity. I found the stars dotted quite casually about the sky, and I wanted to know what the sun was. Especially the phenomena of the moon struck me as extraordinary, and quite passed my comprehension; there must be some mystery to account for those many phases, I conjectured. Nor could I feel any greater certainty about such things as the passage of lightning, the roll of thunder, the descent of rain and snow and hail.

In this state of mind, the best I could think of was to get at the truth of it all from the people called philosophers; they of course would be able to give it me. So I selected the best of them, if solemnity of visage, pallor of complexion and length of beard are any criterion—for there could not be a moment's doubt of their soaring words and heaven-high thoughts—and in their hands I placed myself. For a considerable sum down, and more to be paid when they should have perfected me in wisdom, I was to be made an airy metaphysician and instructed in the order of the universe. Unfortunately, so far from dispelling my previous ignorance, they perplexed me more and more, with their daily drenches of beginnings and ends, atoms and voids, matters and forms. My greatest difficulty was that, though they differed among

themselves, and all they said was full of inconsistency and contradiction, they expected me to believe them, each pulling me in his own direction.

Friend. How absurd that wise men should quarrel about facts, and hold different opinions on the same things!

Menippus. **Ah, but keep your laughter till you have heard something of their pretentious mystifications. To begin with, their feet are on the ground; they are no taller than the rest of us 'men that walk the earth'; they are no sharper-sighted than their neighbors, some of them purblind, indeed, with age or indolence. And yet they say they can distinguish the limits of the sky, they measure the sun's circumference, take their walks in the supra-lunar regions, and specify the sizes and shapes of the stars as though they had fallen from them. Often one of them could not tell you correctly the number of miles from Megara to Athens, but has no hesitation about the distance in feet from the sun to the moon. How high the atmosphere is, how deep the sea, how far it is round the earth— they have the figures for all that. Moreover, they have only to draw some circles, arrange a few triangles and squares, add certain complicated spheres, and lo, they have the cubic contents of Heaven.**

Then, how reasonable and modest of them, dealing with subjects so debatable, to issue their views without a hint of uncertainty; thus it must be and it shall be; contra gentes they will have it so. They will tell you on oath the sun is a molten mass, the moon inhabited, and the stars water-drinkers, moisture being drawn up by the sun's rope and bucket and equitably distributed among them.

How their theories conflict is soon apparent; next-door neighbors? No, they are miles apart. In the first place, their views of the world differ. Some say it had no beginning, and cannot end; others boldly talk of its creator and his procedure. What particularly entertained me was that these latter set up a contriver of the universe, but fail to mention where he came from, or what he stood on while about his elaborate task, though it is by no means obvious how there could be place or time before the universe came into being.

Friend. You really do make them out very audacious conjurers.

Menippus. My dear fellow, I wish I could give you their lucubrations on ideas and incorporeals, on finite and infinite. Over that point, now, there is fierce battle; some circumscribe the All, others will have it unlimited. At the same time they declare for a plurality of worlds, and speak scornfully of others who make only one. And there is a bellicose person who maintains that war is the father of the universe.

As to Gods, I need hardly deal with that question. For some of them God is a number; some swear by dogs and geese and plane-trees. [note: Socrates made a practice of substituting these for the names of Gods in his oaths.] Some again banish all other Gods, and attribute the control of the universe to a single one; I got rather depressed on learning how small the supply of

divinity was. But I was comforted by the lavish souls who not only make many, but classify; there was a First God, and second and third classes of divinity. Yet again, some regard the divine nature as unsubstantial and without form, while others conceive it as a substance. Then they were not all disposed to recognize a Providence; some relieve the Gods of all care, as we relieve the superannuated of their civic duties; in fact, they treat them exactly like supernumeraries on the stage. The last step is also taken, of saying that Gods do not exist at all, and leaving the world to drift along without a master or a guiding hand.

Well, when I heard all this, I dared not disbelieve people whose voices and beards were equally suggestive of Zeus. But I knew not where to turn for a theory that was not open to exception, nor combated by one as soon as propounded by another. I found myself in the state Homer has described; many a time I would vigorously start believing one of these gentlemen; “But then came second thoughts.”

So in my distress I began to despair of ever getting any knowledge about these things on earth. The only possible escape from perplexity would be to take to myself wings and go up to Heaven.

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**Post by “Cassius” of September 20, 2021 at 5:15 PM**

Accurate history or not, here is something also relevant, given that it is so widely accepted as true about Plato:

Plato FAQ: "Let no one ignorant of geometry enter"

**ageometr.gif** Image not found or type unknown

## "Let no one ignorant of geometry enter"

Tradition has it that this phrasewas engraved at the door of Plato's Academy, the school he had founded in Athens.

More detail: https://www.storyofmathematics.com/greek_plato.html

## Biography: What was Plato Known for

Plato Image not found or type unknown

Plato (c.428-348 BCE)

Although usually remembered today as a philosopher, Plato was also **one of ancient Greece's most important patrons of mathematics**.

Inspired by Pythagoras, he founded his Academy in Athens in 387 BCE, where he stressed mathematics as a way of understanding more about reality. In particular, he was convinced that geometry was the key to unlocking the secrets of the universe. The sign above the Academy entrance read: "Let no-one ignorant of geometry enter here".

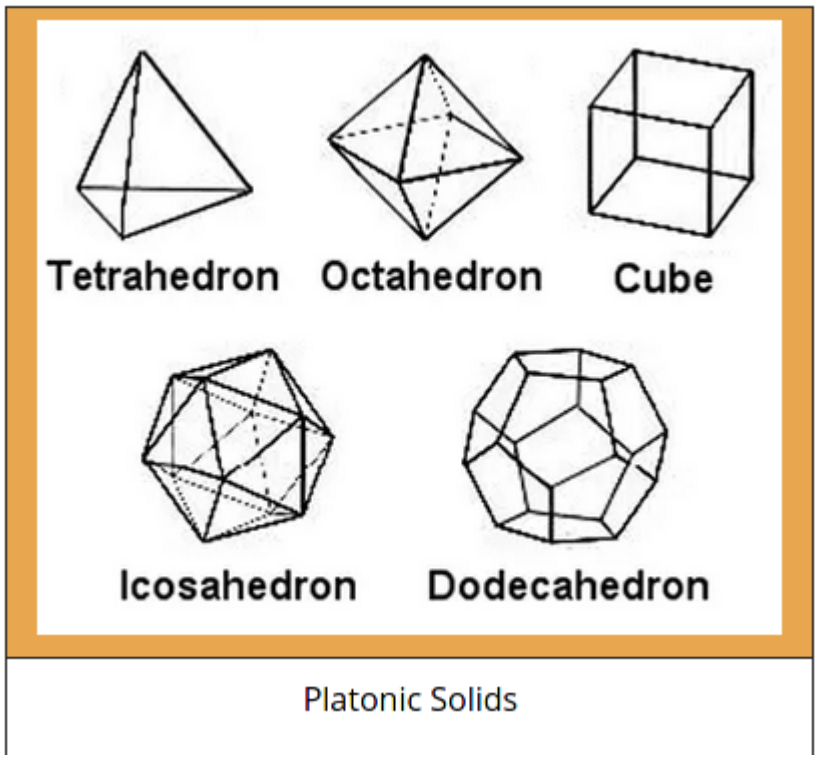
Plato played an important role in encouraging and inspiring Greek intellectuals to study mathematics as well as philosophy. His Academy taught mathematics as a branch of philosophy, as Pythagoras had done, and the first 10 years of the 15 year course at the Academy involved the study of science and mathematics, including plane and solid geometry, astronomy and harmonics. Plato became known as the "maker of mathematicians", and his Academy boasted some of the most prominent mathematicians of the ancient world, including Eudoxus, Theaetetus and Archytas.

He demanded of his students accurate definitions, clearly stated assumptions, and logical deductive proof, and he insisted that geometric proofs be demonstrated with no aids other than a straight edge and a compass. Among the many mathematical problems Plato posed for his students' investigation were the so-called Three Classical Problems ("squaring the circle", "doubling the cube" and "trisecting the angle") and to some extent these problems have become identified with Plato, although he was not the first to pose them.

## Platonic Solids

Plato the mathematician is perhaps best known for his identification of 5 regular symmetrical 3-dimensional shapes, which he maintained were the basis for the whole universe, and which have **become known as the Platonic Solids**: ***the tetrahedron*** (constructed of 4 regular triangles, and which for Plato represented fire), ***the octahedron*** (composed of 8 triangles, representing air), ***the icosahedron*** (composed of 20 triangles, and representing water), ***the cube*** (composed of 6 squares, and representing earth), and ***the dodecahedron*** (made up of 12 pentagons, which Plato obscurely described as "**the god used for arranging the constellations on the whole heaven**").

The tetrahedron, cube and dodecahedron were probably familiar to Pythagoras, and the octahedron and icosahedron were probably discovered by Theaetetus, a contemporary of Plato. Furthermore, it fell to Euclid, half a century later, to prove that these were the only possible convex regular polyhedra. But they nevertheless became popularly known as the Platonic Solids, and inspired mathematicians and geometers for many centuries to come. For example, around 1600, the German astronomer Johannes Kepler devised an ingenious system of nested




Platonic Solids

ces of the known planets from
egant model when it proved to

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**Post by “Cassius” of September 20, 2021 at 5:20 PM**

Shall we continue for the sake of completeness? 😉

## PYTHAGORAS OF SAMOS

Pythagoras
Image not found or type unknown

Pythagoras of Samos (c.570-495 BCE)

## Biography – Who was Pythagoras

It is sometimes claimed that we owe pure mathematics to Pythagoras, and he is often **called the first “true” mathematician**. But, although his contribution was clearly important, he nevertheless remains a controversial figure.

**He left no mathematical writings himself,** and much of what we know about Pythagorean thought comes to us from the writings of Philolaus and other later Pythagorean scholars. Indeed, it is by no means clear whether many (or indeed any) of the theorems ascribed to him were in fact solved by Pythagoras personally or by his followers.

**The school he established at Croton** in southern Italy around 530 BCE was the nucleus of a rather bizarre Pythagorean sect. Although Pythagorean thought was largely dominated by mathematics, it was also profoundly mystical, and Pythagoras imposed his quasi-religious philosophies, strict vegetarianism, communal living, secret rites and odd rules on all the members of his school (including bizarre and apparently random edicts about never urinating towards the sun, never marrying a woman who wears gold jewellery, never passing an ass lying in the street, never eating or even touching black fava beans, etc) .

The members were divided into the “**mathematikoi**” (or “**learners**“), who extended and developed the more mathematical and scientific work that Pythagoras himself began, and the “ **akousmatikoi**” (or “**listeners**“), who focused on the more religious and ritualistic aspects of his teachings. There was always a certain amount of friction between the two groups and eventually the sect became caught up in some fierce local fighting and ultimately dispersed. Resentment built up against the secrecy and exclusiveness of the Pythagoreans and, in 460 BCE, all their meeting places were burned and destroyed, with at least 50 members killed in Croton alone.

The over-riding dictum of Pythagoras’s school was “**All is number**” or “**God is number**”, and the Pythagoreans effectively practised a kind of numerology or number-worship, and considered each number to have its own character and meaning. For example, the number one was the generator of all numbers; two represented opinion; three, harmony; four, justice; five, marriage; six, creation; seven, the seven planets or “**wandering stars**”; etc. Odd numbers were thought of as female and even numbers as male.


The Pythagorean Tetractys

The holiest number of all was “**Tetractys**” or ten, a triangular number composed of the sum of one, two, three and four. It is a great tribute to the Pythagoreans’ intellectual achievements that they deduced the special place of the number 10 from an abstract mathematical argument rather than from something as mundane as counting the fingers on two hands.

However, Pythagoras and his school – as well as a handful of other mathematicians of ancient Greece – was largely responsible for introducing a more rigorous mathematics than what had gone before, building from first principles using axioms and logic. Before Pythagoras, for example, geometry had been merely a collection of rules derived by empirical measurement.

**Pythagoras discovered that a complete system of mathematics** could be constructed, where geometric elements corresponded with numbers, and where integers and their ratios were all that was necessary to establish an entire system of logic and truth.

## The Pythagorean Theorem

He is mainly remembered for what has become known as **Pythagoras' Theorem (or the Pythagorean Theorem)**: that, for any right-angled triangle, the square of the length of the hypotenuse (the longest side, opposite the right angle) is equal to the sum of the square of the other two sides (or "legs").

> Written as an equation: $a^2 + b^2 = c^2$.

What Pythagoras and his followers did not realize is that this also works for any shape: thus, the area of a pentagon on the hypotenuse is equal to the sum of the pentagons on the other two sides, as it does for a semi-circle or any other regular (or even irregular( shape.




Pythagoras' (Pythagorean) Theorem

The simplest and most commonly quoted example of a Pythagorean triangle is one with sides of 3, 4 and 5 units ($3^2 + 4^2 = 5^2$, as can be seen by drawing a grid of unit squares on each side as in the diagram at right), but there are a potentially infinite number of other integer "Pythagorean triples", starting with (5, 12 13), (6, 8, 10), (7, 24, 25), (8, 15, 17), (9, 40, 41), etc. It should be noted, however that (6, 8, 10) is not what is known as a "primitive" Pythagorean triple, because it is just a multiple of (3, 4, 5).

Pythagoras' Theorem and the properties of right-angled triangles seems to be the most ancient and widespread mathematical development after basic arithmetic and geometry, and it was touched on in some of the most ancient mathematical texts from Babylon and Egypt, dating from over a thousand years earlier. One of the simplest proofs comes from ancient China, and probably dates from well before Pythagoras' birth. It was Pythagoras, though, who gave the theorem its definitive form, although it is not clear whether Pythagoras himself definitively proved it or merely described it. Either way, it has become one of the best-known of all mathematical theorems, and as many as 400 different proofs now exist, some geometrical,

some algebraic, some involving advanced differential equations, etc.

It soon became apparent, though, that non-integer solutions were also possible, so that an isosceles triangle with sides 1, 1 and √2, for example, also has a right angle, as the Babylonians had discovered centuries earlier. However, when Pythagoras's student Hippasus tried to calculate the value of √2, he found that it was not possible to express it as a fraction, thereby indicating the potential existence of a whole new world of numbers, the irrational numbers (numbers that can not be expressed as simple fractions of integers). This discovery rather shattered the elegant mathematical world built up by Pythagoras and his followers, and the existence of a number that could not be expressed as the ratio of two of God's creations (which is how they thought of the integers) jeopardized the cult's entire belief system.

Poor Hippasus was apparently drowned by the secretive Pythagoreans for broadcasting this important discovery to the outside world. But the replacement of the idea of the divinity of the integers by the richer concept of the continuum, was an essential development in mathematics. It marked the real birth of Greek geometry, which deals with lines and planes and angles, all of which are continuous and not discrete.

Among his other achievements in geometry, Pythagoras (or at least his followers, the Pythagoreans) also realized that the sum of the angles of a triangle is equal to two right angles (180°), and probably also the generalization which states that the sum of the interior angles of a polygon with $n$ sides is equal to $(2n - 4)$ right angles, and that the sum of its exterior angles equals 4 right angles. They were able to construct figures of a given area, and to use simple geometrical algebra, for example to solve equations such as $a(a - x) = x^2$ by geometrical means.

The Pythagoreans also established the foundations of number theory, with their investigations of triangular, square and also perfect numbers (numbers that are the sum of their divisors). They discovered several new properties of square numbers, such as that the square of a number $n$ is equal to the sum of the first $n$ odd numbers (e.g. $4^2 = 16 = 1 + 3 + 5 + 7$). They also discovered at least the first pair of amicable numbers, 220 and 284 (amicable numbers are pairs of numbers for which the sum of the divisors of one number equals the other number, e.g. the proper divisors of 220 are 1, 2, 4, 5, 10, 11, 20, 22, 44, 55 and 110, of which the sum is 284; and the proper divisors of 284 are 1, 2, 4, 71, and 142, of which the sum is 220).

## Music Theory

Pythagoras is credited with the discovery of the ratios between harmonious musical tones

Pythagoras is credited with the discovery of the ratios between harmonious musical tones

Pythagoras is also credited with the discovery that the intervals between harmonious musical notes always have whole number ratios. For instance, playing half a length of a guitar string gives the same note as the open string, but an octave higher; a third of a length gives a different but harmonious note; etc.

Non-whole number ratios, on the other hand, tend to give dissonant sounds. In this way, Pythagoras described the first four overtones which create the common intervals which have become the primary building blocks of musical harmony: the octave (1:1), the perfect fifth (3:2), the perfect fourth (4:3) and the major third (5:4). The oldest way of tuning the 12-note chromatic scale is known as Pythagorean tuning, and it is based on a stack of perfect fifths, each tuned in the ratio 3:2.

The mystical Pythagoras was so excited by this discovery that he became convinced that the whole universe was based on numbers, and that the planets and stars moved according to mathematical equations, which corresponded to musical notes, and thus produced a kind of symphony, the “Musical Universalis” or “Music of the Spheres”.

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**Post by “Cassius” of September 21, 2021 at 9:15 AM**

Here's an article from the Internet Encyclopedia of Philosophy on "Propositional Logic" which appears to be becoming the term of choice to refer to what Epicurus questioned. Since many of the texts use "dialectic" however we probably still need to correlate those terms

Propositional Logic | Internet Encyclopedia of Philosophy

# Propositional Logic

*Propositional logic*, also known as *sentential logic* and *statement logic*, is the branch of logic that studies ways of joining and/or modifying entire propositions, statements or sentences to form more complicated propositions, statements or sentences, as well as the logical relationships and properties that are derived from these methods of combining or altering statements. In propositional logic, the simplest statements are considered as indivisible units, and hence, propositional logic does not study those logical properties and relations that depend upon parts of statements that are not themselves statements on their own, such as the subject and predicate of a statement. The most thoroughly researched branch of propositional logic is classical truth-functional propositional logic, which studies logical operators and connectives that are used to produce complex statements whose truth-value depends entirely on the truth-

values of the simpler statements making them up, and in which it is assumed that every statement is either true or false and not both. However, there are other forms of propositional logic in which other truth-values are considered, or in which there is consideration of connectives that are used to produce statements whose truth-values depend not simply on the truth-values of the parts, but additional things such as their necessity, possibility or relatedness to one another.

Or is it possible that we need to consider "Dialogical Logic"

Dialogical Logic | Internet Encyclopedia of Philosophy

# Dialogical Logic

Dialogical logic is an approach to logic in which the meaning of the logical constants (connectives and quantifiers) and the notion of validity are explained in game-theoretic terms. The meaning of each logical constant (such as “and”, “or”, “implies”, “not”, “every”, and so forth) is given in terms of how assertions containing these logical constants can be attacked and defended in an adversarial dialogue. Dialogues are described as two-player games between a proponent and an opponent. A dialogue starts with an assertion made by the proponent. This assertion can then be attacked according to its logical form by the opponent. Depending upon the kind of attack, the proponent can now either defend against, or attack, the opponent’s move. The two players alternate until one player is unable to make another move. In this case, the dialogue is won by the other player who made the last move. An assertion made in the initial move by the proponent is said to be valid, if the proponent has a winning strategy for it, that is, if the proponent can win every dialogue for each possible move made by the opponent. The dialogical approach was initially worked out for intuitionistic logic and for classical logic; it has been extended to other logics, among them modal logic and linear logic.

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I see there does not appear to be an entry on "Dialectic"

Dialectic - Wikipedia

# Dialectic

From Wikipedia, the free encyclopedia

Jump to navigationJump to searchFor varieties of language, see Dialect. For electrical insulators, see Dielectric.

**Dialectic** or **dialectics** (Greek: διαλεκτική, *dialektikḗ*; related to dialogue; German: *Dialektik*), also known as the **dialectical method**, is a discourse between two or more people holding different points of view about a subject but wishing to establish the truth through reasoned argumentation. Dialectic resembles debate, but the concept excludes subjective elements such as emotional appeal and the modern pejorative sense of rhetoric.[1][2] Dialectic may thus be contrasted with both the eristic, which refers to argument that aims to successfully dispute another's argument (rather than searching for truth), and the didactic method, wherein one side of the conversation teaches the other. Dialectic is alternatively known as *minor logic*, as opposed to *major logic* or critique.

Within Hegelianism, the word *dialectic* has the specialised meaning of a contradiction between ideas that serves as the determining factor in their relationship. Dialectical materialism, a theory or set of theories produced mainly by Karl Marx and Friedrich Engels, adapted the Hegelian dialectic into arguments regarding traditional materialism. The dialectics of Hegel and Marx were criticized in the twentieth century by the philosophers Karl Popper and Mario Bunge.

Dialectic tends to imply a *process* of evolution and so does not naturally fit within classical logics, but was given some formalism in the twentieth century. The emphasis on process is particularly marked in Hegelian dialectic, and even more so in Marxist dialectical logic, which tried to account for the evolution of ideas over longer time periods in the real world.

of course THIS, referencing Popper, who is an author Martin has discussed reading:

## Criticisms[edit]

Karl Popper has attacked the dialectic repeatedly. In 1937, he wrote and delivered a paper entitled "What Is Dialectic?" in which he attacked the dialectical method for its willingness "to put up with contradictions".[62] Popper concluded the essay with these words: "The whole development of dialectic should be a warning against the dangers inherent in philosophical system-building. It should remind us that philosophy should not be made a basis for any sort of scientific system and that philosophers should be much more modest in their claims. One task which they can fulfill quite usefully is the study of the critical methods of science" (Ibid., p. 335).

In chapter 12 of volume 2 of *The Open Society and Its Enemies* (1944; 5th rev. ed., 1966), Popper unleashed a famous attack on Hegelian dialectics in which he held that Hegel's thought (unjustly in the view of some philosophers, such as Walter Kaufmann)[63] was to some degree responsible for facilitating the rise of fascism in Europe by encouraging and justifying irrationalism. In section 17 of his 1961 "addenda" to *The Open Society*, entitled "Facts,

Standards and Truth: A Further Criticism of Relativism", Popper refused to moderate his criticism of the Hegelian dialectic, arguing that it "played a major role in the downfall of the liberal movement in Germany [...] by contributing to historicism and to an identification of might and right, encouraged totalitarian modes of thought. [...] [And] undermined and eventually lowered the traditional standards of intellectual responsibility and honesty".[64]

The philosopher of science and physicist Mario Bunge repeatedly criticized Hegelian and Marxian dialectics, calling them "fuzzy and remote from science"[65] and a "disastrous legacy".[66] He concluded: "The so-called laws of dialectics, such as formulated by Engels (1940, 1954) and Lenin (1947, 1981), are false insofar as they are intelligible."[66]

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That last line is a good one: **"False insofar as they are intelligible!"**

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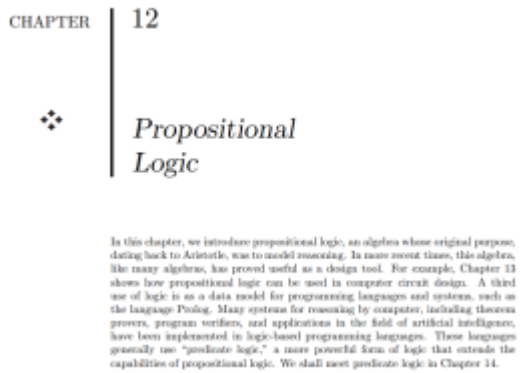
## Post by “Cassius” of September 21, 2021 at 9:22 AM

This also comes up and looks like it might be an interesting Paper, along the lines of the one Martin was quoting from in the presentation:

http://infolab.stanford.edu/~ullman/focs/ch12.pdf



CHAPTER 12

*Propositional Logic*

In this chapter, we introduce propositional logic, an algebra whose original purpose, dating back to Aristotle, was to model reasoning. In more recent times, this algebra, like many algebras, has proved useful as a design tool. For example, Chapter 13 shows how propositional logic can be used in computer circuit design. A third use of logic is as a data model for programming languages and systems, such as the language Prolog. Many systems for reasoning by computer, including theorem provers, program verifiers, and applications in the field of artificial intelligence, have been implemented in logic-based programming languages. These languages generally use "predicate logic," a more powerful form of logic that extends the capabilities of propositional logic. We shall meet predicate logic in Chapter 14.

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## Post by “Cassius” of September 21, 2021 at 9:24 AM

A good time to restate the question:

**What we are trying to do ultimately is get a firm fix on what it was that Epicurus was rejecting, while still embracing "reason" in PD16!**

All this discussion of details is irrelevant and worthless unless we keep that goal in mind.

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## Post by “Joshua” of September 21, 2021 at 9:50 AM

I mentioned on the podcast the Principle of Explosion. It's not exactly as I described it, but that's the wikipedia page.

It's similar to the Hermarchus problem under discussion, if not an exact fit.

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## Post by “Cassius” of September 21, 2021 at 10:04 AM

OMG that is very interesting! Thank you Joshua! What what a great Latin phrase for the pseudo-Romans like Don and me -- **EX FALSO SEQUITUR QUODLIBET!** How many occasions that fits!

And I bet you're right that if we researched Soissons we could find more that is relevant to the essential insight of the "It isn't necessary that Hermarchus be either alive or dead tomorrow so I'm not engaging in your game" observation!

In classical logic, intuitionistic logic and similar logical systems, the **principle of explosion** (Latin: *ex falso [sequitur] quodlibet*, 'from falsehood, anything [follows]'; or *ex contradictione [sequitur] quodlibet*, 'from contradiction, anything [follows]'), or the **principle of Pseudo-Scotus**, is the law according to which any statement can be proven from a contradiction.[1] That is, once a contradiction has been asserted, any proposition (including their negations) can be inferred from it; this is known as **deductive explosion**.[2][3]

The proof of this principle was first given by 12th-century French philosopher William of Soissons.[4] Due to the principle of explosion, the existence of a contradiction (inconsistency) in a formal axiomatic system is disastrous; since any statement can be proven, it trivializes the concepts of truth and falsity.[5] Around the turn of the 20th century, the discovery of contradictions such as Russell's paradox at the foundations of mathematics thus threatened the entire structure of mathematics. Mathematicians such as Gottlob Frege, Ernst Zermelo, Abraham Fraenkel, and Thoralf Skolem put much effort into revising set theory to eliminate these contradictions, resulting in the modern Zermelo–Fraenkel set theory.

As a demonstration of the principle, consider two contradictory statements—"All lemons are yellow" and "Not all lemons are yellow"—and suppose that both are true. If that is the case, anything can be proven, e.g., the assertion that "unicorns exist", by using the following argument:

1. We know that "Not all lemons are yellow", as it has been assumed to be true.
2. We know that "All lemons are yellow", as it has been assumed to be true.
3. Therefore, the two-part statement "All lemons are yellow OR unicorns exist" must also be true, since the first part "All lemons are yellow" of the two-part statement is true (as this has been assumed).
4. However, since we know that "Not all lemons are yellow" (as this has been assumed), the first part is false, and hence the second part must be true to ensure the two-part statement to be true, i.e., unicorns exist.

In a different solution to these problems, a few mathematicians have devised alternate theories of logic called *paraconsistent logics*, which eliminate the principle of explosion.[5] These allow some contradictory statements to be proven without affecting other proofs.

(until such time as OMZ is established to mean Oh My Zeus I've stuck with OMG)

Now we have to know what a PARVIPTONIAN is!

**William of Soissons** was a French logician who lived in Paris in the 12th century. He belonged to a school of logicians, called the Parvipontians.[1]

## ^ William of Soissons fundamental logical problem and solution

William of Soissons[2] seems to have been the first one to answer the question, "Why is a contradiction not accepted in logic reasoning?" by the Principle of explosion. Exposing a contradiction was already in the ancient days of Plato a way of showing that some reasoning was wrong, but there was no explicit argument as to why contradictions were incorrect. William of Soissons gave a proof in which he showed that from a contradiction any assertion can be inferred as true.[1] In example from: *It is raining (P) and it is not raining (¬P)* you may infer *that there are trees on the moon (or whatever else)(E)*. In symbolic language: P & ¬P → E.

If a contradiction makes anything true then it makes it impossible to say anything meaningful: whatever you say, its contradiction is also true.

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### Post by “Cassius” of September 21, 2021 at 10:13 AM

Also need to note for Don't benefit here that while I still today think that the issue of absence of necessity, arising from human free will, is an important part of the refusal to say that hermarchus must be either alive or dead tomorrow, I continue last night's caveat that I could be wrong on that and that there may still be a purely logical point beyond necessity that Epicurus was concerned about.

So I would say that until that issue is resolved we're still on the hunt for the most exact way to express Epicurus' concern.

Maybe it's two steps that are independent of each other in the Hermarchus example ----

1 - there's no direct linkage (necessity) between the proposition and the conclusion. (a general objection to all propositional logic)

2 - the reason there's no direct linkage in this particular case is the presence of human free will. (the specific absence of linkage that applies in this case)

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### Post by “Don” of September 21, 2021 at 10:15 AM

> Quote from Cassius
>
> for the pseudo-Romans like Don and me

LOL.Bite your tongue, ο φίλος μου! I'm Team Barbarian all the way.

---

## Post by “Godfrey” of September 21, 2021 at 3:12 PM

> Quote from Cassius
>
> **What we are trying to do ultimately is get a firm fix on what it was that Epicurus was rejecting, while still embracing "reason" in PD16!**
>
> All this discussion of details is irrelevant and worthless unless we keep that goal in mind.

Exactly.

But even more important is to understand what Epicurus was proposing! It would be great to have a presentation discussing that; I've found it quite a challenge sorting through Methods of Inference. I would find it extremely useful, and would be quite grateful, if someone with more knowledge of the subject than I have could put something together.

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## Post by “Cassius” of September 21, 2021 at 3:25 PM

> Quote from Godfrey
>
> But even more important is to understand what Epicurus was proposing!

Right -- I think the two go hand in hand.

A lot of this comes down to the struggle as to whether to consider the senses to be adequate to reveal reality to us, or whether we need something more (divine revelation, or the analogous "dialectical logic"). The Platonists and adherents of propositional logic want to consider the results of their calculations to transcend the reality of our senses, but in truth it doesn't, and is

dependent on the reality of our senses to be relevant to us.,

Ultimately I think we can get a good glimpse by seeing what Lucretius is focusing on in the key section of Book 4, starting around line 470. Knowledge, including all valid rational analysis, is ultimately based on the senses.

So when you combine emphasis on the senses as our realm of reality and you layer on the passions (pleasure and pain) as the ultimate test of what "matters" to us then you've got a prescription for a full and complete approach to determining all truth that is relevant to us, Then when you add in the rejection of necessity (especially when it involves animate agency) you reject the gamesmanship involved in any kind of dialectical logic (which has nothing to do with any of those) because you always insist that the test of truth goes back (regardless of abstract formulas) to what we sense, pain/pleasure, and how we "anticipate."

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## Post by “Godfrey” of September 21, 2021 at 4:56 PM

I think that this much is pretty clear. Is this all that Philodemus is saying in Methods of Inference, or is he putting Epicurean reasoning into more formal terms?

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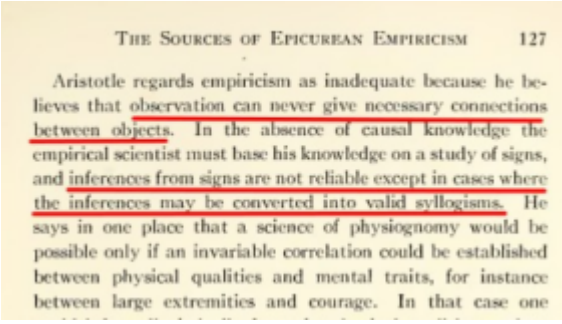
## Post by “Cassius” of September 21, 2021 at 5:49 PM

Probably better to say that he is responding to formal arguments about why Epicurean reasoning is insufficient by pointing out that all methods of verifying the truth of arguments based on formal logic ultimately themselves trace back to the senses / canonical faculties.

That sentence I keep highlighting in Delacy I think is most illustrative: The non-Epicurean Greeks allege that nothing can be confidently considered to be true unless you can supposedly validate the assertion through propositional logic.



THE SOURCES OF EPICUREAN EMPIRICISM 127

Aristotle regards empiricism as inadequate because he believes that observation can never give necessary connections between objects. In the absence of causal knowledge the empirical scientist must base his knowledge on a study of signs, and inferences from signs are not reliable except in cases where the inferences may be converted into valid syllogisms. He says in one place that a science of physiognomy would be possible only if an invariable correlation could be established between physical qualities and mental traits, for instance between large extremities and courage. In that case one

The flaw in that argument is, as we discussed, that the propositions have no inherent "necessary" connection to true reality, so that all attempts to verify any logical proposition ultimately depend upon the senses.

In addition, the question arises as to under what circumstances an EPICUREAN is justified in asserting the truth of any assertion that cannot be verified through the senses themselves (such as assertions about places you have never been before).

The opponents allege that propositional logic is the best way to make assertions about issues such as that.

Philodemus argues that sufficient confidence can be attained in assertions about things which have never been experienced based on principles of analogy, without the use of dialectical logic.

That's the reference by Diogenes Laertius this way, where he emphasizes "analogy, similarity, and combination" - means which are unrelated to propositional logic. If I recall Philodemus goes into a number of examples, or at least emphasizes this argument, as the proper response to reliance on propositional formal logic:

*Logic they reject as misleading. For they say it is sufficient for physicists to be guided by what things say of themselves. Thus in The Canon Epicurus says that the tests of truth are the sensations and concepts [preconceptions / anticipations] and the feelings; the Epicureans add to these the intuitive apprehensions of the mind. And this he says himself too in the summary addressed to Herodotus and in the Principal Doctrines. For, he says, all sensation is irrational and does not admit of memory; for it is not set in motion by itself, nor when it is set in motion by something else, can it add to it or take from it. Nor is there anything which can refute the sensations. For a similar sensation cannot refute a similar because it is equivalent in validity, nor a dissimilar a dissimilar, for the objects of which they are the criteria are not the same; nor again can reason, for all reason is dependent upon sensations; nor can one sensation refute another, for we attend to them all alike.* ***Again, the fact of apperception confirms the truth of the sensations. And seeing and hearing are as much facts as feeling pain. From this it follows that as regards the imperceptible we must draw inferences from phenomena. For all thoughts have their origin in sensations by means of coincidence***

***and analogy and similarity and combination, reasoning too contributing something**. And the visions of the insane and those in dreams are true, for they cause movement, and that which does not exist cannot cause movement.*

(I gather that "apperception" is intended to refer to repeated perceptions, indicating that what confirms the truth of a single sensation is the repeated experience of the same perception under the same conditions.)

You get into issues here too that I think are related to Frances Wright. She ended up (wrongly I think) taking the position ultimately that NOTHING but observation is significant - that you should never develop any conclusions or theories based on those perceptions, you should just trace one perception after another so long as you remain interested. I think Philodemus is a good place where we see that that was not Epicurus' position: Epicurus was apparently very willing to embrace theories about things which cannot be perceived (such at atoms) despite accepting that he had never and will never perceive them. He avoids improper dogmatism by accepting that sometimes we have to "Wait" and sometimes we have to accept multiple possibilities without choosing between them. But I think the point that Philodemus shows is that Epicurus did not go Frances Wright's extreme.

What's left of "On Methods of Inference" seems designed to argue that Epicurean theory is that under proper conditions we can and should reach inferences (opinions as to what is true) about things which cannot be perceived directly.

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## Post by “Cassius” of September 21, 2021 at 6:21 PM

I look forward to having my commentary picked apart and corrected so I can get it better myself, but that's the best I can do at the moment.

The reason I think this is so profoundly important is that it is the ultimate resting point for the assertion that there is no "right" and "wrong" in the abstract. And unless we are a direct descendant of Nietzsche that attitude is what we were taught by our parents no matter whether they were snake-handling bible-banging rightists or Marxist humanist leftists. Everyone wants to enshrine their perspective in some kind of transcendental justification, and it seems to me that Epicurus is the most aggressive opponent of every variant of that.

In Epicurus' time it was stoicism and platonism vs standard Greco-Roman religion and even eastern mysteries including Judaism.

In our time the labels have changed but the attempt to justify one size fits all rules continues with just as much force, and maybe more , as it is now backed with modern technology and. Instant communication that triples down on the peer pressure.

As I see it Epicurus is the only philosophy who offers a reasonable and even compelling worldview that stands in opposition to that transcendental - idealist attitude

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### Post by “Godfrey” of September 21, 2021 at 6:50 PM

I second your last statement Cassius! And I don't see anything to pick apart in your commentary. What I'm trying to discern is whether there are any Epicurean formulas comparable to the formulas for various types of logic. These would be useful both for discussion with non-Epicureans, and also for practical decision making. Personally I find the Canon very useful, as well as considering pleasures and desires in my decisions; I'm just curious as to whether there is evidence of "formulaic" reasoning in Philodemus.

I'll need to wade back into OMOI, but I won't be getting to it for awhile. I can only take it in small doses before I get lost in the terminology 😕

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### Post by “Cassius” of September 22, 2021 at 8:18 AM

Another point as to the significance of what we are talking about:

It seems to me that a good case can be made that Plato's entire form of argument is encompassed within this term of "dialectic." Epicurus was objecting not just to conclusions, but to the entire "logic-based" approach.

So for example we have Plato's Philebus, which is one of the primary Platonic dialogues arguing against the view that pleasure is the guide of life. We have dialectical exchanges such as this:

> Quote
>
> *SOCRATES:* ***Have pleasure and pain a limit, or do they belong to the class which admits of more and less****?*

> *PHILEBUS: They belong to the class which admits of more, Socrates; for pleasure would not be perfectly good if she were not infinite in quantity and degree.*
>
> *SOCRATES: Nor would pain, Philebus, be perfectly evil. And therefore the infinite cannot be that element which imparts to pleasure some degree of good. But now — admitting, if you like, that pleasure is of the nature of the infinite — in which of the aforesaid classes, O Protarchus and Philebus, can we without irreverence place wisdom and knowledge and mind? And let us be careful, for I think that the danger will be very serious if we err on this point.*
>
> *PHILEBUS: You magnify, Socrates, the importance of your favourite god.*
>
> *SOCRATES: And you, my friend, are also magnifying your favourite goddess; but still I must beg you to answer the question.*
>
> *SOCRATES: And whence comes that soul, my dear Protarchus, unless the body of the universe, which contains elements like those in our bodies but in every way fairer, had also a soul? Can there be another source?*
>
> *PROTARCHUS: Clearly, Socrates, that is the only source.*
>
> *SOCRATES: Why, yes, Protarchus; for surely we cannot imagine that of the four classes, the finite, the infinite, the composition of the two, and the cause, the fourth, which enters into all things, giving to our bodies souls, and the art of self-management, and of healing disease, and operating in other ways to heal and organize, having too all the attributes of wisdom; — we cannot, I say, imagine that whereas the self-same elements exist, both in the entire heaven and in great provinces of the heaven, only fairer and purer, this last should not also in that higher sphere have designed the noblest and fairest things?*
>
> *PROTARCHUS: Such a supposition is quite unreasonable.*
>
> *SOCRATES: Then if this be denied, should we not be wise in adopting the other view and maintaining that there is in the universe a mighty infinite and **an adequate limit**, of which we have often spoken, as well as a presiding cause of no mean power, which orders and arranges years and seasons and months, and may be justly called wisdom and mind?*
>
> *PROTARCHUS: Most justly.*
>
> Display More

So what I have argued before, and will still argue, is that an argument against Pleasure as the goal such as this needs to be approached on two levels:

(1) You can point out that these propositional classes that Plato is throwing around - here, (1)"those things that have a limit," and (2) "those things that do not have a limit" in that there can always be more or less of them - have to be tied to reality in order for them to have any significance to us. "Tying them to reality" means verifying them through the canonical faculties (senses, passions, anticipations). That's a general way that you can respond to any propositional reasoning, by diving into the definitions and questioning those.

(2) You can opt out of this entire line of reasoning by taking the position cited by Torquatus: "This Epicurus finds in pleasure; pleasure he holds to be the Chief Good, pain the Chief Evil. This he sets out to prove as follows: Every animal, as soon as it is born, seeks for pleasure, and delights in it as the Chief Good, while it recoils from pain as the Chief Evil, and so far as possible avoids it. This it does as long as it remains unperverted, at the prompting of Nature's own unbiased and honest verdict. Hence Epicurus refuses to admit any necessity for argument or discussion to prove that pleasure is desirable and pain to be avoided. These facts, be thinks, are perceived by the senses, as that fire is hot, snow white, honey sweet, none of which things need be proved by elaborate argument: it is enough merely to draw attention to them. (For there is a difference, he holds, between formal syllogistic proof of a thing and a mere notice or reminder: the former is the method for discovering abstruse and recondite truths, the latter for indicating facts that are obvious and evident.) Strip mankind of sensation, and nothing remains; it follows that Nature herself is the judge of that which is in accordance with or contrary to nature. What does Nature perceive or what does she judge of, beside pleasure and pain, to guide her actions of desire and of avoidance?"

So arguably Epicurus is telling people not even to engage in propositional logic of the dialectical sort given its propensity to be confusing and easily tending toward manipulation in the hands of skillful people (like Plato).

But I don't think Epicurus relied solely on "don't do dialectical argument." Just like we did in Martin's presentation, it is readily possible - for those who are so inclined - to dig into the premises and point out that the propositions are not consistent with reality. You can then restructure the propositional formulas into forms which more accurately approximate reality. But even there you have to keep in mind that it will only be an approximation of reality, and no matter how strong your formulation may appear, it will never be universally applicable to all people at all places and at all times. The entire structure of propositional logic is itself limited in what it can do, and that always has to be kept in mind or you'll get seduced by the apparent power of the propositional forms.

(More or my cites on this issue are here: The Full Cup / Fullness of Pleasure Model )

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## Post by “Martin” of September 22, 2021 at 2:05 PM

**Blunders during my presentation**

As mentioned and corrected in my additions and during the presentation, the truth table for OR on Slide 11 of the tutorial is wrong. While presenting, I wrongly mentioned that the examples on Slide 12 were wrong, too, but no, I merely got confused by the "ands" in the text. The examples for OR are correct.

My second blunder was to wrongly identify q as a premise at the beginning of my explanation of Slide 13. I corrected it immediately but the confusion may have lead comments off track.

The motivation for making the presentation was to show that a false premise in a syllogism does not necessarily mean that the conclusion is false, too. This mistake is easily made because often it is actually the case that the conclusion is false, too. That experience may misguide our intuition. Toward the end of my presentation, I made my third blunder by myself making that false inference to call a conclusion false upon finding a premise of an implication to be false but became aware of it only after the session. So, we need to make sure that my withdrawal of that statement accompanies the podcast.

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## Post by “Martin” of September 22, 2021 at 2:18 PM

**On dialogical logic**

C. F. v. Weizsaecker's uses dialogical logic to justify usage of statements on the past in logical arguments in the book which I mentioned as reference in comment #10. (That justification does not work for statements on the future.)

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## Post by “Cassius” of September 22, 2021 at 2:44 PM

Martin after I finish editing this week's podcast I am going to turn to editing this presentation. I want to get it out as soon as possible but there's no deadline or schedule so we will take as much time as we need to get it right. Before we release it to the public at all I will post it for the participants to review first, and we will make sure that we get it into good form before going further.

We can even talk about doing another session to record over from scratch, but I think if we edit properly, and I insert some good caveat material as an introduction at the beginning, we can

get something well worth using.

I know myself that I make mistakes all the time and we can't let the "perfect be the enemy of the good" or else we wouldn't be here today having come as far as we have. We'll explain any misstatements that we leave in, and we'll also emphasize that just like with postings on the board people have to be free to change their minds, learn new ways to state things, etc.

I just appreciate how much effort you've put into this already, and I am confident that by us all working through these issues - mistakes and all - the final conclusions and implications of this information will become much more clear.

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## Post by “Martin” of September 28, 2021 at 2:52 AM

That I sometimes say "aeh" was known to me but not that I did it that often during the presentation. It sounds terrible and must be annoying to listeners.

Another blunder was that while explaining a truth table, I repeatedly said "column" instead of "row".

I suggest to remove the following passages:

7:58 - 11:02 (detour on quantum and fuzzy logic)

25:26 - 25:38 (wrong statements about Slide 12)

25:50 - 26:32 (my confusion about premise and conclusion)

around 27:17 ("I mixed them up" because if 25:50 - 26:32 is removed, it does no more apply)

28:53 - 28:58 (another reference to my confusion)

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## Post by “Cassius” of September 28, 2021 at 4:57 AM

Note: Martin's post there is referring to a preliminary edit, so when a version is posted to this thread the parts he is suggesting be taken out will not appear. I also note that while I do remove particularly long strings of "ahs" in the editing process, I don't attempt to remove them all in Martin's case because I find them a positive part of his German accent that actually adds to the full effect rather than detracts. If anyone has suggestions on how I can improve editing of

the final released versions of this or the podcast please post or feel free to private message me.

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## Post by “Cassius” of October 6, 2021 at 3:57 PM

In looking up Chrysippus this afternoon I see that there is material on Wikipedia relevant to this discussion:

### Syllogistic [ edit ]

Chrysippus developed a syllogistic or system of deduction in which he made use of five types of basic arguments or argument forms called indemonstrable syllogisms, which played the role of axioms, and four inference rules, called *themata* by means of which complex syllogisms could be reduced to these axioms.[34] The forms of the five indemonstrables were:[35]

| Name[36] | | Description | Example |
|---|---|---|---|
| Modus ponens | | If A, then B. A. Therefore, B. | *If it is day, it is light. It is day. Therefore, it is light.* |
| Modus tollens | | If A, then B. Not B. Therefore, not A. | *If it is day, it is light. It is not light. Therefore, it is not day.* |
| Modus ponendo tollens | i | Not both A and B. A. Therefore, not B. | *It is not both day and night. It is day. Therefore, it is not night.* |
| | ii | Either A or B. A. Therefore, not B. | *It is either day or night. It is day. Therefore, it is not night.* |
| Modus tollendo ponens | | Either A or B. Not A. Therefore, B. | *It is either day or night. It is not day. Therefore, it is night.* |

Of the four inference rules, only two survived. One, the so-called first *thema*, was a rule of antilogism. The other, the third *thema*, was a cut rule by which chain syllogisms could be reduced to simple syllogisms.[37] The purpose of Stoic syllogistic was not merely to create a formal system. It was also understood as the study of the operations of reason, the divine reason (*logos*) which governs the universe, of which human beings are a part.[38] The goal was to find valid rules of inference and forms of proof to help people find their way in life.[25]

### Other logical work [ edit ]

Chrysippus analyzed speech and the handling of names and terms.[17] He also devoted much effort in refuting fallacies and paradoxes.[17] According to Diogenes Laërtius, Chrysippus wrote twelve works in 23 books on the Liar paradox; seven works in 17 books on amphiboly; and another nine works in 26 books on other conundrums.[39] In all, 28 works or 66 books were given over to puzzles or paradoxes.[39] Chrysippus is the first Stoic for whom the third of the four Stoic categories, i.e. the category *somehow disposed* is attested.[40] In the surviving evidence, Chrysippus frequently makes use of the categories of *substance* and *quality*, but makes little use of the other two Stoic categories (*somehow disposed* and *somehow disposed in relation to something*).[41] It is not clear whether the categories had any special significance for Chrysippus, and a clear doctrine of categories may be the work of later Stoics.[41]

This below is not immediately relevant, but a good reminder for anyone who isn't aware of it and how it plays into Chryssipus' thinking:

**On Passions** [ edit ]

*Main article: On Passions*

The Stoics sought to be free of the unruly emotions, which they regarded as being contrary to nature. The passions or emotions (*pathe*) are the disturbing element in right judgment.[93] Chrysippus wrote a whole book, *On Passions* (Greek: Περὶ παθῶν), concerning the therapy of the emotions.[96] The passions are like diseases which depress and crush the soul, thus he sought to eradicate them (*apatheia*).[96] Wrong judgements turn into passions when they gather an impetus of their own, just as, when one has started running, it is difficult to stop.[97] One cannot hope to eradicate the emotions when one is in the heat of love or anger: this can only be done when one is calm.[98] Therefore, one should prepare in advance, and deal with the emotions in the mind as if they were present.[99] By applying reason to emotions such as greed, pride, or lust, one can understand the harm which they cause.[99]

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## Post by “Martin” of October 8, 2021 at 2:47 AM

Assuming that the Wikipedia section on Chryssipus' syllogistic correctly describes what he wrote, he certainly knew how to apply logic but he did not have a deep understanding of logic.

His "indemonstrables" are very well demonstrable because they are well known theorems of logic, which can be proven e.g. by truth tables. There is no point in using them as axioms because they are proven theorems and therefore readily available for further proofs.

His syllogistic seems to be a regression to times before Aristotle. It is not wrong but a detour in the history of philosophy and for the dust bin.

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## Post by “Cassius” of October 10, 2021 at 8:03 PM

Ok before I start circulating this link to the world and only afterwards find some fatal flaw, please have a look at Release Candidate One of the Propositional Logic video featuring Martin's presentation from September 20, 2021.

The formal presentation begins at 4:20. If you would like to skip the formal part and go straight to the conclusion and the panel discussion, skip to 44:00.

(See below for Release Candidate Two)

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### Post by “Cassius” of October 10, 2021 at 8:30 PM

I see this first edition has annoying flashes between several of the initial slides. I will fix that and reupload.

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### Post by “Martin” of October 11, 2021 at 3:41 AM

Thanks for adding Slide 5 in the introduction. However, the spelling of my family name is wrong. Please correct to "Huehne".

At the cut around 9:26, something is missing.

At the cut around 10:19, something is missing.

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### Post by “Cassius” of October 11, 2021 at 8:56 AM

Thanks Martin! Revised version coming up in maybe an hour.

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### Post by “Cassius” of October 11, 2021 at 10:17 AM

Release Candidate Two:

https://youtu.be/ZP1cQTBP1Ng

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### Post by “Cassius” of October 12, 2021 at 3:47 PM

I am sure that this "release candidate two" probably still has some bugs in it, but I am thinking the big ones (misspelling Martin's name in particular!) have been corrected, so I will likely post this to the Facebook group and perhaps other places later this week.