Logic

In the last chapter I presented two mainstream logical methods, Aristotelian and Boolean and I would like to continue our discussion using them. Are they by any means the only two methods? No, but then this is the *15-minute* lesson not the spend-the-rest-of-your-life-committing-terms-to-memory lesson. For our purposes at this point, we will stick to these two as sufficient to illustrate the point about how do we think about truths.

With that in mind, let us get this out of the way: when we use the word *truth* we think of it in terms of a specific statement not an overall general idea. That is to say we are formally thinking of it more as a promulgated statement which is the basis for other statements and not necessarily as the end objective conclusion (as in 'ultimate truth'), nor necessarily as 'true' in the sense of *valid*. Do not quote me on this but as an initial way of offering explanation, *truths* in Logic are the premises of arguments from which we derive a conclusion or another *truth*. To this we apply logic standards which are the meat of this discussion (structure, fallacy, etc.). The fancy words we could use for a truth are *thesis* or *premise,* but *a rose by any other name, will still give us a conclusion*.

Supercalifallacylogicalidoscious

So we start with a concept which, like *supercalifragilisticexpialidocious*, may be the strangest word you have ever heard: Logic. We may think we understand what it means, but we do not. Logic is not merely a term, it is a system, a way of life. When we think logically we are thinking *critically*. We are categorizing, ordering and curtailing our thoughts, keeping a watch over our tongues (cf. *Sirach* 22:27) as it were, in best tradition of the truly humble saints. By this method we can consistently share, organize, and evaluate specific aspects of an argument and determine its validity and soundness. This is the method of "right thinking" (or in the Greek 'orthodoxy'). Starting here gives us a *lingua franca*, the confidence and the means to examine and understand. That said (again) let us move to logical thinking.

Aristotle: The Square of Opposition

Establishing a framework from which to operate is primary to our journey. Among his many gifts to the world, the Greek philosopher Aristotle (4th century BC) laid out for us the 'limits' of thinking, that is, what thoughts are viable within logic, or to put it another way (which I apparently do with great alacrity throughout this work) *what are the possible viable deductive paths of argumentation*?

The sum of Aristotle's thought is encased in the doctrine known as the "Square of Opposition." Through it he hoped to finalize the boundaries of argumentation making it possible to have an argument in a controlled, logical way (do not worry, there will be more on this later) in opposition as to how it was being practiced around him at the time.

Syllogisms (in the form of *truth, truth, new truth*) are the basis of Aristotelian logic. The square of opposition is a diagram showing how *theses* (hypothesis/ideas hence *thesis* and *antithesis*) – not the 'truths' themselves – are logically related. The diagram is just a useful way

to keep them straight (or diagonal as the case may be). The *theses* concern logical relations among four logical forms or *operations* (logical relationships):

NAME	FORMAT	AKA
A	Every *S* is *P*	Universal Affirmative
E	No *S* is *P*	Universal Negative
I	Some *S* is *P*	Particular Affirmative
O	Some *S* is not *P*	Particular Negative

Table 1: Aristotle's Logical Theses

These theses are fairly self-explanatory, but I will expound anyway: what it comes down to are a *general* true and false and a *particular* true and false. For Aristotle these four statement types pretty much summed up all that you could say, at least logically. It is the relationship of these four simple statements that are shown in the square. The four theses are placed at the corners of a diagram in opposition to one another and is, as said, called the *square of opposition* (Figure 1, though to be honest it looks more like a rectangle of opposition).

The corners are connected by specific oppositions:

- ***Contradictories***: if they cannot both be true and they cannot both be false.
- ***Contraries***: if they cannot both be true but can both be false.
- ***Subcontraries***: if they cannot both be false but can both be true.
- ***Subaltern*:** (think *sub* as in *below*) must be true if its superaltern is true
- ***Superaltern*:** (think *super* as in *above*) must be false if the subaltern is false

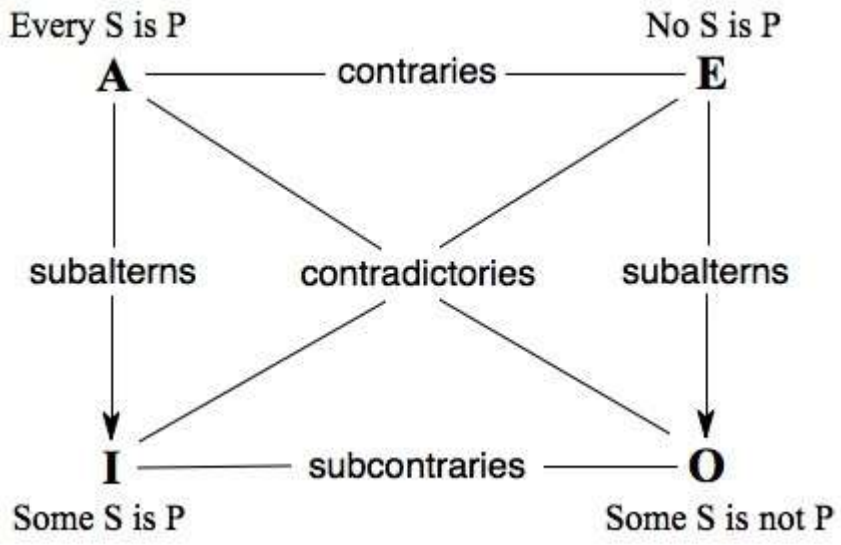

Figure 1: The really non-rectangular *Square of Opposition*

Just as the four logical operations are set in pairs, the *theses* embodied in this diagram are thereby further grouped into relational pairs:

- 'Every *S* is *P*' and 'Some *S* is not *P*' are contradictories.
- 'No *S* is *P*' and 'Some *S* is *P*' are contradictories.

- 'Every *S* is *P*' and 'No *S* is *P*' are contraries.
- 'Some *S* is *P*' and 'Some *S* is not *P*' are subcontraries.
- 'Some *S* is *P*' is a subaltern of 'Every *S* is *P*'.
- 'Some *S* is not *P*' is a subaltern of 'No *S* is *P*'.

Confused? Don't be. When we think of an idea, we place it somewhere in this square and then evaluate it. The next idea added is in relationship to that point at another point on the square. If the idea does not fall into a relationship noted by the square then we must disregard it. Simple Enough? Think of it this way: "*Every planet is made of rock*" and "*Some planets are not made of rock*" are *contradictory* ideas, only one can be true, and we can disregard the one which is not. Either all planets are made of rock or they are not, simple enough. If we add "*Every planet is made of gas*" then we can evaluate it on its own or in relationship to the premise we kept. [We can say "*Some planets are not made of rock*" and "*Every planet is not made of rock*", but we can also say "*Some planets are made of rock*" and "*Some planets are not made of rock*" (subcontrary).]

The verbiage added with *alterns* and *contraries* is only a means to evaluate the ideas placed on the square or better yet *where* to place them on the square for evaluation. Contraries exist between like types (general to general or particular to particular); alterns between different types (general to particular or particular to general).

By thinking this way we share a common ground for discussion. This gives logic its power: common understanding and rules.

Boole: Truth Tables

George Boole was a 19th century AD mathematician and I'll spend a minute on his stuff at, as above, a very high and rough level. Logic looks for tools of expression, and Boole proposed the logic method which became the main method for that period (and therefore influences into the 20th century) using mathematical means.

Boole broke the logic down to three basic *operations* (logical relationships, remember?):

NAME	*FORM*
AND	A and B
OR	A or B
NOT	not A

Table 2: Boole's Theses of Operators

These three are part of a total of 16 *operations* which can be applied in what we usually call 'truth tables'; Boole did not invent the truth table but his system is the best illustration of them, like the 'square' above.

AND Form		
Argument A	Argument B	Function Value
False	*false*	False
False	*true*	False
True	*false*	False
True	*true*	True

OR Form		
Argument A	Argument B	Function Value
false	*false*	False
false	*true*	True
true	*false*	True
true	*true*	True

NOT Form	
Argument A	Function Value
false	True
true	False

Table 3: Boole's Truth Tables

Boolean logic presents us with a pared-down, bare-bones semantic guide for discussing a truth (or *premise*). The thought here being that we really do not need to muddy the water with discussions (i.e. all that baggage which Aristotle saddles us with) which are fruitless (in the end) because they are merely manufactured subsets of the basic argument and its truths. He felt that by eliminating all that extra stuff we could have gotten to and through the main truths faster and more logically rather than the 20+ centuries it took to get where he was.

Of course the worst thing about this is that you have been studying using Aristotelian logic for almost a whole semester and suddenly they drop this in your lap. But that is a personal pain which I will bear alone; I on the other hand, have been merciful.

Gödel: *Incompleteness*

As a further sign of my benevolence, at this time I'll throw in the Kurt Gödel (20th century AD) tidbit at no extra cost. You may have heard of Gödel from the popular book *Gödel, Escher and Bach* by Hofstadter. If not (and even if), Gödel demonstrated that in any branch of mathematics (or as we might say 'system'), you would eventually find propositions which you could not prove or disprove using that system. The implication is that *all* logical systems of any complexity have, by definition, a level of *incompleteness*; that is, each of them contains more true statements than it can possibly prove by the methods and rules of that system. In other words they will in and of themselves always be incomplete systems for demonstrating truth.

You are welcome.

Fallacy

Incomplete, flawed or just plain wrong thinking is the source of so many misunderstandings that it deserves its own section just for that reason. For our purposes though, we will restrict ourselves to the realm of philosophical logic. Therefore let us start with the defining of the idea and its ramifications. *Logical fallacy* hinders our ability to form understanding and ultimately our ability to live Plato's "examined life." This failing most often manifests itself in our moral decisions which in my humble opinion (and as you shall see, a large number of philosophers') are the true driving force for which we seek understanding.

Argumentation is mainly a *deductive* process but may sometimes involve *inductive* reasoning. For logic purposes, deductive is preferred because in the end you have a solid *argument* from which you can derive an agreed upon *truth*. Inductive logic tends to only provide a plausible truth, which even though agreed to by a majority of thinkers could still leave

the truth up for grabs. Inductive reasoning also avails one to go down the primrose path of fallacy, because it *sounds* reasonable. But as we should be learning, in logic just because it sounds reasonable does not make it so. *Ergo sum*[1], the use of inductive reasoning for further argumentation might/can really lead to problems later in a method or system but, as we will see, the use of deductive reasoning, with its internal pitfalls, may be misused and therefore not be any better.

Fallacious Thinking

As introduced earlier, a technical way of thinking about fallacies is *formal* (invalid form) and *informal* (invalid argument). The best way to understand these are to think in terms of someone deliberately or accidently misshaping the argument to confuse or confound (formal) or someone deliberately or accidently misshaping some aspect of the argument to confuse or confound (informal). Suffice it to say, most errors tend to be informal.

Recognizing fallacious thinking can be harder than we think, especially because so many of the fallacies appeal to prejudices and stereotypes or seem 'logical enough'. Affronts to logic aside, we define fallacies as flaws or errors in the argument, introduced usually in the premises (though sometimes in the conclusions) and *are often very minor*. Think of adding instead of subtracting or misplacing the parenthesis in a mathematical formula. The effect is that any conclusion drawn from the flawed argument which is used as a later premise only compounds the error throughout the whole of the argument or system. <u>This is a very important point to keep in mind</u>.

The other scariest thing about logical error is that you can reach a *correct* conclusion from *flawed* arguments. For example "Aristotle is a man; All men die; Aristotle is dead" or something like "whales are fish, fish live in the sea, whales live in the sea". In the first argument, the premises are both correct but the order does not lend itself *deductively* to the conclusion – though it does *inductively* (the name Aristotle does not just apply to the Greek philosopher Aristotle but in this context we can *imply* that it does.). In the second example the first fact is wrong, but the conclusion is correct.

Think back to the Aristotle's square or Boole's tables. These are the tools we keep in mind when constructing or evaluating an argument, so that we do not run into the error of the first argument; keeping the logical fallacies in mind helps to keep us from making the error in the second argument.

Thinking Fallaciously

In addition, we must be vigilant in even detecting an argument. Here are some classic example statements like:

"*Have you stopped beating your wife yet?*"

This is <u>not</u> an argument, though it seems to have conclusions all throughout it (it is a formal violation: *Plurium Interrogationum* – too many questions)*. Another inference style statement is:

"*If the Bible is accurate, Jesus must have been the Son of God.*"

[1] Let's just call it "therefore it is".

This is not an argument but an *assertion* that looks like an argument; there seems to be one 'premise' and one 'conclusion' but no statement in the sentence proves any other statement. Arguments are not open to opinion or only one premise.

Finally for your viewing pleasure, look at this one:

"*Einstein made his famous statement 'God does not play dice' because of his belief in God.*"

This also is not an argument but an *explanation*. We cannot derive that Einstein believed in God or what that belief was just because he used the word 'God' in a sentence once. Again there are no statements within the sentence which give proof of any other statement within the sentence. One could even argue that in the last part the word *belief* could be ambiguous.

Get the idea?

Thought Exercise: *What would be an argument then? Let's take the assertion and see if we can do anything with it for example by restructuring it and adding a premise: "The Bible is an accurate, historical document; Jesus makes statements recorded in the Bible;…" What conclusion can we draw? In this case is the first statement a good premise? Is the second?*

Bias and Logical Bias

(Warning: the following contain personal logical reflections of the author that may or may not be embraced by the wider philosophical community but possibly by my mother but only because she loves me)

I think we understand bias (a particular leaning which colors the argument) but is there something known as 'logical bias'? Can we over intellectualize something? Are some statements seen as true by some but not by others? Does a statement *have* to mean something? Can we unwittingly make one system (or even a single truth) the only system for gauging truth?

The simple answer to all these and many other questions is *yes*. In addition to (and usually containing) logical fallacy, we can be biased toward one system or another or method to the exclusion of all others. The argument that something is wrong merely because it disagrees with our own conclusions, or does not follow what we *believe* to be the logic rules is what I would term a *logical bias* (some might call it intellectual hubris). This is in addition to any other biases we bring into the argument. This may not seem like an important point but think about it this way. Religion is often dismissed not from any logical reason but because of a rejection of the principles upon which it is founded. Or worse, some try to use the logic of a system to prove the truth of another system. Science will never prove or disprove religion.

This leads me to address one particular effect from this attitude: the tendency to speak in absolutes based on logic. Some things are considered true throughout history and they can pretty much be depended upon to continue to be true. Say, the earth is round. That was true whether people knew it or understood it to be true (which incidentally they did pretty early on). Well surprise, actually the earth is kind of egg-shaped. Does that bar us from using 'the earth is round' as a premise? If we are figuring rocket trajectories then round may not be good enough, but for most argument's sake, 'the earth is round' works pretty well. What we have to watch is 'once-thought-always-true' mentality (or as I like to classify it: *one track mind, derailed*) as well as the 'well-that-was-disproved-and-therefore-completely-useless' (or *baby with the bathwater*) syndrome.

Fallacies Bergere

Okay, enough wandering. If I recall correctly[2], Aristotle divided fallacies up into three types:

1. **Material**: subject matter of or within the statement(s) – often *unquantifiable* or *incorrect* statements.
2. **Verbal**: communication errors or abuses.
3. **Formal**: structural errors in the argument.

List 1: Aristotelian Forms of Fallacy

(Another probably less formal way to think about them is to divide them up as fallacies of ***relevance***, fallacies of ***causal*** (cause and effect) ***reasoning***, and fallacies caused of ***ambiguity***…as I have said, there are probably as many ways as there are philosophical systems and again, you just have to find the one that suits you.).

Fallacies are easily identifiable as they often have Latin names (** below). The list of fallacies seems to be growing even since I first studied them, but I think that most are subsets of a basic few. By that I mean that you can place most into families which involve the same basic flaw, just as you can group them like we do above. Sometimes the categories fail and some are defined which cross over between two or more categories but that is just me covering up the paucity of this discussion. Still the most effective way to keep them in mind is to group them and remember the groupings. Whatever mnemonic helps go for it! I am sorry, what was I saying? Oh yes. For now, and to be able to continue writing, we will stick with the above method.

Here then, are a choice few:

***Material (their subject)*:**

- ***Ad Verecundiam***: (argument from/to modesty) deferring to another source
    - ***Related Common Example*: Ipse Dixit**: (he himself said) *so and so said/believes it therefore it must be true* (aka Appeal to Authority/Celebrity, etc) slightly different but in the same family.
- ***Ad Hominem***: (at/to the man) as mentioned above, attacking the individual not the truth; one of the most prevalent fallacies in use today.
- ****Plurium Interrogationum*:** (too many questions) also mentioned above, questions couched within statements such that no answer is sufficient for all of the questions.
- *****Non Sequitur*:** (does not follow) presenting two disparate statements as connected.
- ***Circulus in Probando***: (circular argument) assuming the conclusion in the premise(s)
- ***Ignoratio Elenchi***: (ignoring of the chosen [argument]) intentionally diverting attention away from the facts at hand.

***Verbal (their parts)*:**

- ***Argumentum Verbosium***: (verbose arguing) overwhelming by the sheer repetition of words.

[2] Really…someone should really do some fact checking on this work.

- ***Unum Ad Pluribus***: (…from one to all) assuming the whole is true because the parts are [this has an opposition of assuming each from the whole]. This is verbal because it is a confusion of terms.
- **Equivocating** (equal words; can't recall the Latin, or even make it up – just use the root somehow if you feel the need to: *equi vocare*) using a word ambiguously or using a word which could have two or more meanings.
-

***Formal (crimes against argument structure)*:**

- ***Quaternio Terminorum***: (four terms) introducing a fourth element (premise) into the normal three element argument.
- **Negative Premises**: assuming the positive from two negatives – two wrongs do not make a right.
- ***Petitio Principii*:** (appealing to the principle) assuming the conclusion implicitly (or explicitly) within a premise

List 2: Fallacy Styles and Examples

Putting It Together

When we approach a 'truth' or a proposed conclusion logically in order to determine the value or validity of that truth or conclusion, we have to determine what path we will take to get there. There has to be a defined, agreed upon set of rules by which we will argue our truth.

The logical systems presented by philosophers are used to set the boundaries within which they will think and argue. Is the loss of Aristotelian grey areas presented by Boolean logic the end word? Is Aristotelian logic better or worse at reaching logical consensus? Why am I asking you? Peace. Here is where Gödel comes in: to keep ourselves honest we must admit that in any system there comes a time where we will run into a quandary, or paradox, or whatever that we will be unable to solve within the scope we are working…and you know what? That is okay because it forces us to continue to think beyond what we know and are secure/comfortable with. We are forced beyond our biases. We may even, dare I say, look to other systems in which to seek the answers. Logic is a pretty Zen experience then. We *must not* allow ourselves to be overly influenced by either emotional passion or intellectual passion. We *must* allow ourselves to be *open* to all influences and yet *disciplined* to eliminate those which are redundant, extraneous, erroneous, or false.

Still, it is not a cold and passionless discipline. Understanding, enlightenment, peace, or whatever you want to call it should be the result of our search, which should energize our thinking and our actions. We seek God with "*with your whole heart, and with your whole being, and with your whole strength*." (*Deuteronomy* 6:5) Calm rational discussion, based in specific rules and methods will eventually produce for us a system of operation from which we will tackle the world. Like theology, philosophical pursuits only have validity if applied in the real world, the day-to-day workshop of life, not just for ourselves but for everyone and should always involve kindness.

If theology or philosophy insulates us from life then we have failed in our attempt make sense of the world and have fallen into the reality fallacy: what we think is real actually is not, kind of like the oxymoron "Reality TV".

Post Discernment Exercises:

1. When asked about a particular point within a candidate's speech, the commentator's response was "I don't think he really had anything to say." Discuss.
2. The Bible says: "There is no God." (*Psalm* 14); The Bible is literally true; Therefore, there is no God. Discuss.

Man: I came here for a good argument!
Mr. Vibrating: No you didn't, you came for an argument.
Man: Well, an argument's not the same as contradiction.
Mr. Vibrating: It can be.
Man: No it can't. An argument is a connected series of statements to establish a definite proposition.
Mr. Vibrating: No it isn't.
Man: Yes it is. It isn't just contradiction.
Mr. Vibrating: Look, if I argue with you I must take up a contrary position.
Man: Yes, but that's not just saying 'No it isn't.'
Mr. Vibrating: Yes it is!
Man: No it isn't!
Mr. Vibrating: Yes it is!
Man: Argument is an intellectual process. Contradiction is just the automatic gainsaying of any statement the other person makes.
(short pause)
Mr. Vibrating: No it isn't.

Monty Python's Flying Circus: *The Argument Clinic*