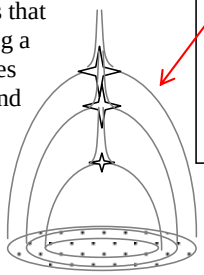
7. The Four Predicables

Proper Vocabulary Usage:
The following Latin words have unusual plural forms: The plural of *genus* is *genera*. The plural of *species* is (again) *species*.

Besides quantity and necessity or possibility, there is a third way to think of propositions, known as the four predicables. The four predicables are the four things that can be indirectly implied by making a proposition.[106] The four predicables are genera, accidents, properties, and definitions.

Genera are essential to their members, so each thing will have only one proximate genus; sets are merely accidental to one another, so there can be a nearly infinite number of sets.



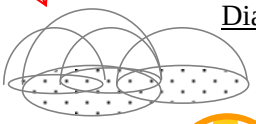
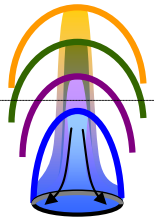


Diagram 3.43

A genus (from Lat. for "kind" or "type" or "class") is a higher class into which lesser forms or classes may be placed (or categorized). The genus of man is primate; the genus of primate is mammal; the genus of mammal is vertebrate, etc. We can distinguish between a proximate genus—the nearest, narrowest grouping possible—and a *summum genus*—the broadest, most universal grouping possible. If a genus is founded on accidental similarities between its members, it is known as a set. If it is founded on essential similarities it is truly a genus. Thus, to a certain extent, genera come from above, whereas sets arise from below.



A property is a quality that permeates through an entire class, but is not primarily essential to the class (usually because it is primarily essential to a higher, broader class).[107] For instance, warm-blood-ness is a

Diagram 3.44

Each higher genus contributes its own special property to the members.

Comment [A1]: After this section, give the students the handout "The Four Predicables Continued' (in Appendix).

Comment [A2]: i.e. the lowest genus that is still 'above,' and thus still able to be considered as a genus.

Comment [A3]: Here, Lat. *summum* means "highest."

[106] Aristotle, *Topica*, I:4(101b17-18), I:8 (103b3-6).

[107] This is not the classical definition of property, as held by Aristotle (cf. *Topica*, I:4 (102a18-31). Aristotle held that properties were things which belonged to one class *only*, and not to a higher class. However, we have here altered the meaning of property to make it correspond to the A-proposition "All [subject(s)] is/are [property]" (cf. Diagram 3.46). Thus a property is a quality that is broader than and universally fills *all of* an entire class, regardless of what other classes it may also apply to (whereas accidents are qualities that fill only *part of* a class). We believe that this is the correct and essential meaning of property (esp. since this new meaning was called for by the exigency of having one of the 4 predicable to correspond to and illustrate the A-proposition); whereas Aristotle's meaning of "property" is actually identical to the meaning of a "specific difference," for specific differences also fill one class only, and no other class.

Alternatively, one could make an Ockham's-razor-style of argument that qualities which belong to a class must be either essential to, or not essential to that class. If they are essential to it, then they are differentia (specific differences, i.e. definitions); if they are not essential to it, then they are accidents. There is no room for a third class in between the two. Now Aristotle said that properties were *not* essential to the class, but if that was the case, they'd be equivalent to accidents. He escapes this conclusion by simply positing that properties happen to apply all of the time, whereas accidents don't. However there is nothing essential about permanency of time. After all, time is itself one of the 9 categories of accidents. Do these things then accompany the class by mere fluke, or coincidence? Of course they don't! There is a very good reason for why they always accompany that class, and that reason has something to do with the class's essence. If the reason were less universal than the class they'd be accidents; if it were commensurately universal with the class, then they'd be part of the very definition of that class; however,

property of humans, because it is present in all humans, but it isn't *primarily* essential to humans, so much as it is primarily essential to *mammals* (a broader genus). Genera and properties are related to one another because we find that each genus contributes its own special property to the classes and individuals within it.

An accident is a quality that is present in a class, but is in no way essential to it. Accidents belong to only some of the members, and not others, or only sometimes, and not always (If it belongs to all the members, always, then it is a property, instead).

A definition (or distinction or 'act-of-delimiting') is a separation that occurs between distinct forms or species within a class. Each species in a genus has a specific difference, namely, the quality that distinguishes it (or makes it 'special'), as different from the rest of the members of the genus.[109] The specific difference is an extra quality *in addition* to the formula of the genus.[110] Thus if the genus "mammal" is that which is "warm-blooded, chordate, living, and thingly," its species "man" would be that which is "*rational*, warm-blooded, chordate, etc." Here, *rational* is the specific difference, and it is a property that belongs only (and thus *primarily*) to men. Another species would have a different specific difference. "Specific differences define both the one species that has it and, negatively, the many species that don't have it.[111]

Negative Definition:

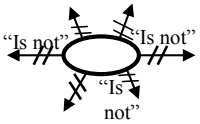


Diagram 3.45

The standard way to define is to cite a thing's genus + specific difference:[108] Thus humans are "rational animals." "Rational" is the specific difference, "animals" the genus. By citing the genus as well, we remove the necessity of having to define something by reference to ALL the things in the universe that is not, and instead permit ourselves to only define it by reference to the things in that genus that it is not.

How the Four Predicables relate to the Four Propositions:

The four predicables relate to the four propositions in the manner shown at right. We will next give some examples of how the two are similar.

A implies a Property.
E implies a Definition.
I implies an Accident.
O implies a Genus.

Definition - No A is B. No horses are men. / No horse-ness is human. Horseness helps negatively *define* men. How does this happen? The specific difference of 'horse-ness' (That they alone of all animals are large, ride-able, four-footed runners that eat oats) helps distinguish them from 'men,' and from many other animals as well.[112] Of course, you'd need to add the specific differences of all these others animals to completely distinguish man in his own right.

Comment [A4]: For instance, the genus of mammals contributes the property 'milk-producing' to all its members. The genus of polygons contributes the property of 'straight-sides-having' to all its members. The genus of butterflies contributes the property 'butterfly-ish' (or some such quality) to all its members.

Comment [A5]: Definition comes from the Latin (*de* "from/about" + *finis* "end").

Comment [A6]: Sometimes the specific difference is called a *modification*, because the genus just by itself is thought of as rather 'ordinary,' whereas the specific difference comes along secondarily, and receiving that base, ordinary kind of being, also adds something additional to it, thereby *modifying* it. Thus in the order of existence the genus is prior and simpler, and the specific difference is secondary and additional.

Comment [A7]: Really, the specific difference is an extra property which unlike most properties *is* primarily essential to the class in question, the species.

Comment [A8]: It does not belong primarily to lawyers, or adults, or Lithuanians, but to *men*.

Comment [A9]: Of the two of these, negative defining is more essential and important because sometimes the members of a class will not have any one distinguishing characteristic proper to them alone. For instance, red is only what is not green nor blue; blue is only what is not green nor red; and green only is what is not red nor blue. Thus the only way you can define red is negatively, not positively. This is what would be expected, since the E-statement, to which definition is inherently connected, is a primarily negative (No __ is ___), not positive (All __ is non-___) statement.

Comment [A10]: Either form of the predication can be used. One deals with beings, the other deals with essences.

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since they are often more universal than the class—and Aristotle has no word to describe such a situation, even though it repeatedly recurs—we distinguish them as *properties*.

[108] Aristotle, *Metaphysica*, VII:12 (1037b29-30).

[109] Aristotle calls the specific difference just a "differentia," or "difference." Cf. *Metaphysica*, V:28 (1024b4-6); V:10 (1018a38-b6).

[110] Ibid.

[111] Cf. Aristotle, *Topica*, I:5 (102a8); cf. *Analytica Posteriora*, II:13 (97a7-11).

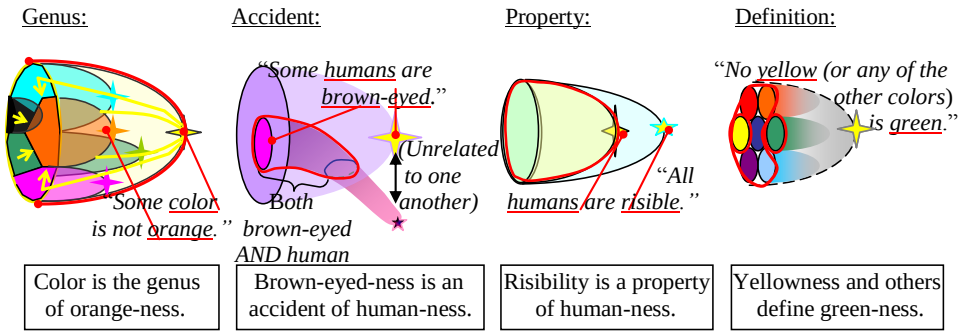
[112] Cf. Aristotle, *Analytica Posteriora*, II:13 (96a37-b2).

Genus - Some A is not B. Some animals are not men. / Some animal-ness is not human. If some animals are not men (and some are men), then 'men' must be one of the species of 'animal,' and 'animal' is the genus of '[hu]man[ness].'

Accident – Some A is B. Some men are 11-fingered. '11-fingered-ness' is an accident of 'humanness.'

Property – All A is B All men have a sense of humor. / All humanness is risible. 'Risibility' is a property of 'humanness.'

We can then diagram these in the following ways: Diagram 3.46



When we diagram them in these ways we see that each of the predicables bears an uncanny resemblance to each of the four propositions. In fact, they are the same thing. Knowing this, we can better understand what it is that we are doing when we predicate, and where such concepts as genus, species, etc. come from (i.e. from Intellect and from the inner mystery of how *word* / λογος divides).

Questions:

1. What are the four predicables? Ans: They are the four situations that characteristically arise between a genus and/or its species, as a result of one of the four propositions.
2. Why are they called predicables? Ans: Because if you are predicating, you indirectly imply one of them.
3. What special property is contributed to human nature by the genus . . .
   a. 'animals?' Ans: Mobile.
   b. 'invertebrates?' Ans: Backboned.
   c. 'mammals?' Ans: Milk-producing / hair-having.
4. Is a property always essential to a class? Ans: Yes. It just isn't always *primarily* essential to it.
5. Is an accident essential to a class? Ans: No.
6. What kind of property is *primarily* essential to a class? Ans: A specific difference.
7. Which kind of definition is more of the nature of definition: positive definition (genus + specific difference) or negative definition (what it is *not*)? Why? Ans: Negative Definition. The true nature of

Comment [A11]: Point out to the students that in the examples of the two previous negative predications (E/definition and O/genus), "men" fell into the predicate. Here in the examples of the positive propositions (A/property and I/accident), "Men" is placed into the subject. If we were instead to again place man into the predicate, you might think that an accident was actually a property. E.g. If you said "some two-legged ones are men," someone might be tempted (perhaps correctly) to say that although "some two-legged ones are men" (as stated), yet "*all* men are two-legged," and therefore two-legged-ness is not an accident, but really a *property* of humans. However if you clearly state that only "*some* men are two-legged" (by putting "men" into the subject), then there is no danger of making what is an accident look like a property. (Likewise, if you clearly state that "*All* men are hand-having," then there is no danger of thinking that what is a property might be just an accident.)

Comment [A12]: Risibility is the ability to laugh (a.k.a. a sense of humor).

Comment [A13]: Ask the students: "Does the statement 'Some color is not orange' imply that some IS orange?" [Ans: Yes! This is how genus is different from definition. In a definition, none of the one quality is the other, but here some is.]

Comment [A14]: Tell the students, "Convert the statement to 'Some brown-eyeds are human.' Is this also true? [Ans: Yes! An I-proposition always converts to something equally true, which tells you that accidents are always accidents of one another: If A is an accident of B, then B is an accident of A ...

Comment [A15]: Generally it is held that only humans laugh (and nothing else). Some might take the position that hyenas, or crows, or even God laughs, but this is probably not the same sort of laughing as human laughter.
Laughter results from the combination of two facts in one's mind, and not just any facts but facts whi ...

Comment [A16]: Tell the students that the better way to think of this E-proposition is "(All Yellow) is not green." We here use parentheses to avoid a potential ambiguity of a Tricky-O proposition. It is often helpful to think of the E-proposition in this way ("(All____) is not____," rather than "No ___ is ___").

Comment [A17]: Have the students compare this Diagram 3.46 with diagrams 3.40 and 3.41 above until they are convinced that the two are the same (i.e. that a genus = an A-proposition, that an accident = an I-proposition, etc.). Also, if desired, have them compare it to the diagram of virtues (Diagram 2.43) in Unit II, as well as to Diagram 4 ...

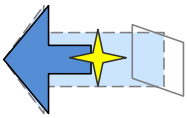
Comment [A18]: "Logos" is Gk. for "word." It connotes the Greek understanding of word as 'unfolding' throughout time and multiplying, producing more and more species and other effects. Many Greeks (Heraclitus, the Stoics, Plato) had an inner understanding of the primal nature of words and rationality as being one of the fundamental ...

Comment [A19]: "Primarily essential" means not only that it always is found in the thing, but that it—more than anything else—is of the nature of *what* that thing is.

definition comes from the E-proposition, "No __ is ___," which is negative, not positive. Alternate Explanation: Even positive definition has implicit negative definition within it (i.e. by naming both the genus and the specific difference (S.D.), it is taken for granted that anything in that genus not having that S.D. is defined outside of it. Alternate Answer: The etymology of the Lat. word "definitio" signifes to delimit or "put an end to," which is more a negative thing (concerned with the perimeter) than a positive thing (concerned with the center). Thus any definition which conceptually surrounds and 'limits off' something in any way is a satisfactory definition.

8. For each of the four kinds of propositions, give an example in standard form, and show how one of the four predicables is implicit in that statement. Ans: Answers may vary. Make sure that in the negative propositions (E and O) the students have the species defined in the *predicate*. Make sure that in the positive propositions (A and I) the students have the thing of which it is a property or accident in the *subject*. Cf. comment in the example (11-fingeredness) on Accidents, above.

Chapter VII. The 3rd Act of the Intellect: Reasoning



1. Reasoning and the Syllogism

Reasoning is the 3rd act of the Intellect. Reasoning is a slow, methodical process by which we 'flesh out' the consequences of what we know.[113] Whereas Apprehension and Judgment occur in the lower realms of human nature, reasoning takes place entirely in the highest level of human nature: the rational level (which is why it is called "reasoning").

Comment [A20]: Human reasoning is discursive, meaning that it happens one thought at a time. By contrast, angelic reasoning is not discursive, but rather angels know what they know instantaneously—by a kind of intellectual sight. Thus human reasoning accomplishes by separate acts (2nd acts), what angels possess all at once (as a 1st act).

No matter what kind of modus the syllogism follows, it is still true that the syllogism is a kind of 'fleshing out of truth' based on what is already known.[114] For instance, if I haven't yet considered all the relationships of A's essence to lesser matters, I can start to figure it out on the basis of one thing that I already know (B): If I know that All B is A (upward) and No B is C (rightward), then I can conclude that "some A is not C" (angling downward to the right).

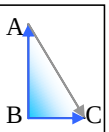


Diagram 3.47

[113] Aristotle, *Analytica Posteriora*, I:1 (71a6); cf. I:34-II:3(90a35).

[114] Aristotle, *Analytica Priora*, I:1 (24b18-19). One way in which truth is fleshed out is that one of the premisses is always "like the conclusion" (Cf. Diagram 3.47, in which one of the sides "No B is C" is like the diagonal conclusion "Some A is not C," inasmuch as both are negative and go in the same direction—toward C.) Aristotle, *Analytica Priora*, I:24 (41b27-30).

Even though it occurs purely at the rational level (which is silent and eternal), reason is not totally unknowable. Acts of reasoning can still be represented by combining propositions—its building blocks—in various ways, and these combinations can be diagrammed. Thus we can come to understand the paths of reasoning by carefully analyzing and diagramming the deliberate judgments that make up the reasoning process.

Diagram 3.48

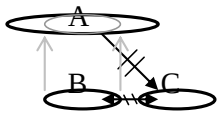


Diagram 3.47 above, fully diagrammed

The primary act of reasoning is the syllogism, which is a way by which from the knowledge of two known judgments we can come to the knowledge of a third judgment.[115] There are many ways to reason based on the context, but the syllogism is unique because it enables you to figure out (infer) certain truths automatically without any outside contextual knowledge. A syllogism is thus a 'figuring out' of the peripheral consequences of the 'natural thrust' or 'force' of a proposition. For instance, if you say that "No C is B," one of the consequences of this statement is that anything which contains this B, cannot be C either; so if you add the additional proposition that "some of A is B," then you can conclude that *that part of* A is not C, either. We see then in this circumstance (the circumstance of some A being B), that the natural import of "No C is B" is also that "some A is not C."

The first two judgments in a syllogism are called "premises," and the last judgment is called the "conclusion."[116] One premise is called "Major" because it contains the "Major Term," and one premise is called "Minor" because it contains the "Minor Term."[117] The Major Term is represented "P" because it forms the predicate of the Conclusion; the Minor Term is represented "S" because it forms the subject of the Conclusion. Besides these two terms, there is also a third term, called the "Middle Term (represented "M") because it connects the two premises together.[118]

There are four possible Figures of the syllogism, each with a different configuration:

Comment [A21]: Emphasize to the students that each of these are in standard form. However, in real life you might see things not in standard form, and out of place. For example, maybe the top line will be on the bottom, and the bottom on the top; or maybe one of the premises will need to be converted or obverted.

The 1st Figure	The 2nd Figure	The 3rd Figure	The 4th Figure
M is P	P is **M**	**M** is P	P is **M**
S is M	S is M	M is S	M is S
∴ S is P	∴ S is (not) P	∴ (some) S is P	∴ S (would) be P
			∴ P belongs to S

* The three stacked stones (∴) is a symbol meaning "Therefore."

The four Figures are written in this way to show that the 2nd Figure always proves a negative conclusion (E or O), the 3rd Figure always proves a particular conclusion (I or O), and the 4th Figure only proves something essential (though not necessarily

[115] Aristotle, *Analytica Priora*, I:1 (24b18-19); *Topica*, I:1 (100a25-26).
[116] Aristotle, *Analytica Priora*, I:1 (24a16).
[117] Aristotle, *Analytica Priora*, I:4 (26a23); I:5 (26b36-39); I:6 (28a12-14).
[118] Aristotle, *Analytica Priora*, I:4 (25b36).

existential).[119] We see then that the 2nd, 3rd, and 4th figures are each deficient from the 1st Figure in some special way: [120] The 2nd Figure loses the ability to prove positive propositions (~~A or I~~); the 3rd Figure loses the ability to prove universal propositions (~~A or E~~); and the 4th Figure loses the ability to prove what is actually the case (~~is~~) and instead only proves what essentially would be the case. We can therefore gain all necessary insight about the syllogism, simply from studying the 1st Figure.

How to determine Figure

Generally to determine what figure a syllogism is in, you first look to see where the Middle Terms lie.[121] If they are both on the right side, it is the 2nd Figure. If they are both on the left side, then it is the 3rd Figure. If they are both diagonal, one from another, then it is either the 1st or 4th Figure. To determine whether it is 1st or 4th, you must look to see whether the conclusion flows in the same direction as the premises. For instance if X--->Q---->R is the flow of the argument (i.e. "All X is Q, all Q is R"), then if the conclusion flows in the same direction (i.e. "All X --IS--> R"), it is 1st Figure. However, if the conclusion flows in the opposite direction (i.e. "X<---IS---R *some*," read right-to-left), then it is the artificial 4th Figure.

Moods

Each figure of the syllogism has a determinate number of moods, which constitute all the possible ways that that figure can be valid. Each mood has a special name, whose three vowels (A,E,I,or O) indicate what kinds of propositions make it up. The 1st Figure contains exactly four valid moods "Barbara," "Darii," "Celarent," and "Ferio."

Each mood's name has three vowels that tell you what propositions it is made of: "c**E**l**A**r**E**nt" contains the vowels E – A – E.
Major Premise ~~"No M is P"~~ (E)
Minor Premise ~~"All S is M"~~ (A)
Conclusion ∴ "No S is P"(E)

Barbara:	Darii:	Celarent:	Ferio:
All B is C	All B is C	All B is C	No B is C
All A is B	some A is B	No A is B	some A is B
∴ All A is C	∴ some A is C	∴ No A is C	∴ some A is not C

The word "Barbara" has three A's in it. Consequently Barbara is composed of three A-propositions. The word "Darii" has one A and two I's, and so it's mood has an A-premise, an I-premise, and an I-conclusion. The same can be said for the other moods.

Generally to determine what mood a thing is in, you *must* first determine what figure it is in. Once you know what figure it is in, then and only then can you select from the moods appropriate to that figure. The reason you must do this, is because sometimes

[119] Aristotle, *Analytica Priora*, I:5 (28a8), I:6 (29a16-17), I:4 (26b31); *Analytica Posteriora*, I:14 (79a25f).
[120] Aristotle, *Analytica Priora*, I:7 (29a30-31), I:12 (29b24-25), I:23 (40b18-23).
[121] Aristotle, *Analytica Posteriora*, I:32.

Comment [A22]: The 4th Figure often violates the existential fallacy. For instance, "All animals are things [Major premise], All unicorns are animals [Minor Premise], therefore Some things are unicorns [Conclusion]." This syllogism supposedly proves *that unicorns exist*. Of course, unicorns don't exist. Thus the 4th Figure only proves what *would* be true, should the concepts of the terms themselves *really* exist.

Comment [A23]: Ask the students: So in what figures can a universal affirmative ("A-proposition") be proved? [Ans: *Only* in the 1st Figure! Cf. Aristotle, *Analytica Priora*, I:26 (42b33).] Tell the students: "Because the first figure alone can prove an A-proposition, the first figure is the only figure fit for making an advance in scientific knowledge." Aristotle, *Analytica Posteriora*, I:14 (79a19); cf. footnote at the end of Section 3.6.4.

Comment [A24]: Another way you can think about it is that in the 1st Figure, the relevant terms (S and P) seem to 'drop straight down' into the conclusion. In the 4th Figure, they don't.

Comment [A25]: Aristotle did not know about the 4th Figure, or at least did not write about it.

Comment [A26]: Moods were invented in the Middle Ages, and many of them use Italian words or names.

Comment [A27]: It is no accident that the First Figure has 4, and exactly four moods. The first figure has four, and only four moods, because each one of them proves a different kind of proposition (A, E, I, or O) as its conclusion.

Comment [A28]: "Valid" means that from the premises given (regardless of what those premises may say) they infallibly confer truth upon the conclusion (regardless of what the conclusion may say). From 3 premises, and 4 possible choices for each premise, theoretically every figure would have 4^3=64 possible moods. However in the 1st Figure, only 4 of these are valid; in the 2nd Figure again only 4 are valid; in the 3rd Figure, 6 are valid, and in the 4th Figure 5 are valid. Thus out of 64x4=256 total possible moods, there are only 19 that are valid (and 14 if you discount the 4th Figure, whose validity is questionable since it violates the existential fallacy).

Comment [A29]: Here, instead of using S's, M's and P's, we're using A's, B's, and C's. Remind the students that since we are here making 1st Figure syllogisms, as we write the premises (each premise of the format "All/some ___ is(n't) ___") we always keep the B's in the same places: at the top-right and in the bottom-left (cf. the example of the 1st Figure earlier in this section, using M's, S's and P's). We also always keep the C (The Major Term) in the top row (The Major Premise), and we always keep the A (the Minor Term) in the Second Row (the Minor Premise). ...

Comment [A30]: After the students have looked over these four moods, you might point out to them a handy trick to figure out the 1st Figure: Remove both middle terms and drop the major and minor terms—including the minor term's quantifier—straight down. Of course they will also have to keep any negatives, as we shall learn in the next section, bu ...

two separate moods will have identical vowels (e.g. "Celarent" in the 1st Figure and "Camenes" in the 4th Figure both have one A and two E's), and to make matters worse, it doesn't really matter which vowel comes first. For example, Darii is essentially Darii, whether it is AII or IAI. The only way you can then distinguish it from Datisi, is by knowing that Darii is in the 1st Figure (M's diagonal), whereas Datisi belongs to the 3rd Figure (M's at left).

Questions:

1. What is reasoning? Ans: It is a slow, methodical process by which we 'flesh out' the consequences of what we know.
2. In each of the syllogisms in this section, draw a single oval around both of the Middle Terms.
3. What must you do before you determine mood? Ans: Determine figure.
4. Fill in the blanks: The _____ Term forms the subject of the conclusion. The _____ Term forms the predicate of the conclusion. Ans: Minor, Major.
5. Which of the following still represent the mood "Darii?"

All B is C	some A is B	All B is A	some C is B
some A is B	All B is C	some C is B	All B is A
∴ some A is C	∴ some A is C	∴ some C is A	∴ some C is A

Ans: All four! The first one is the standard form of Darii shown in the previous section. In the second, the Major and Minor premises have just been switched from their locations, but that doesn't matter: It is still essentially the same syllogism. In the third, the Major and Minor terms have instead been switched, but this doesn't matter: it is still essentially the same syllogism. In the fourth exapmle, *both* the Major and Minor premises' locations, *and* the Major and Minor terms have been switched.

6. Research project: Find all 19 valid moods of the syllogism.

Ans: 1st Figure	2nd Figure	3rd Figure	4th Figure
b**A**rb**A**r**A**	c**E**s**A**r**E**	d**A**r**A**pt**I**	br**A**m**A**nt**I**p
c**E**l**A**r**E**nt	c**A**m**E**str**E**s	d**I**s**A**m**I**s	c**A**m**E**n**E**s
d**A**r**II**	f**E**st**I**n**O**	d**A**t**I**s**I**	d**I**m**A**r**I**s
f**E**r**IO**	b**A**r**O**c**O**	f**E**l**A**pt**O**n	f**E**s**A**p**O**
		b**O**c**A**rd**O**	fr**E**s**I**s**O**n
		f**E**r**I**s**O**n	

2. Verifying a Syllogism's Validity

A useful tool for figuring out whether syllogisms are valid is by checking distribution. Distribution is the application of a term to all, or only some of its class (recall Section 3.5.4).[122] In regard to the subject, a term is "distributed" if it has the universal quantifier "All" in

A: All S (D) is P (U).
E: No S (D) is P (D).
I: some S (U) is P (U).
O: some S (U) is not P (D).

[122] Aristotle, *De Interpretatione*, 7 (17b13).

Comment [A31]: Emphasize to the students that the ordering of the premises *really doesn't matter*. Even though we name the mood "Celarent" with E coming first and then A, that really doesn't matter, at all. As long as the middle term is diagonaling in some way (rather than both at the right or both at the left as in the 2nd and 3rd Figures), and the major and minor terms drop straight down into the conclusion (in the 4th figure they don't drop straight down, but rather diagonal down and 'swap'), then it is still the 1st Figure. Once you know it is the first figure, as long as one of the premises is E and the other is A (in either order, it doesn't matter which comes first), you know it is Celarent. Thus the terms 'Major Premise" and "Minor Premise," "Major Term," and "Minor Term" often move around fluidly in their positions, and should not be thought of as rigidly 'possessing' a certain location (e.g. top row left side) of the syllogism. They do possess this location when the syllogism is in standard form (as shown in the previous section), but syllogisms are often not in standard form.

Comment [A32]: It is still essentially Darii, because in both examples, you have one I-proposition combining with one A-proposition, and the tail-end of the I proposition matches up with the head of the A-proposition. The variables used (A/B/C/M/S/P/etc.) don't matter. Ask the students: So what is essential to Darii? [Ans: One I-premise, one A-premise, and 1st Figure-ness.]

Comment [A33]: After the students have done this project, give them the handout (in Appendix) on the 19 (or really 12) valid moods of the Syllogism.

front of it, and it is "undistributed" if it has the particular quantifier "some" in front of it. In regard to the predicate, you must either figure it out from the context (asking yourself, "Does this intend to talk about every member of the class or just some of them?") or follow the chart reprinted above, at right. Here we see that negative propositions have a distributed predicate (because when you deny, you refer negatively to the *entirety* of that concept), and positive propositions have an undistributed predicate.

By verifying three simple rules, you can confirm whether a syllogism is valid:

1. The Middle Term must be distributed at least once.[123]
2. If one of the premises is negative, the conclusion must be negative. If both are negative, *nothing follows* (the syllogism would be invalid)![124]
3. No term can be more distributed in the conclusion than in the premises.

The concept of distribution shows us that in syllogizing we must be putting concepts fully distributed (i.e. referring to all of the class, or 'bursting at the seams') into other concepts that are not fully distributed (i.e. horizontally 'trailing off' into more content, about which we are not concerned)—cf. Diagram 3.49.[125] Only in this way can one lesser concept *belong* to another. However, if a term is more distributed in the conclusion than it was in the premise, then we have reversed this process (i.e. flipped Diagram 3.49 upside-down), and committed a fallacy of *over-extension* (overextending that term). For example if I say "All Basques are men; some animals are not men. Therefore, no animals are Basques," I would be over-extending the term "animal," because in the 2nd premise it is undistributed, whereas in the conclusion it is distributed. To avoid this mistake, I would need to say "Some animals . . ." in the conclusion, not "No animals . . .."

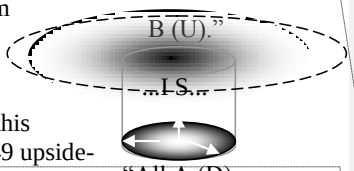


Diagram 3.49

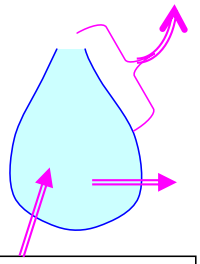

Things can be put into or out of the context, and the context itself can be put into or out of other things.

Diagram 3.50

The same issue of distribution applies to the Middle Term. The Middle Term must be distributed at least *once*, and if it isn't, then nothing follows.

The Middle Term forms the *context* for the syllogism (Sort of like a carrier, or purse, or capsule, or water-droplet). Things are either put into that context, or distinguished as being outside of it. On the basis of how things are put into, or out of that context, and on the basis of whether the context itself is put into something else (while carrying things inside of it), the things themselves can then be either connected (with both inside that context, at least in part) or separated (with one inside and one outside of that context, at least in part). Thus the Middle Term is as-it-were the pre-

[123] Aristotle, *Analytica Priora*, I:4 (26a21); I:6 (29a8), I:14 (33a34-37).
[124] Aristotle, *Analytica Priora*, I:24 (41b6-9, 27-30).
[125] Aristotle, *Analytica Priora*, I:1 (24b27-28); *Analytica Posteriora*, I:4 (73b27-32).

Comment [A34]: Point out to the students that E propositions really do have the quantifier All at the start of them, but it is just hidden: "No S is P" is really "(*ALL* S) <—isn't—> (P)."

Comment [A35]: This means that the Middle Term must somewhere have an "All" in front of it, or a "not" in front of it (or a "No" way out in front of the whole proposition, since "No. . . " is short for "All . . . is not . . ..").

Comment [A36]: *Nothing follows from a negative*. This principle is universally true . . . (1) In logic: Just because a premise was false doesn't mean the conclusion deduced from it is also false. (2) In sweeping generalizations: Just because one of the employees was a 'bad apple' doesn't mean that the whole institution is bad. (3) In negative moral situations: Just because things are going badly for you, doesn't mean that you should 'pass it on' and in turn do bad things to others, as well. (4) In positive moral situations: Just because you're not worse, or as bad as another person, doesn't mean that you're necessarily *good*. (5) In contests of Will: Just because one battleship sinks, or one football play fails, doesn't mean that that side is doomed to failure. Rather sometimes its margin of victory is found in something else (e.g. aircraft carriers, or the kicking team's field-goals), and what was lost wasn't needed anyway.

Comment [A37]: Thus if one term is particular in the premises ("Some," or the predicate of an affirmative proposition), it cannot be distributed in the conclusion ("All," or the predicate of a denial). If it were, it would be a fallacy of over-extension, as stated in the next paragraph.

Comment [A38]: The Middle Term, however, which links the two propositions, is a case where we often put the part-ness of a concept into the fullness of the concept. We can do this because when we put the Middle Term (in one proposition) into the Middle Term (in the other proposition), we are not putting one concept into another, but one concept into itself, and so here we can put the part into the whole; however normally (i.e. within a single proposition), we do the reverse of this and put the *whole* of one concept—a distributed subject—into the *part* of another—the undistributed predicate (cf. diagrams 3.49 and 3.50).

Comment [A39]: Imagine as if we were to flip the Diagram, but not the label. In this situation, you would clearly see that "All" of the wider concept could not possibly fit *into* the smaller concept.

Comment [A40]: Thus the Middle Term is like the 'engine' of the force of the syllogism (cf. Diagram 3.51, where you can imagine the pipe as a kind of jet-engine, or gun.): It gives force to connecting the Minor Term to the Major Term, yielding a conclusion. If the middle is undistributed in both premises, and a conclusion is drawn, it is a Fallacy of an Undistributed Middle Term.

existing *intellectual* component of the syllogism,[126] and the premises themselves—which forcefully 'put things into' others—are as-it-were the *willful* component of the syllogism.

Comment [A41]: Interesting fact: At about the age of 2, children begin developing their Will, and it is then that they like to 'put things into' others. Ask the students: "Why do you think children like to do this?" [Ans: Because they are performing syllogisms, using objects. They are delighting in thinking to themselves "All the pieces are inside" (an A-proposition) or "This can't be put in that" (an E-proposition), etc.]

Questions:

1. Circle any terms that are over-extended. Then either check off the syllogism as 'valid' or re-write what the conclusion should be, or write "nothing follows."

a. some A is B	b. All B is C	c. No A is B
All C is B	some A is B	All B is C
All C is A	some C is A	some A is not C
Ans: [B is overextended]		[C is overextended]
Nothing follows.	✓ Valid.	some C is not A

2. Fill in the blanks: If the Middle Term is over-extended then _____; if one of the other terms is over-extended, then _____.
   Ans: Nothing follows; the conclusion is wrong.
3. Write whether the following syllogisms are invalid, and if invalid, why:
   a. Some men are strong.
      All Basques are men.
      Some strong ones are Basques.
      Ans: Undistributed Middle Term.
   b. Marijuana use is medical.
      No medical things should be forbidden.
      No marijuana use should be forbidden.
      Ans: Overextension of the Minor Term.
   c. Some living things are strange.
      All men are alive.
      Some men are strange.
      Ans: Undistributed Middle Term.
   d. Nothing fun is boring.
      All boring things are part of life.
      No life is fun.
      Ans: Overextension of the Major Term (life).
   e. It's forbidden to do bad things.
      Some judging of others is bad.
      Therefore, don't judge!
      Ans: Overextension of the Minor Term (judging).

[126] Aristotle would add that the middle term is the *cause* of the conclusion (*Analytica Posteriora*, I:33 (89a16), I:34 (89b16)), at least in syllogisms of the reasoned fact (I:13 (78a25ff), cf. box in Section 3.8.1, under "Deduction.").

3. Understanding Syllogisms[127]

The Pipe

Proper Vocabulary Use:
Modus Ponens is Lat. for "Mode of putting [or depositing]." *Modus Tollens* is Lat. for "Mode of taking." We will study these more in Section 7.

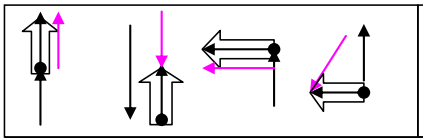
The force of a syllogism (represented by the wide arrows in diagrams 3.52 and 3.53), is what mental action you must undertake in order to figure out (or solve) the syllogism, and produce a conclusion. In a way, it is the *tendency* of the syllogism, as when you ask yourself "Where is it [the argument] *tending toward*?"

In the 1st Figure, the force of the syllogism is in parallel with the Major Premise. Here, the Major Premise is like a kind of rule, or pipe (or gun), or mathematical *function* into which you 'plug in' something at one end, and from which you then automatically 'get out' something at the other end. This is the distinctive characteristic of *Modus Ponens*, and *Modus Ponens* characterizes the 1st Figure. In the 2nd Figure, the Major Premise is again a pipe, but this time, the force of the syllogism is directly against the Major Premise. By denying something at one end (i.e. plugging up the pipe), you are forced to deny something *even more* at the other end. This reversal is how *Modus Tollens* works.

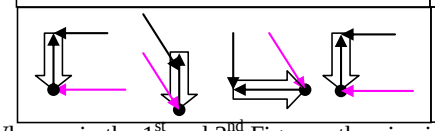
Diagram 3.51

Subj. ...*is*... Pred.

Diagram 3.52



In M*odus Ponens*, the force of the syllogism will be in the same direction as the major premise.



In *Modus Tollens*, the force of the syllogism is in the opposite direction as the major premise.

Whereas in the 1st and 2nd Figures, the pipe is the Major Premise, in the 3rd and 4th Figures, it is the Minor Premise. In the 3rd Figure, the force of the Syllogism reverses direction and flows down the pipe provided by the Minor Premise. Moreover, in the 3rd Figure, the force of the Syllogism is *identically the conclusion*, which is why the conclusion is so natural and easy to recognize in the 3rd Figure. In the 4th Figure, the force of the syllogism goes directly *against* the conclusion. The 4th Figure is the most *unnatural or counter-intuitive* figure. None of the premises in the 4th Figure suggest or 'bespeak' in any way what the conclusion should be, which is why the 4th Figure must be solved in two separate steps. In the 4th Figure you have to first figure out what the unique relationship is between the Major and Minor terms, and then, discarding what you just said in discovering this, 'start over' again at the other end of the syllogism, and restate the conclusion anew. We see then that each syllogism has a kind of pipe (Most obvious in the 1st and 2nd Figures), and the force of the syllogism somehow flows—depending upon the Figure—up or down it.

[127] Ex me. The models/analogies (pipe, hinge, and mathematical operators) proposed in this section are originally my own.

Comment [A42]: It is absolutely imperative that students have out in front of them the Handout "The Valid Moods of the Syllogism" (see Appendix) while going over this section. They will understand the general statements so much more if they can simultaneously see tangible examples of what is being declared.

Comment [A43]: In math, a function f(x) = 3x + 6 has the input on the right side of the equals sign, and the output on the left side of the equals sign. Thus the function is like a pipe or engine in which things flow from right to left.

Comment [A44]: This transfer from input to output is the *force* of the syllogism (at least, in the 1st Figure).

Comment [A45]: Notice how the wide, dotted arrow in the second example of Diagram 3.53 is going *against* the thin, solid arrow.

Comment [A46]: If the first figure is like a gun shooting, the second figure is like a gun back-firing (because it has been plugged at the tip of the barrel).

Comment [A47]: Continuing the gun analogy (from prior comments), the 3rd figure is like when you are restocking the gun with a ram-rod: The ram-rod is the conclusion and flows backward down the barrel (against the direction that the gun is designed to shoot).

Comment [A48]: In other words, the conclusion flows *through* the Minor Premise: If the Minor Premise says one thing, the conclusion uses and starts off from the exact same idea-matter presented by the Minor Premise.

Comment [A49]: 3rd Figure syllogisms practically give you the answer.

Comment [A50]: Continuing the gun analogy from previous comments, in the 4th Figure it is as if you are firing the gun as it was designed (as in the First Figure), but the bullet (the conclusion) is coming out backward.

Comment [A51]: Because the conclusion and force are against each other, in the 4th Figure you have to really understand what is going on.

Comment [A52]: By up- or down-ness, we mean either going with the arrow representing that statement (i.e. "down" it), or against the arrow (i.e. "up" it).

The Hinge

In the examples at the start of this chapter, the M term opposite the Major Term (opposite what will become the predicate of the conclusion) is always in **Boldface**. This is the *hinge* of the syllogism. Every syllogism involves either plugging one entire premise into the hinge-term, or having two premises emerge out of the hinge-term.

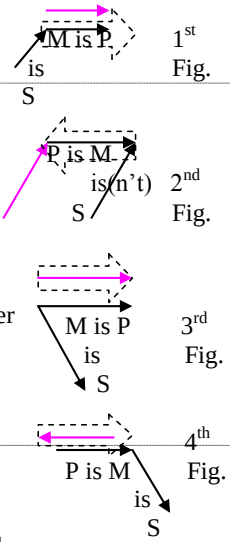


Diagram 3.53

In the 1st Figure, the hinge is on the left side of the syllogism. This makes the syllogism bend, according to the manner shown at right. You put/push all of S into the hinge (by saying "S is M"). Consequently S takes the place of M and results in the force of the syllogism's *conclusion* (in pink) being rightward-directed.

In the 2nd Figure, the hinge is on the right side of the syllogism (since all Ms in the 2nd Figure are on the right side). In the 2nd Figure, you put the Minor Premise into the M, and this immediately—and as-it-were *retroactively*—generates an identical (effectively parallel) proposition as if you were also putting the S into the P (because the P is part of M, usually). Thus the conclusion "S is P" effectively 'slides out sideways' from the Minor Premise. It is as if the force of the argument is flowing backward, back up the pipe. It should be noted however that the 2nd Figure is the figure of negative arguments: If something isn't in the whole, then it can't be in the part, either (and this is *Modus Tollens*, par excellence). Since we're here 'ruling out' rather than 'ruling in,' it is then as if the backward flow is actually occurring around the *outside* of the pipe rather than in it (which explains how it can accomplish the counterintuitive feat of flowing backward, since it is contrary to nature for things to flow back up the way they're intended to go).

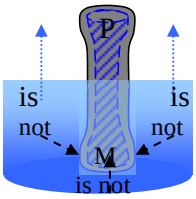


Diagram 3.54

In the 3rd Figure, the hinge is on the left side of the syllogism (since all Ms in the 3rd Figure are on the left side). In the 3rd Figure, you convert the Minor Premise, and then starting from the Minor Term, you merely 'read' out the answer, picking up any "Some"s or "Not"s that you may encounter along the way. The 3rd Figure is the figure of addition. Thus when you 'add on' the "Some" or the "Not" it doesn't affect any other part of the conclusion. This is the way addition works—simple and easy! It is merely cumulative. The 3rd Figure thus is extremely intuitive. In fact the force of the 3rd Figure is the very conclusion itself: It is the most natural thing to say, given what has been stated.

The 4th Figure is just an artificial version of the 1st Figure, in which you are making the syllogism run backward from how it is naturally inclined to go. Consequently, in the 4th Figure, the premises have been flip-flopped (between Major and Minor), so that you are now focusing on what was the Minor Premise. In the Fourth Figure, you convert the minor premise—i.e. the Pipe itself, which *would be* the Major Premise if it were 1st Figure—and you treat it as a 2nd Figure. Thus in the 4th Figure, the conclusion slides out sideways (just as it did in the 2nd Figure), from the converted Minor

Comment [A53]: In order to help the students understand Diagram 3.53, it is highly recommended that you pass out the Handout "The Valid Moods of the Syllogism," found in the Appendix.
Remind the students that the final outcome represented by the pink arrow has to be S . . . is . . . P. Thus, in Diagram 3.53, after—and as a result of—the operation of the Minor Premise ("S is M"), the "S" shown, *relocates* to the start of the pink arrow (in the 2nd Figure the "S" is as-it-were already at the start of the pink arrow).

Comment [A54]: Tell the students to imagine 'plugging' or compressing the whole "S is M" premise into the M (using an upward motion) in the 1st Figure part of Diagram 3.53. Once this is done, S (or some part of it) takes the place of the M, and you have your conclusion, "S is P."

Comment [A55]: In other words, if the minor premise is an E-proposition, the conclusion will be an E-proposition. If the minor premise is an I-proposition, the conclusion will be an I-proposition. The sole exception to this is Festino, in which the minor premise is an I-proposition, and the negative from the major premise combines with it to give a conclusion that is an O-proposition. However inasmuch as I is like O, it is almost parallel.
What we mean by "parallel:" In these sorts of diagrams (esp. those in the Handout in the Appendix), A-propositions will generally be ...

Comment [A56]: Except in Festino.

Comment [A57]: In the 2nd Figure part of Diagram 3.53, have the students imagine the whole pink arrow, without turning, drifting leftward out of the black arrow.

Comment [A58]: This is an alternative model, slightly different from (and indeed more correct than) the model of a gun 'back-firing' as proposed in a comment in the previous sun-section. It is "more correct" because a denial more essentially refers t ...

Comment [A59]: It is as if the water is flowing not down through the inside of the pipe, but instead mounting up and rising all around the outside of the pipe (cf. Diagram 3.54). In this way the water, starting at the location of the predicate—by denyi ...

Comment [A60]: For instance, if the minor premise is "All B is A," you change it into "some A is B." Thus you generally follow all the rules for converting.

Comment [A61]: Note captions on the far right of the Handout "The Valid Moods of the Syllogism." The 1st Figure is like multiplication, the 2nd Figure is like division, the 3rd Figure like addition, and the 4th Figure like subtraction.

Comment [A62]: It is the converting of the Minor Premise that makes the 4th Figure not existential, but only essential. After all, in the 2nd Figure, the pipe 'flowed' backwards as *Modus Tollens*. Thus if we are flipping the pipe (by now ...

Comment [A63]: Remind the students that the 1st Figure and 4th Figure are nearly identical. Indeed, the following match up in similarity: Barbara (1st Fig.) and Bramantip (4th Fig.); Celarent (1st Fig.) and Camenes (4th Fig.); Darii (1st Fig.) and Dimaris (4 ...

Premise. However the 4th Figure is different from the 2nd Figure in that the 4th Figure can be not just negative, but positive as well. Thus the 4th Figure slides out left not outside the pipe (cf. Diagram 3.54) but *inside* the pipe. This is *truly* unnatural: Things don't flow backward in causality. The only way this can occur is if you are not concerned for causality but merely *revising or rethinking or rearticulating* what you already know. This revision is the true force of the 4th Figure. Since the 4th Figure merely revises, and doesn't truly cause, it obviously has nothing to do with existence (which depends par excellence on an efficient cause), but has only to do with essence.

Analogy to Mathematical Operations

Modus Ponens is a kind of multiplication: The operation performed by the Minor Premise gets combined with the operation performed by the Major Premise, and the two have a multiplicative effect on one another in producing the conclusion. Thus the operation performed by the 1st Figure is analogous to multiplication. By contrast, in the 3rd Figure, the premises do not propel the conclusion, but merely serve as a platform on which quantifiers and qualifiers ("some"s and "not"s) can be presented. Thus in the 3rd Figure, things do not multiply, but merely add. The statements "B is C" and "B is A" bear no inherent connection to one another, but rather *diverge* in their forcefulness. Since they aren't formally combining, the best that the forms A and C can do is stand side-by-side. Thus in the 3rd Figure, you merely 'sum up' what you already know in the conclusion. In the 2nd Figure, *Modus Tollens* is a kind of division. When two things are in ratio to one another, if you divide one of them by a certain percentage, you must divide the other by an equal percentage. This is what happens in *Modus Tollens*. In *Modus Tollens*, we often divide something, either just in part, or to an infinite degree (in which case it gets reduced all the way down to zero). The former case is represented by the conclusion "some A is not C," the latter by the conclusion "No A is C." Thus the 2nd Figure is the figure of division. The figure most akin to this is the 4th Figure, which is the figure of subtraction. In the 4th figure, by converting the Minor Premise, we are 'taking something away' from the Minor Term. What are we taking away? We are taking away some of its universality; we are making "All" into "some," or even "none." Thus the 4th Figure isn't *Modus Tollens* in a formal sense, but only in a material sense. We see then that the mental operations symbolized by the four figures give us the four operations known to algebra.

Questions:

1. What is the hinge of the syllogism? Be specific! Ans: The Middle Term (In particular, it is the one opposite the Major Term).
2. What must you do to the Minor Premise in the 2nd and 4th Figures?
   Ans: Convert it, following all the rules of conversion.
3. Given the following sets of premises, write which figure it is, circle the hinge, and then propose a conclusion:

a.	b.	c.
No B is C	No B is C	some A is B
some A is B	some B is A	No C is B (careful!)
Ans: some A is C	some A isn't C	some A isn't C
(1st Figure)	(3rd Figure)	(2nd Figure)

Comment [A64]: Multiplication is not just the 3 x 4 multiplication with which we are concerned in grade school. Multiplication also concerns things like the *dot-product*, used in things like Matrix Algebra. Indeed any time one thing formally combines with another, multiplication has occurred. Thus multiplication is the combining of two forms.

Comment [A65]: The "is" of the one gets combined with the "is" of the other, producing an "is" in the conclusion which has double the force of both. This can be heard by a certain emphasis or extra drawn-out-ness with which the "is" is said, each subsequent time.

Comment [A66]: Really both Middle Terms are the hinge because they get combined together into one. However, of the two, we call the one opposite the Major Term more of the hinge, in order to keep the syllogizer correctly goal-focused on the predicate of the conclusion (which is the Major Term). As long as the syllogizer does this, he/she won't get disoriented, and totally mess up, thinking that the Major Term is the Minor Term, and changing the Figure and Mood into something radically different from what they are.

d. No B is C
some B is A
some A is not C
(3rd Figure)

e. All C is B
All B is A
some A is C (4thFig.) or...
All C is A (1st Fig.)

f. All C is B
some A isn't B
some A isn't C
(2nd Figure)

4. Given the following syllogisms, write which figure it is, circle the hinge, and then propose a conclusion. If it is a 4th Figure, rearrange the premises to make it into a 1st Figure.

a. No strong things pout.
All horses are strong.
Ans: No horses are pouters.
(1st Figure)

b. All microwave ovens are fast.
Some appliances aren't fast.
Some appliances aren't microwaves.
(2nd Figure)

c. All green things are soothing.
some green things are plants.
some plants are soothing.
(3rd Figure)

d. All stop signs are red.
All red things are unsettling.
All stop signs are unsettling.
(4th Figure made 1st Figure)

5. Given the following figures, identify which statement is the pipe:

a. All men are animals.
All animals are things.
All men are things (1st Fig.).
Ans: All animals are things.

b. Some crickets chirp.
All chirpers are soothing.
Some soothers are crickets(4th).
Ans: All chirpers soothe.

c. All astronauts are oxygen-supplied;
Some space-objects are not oxygen-supplied;
Some space-objects are not astronauts (2nd Figure).
Ans: All astronauts are oxygen-supplied.

d. No horses are cows.
All horses are animals.
Some animals aren't cows.
Ans: All horses are animals. (3rd Fig.)

6. Look at the handout entitled "Valid Moods of the Syllogism (In the Appendix). How many valid moods are there in each figure, not counting those that are really derivatives from another figure?
Ans: There are exactly 4 Moods in each Figure.

7. Which figure is the figure of . . .
a. all negative arguments? Ans: 2nd Figure.
b. all particular arguments? Ans: 3rd Figure.
c. essential arguments? Ans: 4th Figure.
d. existential arguments? Ans: 1st Figure.

8. Which figure is the figure of . . .
a. *Modus Ponens*? Ans: 1st Figure.
b. *Modus Tollens*? Ans: 2nd Figure.
c. addition? Ans: 3rd Figure.
d. subtraction? Ans: 4th Figure.
e. a kind of multiplication (multiplying two concepts)? Ans: 1stFigure.
f. a kind of division (dividing one concept from another)? Ans: 2nd Figure.

Comment [A67]: To identify the pipe, students must first figure out which is the Minor (for the 3rd and 4th figures) or Major (for the 1st and 2nd figures) Premise. You may wish to have the students draw an actual *pipe* around the premise that is the pipe. However to make it most clear what is happening here, you may even wish students to diagram the mood in question (see Handout "The Valid Moods of the Syllogism"), and draw the pipe around the arrow in the diagram which represents the correct premise. When they do this, then they will also be able to clearly see how the conclusion also flows either up or down it.

Comment [A68]: Point out to the students how in the 4th Figure, we 'reverse direction' within the pipe to get our conclusion: Where we just concluded to the word "soothing" at the end of the premises, in the conclusion we now start over with "soothing," and go the other way, back down to "crickets.'

Comment [A69]: Discount Disamis, Datisi, Fresison, and the top half of Fesapo. Ferison and the lower half of Fesapo may be kept.

g. *Modus Ponens* in a material sense? Ans: The 3rd Figure
h. *Modus Tollens* in a material sense? Ans: The 4th Figure.

9. Associate: Which figure is the figure of . . .
a. re-articulation? Ans: The 4th Figure.
b. natural flow? Ans: The 3rd Figure.
c. powerful deductions? Ans: The 1st Figure.
d. *a fortiori* arguments, such as exposing hypocrisy. Ans: 2nd Fig.

4. Higher-Order Reasoning

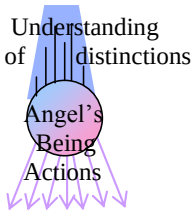


Diagram 3.55

Unless a human has built up a broad, deep, or thorough understanding of some science or art, a human normally considers only one thing—at best, one A-proposition—at a time. By contrast, since an angel's very being is to know and act in a certain respect, they understand all about that kind of being all at once (in all its distinctions), from the very first moment of their existence. This is because angels are gazing upon the face of God, who makes known to them the truth that is necessary to them in one single, unified communication.[128] Seeing this, the angel is able to recognize all implicit distinctions and subtleties instantaneously. Consequently, angels' Intellects are much stronger and faster than humans'.

Comment [A70]: Not with visible eyes (since angels don't have bodily eyes), but with their Intellects.

The human Intellect is slow, because it is discursive.[129] To be discursive, means that it must reason laboriously from one truth to the next, comparing only two truths (or at most *a few* truths) at a time, to see their logical import. One way in which the slow discursiveness of human reasoning can be carefully kept track of, is by means of Truth-tables.

Truth-Tables

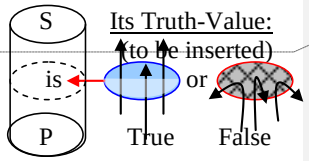
Human beings consider one, two, or at most only a few truths at a time, rather than simply understanding everything at once, tied together in all its distinctions (cf. diagrams 3.6-8, 3.11), the way angels do.[130] Thru Truth-tables, we can begin to understand a little bit of what it must be like to have that direct and integrated vision of truth that is proper to angelic knowledge.

A Truth-table is a means to consider the truth of a complex proposition by means of the truth of its individual parts. In a Truth-table, we build the structure of the complex proposition up from the simple truths that form the parts of its foundation. We will now consider the individual truths that are the basis for a Truth-table.

[128] Aquinas, *Summa*, I.58.1.ad2, I.58.2.c.
[129] Aquinas, *Summa*, I.14.7.c; I.58.3.c.
[130] Aquinas, *Summa*, I.85.5.c; I.79.8.c.

Terms in a Truth-Table

Diagram 3.56



In a Truth-table, rather than thinking of each proposition as an extended-out act of predication, we think only of the truth or falsity that connects the subject to the predicate and as-it-were 'resides' in the copula. Either Truth flows smoothly from subject to predicate (because the predicate is suitable to the subject), or Truth 'bounces off' and is repelled (because something in the predicate repels union with the subject). Therefore even though the proposition is vertically extended out and complex, we can represent it just as a flat, material, 2D cross-section through which the truth must flow. Consequently in Truth-tables we think of and represent the entire complex propositions as just a simple thing with a single variable: (P) or (Q) or (R.) We must not forget however, that each of these single letters represents an entire vertical sentence passing through it (i.e. the whole cylinder in Diagram 3.56, e.g. "Horses are red"). In conclusion then even though sentences are formal things, Truth-tables treat them in a material fashion.

Questions:

1. Does higher-order reasoning involve combining forms or matters?
   Ans: In higher-order reasoning, we are combining complex *forms*, which have complex and dynamic content, and need an entire sentence to be expressed, even though this sentence can also be implicitly represented by the single, material-like copula-word (the "is" or "is not") at its center.
2. Does a Truth-table treat sentences in a material or formal fashion? Ans: Material.
3. In what direction does a Truth-table typically build truth? Ans: Upward.
4. Define "discursive." Ans: Passing from one thing to the next, one at a time.
5. What are some consequences of our thinking being discursive? Ans: We reason slowly (only two truths at a time), we make mistakes, we have trouble getting our mind around complex matters, and we often get lost in the reasoning process (e.g. reasoning in the wrong direction, when trying to solve a math problem).
6. Do angels reason? Explain. Ans: No. Angels do not reason but merely understand even complex situations with simple cognition, by beholding the fact of the matter in God (or in some other angel). Also, an angel is called "an intellect" signifying that it doesn't gaze with bodily eyes, but rather understands through its whole being.

Comment [A71]: If students want to know why the truth arrows point upward in Diagram 3.56, and not downward as truth is supposed to go (as in. Diagram 1.5), remind them that truth is the suitability of the lower back to the higher, so it is showing that P is true of S.

Comment [A72]: You can think of Truth and Falsity as respective permeability or impermeability—openness or closed-ness—to Truth flowing through from subject to predicate (Note the crisscrossed chain-linked-fence pattern, blocking the flow of Truth, within the falsity oval).

Comment [A73]: If they wish, the students can imagine it as 'crushing' or 'compressing' the whole cylinder in Diagram 3.56 into a single, flat circle.

Comment [A74]: It is complex because it has a three parts: (1) a subject, (2) a copula, and (3) a predicate. In crushing it, it becomes simple with just one part: the variable "P" (or "Q").

Comment [A75]: In short, we are dealing with entire complex sentences (made up of three elements: a subject, a copula, and a predicate) as if they were just a single, pure concept, that is, a single thing. In terms of diagramming, we represent the whole cylinder by just the flat cross-section of its copula: Is the Being really flowing through it into the predicate (as "true") or is the statement such that the only way that we can justify it, and make it right is by contradicting it and denying that any Being is really there passing through (i.e. as "false")?

Comment [A76]: Tell the students to watch out for the following possible confusion: The letter "P" is commonly used to refer both to the predicate in a sentence ("S is P"), and to the antecedent part of a conditional statement (If P, then Q, or "If [it is true that] P then [it is true that] Q"). These two uses are completely unrelated, as one is a single term, whereas the other is an entire sentence. Thus the two Ps in circles above (one in diagrams 3.51, 3.54, and 3.56; and the other in the line above this comment) are completely different kinds of things: One represents a predicate whereas the other represents a foreshortened or 'crushed' sentence.

Comment [A77]: It treats them in a material fashion because it considers all the propositions (proposition P, proposition Q, proposition R), without regard to order, or to which comes first essentially in the order of Being. Thus a Truth-table is as-it-were amassing or accumulating a pile of matter (or evidence), in a bottom-up, fashion rather than in a logical top-down fashion. Note: The Truth-table, considering things in a material way, will reach the very same conclusion as a person who considers things in a formal way, deciding which statements are essentially prior. However the Truth-table reaches this conclusion by 'brute force,' that is, by predetermined methods of computation, not by inner comprehension. We will learn how to perform these methods of computation in Section 6.

Comment [A78]: If the students desire more explanation, refer them to Diagram 3.61, in which large complex truths ("If P and not-Q then R.") are built up from simple truths ("P," "not-Q," etc.).

5. Operators in a Truth-Table

There are four common operators in a Truth-table:[131]

Operator	Function	Symbol(s)	Proposition Involved
AND	Conjunction	/\	An I-proposition
OR	Disjunction	\/	An E-proposition
NOT	Negation	–, ´	An O-proposition
IF...THEN...	Conditional	--->	An A-proposition

* In each of the examples above, the predication or positing of a complex statement using that particular operator (And/Or/Not/If...then) involves the corresponding kind of proposition (A/E/I/O) circumstantially present.

IF . . . THEN . . .

An 'If . . . then (a.k.a. "conditional")' statement implies that one thing is necessarily dependent upon some other. The two parts of an 'If-then'-statement are called the antecedent ("If") and the consequent ("then"). The thing dependent (the antecedent) somehow takes its being from or through the consequent. Thus if the antecedent occurs, then we can also be sure that the consequent is already present.

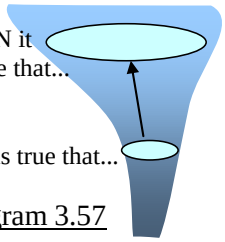


Diagram 3.57

The following all signify an If-then conditional statement:
If P, then Q.
P, only if Q.
Q, given that P.
Q, provided that P.
Q, on condition that P.
P implies Q.
P entails Q.
Q, in the event that P.
Q, in case [that] P.
Q is a necessary condition for P.
P is a sufficient condition for Q.

In addition to the original conditional statement (which we call "positive"), there can also be an inverse, a converse, and a contra-positive. The inverse involves negations of both the antecedent and the consequent; the converse involve swapping of antecedent and consequent; and the contra-positive involves both negations and swapping.

Positive: "If the clock strikes 12, then the spell will be broken."
Inverse: "If the clock doesn't strike 12, the spell will not be broken."
Converse: "If the spell is broken, then the clock has struck 12."
Contra-positive: "If the spell is not broken, then the clock hasn't struck 12."

We find that although in certain circumstances all four may be true (a case of *material identity*), yet this is not always the case. For instance, if the spell might be broken by something else—say striking 11 or 1—the positive would remain true, but the converse

[131] Cf. Flage, *Understanding Logic* (Prentice-Hall, Upper Saddle River, NJ: 1995), 196-197.

Comment [A79]: When you focus on "Some" of something there is always the implication that there is also *more* or *other* of it (cf. "I-propositions" in Diagram 3.40A). This situation or circumstance 'opens the door' for the use of the operator "AND." Thus when you predicate "(___ is ___) AND (___ is ____)," you are positing a complex reality (A larger overriding circle enclosing two smaller circles), *some* of which is one sentence, and *some* of which is the other sentence (cf. Diagram 3.58).

Comment [A80]: In an E-proposition, at least one thing must be here-and-now false: If "No men are horses," then between the two implied statements "It is a man" and "It is a horse," at least one of them is necessarily false, and maybe both. Thus just as an E-proposition expresses negative respect of the other thing's essence (cf. Diagram 3.45), so an OR-statement expresses negative respect of the other thing's existence. Thus any truth for one is automatic falsity for the other, and any falsity for one has no bearing upon the possible falsity of the other.

Comment [A81]: An A-proposition is the height or apex of affirmation, and O contradicts it (cf. Diagram 3.36). Thus by using O-propositions, you are indirectly saying "It is false that . . . [whatever its contradictory affirmation would be]." For instance if a person says "men err" (understood as either A or I) you would be indirectly saying "*It is false that* men err" if you could find the counter-evidence that "some men are not erring" (O). Thus O is an *objection* to the truth of something: It always implies or suggests an earlier-stated proposition th ...

Comment [A82]: When you affirm that "All men are animals" you are saying that "If they are men, then they are animals."

Comment [A83]: We must keep in mind that the antecedent and consequent are *whole statements* (that may be true or false), not individual things. Thus they may have some essential connection to one another (e.g. IF "All men [$\mathbf{S_1}$] are animals [P_1] THEN "All men [$\mathbf{S_1}$] are things [P_2]," in which the same subject occurs in both statements); but they ...

Comment [A84]: Dependent is from Lat. for "hanging down." Hanging down from what? Hanging down from what it is dependent upon. Note in Diagram 3.57 how the 'If' statement is dependent upon (or hanging down from in its being—see blue) the 'Then'-statement. Indeed, we can make an If- ...

Comment [A85]: Note the blue downward flow (growing darker as it goes down) in Diagram 3.57. It might be seem like the "If" should be the cause, and the "Then" the effect (e.g. the chain-reaction represented by the statement "If you roll the ball then the pins will fall."), but this is an If-then statement operating down in the physical realm (which we v ...

Comment [A86]: Point out the arrows in the box below, and ask the students what they signify. [Ans: That the Positive and Contrapositive are equivalent in truth-value (i.e. effectively the same statement); and the Inverse and Converse are equivalent in truth-value.]

Comment [A87]: The four are identical when the spell being broken is caused ONLY by the clock striking 12, and not by anything else.

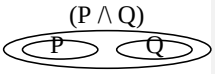
and inverse would be falsified. Thus we find that the positive and contra-positive are always identical, and the inverse and converse are always identical, as is obvious in the following example. This is *formal identity*, when the two sentences are signifying effectively the same situation / state-of-being, regardless of just *how* they express it.

> Positive: "If it is a robin, then it is a bird." ✓
> Inverse: "If it is not a robin, then it is not a bird." ×
> Converse: "If it is a bird, then it is a robin." ×
> Contrapositive: "If it is not a bird, then it is not a robin."✓

As seen in the clock-striking-11-or-1 example, the 'If-then' statement as a whole isn't false just because some other 'If'-condition was offered. The 'If-then' statement as a whole is false only when the 'If'-part is true in these circumstances, but the 'Then'-part is false (e.g. if it were a robin, but not a bird). We see then that it is very hard to disprove an 'If-then' statement, and that it takes a special situation to falsify its stated bond of dependence of one thing upon another.

AND

Diagram 3.58

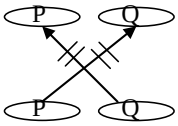


Using the operator 'And,' we are able to simultaneously suggest materially side-by-side parts of some greater unity. Here we have 'added on' in a horizontal direction. The operator 'And' comes from the I-proposition, suggesting that 'And' indicates an *accidental* unity: If it were a substantial unity, you wouldn't use 'And' but one part would *belong to* the other, as happens in an 'If-then'-statement. Since it is accidental, an 'And'-statement is slightly artificial: It exists simply because you *chose* to put these two propositions together, in this way.

The operator 'And' is true only when both parts are true.

OR

Diagram 3.59



The operator 'Or' designates that one of the two possibilities is true, but not both. To indicate that it is 'Exclusive-Or' (with the truth of one excluding the truth of the other), rather than 'Inclusive-Or,' it is also often expressed "Either . . . Or," or "XOR" (with the "X" standing for "Exclusive"). The 'Or'-statement comes from two contradictory affirmations: "If it is P then it is not Q," and "If it is Q then it is not P," or (P <—/—> Q). Here P and Q are at least contraries, and in some cases contradictories. If they are contraries then the 'Or'-statement is somewhat artificial because there is nothing that says that you should oppose these two, rather than two others; however if they are contradictories then the 'Or'-statement is a natural occurrence. 'Or' suggests horizontal respect of one another's essences, but no surrounding unity. Hence a true 'Or'-statement defines P and Q's essences by way of opposition to one another, but doesn't necessarily indicate whether P or Q really exist. In fact, of the two, at least one of the parts is absolutely guaranteed not to exist (or at least not here and now), and thus to be false.

Comment [A88]: This term is misused. Most people say that material identity means a=b, and formal identity means a=a. However material identity should be the more complete and total identity, inasmuch as matter is the source of the repeatable and identical Unit, whereas form is where one thing merges into another. Thus we insist here that a=b should properly be called *formal identity*, and a=a (correlatives)—though it is a much stronger kind of identity—should properly be called *material identity*.

Comment [A89]: For added insight, ask the students, "What is the only way in which the Positive and Contra-positive differ?" [Ans: Returning to the pipe/gun model of Section 3.7.3, the positive flows in one direction through the inside of the pipe, whereas the negative flows in the reverse direction around the outside of the pipe. This is the archetypical difference between *Modus Ponens* (affirming) and *Modus Tollens* (denying, and referring negatively to what is outside).]

Comment [A90]: Actually, it comes from two I-propositions. An I-proposition travels from a large class down into some smaller part of that larger class (Cf. Diagram 3.40). For instance, it travels from Birds to Robins, as in the sentence "Some birds are robins." Just as an I-proposition is vertical (cf. Diagram 3.41), so also this situation can also be described by a vertical AND-statement: "It is a bird [higher] AND it is a robin [lower]." The horizontal AND-statement shown in Diagram 3.58 then comes from two such vertical AND statements: For example, "Robins AND Cardinals" comes from "Birds and Robins" and "Birds and Cardinals." Thus the AND-statement is really primordially *vertically*-downward-directed (like the I-statement), but because of this it is also secondarily and accidentally *horizontally*-directed.

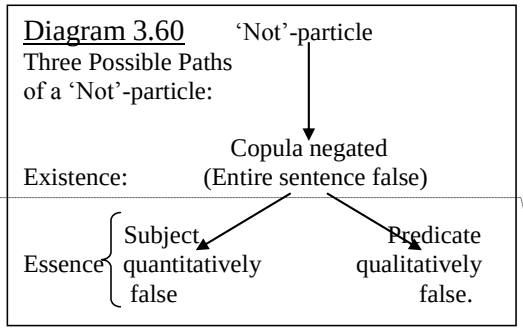
Comment [A91]: Inclusive-Or, indicating that one or the other or both is true, would just be expressed by two side-by-side premises, without any operator between them. By simply affirming both it would be understood that both would be intended to be true, but the possible falsity of one wouldn't rule out, rule in, or imply anything at all about the truth or falsity of the other.

Comment [A92]: Using Diagram 3.59, demonstrate to the students the two negative IF-then statements that make up an OR-statement. Then, if desired point out to them the similarity of these two crossing If-then statements to the two crossing connections of shadow (connecting bad things) or sun (connecting good things) in Diagram 2.50.

Comment [A93]: Although there *may be* some amount of verticalness in their contrary relation (as when you say "No animals [an incidentally high genus] are sodium hypochlorite crystals [an incidentally low species in a completely separate category]"), yet there must *always* be horizontal respect of one another. They must always be this horizontalness because you cannot oppose two crossing 'If . . . Then' statements without having each one's subject *lower* in a certain respect than the other's predicate. This relative lower-ness of each one to the other is expressed in a certain 'dip' or emphasis of the voice: "*If* A, then not B; *If* B, then not A " Thus there is an implicit equality or 'level ...

NOT

When you negate a statement, you place a 'Not'-particle onto it. Primarily, this 'Not'-particle negates the existential part of the sentence, the copula: If you say "Men are strong," then negating it makes it "Men aren't strong." Here the not-particle has attached to the copula, and so you are negating the existence or truth of men being strong. However, when you negate, it is not at first clear which part(s) of it you are negating. You may be negating some part of the statement that is entirely simple, tiny, unimportant, and incidental; but if it is indeed wrong, then its wrong-ness gives you license to negate the whole statement. Thus, alternatively, the 'Not'-particle can simplify its job by simply attaching to (and negating) the essence of either just the subject, or just the predicate. Then it either becomes "Men are not-strong/non-strong" (negating the predicate, but still supposing that 'Men' as a class exist), or it becomes "Not all men are strong." In this latter case, the phrase "Not all" negates the essence of the subject as being a complete universal class. As we remember from Section 3.6.3 on tricky-O, "Not all" is equivalent to the standard O-proposition "some are not." You may later choose to make the further judgment that "No men are strong," but for now the most basic thing that your negation implies is only that "Some men are not strong," which is why 'Not' is fundamentally equivalent to an O-proposition. Thus when you negate a statement, you either state that it is existentially false, or you imply that there is a mistake about its predicate, or you imply that there is an exception to its universality.[132] In any case, there is something wrong with the sentence, and it needs to be reworked in order to become truthful.



Since the 'Not'-particle can go in one of three ways, all of which are internal to the sentence, we represent 'Not' in diagrams by crossing out the central portion of the sentence (see oval above at right). By doing this, we signify that the sentence's integrity doesn't hold together. In logic and Truth-tables, we represent "Not P" as –P or P' (the latter pronounced "P prime").

We see then that two of the operators ('And' and 'Or') perform a mainly *horizontal* function, while two perform an at-least-in-part *vertical* (i.e. formal) function. We see also that two of them ('If-then' and 'Not') represent an *internal* unity (or disunity), and two of them ('And' and 'Or') represent an *external* (dis)unity.

In addition to the four operators described above, there is also commonly used what is called the "Bi-conditional," symbolized <--->, and translated "If and only if." The bi-conditional is short for "(If P then Q) /\ (If Q then P)." The bi-conditional applies to *correlatives* (e.g. "Joe" and "My oldest brother;" or "If Today is Tuesday" <--> "Tomorrow is Wednesday;" etc.).

[132] Ex me. This analysis is my own.

Comment [A94]: For instance, in the statement "Joe Springly, isn't it true that you are a bus-driver and that yesterday you saw a murder committed at 7th and C streets, and it was committed by that man there in the defendant box," Joe could deny it by saying "No, that is not true, I'm not a bus-driver." Thus when you say "No" or "Not" or "That's false" to something, nobody knows what part of the statement you are objecting to, and it may be something extremely trifling and small. The practice of objecting on the basis of something small, and not taking the initiative to tell what part of it you are objecting to (thus forcing them to 'drag it out of you,' if they want it), but just objecting to the whole thing generally because one part of it is wrong is known as Mental Reservation, and is a technique involved in hiding the Truth from those who presumably do not have a right to it (If they did have a right to it, you would be obligated to tell them the whole truth, and not practice mental reservation). Other kinds of mental reservation, involve saying something positive but which has a double-meaning, such that although one understanding of it is in fact true, the other sense of it is misleading (e.g. saying "Where is the money? . . . It's out of my hands," when the money is really in the cash-register drawer, but the person thinks you're saying that you don't have control of it at all). If the listener just assumes that they understand what you mean, and takes it in the wrong sense, you are not then obligated to correct them and show them their mistake, unless they have a right to the information. Total mental reservation involves just staying silent.

Comment [A95]: Here it is really "[Some] Men are not-/non-strong." Consequently pronounce the proposition as if you're merely *admitting* or *objecting*, not as if you're trying to universally categorize 'All men' into the class of 'the strong.'

Comment [A96]: Another piece of corroborative evidence that NOT is equivalent to an O-proposition is the cardinal virtue to which they are both related: Temperance. In Temperance, you don't foreswear the entire enjoyment, but only so much of it as is unhealthy. Thus the spirit of temperance is "Some is Not good for me" (O), not "None of it is good for me" (E). Likewise, the spirit of temperance is expressed in "Oh, no, NOT that [e.g. another helping of food]," not "Either [the chocolate cake] . . . OR [the pie] . . .."

Comment [A97]: 'Or' is horizontal because it is completely material (i.e. not formal)—having to do with the matter of a statement (see round oval, cf. Diagrams 3.59 and 3.38)—and matter is always horizontal.

Comment [A98]: The If-Then statement is clearly vertical, but the NOT-statement might not be so clear. However, since Being comes from above, Non-being (even though it isn't really anything) could also be visualized as coming from above. Thus the NOT-statement, functions mainly vertically (cf. crossed-out parts of Diagram 3.63).

Comment [A99]: Correlatives are a case of material identity, not formal identity (Recall discussion after the second box under the "If-Then" subsection.

Questions:

1. Underline the antecedent and circle the consequent:
   a. If it rains tomorrow, then we won't go skydiving.
   b. If you should look, you would faint.
   c. The dog will like you, *provided that* you feed it something.
   d. Cleaning the house, *entails* washing the floor.
   e. Being president *implies* giving speeches.
   f. *In case* I die, give this to my family.
2. Write the inverse, converse, and contra-positive of the following statements: Of the four, check off (✓) the ones that 'make sense.'
   a. "If today is Tuesday, then Tomorrow is Wednesday." ✓
      I: If today isn't Tues., then tomorrow isn't Wednesday. ✓
      C: If tomorrow is Wednesday, then today is Tuesday. ✓
      CP: If tomorrow isn't Wed., then today isn't Tuesday. ✓
   b. "If you are right, then there is nothing to fear." ✓
      I: If you are not right, then there is something to fear.
      C: If there is nothing to fear, then you are right.
      CP: If there's something to fear, then you're not right. ✓
   c. All tulips are pretty. (First convert it to a conditional statement:)
      P: If it is a tulip, then it is pretty. ✓
      I: If it is not a tulip, then it is not pretty.
      C: If it is pretty, then it is a tulip.
      CP: If it isn't pretty, then it's can't be a tulip.✓
3. Fill in the chart:

Proposition	Operator	Examples
A	IF-THEN	If it is A then it is B. <=> All A is B
E	OR	Either it is A OR it is B <=> No A is B
I	AND	A And B => some A is B
O	NOT	*Not* (A is B) => some A is not B.

4. Give an example of an 'Either-Or' statement which is perfectly valid, but whose part(s) do not yet exist (i.e. at least one is not here true). Write the two 'If-then'-statements that are as its basis (cf. Diagram 3.59). What do you have to do to the consequent (the 'Then'-part) in each of these statements? Ans: "Either today is Friday, or tomorrow it will rain." This implies that (1) "If today is Friday then tomorrow it will NOT rain." (2) "If tomorrow it will rain then today is NOT Friday." In each case you have to negate the consequent.
5. What are the three things that a 'Not'-particle can do?
   Ans: It can negate the existence of the copula, or it can negate the essence of either the subject or of the predicate. If it negates the essence of the subject it tends to negate primarily the quantifier "All" making it "Some are not." If it negates the essence of the predicate, it tends to just negate its quality making it "non-_____."
6. Research project: Write a paragraph about what dialectic is, who historically used it and how it uses 'Either-Or' statements. Ans:

Comment [A100]: This symbol means "implies."

Comment [A101]: By "parts" we mean the two ideas or sentences on either side of the "OR."

Dialectic is the art of opposing two antitheses, and forcing the listener to assent to one of them. By forcing the listener to choose between one of two possibilities, the dialectician forces the listener into a particular conclusion. Traditionally the Sophists would teach in this way, forcing their listeners into conclusions that they were not prepared to affirm. Often they would do it by posing 'False dilemmas,' a kind of fallacy in which it is suggested to the listener that there are only two alternatives, when there are really more. For example, "The Milesians are growing stronger than us. Do you want to be destroyed, or do you want to go attack the Milesians first?" Alternative answer: Hegel was also a philosopher who studied dialectic, and proposed a theory of history, that history is advancing in a dialectic manner.

Comment [A102]: e.g. "Either it is a closed figure, or it is not a closed figure. If it is a closed figure, then either it is a polygon or it is not a polygon. If it is a polygon, then either it is a regular or irregular polygon. If it regular, then either it has an even number of sides or an odd number of sides. If it has an even number of sides, then either it is a right polygon or it is not a right polygon. If it is a right polygon, then it is a square!"

Comment [A103]: Hegel was a 19th century philosopher whose writings indirectly led to Socialism and Communism. He proposed that whenever a thesis is proposed (in art, culture, politics, world opinion, etc.), it is soon followed by an antithesis, and then from the two of these there eventually emerges a kind of synthesis. This synthesis becomes a new thesis, which is opposed by another antithesis, and the process continues on and on.

6. Constructing and Diagramming a Truth-Table

Constructing

To construct a Truth-table, we begin from single simple truths, and then proceed to construct more and more complex statements. To begin with, we make a single column for each of the simple truths involved, and there consider all the different possible combinations of truth or falsity. With two simple truths, one could be true, and the other false; or the first could be false and the other true; or both could be false; or both could be true. Thus from two simple statements (P and Q), there are four different possible combinations of truth and falsity. With three simple statements (P and Q and R) there would be 2^3=8 different possible combinations.

P	Q
T	T
T	F
F	T
F	F

Once we have laid out all the different possibilities, from there we can construct more and more complex statements. Of particular importance is the truth-value of the four operators ('And,' 'Or,' 'If-then,' 'Not') that we already know. These operators function in the following ways:[133]

P	Q	P /\ Q
T	T	T
T	F	F
F	T	F
F	F	F

P	Q	P \/ Q
T	T	T
T	F	T
F	T	T
F	F	F

P	Q	P --> Q
T	T	T
T	F	F
F	T	T
F	F	T

P	P'
T	F
F	T

Here we see that "P /\ Q" is true only when both P is true and Q is true. By contrast "P \/ Q" is true so long as at least one of them is true. The conditional "If P then Q" (P-->Q) is true as a statement in all cases except the special case where the *antecedent* (the "If" part) is true and the *consequent* (the "then" part) is false. Lastly, if "P" is true, "not P" (represented P' or –P) is of course false.

Comment [A104]: The students *must* memorize these.

Comment [A105]: This is not XOR (Exclusive OR), covered in the previous section, but rather just (inclusive) OR. Exclusive OR required that one be true, or the other be true, but not both. Here, we admit the possibility that both might be true, as we can see from the first line of its truth table. Consequently, this kind of OR is a bit more general than the kind which derives from the radical separation of the E-proposition.

Comment [A106]: Short explanation: If the antecedent is false, the statement as a whole is presumed true at least until proven otherwise.

Longer explanation: In general, the 'If-then' statement is false only when the antecedent is true and the consequent false because the consequent may be 'occasioned' by something other than the antecedent. For instance, the statement "If it rains the bugs will disappear" is true even if it doesn't rain, but instead snows, and the bugs equally disappear. It is still true that "if it *should* rain the bugs *would* disappear," regardless of the fact that this time they disappeared because it snowed. Thus given an 'If-then' statement, the only thing we can do is conclude or infer in one direction (from the presence of the antecedent *rightward* to the necessity of the consequent), not vice versa. Only if this rightward kind of inferring fails (by the truthfulness of the antecedence by falsity of the consequent) can the whole 'If-then' statement be called "false."

[133] Cf. Flage, *Understanding Logic* (Prentice-Hall, Upper Saddle River, NJ: 1995), 196-197.

Once we understand how the various operators function, then we can proceed to construct a really complex situation, simply by using them in various combinations:

P	Q	R	Q'	P /\ Q'	(P /\ Q') --> R
T	T	T	F	F	T
T	T	F	F	F	T
T	F	T	T	T	T
T	F	F	T	T	F
F	T	T	F	F	T
F	T	F	F	F	T
F	F	T	T	F	T
F	F	F	T	F	T

"If today is Sunday (P) and it isn't raining (Q'), then tomorrow is a planting day (R)."

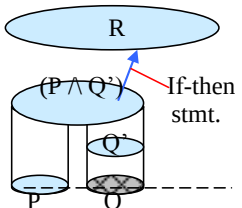
The results show us that the statement is false only when P is true, Q is false and R is false, that is, only when Today is Sunday, it isn't raining, and tomorrow is *not* a planting day.

As we go along, we evaluate the truth of each new column according to truths in the columns we already know (see orange arrows). Once we've figured out a column, then we can treat it as a single unit (as if it weren't complex, but just a simple variable like P or Q or R), for the purposes of including it in larger columns in the future. By treating whole columns as single units (no matter how long its formula is), then at any given time, even though we are really comparing huge formulae, we are really only comparing the truth values of two items whose possible truth-values we have already 'written out' in columns previously done. Thus we advance to complexer and complexer truths in the simplest, most incremental way possible.

Comment [A107]: Tell the students not to try to make too great of a jump at once. Although we might be able to 'skip' making a column for 'not Q' (since it is just the opposite of whatever was in the 'Q' column), we certainly wouldn't skip the column for P /\ Q', because we'd be practically guaranteed to make a mistake somewhere.

Diagramming

Diagram 3.61



The formula "If P and not-Q, then R" is really the above truth-structure.

What is it that we are doing when we construct a Truth-table? We are constructing complex truths from very simple truths that we already know. The foundations—or simple components—of the structure (P, Q, R) are what primarily changes in its truth-value (from true to false, or back to true), and as these change, higher levels that depend upon them may or may not change as their truth is or isn't in turn implicated. We see then that complex propositions involve a certain structure whose truth (true blue or false criss-crossed gray) is dependent on the truth-value of what is below. Now we shouldn't think from this that truth flows upward (it flows downwards); instead we should recognize that many times we need to come to know the truth of the grand whole, through the truth or falsity of its contributing parts.

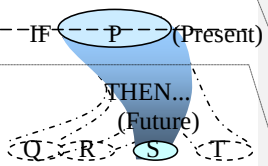
Comment [A108]: One way you can show that it flows downward is that the only time an If-then conditional statement is false, is when the antecedent (lower) is true, but the consequent (higher) is false. The only reason this could be wrong is because truth is having to flow through the higher to the lower, and it is a contradiction to have something false above flowing into what is true below (It wouldn't be able to get there, cf. first comment in Section 3.6.2 above).

As truth flows through a complex proposition, it flows through the entire proposition (or through as much of it as is true) all at once. Consequently in Diagram 3.61, the truth of P is included in the truth of (P /\ Q'); and the truth of (P /\ Q') is included in the truth of R, though perhaps only accidentally and by chance (i.e. hypothetically), rather than necessarily. Reversing direction, the truth of P /\ Q' is also implicitly included in the truth of its respective parts: (first the truth of P; and then the falsity of Q). It doesn't matter that (P /\ Q') it is an artificial unity; we have the ability to

invent concepts and group things artificially, if we so choose. The ability to easily pass vertically up and down in a complex proposition is known as inference.

Intellect in the Physical Realm

Diagram 3.62



If you roll the ball (P), then the pins shall fall (S) [or something else].

Whereas most If-then statements describe spiritual realities that are here-and-now present, some If-then statements describe instances of *physical* causality of something to happen in the future. For instance, "If you roll the ball, then the pins shall fall." This statement describes a result possibly destined to come into being in the future, and not yet present. The causality at work here is efficient causality, as work through the Becoming of a physical chain-reaction, rather than the formal causality of abstract, already-present spiritual Being (as in Diagram 3.61). Thus, If-then statements that describe physical actions, unfold in a downward manner (they have as-it-were 'flipped down' into the physical mindset), and cause smaller and smaller (and less- and less-certain) effects, as described by the process of entropy.

Questions:

1. In the Truth-table above, what columns do Column 5 (P /\ Q') come from? Ans: Column 1 (P) and Column 4 (Q').
2. Make a Truth-table to evaluate the truth of the following statement: "If Either Today isn't Tuesday (P') or it is the 1st week of the month (Q), then the SCA will use the auditorium (R)."

P	Q	R	P'	P' \/ Q	(P' \/ Q)-->R
T	T	T	F	T	T
T	T	F	F	T	F
T	F	T	F	F	T
T	F	F	F	F	T
F	T	T	T	T	T
F	T	F	T	T	F
F	F	T	T	T	T
F	F	F	T	T	F

3. Make a Truth-table of the following situation: "If the cheerleaders have a competition (Q), then they will use the gym (R), *unless* ("If not . . .") the football team is using the gym (P)." Then describe in a complete sentence when this statement will be false.

P	Q	R	Q -> R	P'	P'--> (Q-->R)
T	T	T	T	F	T
T	T	F	F	F	T
T	F	T	T	F	T
T	F	F	T	F	T
F	T	T	T	T	T
F	T	F	F	T	F
F	F	T	T	T	T
F	F	F	T	T	T

Ans: This statement will be false whenever the cheerleaders have a competition, but do not use the gym, and the football team isn't using the gym, either.

Comment [A109]: A Truth-table differs from angelic knowledge in this, that the Truth-table goes where you want it to go and is partially willful, taking time and discursive computation, whereas angelic knowledge instantaneously recognizes the truth of everything that can possibly be inferred from the component parts, as well as what hypothetically might be inferred (by an If-then connection), but not necessarily.

Comment [A110]: E.g. you can infer the truths of "P" and then "Q'" from the single truth "P /\ Q';" or conversely, you could infer the truth of the grand "P and Q'" from the truth of P and the falsity of Q. Thus inference can move vertically in either direction.

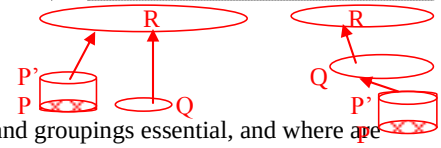
Comment [A111]: Point out to the students in Diagram 3.62 that because of the effects of entropy and chaos (cf. Diagram 1.59), what we intend to cause to happen (S), doesn't always happen, but sometimes something else instead (Q, R, or T). We say that this other thing happened "accidentally."

Comment [A112]: We purposefully use the word "shall" rather than "will," to describe future physical events. We will learn the reason for this later in Section 4.1.3.

Comment [A113]: "Unless" signifies "If not . . ." (cf. Box at the head of the previous section).

4. Evaluate the truth of the statement "((A-->B) ∨ (A—>G)) --> (B or G)." Is it always true? Ans: No. It is false when A is true, but B is false and G is false.

5. Diagram the situations indicated above in questions 2 and 3.



6. Where are If-then statements and groupings essential, and where are they accidental? Ans: In the spiritual realm, both are essential & necessary; in the physical realm, both are accidental.

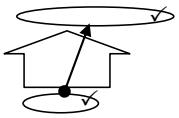
7. How do If-then statements change as they pass into the physical realm? Ans: They become accidental and subject to chance (rather than necessary), because they are now operating by efficient causality and Becoming, rather than by formal causality and Being.

8.Think: How then would AND, OR, and NOT statements appear in the physical realm? Ans: In physical particles bonding (AND), repelling (OR), or containing (NOT). Alternate macroscopic answer: AND would appear as a complex situation, OR as an impossibility, and NOT as the possession of a part.

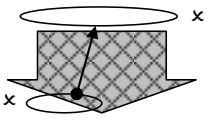
7. Other Kinds of Inference

Reasoning delights in being able to infer many things on the basis of *Modus Ponens* or *Modus Tollens*. In general *Modus Ponens* is an upward deduction, while *Modus Tollens* is a downward deduction. There are at least nine famous rules of inference, five of them here using a form of *Modus Ponens*, and three of them here using a form of *Modus Tollens*.[134] The first two are *M. Ponens* and *M. Tollens* themselves:

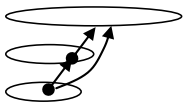
1. *Modus Ponens*
   If P then Q.
   P.
   ∴ Q.



2. *Modus Tollens*
   If P then Q.
   Not Q.
   ∴ Not P.



3. Hypothetical Syllogism
   If P then Q.
   If Q then R.
   ∴ If P then R.



[134] Flage, *Understanding Logic* (Prentice Hall, Upper Saddler River, NJ: 1995), 234.

Comment [A114]: It is suggested that in answering, a truth table be drawn in the margin to assist in figuring it out.

Comment [A115]: Exception: Per se series of causality do occur in the physical realm (cf. the discussion of the Bell inequality in Section 1.4.2), and when this happens, the relationship between cause and effect is not accidental, but essential (or rather, existential).

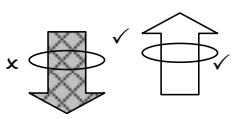
Comment [A116]: 'NOT' contains at least an implicit O-statement ("Some is not"), and maybe an implicit E-statement ("No/none is"). Although if *none* of something is you, you certainly don't possess it, nevertheless if only *some* of something isn't you, then some of it *is* you, and you do possess it! Thus 'NOT' *indirectly* implies containing or possessing something which is part of you. Now something can be part of you either in quantity or in quality (cf. the two lower corners of Diagram 3.60). If it is part of you in quantity, than you possess it as a part. If it is part of you in quality, then it may be coextensive with your matter, but lacks some other forms that are also essential to you. For instance, you possess a vegetable nature, which is coextensive in terms of matter with your body, but it lacks the higher forms of animal-ness and rationality. Thus you possess, a certain vegetable quality within you, but are 'not' a vegetable; likewise you possess a certain animal quality, but you are 'not' an animal; likewise, you possess a certain 3D quality, but are 'not' just a body; and you possess a liver, but are 'not' just a liver. What are you? You are a *human*, for this describes all of the forms and all of the matter within you.

Comment [A117]: Cf. Diagram 1.27.

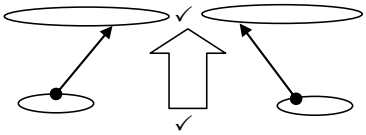
Comment [A118]: In the physical realm, it would be the reverse for *Modus Ponens*: *Modus Ponens* would be a downward action. However, since nothing is certain in the physical realm, the reverse *Modus Tollens* could not operate by means of this downward-directed If-then statement (e.g. Sometimes the pins would not fall [lower effect], even though you did try to roll the ball at them [higher cause], but just missed), because there isn't any necessity in the downward-directed If-then relationships. Rather, in the physical realm, *Modus Tollens* continues to exist in its spiritual mode: E.g. "If that thing there is an arm [lower effect], then it is part of a body [higher cause]; it isn't part of a body; then it must not be an arm." Here, *Modus Tollens* is relying on an upward-directed If-then statement as its pipe (cf. Diagram 3.61 and 3.54), which gives formal present necessity, and therefore enables the reverse *Modus Tollens* inference to be made; it is not relying on a downward If-then relationship (as in Diagram 3.62).

Comment [A119]: When we say "Not Q," we are essentially saying "It is false that [statement Q]." Thus, we use the crossed-out hash-marks for falsity (cf. Diagram 3.61 and the 'Not'-particle shown earlier in Section 5).

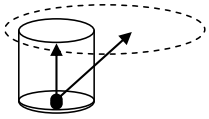
4. Disjunctive Syllogism
Either P or Q.
Not P.
∴ Q.



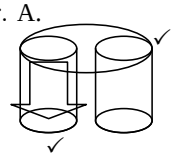
5. Constructive Dilemma
If A then B AND If G then P.
Either A or G.
∴ Either B or P.



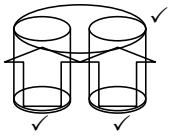
6. Absorption
If A then B.
∴ If A then A AND B.



7. Simplification
A and B.
∴ A.



8. Conjunction
A.
B.
∴ A and B.



9. Addition
A.
∴ A or B.

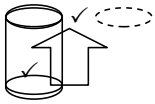


Diagram 3.63

Once you have proved or verified an inference to yourself, then it becomes a theorem (from Gk. for "something seen"). You can even name theorems, and then use them instantaneously—simply by citing their names—without re-proving them again. However it is important to only suppose and use and rely upon those inferences that you actually verify by truth tables. After all, what may appear to you to be a true inference may really be false in some cases.

Examples 1 and 2 above are called conditional syllogisms and respectively are what is usually meant by the phrases "*Modus Ponens*" and "*Modus Tollens*." Although we used these terms in Section 3.7.3 to apply to entire figures of syllogisms, this was not their normal usage. Rather, *M. Ponens* and *M. Tollens* usually refer to just the specifically conditional syllogisms (1 and 2 above), not to whole figures of syllogisms.

Questions:

1. Which of the above ways are *M. Ponens*, and which are *M. Tollens*?
   Ans: 2, 4, and 7 are *M. Tollens* (i.e. downward directed).
2. Use a Truth-table to prove that the following are identical. (1) If P then (Q or R); (2) (If P then Q) or (If P then R).

P	Q	R	Q ∨ R	P--> (Q ∨ R)	P--> Q	P--> R	(P --> Q) ∨ (P--> R)
T	T	T	T	T	T	T	T
T	T	F	T	T	T	F	T
T	F	T	T	T	F	T	T
T	F	F	F	F	F	F	F
F	T	T	T	T	T	T	T
F	T	F	T	T	T	T	T
F	F	T	T	T	T	T	T
F	F	F	F	T	T	T	T

Comment [A120]: The author regrets that this theorem is called "Addition." After all an OR-statement is a higher-order form of an E-statement, which is associated to division (and the 2nd Figure of the syllogism), not addition. Rather, Addition has to do with I-statements and the AND-operator. It is suggested that this theorem instead be called "Expansion," and that the previous theorem #8 be called "Addition," instead.

Comment [A121]: For instance, consider the *Modus Tollens* version of Constructive Dilemma: "(If A then B) AND (If G then P). Not (B or P). Therefore not (A or G)." You might assume that this is true, but if you work it out in a truth table, you will discover that it is false when B and P are false, and either or both of A and G are true.

3. Supply one of the theorems above as a reason to justify each statement in the following proof.

Given: Either P or Q. If P then Q. If Q then R. Not R.
To prove: Either Q or S.

Statements	Reasons
1. If P then Q, If Q then R.	1. Given.
2. If P then R.	2. Hypothetical Syllogism.
3. Not R.	3. Given.
4. Therefore not P.	4. Modus Tollens.
5. But Either P or Q.	5. Given.
6. Therefore Q.	6. Disjunctive Syllogism.
7. Therefore Q or S.	7. Addition.

4. Give statements and reasons to prove the following:

Given: If the child is precocious then she'll go ahead a year. Either the child is precious or normal. If the child is normal she'll get extra attention. This child will not get extra attention.
To prove: The child is precocious and will go ahead a year.

Statements	Reasons.
1. If the child is normal, she'll get extra attention.	1. Given.
2. The child will not be given extra attention.	2. Given.
3. Therefore the child is not normal.	3. M. Tollens.
4. Then the child is precocious.	4. Disj. syll.
5. If the child is precocious, she'll go ahead a year.	5. Given.
6. Therefore she will go ahead a year.	6. M. Ponens.
7. So she's precocious and will go ahead a year.	7. Absorption.

5. Compare and contrast Truth-tables (Question 2) with formal two-column proofs (Questions 3 and 4). Which is better for which purposes? Ans: A Truth-table is better for careful, first-time deduction. A formal two-column proof is faster and more efficient at producing an answer.

Comment [A122]: The purpose in doing this question is just to give students a little experience in doing proofs. It is expected that they will have much more such experience in Logic or Euclidean Geometry.

Chapter VIII. Science

1. Induction, Deduction, and Intuition

So far, we have seen that all Truth comes from and exists as absolutely true, necessary, and essential propositions: A, E, I, or O-statements, or their higher-order derivatives—If-then, OR, AND, or NOT–statements, respectively.[135] Up to this point we have extensively studied how to deduce what truths would theoretically follow from what other truths, and this is an important part of developing good reasoning skills. However just because we can perform mental acrobatics and reason logically, doesn't mean that this is the only way to come to surely know something. There is a second and more ordinary way to come to the knowledge of some fact, and this is from physical evidence, through induction. Induction is a way to come to particular (not universal) truths, based on our own personal experience.

Of the two, one might think that Induction is primary (as if any deduction that can occur must first come from inductively-obtained truths), but this is not really true. Although all knowledge must be obtained *through the senses*, yet all knowledge doesn't have to be obtained *by induction*. Why not? Because sometimes—through Action, and through our Intellect's intuitive understanding of that Action—we come to know a truth or principle as universally true in *this* case, regardless of what other cases might arise. Inasmuch as we know a principle as universally and absolutely true here and now, we can use it as a starting point for deduction, and totally bypass induction and other sampling methods. For instance, one might absent-mindedly cough and, by doing so, come to inwardly know (feeling it 'in one's bones') that "(This) Coughing is good (for me)." The person hasn't taken the time to study all other kinds of coughing (e.g. the deadly diseases of whooping cough or TB), to consider the worst cases in which coughing might occur, but he/she still universally knows that, coughing is something good (i.e. it is a natural bodily reflex that occurs for some important physical reason). As a deeper, more complex instance, a person who has never seen or touched a basketball before, might have a good chance of making a basket on their first try, simply by reflecting upon the ball, getting the 'feel' of it, and realizing (by abstraction) that the ball isn't just a basketball, but more fundamentally a ball and, beyond that, a solid. Thus they would already have ideas about how they ought to shoot it, expecting that it would bounce in a certain way (because it is round), and not collapse when it hits the rim (becuase it is a solid) We see here that a person isn't just intuiting one fact, but intuiting multiple truths, based on abstraction and then simple and pure reflection upon each of its abstracted aspects. This simple and pure reflection, this entering of one's mind into the situation or

[135] Aristotle calls these absolutely true propositions (absolute inasmuch as they are in the spiritual realm), "universal [law]s." By this he doesn't mean that they concern a universal (A or E propositions), but that they are true always and everywhere. Thus Aristotle would consider it a "universal," that "Some men are Celtic." This proposition is a particular proposition ("Some"), but it is universal, inasmuch as it is absolutely true, i.e. always and everywhere (Cf. Section 3.6.6 and Diagram 3.67 on how "always and everywhere" is the universal quantifier in the material realm). Conversely an uncertain, tenative, and/or hypothetical proposition (e.g. "Maybe my letter will come today), would not be a universal to him. Aristotle, *Metaphysica*, III:6 (1003a14); cf. the basis for this in *Analytica Posteriora*, II:19 (100a16-b1), where he talks of even the apprehension of a single thing as "the earliest universal" in the soul.

Comment [A123]: Induction and Deduction come from Lat. for "leading toward" and "leading from."

Comment [A124]: Ask the students: "What is a 'particular truth?'" [Ans: An I- or O-proposition] "What is a 'universal truth,'" [Ans: An A- or E-proposition].

Comment [A125]: Knowledge can be occasioned by sensation, but still be deductive. For instance, if I see a ball, and abstract its shape from it, and then deduce that any point on the surface of it would be equidistant from the center, I have not seen the center, but I have deduced something universally true about all balls, just from having seen this one. Thus (to use a term in the box below) a priori knowledge arises *indirectly* from sensation, in those who have true spiritual intellects, i.e. humans. This is different from a posteriori knowledge which emerges directly from sensation and—in a certain sense, i.e. switched into the spiritual mindset as an I-proposition—is one with the sensation itself.

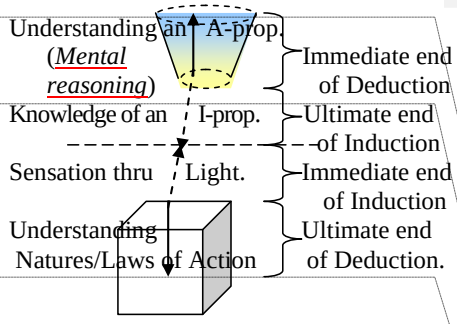
Comment [A126]: Although the actions themselves are outgoing (in the manner of diagrams 2.14, 2.22, and 2.34), the experience and sensation and subsequent knowledge of what it is like to do that action is incoming. Because this experiential knowledge is a direct and necessary result of performing the action (rather than a merely possible result), it is inherently deductive rather than inductive.

Comment [A127]: It is as if one were to think: "I did this action, and it worked here, and was successful, and so I know that the principle of it worked here, in this case . . . . but I could have performed this action absolutely anywhere else, instead, and thus the principle behind this action is universally true, no matter where it occurs." Only Action enables one to draw this universal conclusion; conversely Sensation is always of something particular. Thus the Senses may be deceiving, but Action is not.

Comment [A128]: In physics language we say that "the angle of incidence [by which it hits the backboard], equals the angle of reflection [by which it bounces off the backboard]."

object, and most especially into its abstracted aspects, is called Intuition. As we have seen and shall see again in Diagram 3.67, this kind of reflection is enormously strengthened by a single successful action (rather than just reflective sensation). However, even without such action (i.e. just by careful reflection), one can still often recognize most of the several truth(s) involved. After all, there are certain laws and characteristics accompanying each of the levels of abstraction, and the person who knows these characteristics will deduce how the thing naturally functions, as we saw in the basketball example. Thus, either by reflecting, or just by rapidly doing and causing things (using a downward form of If-then causality, cf. Diagram 3.62), we gain intuitive experience of the things we are using, and are thence able to deductively infer many other truths about them.

Induction Diagram 3.64



Induction is a passage from things to concepts; Deduction is a passage from concepts back ultimately to individual things.[137]

What then is Induction? Induction is a way by which we use our senses to apprehend diverse facts, and from those facts conclude to an accidental (i.e. not necessary, nor always and everywhere) conclusion, i.e. to an I- or O-proposition.[136] In Induction we enumerate a sufficient number of particulars or individuals until we are satisfied that they illustrate a sufficiently broad spiritual truth, and then we declare that particular truth based upon the evidence that we found among the individuals. Induction, however, is generally incomplete and unsatisfactory for coming to *universal* truths. For instance, if you can discover that "This tree drops its leaves, that tree drops its leaves, those trees drop their leaves, etc.," at some point you might come to expect that "*All* trees drop their leaves." However, this does not really follow, and is in fact a fallacy of overextension. After all, how do you know that there might not be a tree or class of trees which don't drop their leaves (e.g. conifers), and which you haven't yet encountered? Thus sampling and polling and other inductive methods are generally unsatisfactory ways for making dependable advances in scientific knowledge;[138] at best, they can only affirm that something is the case probably or most of the time, at least as represented in these particular cases.

To legitimize induction, and make it worthwhile, there must be prior (a priori) understandings in the mind, and this understanding usually takes the form of previously deductively discovered truths. In other words, there must be a pre-existent framework in the Intellect, in which to place any inductively obtained data and their consequent

[136] Cf. Aristotle, *Analytica Posteriora*, I:1 (71a8), I:13 (78a34-35).
[137] Aristotle, *Topica*, I:12 (105a13); cf. *Analytica Posteriora*, II:19 (100a11, b4).
[138] Note here that we are talking strictly about advances in scientific knowledge, what modern scientists would call new "laws." Scientific knowledge demands absolute accuracy. However, as regards lesser endeavors, other less rigorous kinds of knowledge ("often, and for the most part") are good enough. Cf. Aristotle, *Ethica Nicomachea*, I:3 (1094b19-27). It would be an impractical mistake to demand scientific levels of proof in all things, just as nearly all philosophers from Descartes (1637) to Kant (1781) did.

Comment [A129]: This is why people sometimes discover and invent things just by having gotten lucky, and done it *once*, by accident. This is how things like the magnetic compass and the microwave were invented (When a person walked in front of a powerful naval radar, and it melted the candy-bar in his pocket.). Ask the students to think of other things which were invented before the science explaining them was understood.

Comment [A130]: The philosophical term for accompanying is "concomitant." These are concomitant properties, accompanying a certain level of abstraction into the thing's essence. Examples of concomitant properties of mammalian-ness would be milk-producing, hair-having, etc.

Comment [A131]: Thus, people can deductively figure out certain systems and mazes and logic puzzles, merely by doing: They rapidly try different things, in a way that is intuitive, prudent and probing, but by no means systematic, comprehensive and total (as you would in an induction). In so doing, they eventually discover its algorithm, that is the inner secret of its functioning, and thereby understand it through and through, even though they never performed a systematic induction. This is how people solve things like rubriks cubes and chord- ...

Comment [A132]: Indeed, most brilliant inventions occur by deduction and the figuring out of algorithms, rather than by induction and controlled, systematic experiments.

Comment [A133]: In Diagram 3.64, tell the students that Deduction really contains particular I-propositions, too, but the diagram is just showing what is essential to deduction and/or induction, i.e. the capacities in which they are unique are most ...

Comment [A134]: Point out to the students in Diagram 3.64, how in the spiritual realm, the arrow of induction points downward, i.e. in the same standard direction as an I-proposition (cf. Diagram 3.41). By contrast, the arrow of deduction points ...

Comment [A135]: What you really should say, is "All these trees (of this kind of deciduous nature) drop their leaves." Thus you connect the external observation to the correct internal principle: deciduousness, not tree-ness. However, because ...

Comment [A136]: Point out to the students that sampling and polling are generally horizontal ways of gathering evidence, not vertical ways. Consequently they cannot be definitively relied upon

Comment [A137]: This follows from the fact that induction only proves particular (I or E) propositions, not universal (A or E) ones. Cf. Last footnote of Section 3.6.4. In Diagram 3.65, an advance in scientific knowledge would be ...

Comment [A138]: The terms "a priori" and "a posteriori" were largely popularized by Immanuel Kant (1724-1804 AD), who used them to describe knowledge before, or after experience.

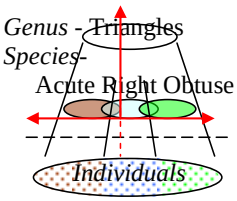
Comment [A139]: Deductively known truth is like a wall of mailboxes, with all its empty but possible distinctions; inductively-obtained truth is like the letters that you file into those mailboxes, i.e. particular instances.

conclusions. After all, what good is it to sample and discover that about 52% of the voters in one's district are Democrats, if one doesn't yet have the bigger picture of what sorts of Democrats they are, what issues are at stake, how big the district's population and potential power-base is, etc.? Inductive evidence then becomes much more valuable when it can reflect upon and illuminate things already known. However just by itself—i.e. to one existing in a blind vacuum—inductive evidence can be comparatively useless. An induction is then complete, when it occurs in the context of deduction (see Diagram 3.65).[139] Deduction surveys the limits of the subject, and tells one something about all the major classes and subclasses that it contains, and how they operate; guided by this deductive knowledge, induction can then methodically sample all these major species or sub-groups available. When an induction is incomplete, it samples at random, but samples enough to feel (justly-or-not) that its conclusions are nevertheless warranted.

A priori (Lat. "from what is earlier") is knowledge which is the fruit of past deductions. It is knowledge of universal axioms and laws, as well as any infused knowledge, or blindly accepted and believed truths. In sum, it is knowledge which *precedes* experience of the evidence.

A posteriori (Lat. "from what is later, or consequent") is knowledge which occurs *after*, and *because of* having had experience of the evidence. It is knowledge of individual facts, resultant *hypotheses and theses*, and anything based upon induction, rather than deduction.

Diagram 3.65



A Complete Inductive Argument (*Deductively Assisted*):

Statements	Reasons
These acute triangles add to 180°	Inductive Experience
These right triangles add to 180 °	Inductive Experience
These obtuse triangles add to 180 °	Inductive Experience
BUT Triangles are/have/consist of only those that are acute, right, or obtuse.	Deductively known consideration
All triangles (probably) add to 180 °.	Conclusion

Deduction

Deduction is a way by which, from truths already known, we may with certainty conclude to new truths.[140] Deduction is an activity in which rationality/reasoning (and the 19 syllogisms covered in Chapter VII) is the *means*, both of coming to new truths, and of effective action (cf. bottom halves of diagrams 3.64 and 3.67). Unlike induction, the truths uncovered in deduction are necessary and essential—as essential as the premises are—and may be universal (if the premises are universal). In deduction we uncover universal laws of nature that are known by us in the spiritual realm, and consequently can be imagined and dependably acted upon in the physical realm.

Animals cannot deduce (nor imagine things inside of other things), because it would require them to be able to intuitively understand natures in themselves. An animal

[139] Ex me. This idea for legitimizing induction is originally my own.
[140] Aristotle, *Analytica Priora*, I:1 (24b19).

Comment [A140]: such as animals, who do not have the illuminating light of the intellect.

Comment [A141]: The field of statistics, often used in polling, studies when it is warranted to make a statement.

Comment [A142]: Remind the students that 5 of the 19 syllogisms prove universal propositions, esp. Barbara which alone proves a universal affirmative "A-proposition." Thus it is possible to deduce universal truths; it is not possible to induce universal truths (or, if so, only incompletely).

Because it isn't possible to *in*duce universal truths, many scientists and academics (who use induction in the scientific method), believe in Relativism, i.e. that there is no universal and eternal truth out there. However, what they are forgetting is that there is one syllogism—Barbara—which certainly proves higher universal truths, and that this certainty of the universal conclusion is not inductive at all (following the scientific method), but deductive (only on one's powers of apprehension and abstraction). Thus there are indeed universal truths, and they are immediately available to every human intellect.

Comment [A143]: i.e. through a syllogism of, not speculative reason, but practical Reason.

Comment [A144]: Often these universal laws of nature are not just physical laws, nor just sensate laws of electricity and light, but applications of the highest rational laws down into the sensate or physical levels. For instance, in the Barbara syllogism, "All beings get their being from outside themselves" [a Rational law], all giraffes are beings [intuition], therefore "All giraffes must eat [i.e. to get their being from outside themselves]," one is knowing the necessity to eat *as an instance* of the broader principle of all things' needs to acquire their being from outside themselves.

Comment [A145]: For this, they would need a true, fully spiritual (i.e. rational) Intellect.

can look into another creature and know it as a certain sensate and physical phenomenon, but the animal cannot look into it and know it *as a fully spiritual* (i.e. non-material) *being/nature*, because animals have no fully spiritual soul. Thus animals induce and become aware of particular present situations, but they do not deduce, because although they gain experience about many physical things and patterns in life, yet they do not think of them in absolute or universal terms.[141]

Comparing Induction and Deduction

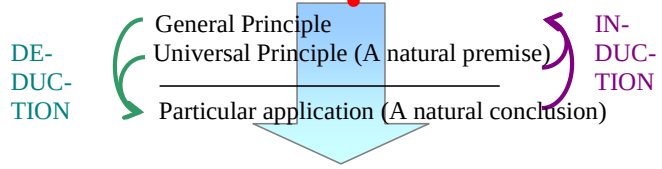
The end of induction is rationality/Reason, i.e. to rise to the knowledge of a particular truth (an I-or O-proposition) from prior physical evidence (cf. Diagram 3.64). Conversely, the ends of deduction travel in the opposite direction.[142] The *immediate* end of deduction is to discover new truths (sometimes higher, universal ones, but more often lower, particular instances or applications of those higher truths, which is why sometimes induction and deduction can both uncover the same I- or O- truths). However, the *ultimate* end of deduction is practicality, i.e. to cross back into the physical realm and figure out how we and other things (should) act, based on what we already know about their spiritual natures. Thus induction begins in the practical and leads to the speculative, whereas deduction begins in the speculative and leads back to the physical (cf. Diagram 3.64).

Induction yields knowledge of the fact, when you can state *that* something is the case.	Proof of the fact is called "*Quia demonstration*" ("*Quia*" is Lat. for "that.")
Deduction yields knowledge of the reasoned fact, when you can state *that* something is the case, and *why* (or for what higher reason) it is the case. You know you have the reasoned fact when the premises truly *cause* the conclusion, i.e. when you can state "__[The conclusion]__ *because* __[Premise 1]__ and __[Premise 2]__."	Proof of the reasoned fact is called "*Propter Quid* demonstration" ("*Propter Quid*" is Lat. for "for the sake of what [higher reason]").[143]
☞Why do you think induction only gives the fact?	

Induction and Deduction can also be distinguished by how they appear in the syllogism. In deduction we begin from what are usually broad, and general principles and, combining them as premises, we obtain unique conclusions that usually apply to specific

The Natural Flow of Argument:

Diagram 3.66



Comment [A146]: i.e. the spiritual, rational realm, *above* the dashed line.

Comment [A147]: (also the realm of practicality and action).

[141] Cf. Aquinas, *Summa*, I-II.11.2.c; Aristotle, *Analytica Posteriora*, II:19 (100a6-7, 16-17).
[142] Ex me. This description of induction versus deduction, esp. as represented in Diagram 3.64, is my own .
[143] Aristotle, *Analytica Posteriora*, I:13. Cf. Aquinas, *Summa*, I.2.2.c.

circumstances or situations. However, in induction things reverse and go in an unnatural direction. In Induction, we begin from what should naturally be the conclusion—but is instead used in induction as a premise—and we conclude to what is naturally a premise—though induction sees it as a conclusion.[144] The reason for this is that whereas deduction is clearer in itself, induction is clearer to us.[145]

Questions:

1. What is a priori knowledge? What is a posteriori knowledge? Ans: A priori knowledge that is the result of deductione; a posteriori is the result of induction. Alternate answer; A priori is knowledge obtained before or absent from experience of the physical evidence; a posteriori is knowledge obtained after and because of experiencing the physical evidence.
2. Of the four propositions, which can be obtained inductively, and which must be obtained deductively? Ans: A and E must be obtained deductively; I and O can be obtained inductively.
3. What are some major differences between induction and deduction? Ans: Deduction considers things in their own natures; induction concerns appearances. Deduction yields knowledge of the reasoned fact; induction only knowledge of the fact. Deduction follows the natural flow of argument/causality; induction goes against it. Deduction is clearer in itself; induction is clearer to us. Deduction uses apprehension and understanding; induction uses only sensation. Deduction passes from the spiritual to the physical (and does so perfectly); induction passes from the physical to the spiritual (and does so imperfectly). Deduction enables sure action and imagination; induction enables only unsure actions and incomplete imagery.
4. Circle the correct answer: Induction occurs by inference that is (sufficient/necessary); deduction occurs by inference that is (sufficient/necessary). Ans: Ind. is sufficient; ded. is necessary.
5. Do(es) induction or deduction pass into the opposite realm? Ans: Both.
6. Explain the maxim "Show don't tell." Ans: Showing has to do with inducing, telling with deducing. If you show someone something, they are more inclined to remember it and the reasons for why it has to be the way it is, than if you merely tell them about it.
7. Think: If you are inducting and trying to draw conclusions and you are examining individuals, does it matter which or how many individuals you sample? What is the best policy? Ans: Yes; you should sample a representative number of individuals from every class and you must leave out no sub-classes (for example even if you poll from every state, you can't claim to speak for the entire nation if the only people you polled were *men*).
8. Using Diagram 3.65 as a model, write the proper deductive argument

[144] Aristotle, *Analytica Priora*, II:23 (68b15f,33-35).
[145] Aristotle, *Analytica Priora*, II:23 (68b35-36).

Comment [A148]: To help the students understand Diagram 3.66, it may help to take the students through the twinkling planets example, offered by Aristotle in *Analytica Posteriora*, I:13. Ask the students to think about what is really causing what: Does lack of twinkling cause nearness, or does nearness cause lack of twinkling? Then take them through the two syllogisms offered (78a30-b2), and asked them to decide which is the more correct syllogism.

Comment [A149]: It should be a conclusion inasmuch as it is a more particular application, a broad, general principle as most premises should be. It should also be a conclusion inasmuch as it naturally follows from the other two statements, not they from it.

Comment [A150]: It is clearer (or in Aristotle's words, "more knowable") *in itself* because the universal principles in themselves, being more ethereal and absolute, more naturally produce undeniable conclusions. After all, you don't even need to see the evidence to recognize the cogency of a deductive argument.

Comment [A151]: It is clearer (or in Aristotle's words, "more knowable")*to us* because we are physical-minded, and so we more naturally assent to the truth of particular statements and facts, than to broad, sweeping, universal principles (which, because they seem so otherworldly and absolute, perhaps scare us a little bit).

Comment [A152]: In answer to the question posed in the box, induction only gives knowledge of the fact, because it figures thing out in a backward, reversed way, not in the way that the natural flow of causality causes things to occur (see the blue in Diagram 3.66).

Comment [A153]: Have the students compare this inductive argument to the one on the previous page. How are they different?

Comment [A154]: In A and E, we are rising from a species (e.g. "robins") to a genus ("birds") to the genus that contains it. Relative to one another, the species is here a particular part of the genus, and the genus a universal quality in the species. Thus the syllogisms which use A-propositions (such as "Barbara") though in themselves deductive, nevertheless have premises which had to be inductively obtained.

Comment [A155]: Deduction passes from the spiritual realm into the physical when a deduced truth enables one to *predict* how physical reality will act. Deduction passes from the physical realm into the spiritual realm when one's necessary experience of one's own actions convinces oneself of some higher spiritual truth (e.g. that "Coughing is good."). Induction passes from the physical realm into the spiritual realm when the horizontal sampling of physical evidence indicates some particular spiritual truth.

Comment [A156]: However it is also necessary later to tell them about it, too, so that they may understand the principle of it, and may use it dependably in their own deductions.

that corresponds to the inductive one in Diagram 3.65. Ans:

Statements	Reasons
All triangles add to 180°.	Universal principle
BUT Triangles are/have/consist of only those that are acute, right, or obtuse.	Deductively known consideration
Acute triangles add to 180°	Conclusion
Right triangles add to 180°	Conclusion
Obtuse triangles add to 180°	Conclusion

9. Can animals deduce and/or induce? Why or why not? Ans: Animals can only induce (or recognize particular facts) because it relies only upon sensation/instinct; animals cannot deduce (nor recognize universal facts), because it relies upon rational (fully spiritual) understanding.
10. Why can deduction uncover both universal (A and E) and particular (I and O) principles? Ans: Because 5 (Barbara + the 4 negative syllogisms) of the 19 syllogisms yield universal conclusions; the other 14 syllogisms yield particular conclusions.
11. Does empirical science and the scientific method more use induction or deduction? Ans: Induction.
12. In the realm of human knowledge can inductively-obtained conclusions stand by themselves? Ans: No, to indicate something universal (i.e. some sure principle), they always require the assistance or framework of deductively-obtained universal truths.

Comment [A157]: This is why all the scientists are called "Doctors of Philosophy" (Ph.D.). They must first understand philosophy, and proper deductive reasoning (i.e. logic and math) and only then apply the inductive conclusions of their particular field.

2. The Term "Science"

Logic defines the inner workings of reasoning, but the establishment of a science as a complex structure in the mind is the place where reasoning bears its real fruit. Thus we naturally consider sciences next.

The common understanding of "Science," as the term is used today is different from what it meant, classically. Today when we speak of "Science" we mean empirical science, namely, anything that can be proved by experimental and repeatable methods. Thus today we talk only about chemistry, physics and, at the extreme, such things as experimental psychology as being "sciences." This empirical notion of "science" is based on the principle of complete induction, that when you survey all the possible explanations for a fact, and test each one, you can inductively prove which one of them is the higher explanation or reason (*ratio*) for a certain observed phenomenon. This idea of "Science" came into fruition only relatively recently by the publication of a textbook of accepted methods and criteria for establishing truth, by J.S. Mill (1806-1873).[146]

However, the older classical meaning of a science was based instead on the principle of Deduction. To the classicists, a science was any ordered body of knowledge in which lower truths would depend upon and hang from (and thus be deduce-able from) higher truths. Thus by the classical meaning of the term, there could be a science of

[146] John Stuart Mill, *A System of Logic* (Longmans, London: 1925).

"rhetoric" or "grammar" or "concrete mixing," or "sailing" or "growing vegetables," etc. It didn't mean that you had to take measurements and quantify amounts in order to have a science. Indeed even such things as "prayer" and "devotion" and "self-discipline" and "governing" could all be called 'sciences' (e.g. "the science of the spiritual life"), if you truly knew what you were doing in them. In short, anything that you 'knew' in an ordered way could be called a science. It is this classical and rational meaning of a science that we will study below, in order to establish just how we come to know new truths.

The classical idea of a science was focused on obtaining epistematic knowledge (or episteme). You had obtained epistematic knowledge of something when you had truly 'gotten your mind around it' so that there were no more questions to be asked about it. Episteme (from Gk. for "standing upon") is had when you know not only all there is to know in the science, but also what each thing stands (or depends) upon. In other words it is when you both know and understand at the same time (cf. diagrams 3.11, 3.6). When you have epistematic knowledge, if anybody asks you a question you can answer it in the best way possible, because you know all the 'why's,' that is, you know *immediately* which fact(s) it comes from. Ultimately all sciences 'rest upon' (in the physical mindset) or 'hang from' (in the spiritual mindset) the first principles, which are usually very generalized and universal statements that are affirmed because of massive amounts of experimentation and study (e.g. not just swans and horses, but universally *all animals* are . . .). Today, empirical science no longer talks about "first principles," but instead speaks of "laws," which are often formulated in a mathematical equation. However, the two are the same thing, one occurring in a logical context, and the other occurring in a physical context (as when we speak of 'the laws of physics').

The above distinction between Principles and Laws is part and parcel of the larger distinction between the modern empirical sciences and traditional rational science (episteme), as described above. These two fields or formats of science are not opposed to each other, as many people think, but should rather compliment each other, as we shall see in the next section. Empirical science is the fruitful source of new observations and facts, and rational science is like the library where all these facts get codified and put into their proper places. Thru syllogistic reasoning process (which we learned in Ch. 7), we can then deduce new facts which will enable us to return back into the empirical realm, better understanding how various natures there function (Cf. Diagram 3.64); here we are entering into the field of reason-informed art and skill, and the applications of technology (from Gk. techne, or "art"). Understanding how to act there in the physical realm will also enable us to more effectively experiment in the future (so as to expand the horizons of Science). Thus there is a kind of closed loop (travelling counter-clockwise in Diagram 2.42), by which the various sciences assist each other.

Recently (within the last 150 years), there has been much debate and wrangling over what constitutes a science, and how we even come to know in the first place.[147] Empiricists point out that all knowledge comes from observation and physical evidence, and so they advocate massive (often expensive) research programs; however they are often ineffective at qualitatively assessing their evidence, and figuring out just exactly

Comment [A158]: This is the root meaning of the word. "Science" is from the Lat. present participle *sciens*, meaning "knowing."

Comment [A159]: επιστημη is a Greek word pronounced "epi-STAY-MAY," meaning "standing upon." The etas (η) are hard e's pronounced in English as hard a's.

Comment [A160]: In Step (4) in Diagram 3.65, the farthlest left thing hangs or 'depends upon' what is immediately to the right of it; and that hangs or 'depends' from what is immediately to the right of it, etc.

Comment [A161]: We might say that you then know it "backwards and forwards." Recall (cf. diagrams 3.6 and 3.11) that knowing is a simple downward process, whereas understanding is a complex upward process. Combine the two and they form a very rigid structure. The knowledge provides the strength, while the understanding determines what goes where.

Comment [A162]: "Immediately" (from Lat. *im-* "not" + *medium* "middle") means that there is no other fact in between the fact in question and its cause. For instance if I ask you "Why do you have the genes that you do?" you could either answer "Because my father had the genes he had, and my mother had the genes she had." Or you could answer "Because my grandfather had the genes he had, and my grandmother . . . (etc)." Here your father and mother are the *immediate cause*, whereas your grandparents would be called the mediated, removed, or *remote cause*).

Comment [A163]: This is the etymology of "depend," from Lat. *de* "down from" + *pendere* "to hang."

Comment [A164]: Cf. the lower-left quadrant of Diagram 2.42, about operative virtues as the practical arts.

Comment [A165]: A case-example of this is the dispute among physicists about how to discover new things about sub-atomic particles. One group wants to build bigger and bigger super-colliders (large circular tracks buried under whole cities and mountainsides in places like Geneva, Switzerland, and Dallas, Texas), each significantly more expensive than those that came before. The other group wants to find other ways (mostly theoretical ones), to compare what we already know and try to solve GUT (Grand Unified Theory), thereby explaining all the particles at once. One side is digging deep; the other is thinking high. Both sides are trying to get at the same answers. Which group is ultimately successful, probably depends upon whether what we already know is enough to solve things, or whether there are key parts of the puzzle that are still missing.

[147] Two books that codify and have compiled much of this modern debate are W.H. Newton-Smith, *The Rationality of Science*, (Routledge, London:1999); and E.D. Klemke, ed., *Contemporary Analytic and Linguistic Philosophies*, 2nd ed. (Prometheus Books: Amherst, NY: 2000).

what it signifies, and no more. Rationalists retort that they know what they know, independent of any physical evidence, and therefore bear suspicion toward anyone who might upset the current worldview with a new discovery. Both these sides are wrong, because both sides *need* the other. Empiricists who specialize in gathering quantity (of evidence) need rationalists to ensure proper processing and reflection upon that evidence, so as to accurately decide just what it does or doesn't signify (i.e. what the 'upshot' of it is); empiricists also need rationalists to analyze the evidence and give them direction and new hypotheses about how to more efficiently experiment in the future. Rationalists who specialize in honing quality (of their worldview), need empiricists to ground them in reality when they stray from it, and to remind them of just how vibrant and extensive the world is, and thus how vast the sea of potentially fruitful answers—and applications—really is. Thus science is really a two-part game, and a true scientist will excel in both fields (experimentation, as well as higher theory).

Questions:

1. What is the difference between a law and a principle? Ans: They are the same, except that the principle is how it exists in the abstract, as what it is, in the spiritual realm; whereas the law is an expression of how it functions in reality, in the physical realm.
2. Pick one field of study, and describe the differences by which modern and classical science would approach investigating it. Ans: Experimental psychology. Modern science would put the person under observation and regard as solid only things proven by inductive experimental evidence. Classical psychology would regard what various wise men had said by their own self-introspection (e.g. Plato, Aristotle, Augustine), and then try to deductively reconcile their perspectives into some unified corpus or system of understanding.
3. What is episteme? What does it mean, and when do you possess it? Ans: Episteme (from Gk. For "standing upon") is the state of knowledge when you both know and understand, that is, when you know all there is to know in some field, and also understand how and why those interrelate to one another..

Comment [A166]: Empiricists often want to over-state the importance of their findings, by extrapolating the patterns they've found, far beyond the horizon of what their discovery actually implies, so as to speculate about things (e.g. life, philosophy, religion) which are totally unrelated to what they're studying, and which may operate by quite different laws. A key example of this is the over-extrapolation of the Darwinian theory (which was quite effective for describing things within the field of Biology) to things like Social Science and Politics (as "Social Darwinism"), which quite rightfully should not operate at all under Darwinian principles because of a key difference between how beasts and humans operate, namely, that humans have Free Will (and hence Love and Mercy). The results were disastrous: Socialism ("the death of creativity"), Nazism ("the survival of the fittest"), and Materialism (the will to wastefully consume up all the natural resources).

Comment [A167]: The error to be avoided here, is to not just 'go into the lab,' and start indiscriminately experimenting upon everything in the same way. Often the scope of a controlled experiment can be narrowed to just exactly what one wants to test

Comment [A168]: Rationalists often become 'hung up' and fixated on a worldview or belief that particularly pleases them (often which they themselves invented); however a well-aimed piece of contrary (or even just oppositely-tending) empirical evidence can shatter the illusion (or exaggeration), and force them to reassess their position (or broaden their horizons) so as to integrate the new facts.

3. Science Itself.

The Objects

The 'material object *quid*' of a science is the material thing(s)—the 'whats' (Lat. *quid*)—that it studies.[148]

The 'formal object *quo*' of a science is one's method of investigating, with special attention paid to

Some possible formal objects:
- Sight or touch
- radar or sonar waves
- methods of investigation (psychology vs. psychiatry)
- the light of divine faith

Comment [A169]: The Lat. word for "what" is *quid*.

[148] Aristotle, *Analytica Posteriora*, I:28 (87a38f).

'how' (Lat. *quo*) one goes about it.[149] The formal object of a science might be, for instance, everything that is investigable by means of a microscope. The invention of a new tool can thus cause a whole new science because it can cast a whole new light upon things.

Comment [A170]: Quo is the ablative of the relative pronoun. Thus it could be translated "by which," as in that *by means of which* you study something.

The Foundation: Axioms and Postulates

To correctly orient a science in the realm of Being, we have things called axioms which are formulations that are so basic, that they tie a science into one of the four Transcendentals, which are ultimately the most basic principles in this universe. Because they are so closely related to Transcendentals, axioms (from Gk. "worthy," as in 'worthy to be believed'[150]) are naturally self-evident: You don't need to check them because anyone in their right mind could not possibly doubt them. Indeed, axioms flow from the nature of Transcendentals, and are consequently fundamental to making rational argument even be possible, and so are naturally understood and recognized.[151]

Comment [A171]: Axioms are things that are so simple that they do not need to be taught, but are habitually believed and recognized. They generally have to do with one of the Four Transcendentals.

Examples of some axioms (along with the particular Transcendental that they come from) are as follows:

(1) (In *physics*) That the whole is greater than the part, and that the whole possesses the part – from Oneness.
(2) (In *metaphysics*:) The law of non-contradiction[152] – from Being.
(3) (In *speaking*:) Signification, i.e. that words *mean* things. – from Truth.
(4) (In *art*:) That the good is desirable in itself. – from Goodness.[153]
(5) (In *practical arts*:) That the goal of all willful activity is Happiness (possession of the complete and total good) – from Goodness.[154]
(6) (*In logic*:) The law of the excluded middle[155] – from Truth.
(7) (In *mathematics:*) The subtraction property of equals[156] –from Oneness.

Additionally, certain other formulations are also taken as axiomatic because though not connected to a Transcendental, yet they are the most basic thing in that science, from which all other deductions flow. These other things are often called postulates (from Lat. *postulare*, "to demand").[157] For instance, in Math, you might postulate the existence of a

[149] Aquinas, *Summa*, I.1.3.c, ad2. Cf. Aristotle's use of "qua" [The feminine of "quo"] in *Metaphysica*, IV:2 (1003b13-22).
[150] Aristotle, *Analytica Posteriora*, I:2 (72a19).
[151] On axioms enabling rational argument, see Aristotle, *Analytica Posteriora*, I:11 (77a26-32). However the idea that axioms ultimately flow from transcendentals is my own theory. An alternate and simpler theory is offered by Aristotle, who posits that Axioms are "common truths" common not to the subject/species in question, but to a higher genus in question. Cf. Aristotle, *Analytica Posteriora*, I:10 (76a38, b15,21).
[152] Aristotle, *Analytica Posteriora*, I:11 (77a10); *Metaphysica*, IV:3 (1005b18-20).
[153] Aristotle, *Ethica Nicomachea*, I:2 (1094a21).
[154] Aristotle, *Ethica Nicomachea*, I:7 (1097b22).
[155] Aristotle, *De Interpretatione*, 9 (18a29-31).
[156] Aristotle, *Analytica Posteriora*, I:11 (77a30).
[157] Aristotle, *Analytica Posteriora*, I:10 (76a31-37,40, 76b3-4). Aristotle calls postulates "basic truths." The definitions of the terms in these basic truths must first be apprehended to then enable demonstration to

line passing at two points through a circle. This is not something that one can doubt, because you have willfully drawn it, and thus its own existence is as-it-were its own justification. The line's existence doesn't directly flow from any one of the four Transcendentals, but in a way it indirectly flows from the Transcendental of Being, since it is itself a being. Thus postulates are often considered the same things as axioms, although the two are slightly different.

How we Get Universal Truths

In the last section, it was stated that Deductive truths do not come from Induction, but from something else, called Intuition. It is now important to consider what truths can be intuited, and what sort(s) of physical evidence are necessary to establish them. In this investigation we are seeking not just pretty-good knowledge (the degree of certainty offered by Induction), but absolutely certain knowledge (i.e. A and E- propositions), for any deductions will only be as certain as the intuitions from which they come.[158] Thus we must consider how we get knowledge of the premises / first principles.

To answer this perennial question, we must return to the model of human nature presented in Unit II, and to the conversion between the physical and spiritual realms. In Ch. 7 of this Unit III, we have established what happens in the spiritual half of the diagram, as we deductively uncover more and more truths through reasoning using the four A,E, I, and O propositions (cf. Diagram 3.41). However, the empirical half of the diagram still eludes us. How do we establish even one of these higher spiritual/rational propositions from lower empirical/physical evidence?

Comment [A172]: i.e. the physical half, e.g. of Diagram 3.64.

Here, the scholastic principle that "Action follows Being,"[159] is critical for recognizing what we are doing when we learn a new truth. This principle tells us that if the spiritual/rational structure of Being is such as we have presented it in Unit III (i.e. in the predicables and propositions of Ch. 6), then the empirical half must be its mirror image, consistent with the idea of conversion between the physical and spiritual mindsets (recall Section 2.2.4). But how does physical evidence "mirror" reasoning?

The answer is quite simple. What exists essentially and unqualifiedly in the spiritual realm, happens in concrete actions accidentally and in some respect in the physical realm.[160] For instance, if we state that "All men are animals" (in the spiritual realm) then the corresponding expression of this in the physical realm would be that "All men *act* animal-ishly." This is something that we can both observe, and dependably act upon (since we ourselves are animals). Notice how Being (1st act) in the spiritual realm causes Action (2nd act) in the physical realm. Similarly, if we hold it a principle in the spiritual realm that "All water is runny," it would be verified in the physical realm by simply noting that "Water always runs." Here we note that the unqualified universal "All" in the spiritual realm, has now become a qualified "Always" (i.e. in a certain respect, in the accidental category of Time) in the physical realm. We also note that the

Comment [A173]: For instance, we should expect that after a certain length of forced exercise, we will eventually 'hit the wall' and, like all animals, be physically unable to go any farther.

subsequently occur (Cf. *Analytica Posteriora*, I:3 (72b12-13, refuted in 72b24)). These definitions are what we postulate.

[158] Aristotle, *Analytica Posteriora*, I:2 (72a36-b4), II:19 (100b11-15).

[159] "*Agere sequitur esse*." Cf. Aquinas, *Summa*, I.89.1.c; I.75.2.c.

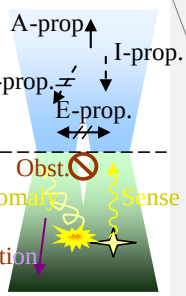
[160] This is the traditional distinction between *secundum quid* and *simpliciter*. Cf. Aquinas, *De Ente et Essentia*, 2:2; *Summa*, I.82.3.c.; also box in Section 2.1.1.

former is a true spiritual Principle (as that term is used in rational science); the latter is merely something that can be verified over and over to the point of being considered a Law (as that term is used in the empirical sciences). Thus there is a mirror-image correspondence between empirical evidence in the physical realm, and the spiritual significance of it in the rational realm. We summarize this mirroring in Diagram 3.67.

Diagram 3.67

Principles:
A: "All ___ is ___."
I: "Some ___ is ___."
E: "No ____ is ___."
O: "Some___ is not ___."

Laws:
Anomaly: "Sometimes ___ doesn't ___."
Obstruction: "____ *never* ____s."
Sense: "*Sometimes* I sense that ___ ___s."
Action:"___ *always* acts in ___ way."



This diagram can give us great insight into how we establish the truth of a proposition in the rational realm. If we wish to establish an I-proposition (e.g. "Some men are 6-fingered"), then we must sense it (by Sight) in the physical realm: We must see (or, if blind, feel) a man who has 6 fingers. If we don't see such a man, then we can't affirm that abstract I-proposition; if we do see such a man, then we can. If we wish to establish an O-proposition (e.g. "Some bears are not dark-colored"), then we must find an instance of one bear which isn't (e.g. a polar bear), again by our faculty of sensation. Thus sensation establishes particular (I or O) truths.

However, if we wish to establish the truth of a universal A- or E-proposition from physical evidence, then we have to do something else: Sensation will no longer suffice. For (as stated in the section on induction), how do we know that we've seen all of the instances of something, and that there might not be another instance, in some other place or time, that is an exception to the rule? Thus it is impossible to establish a universal truth by sensation and inductive methods.[161] Something else must be used, instead. To establish a universal truth, we must *show* that we can use the principle that it operates by, in successful Action. Here, instead of simply observing, we are pre-designing an experiment, beforehand, and seeing if it satisfies our expectations. For instance, if we wish to prove in a universal way that "All catalytic converters are pollution-preventers," then we should investigate the principle by which they remove pollutants (e.g. the reduction of nitrous oxide by a precious metal, to nitrogen and oxygen), and demonstrating this process in the lab (i.e. in action), then we should be confident that it will always happen that way in reality. Thus we are able to affirm that "All catalytic converters [i.e. things that operate in this way by this mechanism] are pollution-preventers." If we wish to prove a universal negative (i.e. "No __ is __."), then

> Aristotle called the method by which we get a first principle from physical evidence, "mind" (νους, pronounced "nous"), or "intuition." Since episteme comes from it (just as syllogisms come from individual propositions), he held that it was the only thing that was more solid and sure than episteme.[162]

Comment [A174]: Using Diagram 3.65, ask the students what in the physical realm yields each of the 4 propositions shown up in the spiritual realm. [Ans: The experience gained from successful Action yields an A-proposition; accurate sensation yields an I-proposition; experience with an obstruction yields knowledge of an E-proposition; and witnessing an anomaly or exception, yields an O-proposition.]

Comment [A175]: Using Diagram 3.67, drill the students, "What verb is used in the rational realm?" [Ans: "Is"] "What verb is used in the physical realm?" [Ans: Some other verb (e.g. "runs"), or "Is + a participle" (e.g. "Is running")] "What quantifiers are used in the rational realm?" [Ans: All, Some, No(ne)] What quantifiers are used in the physical realm?" [Ans: Always, sometimes, never]. "So how then does something occur in the spiritual realm?" [Ans: Absolutely / unqualifiedly / in the abstract / essentially / in eternity] "How does something occur in the physical realm? [Ans: In a certain respect / accidentally / concretely / in particular individuals / here-and-now]

Comment [A176]: We might think it will suffice, and generally it will for general, unscientific conclusions, as Aristotle described in *Analytica Posteriora*, II:19 (100a11-13). However, for solid, sure scientific conclusions, sensation cannot suffice.

[161] This is affirmed by Karl Popper. W.H. Newton-Smith, *The Rationality of Science* (Routledge, London and New York: 1999), 44-45.
[162] Aristotle, *Analytica Posteriora*, II:19 (100b8-17).

we should find some contradiction, some inherent impossibility, usually of one nature being directly incompatible with another, to absolutely rule out any chance of their union. Thus, if we wish to prove that "No sheep are goats," then we should find something in the nature of sheep (e.g. either in their DNA, or in their physical body-structure) that totally excludes and repels something in the nature of goats (DNA or body-structure). We see then that the establishment of universal certainty is due largely to deliberate art and skill and man-made machinery, and not so much (if at all) to random observation and mere chance. We conclude then that knowing universally is due to Action, not to Sensation (cf. Diagram 3.67).

Questions:

1. What is the difference between an axiom and a postulate? Ans: Axioms are general or transcendental principles; postulates are particular or even individual. Both are principles or things that we must first posit in order for deductive argument to be possible.
2. What term does modern science now use, in place of the term "first principles?" Ans: "Laws."
3. Name the formal and material objects for the following sciences:
   a. Experimental psychology. Ans: MO: The human mind. FO: Investigation by means of observation and interviews.
   b. Chemistry. Ans: MO: Atoms and molecules, and their macroscopic elements or compounds. FO: The same, viewed in the light of how they act and react in various situations.
   c. Biology. Ans: MO: Everything living. FO: How it functions, esp. in performing biological processes.
   d. Math. Ans: MO: Numbers. FO: In the context of various equations, functions, and expressions.
4. What in the physical realm corresponds to being in the spiritual realm? Ans: Action (2nd Act). Alternate answer: Time.
5. What must you do if you wish to prove Einstein's Law of General Relativity ($E=mc^2$)? Design an experiment that might effectively do this. Ans: We must blow up a piece of mass (m), get a whole bunch of energy (E), and, measuring them see if the mass lost, times the speed of light squared (c^2) equals the energy gained.
6. To what degree can we be certain of a universal law, as regards our own bodies and their doing what we intend them to do? Ans: We can generally be pretty sure, that our bodies will respond in the way that we intend them to but, not knowing our DNA and our nerve and hormone structures, we cannot absolutely rule out that the body won't revolt and do something unexpected (e.g. have a seizure, or a spontaneous twitch, etc.).
7. T/F: By acting with confidence, we prove that we believe / know the principle by which we're acting to be always the case. Ans: True.
8. What must you know to be universally certain about something? Ans:

Comment [A177]: Biologists define and distinguish species by when they can no longer breed with one another, usually by an incompatibility of DNA, but sometimes by an incompatibility of physical body structure.

Comment [A178]: When you act, it occurs as-it-were in the abstract, in the local arena of your action. However, because sensation is in-coming, you always sense from the 'arena' of the whole physical world, and that is why in sensation there is always the possibility that there might be another individual that you haven't yet seen or considered. Thus Action enables pure and absolute consideration (and intuition of the several universal truths there at work), in a way that Sensation does not.

Comment [A179]: Tell the students, that they must first look up what these letters (E,m,c) mean.

Comment [A180]: However, if this happens, it doesn't reduce our certainty in the universal truth of the principles by which we act (recall that Action gives certainty of universal truths); it is merely a completely separate and unrelated principle that is getting in the way of the principle(s) which we'd like to put into use. This is why when a person is possessed (by a demon) and his/her body is caused to do unexpected things, the demon, though overpowering him/her, never has control over his/her mind and Will: The two are entirely separate principles (the demon's agency and his/her own agency).

Comment [A181]: This assumes that we really do have confidence (based upon some higher reason or principle), and are not just making a show of confidence, as a person would who boldly walks out into a hailfire of bullets (unless they have some supernatural reason to believe they won't be shot, or that it won't matter if they are).

Comment [A182]: If desired, expand this question into a discussion of Faith. Is there any difference between a person who acts on faith, and a person who acts just on supposition or habit? If so, what? [Ans: Yes, the person who acts on faith is acting by a different principle than the one who acts just on normal thought-processes. For example, the person with faith believes that God or some superior officer is in control of the situation, and so they trust that rewards will be there for them in the end, even if rewards are not there for them, right now.)] How does having faith change the nature of the person's action? [Ans: It colors it with a different attitude and spirit.]

The plan or principle (of its nature) by which it was made.

9. Suppose the invention of a new tool or technology has 'broken open' a whole new field of science. How would you go about standardizing this new science? Ans: First gather all the data possible, and group it. Then try different arrangements of causality: What causes what? Lastly, when it has been fully experienced what the capabilities of each of the elements in the field are, propose a final standardized model that explains all observed phenomena.

4. The Framework of Knowledge

The Process of Building a Science by Inductive/Experimental Methods

Even though intuiting higher universal truths and deducing lower particular truths from them is the most effective way of establishing a science, yet many times we just don't have the correct tools to afford us the clarity of vision to enable us to intuit the really deep laws (or high rinciples), that are at the foundation (or pinnacle) of what we are studying. Consequently, we must instead try to build the science from the ground upward, by experimental and inductive methods, combining particular truths first, to try to reach those higher more universal ones later. Of course, proceeding by these inductive methods, nothing is ever absolutely sure (at least not until we reach those ultimate first principles so as to 'figure it all out'), and so there is a degree of tenuousness, and uncertainty in this kind of investigation.

Classically this 'ground up' method was known as Dialectic, where through repeated questioning, the leader would try to construct a belief-system in the listener's minds. The leader would force the listener to choose between two contradictories: "Is [fact 1] because of [explanation A] or [explanation B]?" Whatever the listener chose, the leader would then take that for granted and proceed onward to a higher question: "Okay, is [explanation A] because of [explanation I] or [explanation II]?"

To investigate by inductive methods, we begin from a fact or set of facts and strive to study them more closely, bringing the facts into conformity with one another. As we become aware of more and more facts, we may start to become aware of commonalities between them. If we notice a set of commonalities among an entire class, we may then be led to suggest some explanation for this mysterious unity. Explanations themselves can be either horizontally unrelated; or they can be ordered one on top of—including and explaining—the other, thereby allowing us to construct a complex vertical framework of causality. Since the reasons for things are often very hidden, and three, four, or even many times removed, the latter vertical situation is more common, and here we must search *deeply* for answers. During this process, it is extremely important to exhaustively enter into *each one* of the material objects of the science at the low level at which we can see it, and study it deeply, and even try to mentally *be(come)* those things.

Comment [A183]: I.e. bringing premises together which might yield deduce-able conclusions. Of course, just *any* two premises won't do; they have to be compatible with one another (e.g. with similar terms). Thus bringing two facts into conformity with one another, is like trying to merge two strobe lights that are flickering at different rates, or like trying to find two notes on the piano that harmoniously merge rather than dissonantly clash. When things harmonize, the peaks of one wave are interspersed among the peaks of the other wave in some regular geometric ratio (e.g. 1:3, or 1:4). When they are dissonant the peaks match up some of the time, but not all the time (e.g. 2:3, or 3:7)

Comment [A184]: A commonality between one or several things is a potential middle term. Thus Aristotle says that the process of investigation, is the searching for a middle term. Aristotle, *Analytica Posteriora*, II:2 (90a5-12, 35); I:9 (76a4f); I:10 (89b10). Cf. Aquinas, *Summa*, II:II.49.4.c.

Comment [A185]: Recall that complete horizontalness suggests prior verticality (recall end of Section 7.8 on Induction).

Comment [A186]: Cf. the column of bricks on the left of Diagram 3.7.

In so doing, one will have the best chances of constructing the correct higher, vertical explanation.

In order to arrange things in this vertical way, you must methodically enter into each one of the objects (this is known as investigation or study) and must mentally *be* that thing. Only in this way (acting *as* it) will you be able to gain a complete view of how it functions, and thus its nature. The goal during study then is to be extensive, and if possible exhaustive in searching out all that there is to know about each topic that is studied.

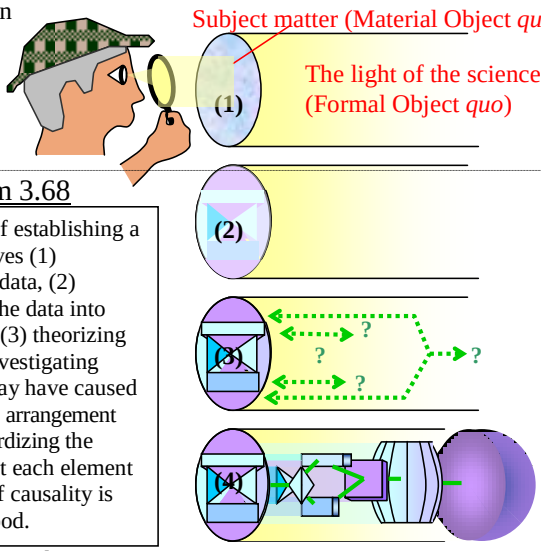


Diagram 3.68

The process of establishing a science involves (1) gathering the data, (2) categorizing the data into distinct types (3) theorizing and further investigating about what may have caused this particular arrangement and (4) standardizing the science so that each element in the chain of causality is fully understood.

* Note: Vertical is →

Hypotheses, Theses, and Laws

Greek:	Latin:
Hypothesis - - - - - - -	*Suppositio*
Thesis - - - - - - - - - -	*Positio*
What English words are these like?	

Along the way of thus inductively building up a science, there are certain classifications that we can give to a reputed truth to describe how confident and sure we are of it. We can classify reputed truths as hypotheses, theses, or laws.

When one is establishing a line of causality (Step 3 in Diagram 3.68), it is important to keep in mind that when explaining the causes of some lower phenomenon, the higher always unilaterally causes the lower, and not vice versa. Thus it is necessary to put oneself in the position of the higher and propose guesses—statements—describing what causes what. Something that one posits or 'puts out there' as an explanation, is known as a(n) (hypo)thesis. In this section we will study theses, as well as their precursors (hypotheses) and their successors (laws).

An hypothesis (involving the Gk. prefix υπο– "underneath") is an educated guess in which one suggests a possible explanation for a fact or group of facts. Hypotheses are made when you are not yet ready to 'put yourself into' and 'take a stand upon' the position that you are defending. Instead, you merely 'cast it forth' in a very preliminary way or 'suppose' it, as a possible explanation. Thus it is understood that an hypothesis could be either right or wrong. The simple goal in hypothesizing is to offer enough suggestions (enough hypotheses) that one of them eventually 'sticks' to the evidence (recall Section 3.5.4 on Learning and Understanding) and is able to grow into a larger

Comment [A187]: This is where technology becomes very useful. You may be completely unable to imagine what it is like to 'be' a DNA molecule; but the invention of a new tool (e.g. a mass spectrometer) may nevertheless enable you to uncover its nature, or even physically *see* it.

Comment [A188]: In Diagram 3.70, point out the thin black arrows of causality, going *against* the direction of inference or discovery (represented by wide green arrows)

Comment [A189]: Ask the students: When one 'throws' something out there as a possible explanation, which gets thrown out lower: an hypothesis, or a thesis? [Ans: Hypotheses, which usually concern one of two opposing contradictories, are more specific, closer to the material realm, and thus lower than theses, which are more general.]

thesis. Thus the goal in hypothesizing is *breadth*: to cover all bases and all possibilities. When one is first dealing with a brand-new set of facts, hypotheses are often proposed to determine the correct direction of causality: Either A causes and precedes B, or B causes and precedes A.[163] At this early stage, hypotheses can usually be empirically tested and out-rightly proved or disproved by a single experiment. Once these basic relationships have been figured out, then one can also hypothesize some very basic suppositions, or guesses about what may be going on in the system as a whole. Thus hypothesizing enables the preliminary investigations by which one can then later link up many facts into a grander explanation, or thesis.

Diagram 3.69

A thesis (from Gk. τιθημι, "to place"), is an adequate explanation for a whole group or system of facts. It is a systematic explaining or 'laying out' of the explanation(s) in a whole area or field of study. Of course fields of study can be very broad, and can merge into other areas of study. Thus a thesis can be less broad than another thesis. Consequently theses may be *corrected*, *expanded*, *updated*, or *integrated* into even broader theses which are even more explanatory and comprehensive.

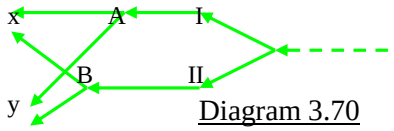
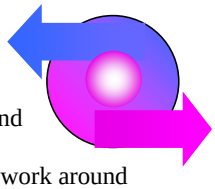


Diagram 3.70

If one arrives at an explanation that is sweeping, comprehensive, and necessarily descriptive of *all* activity/occurrences of a certain type, then that is a law. A law must be true in every case as stated, and so a law can be declared only by a person who has epistematic knowledge of the whole science in question, because only (s)he can foresee any exceptions. Now laws may be subject to exception in the light of other sciences, but at least within the science for which it is formulated, a law should be universally true, and without exception. Thus a law is a *property* of that science's frame-of-reference (its formal object). Consequently, whereas theses and hypotheses may be particular or universal, Laws must always be universal (i.e. an A or E proposition).

Diagram 3.71



Questions and Explanation: What, Why, and How

As we are constructing this framework of knowledge, we should note some basic relationships. When the Will rises higher and higher, investigating prior and prior levels of being and causality, Intellect/understanding—which is like the core or substantial framework around which Will is rising—automatically intuitively understands what the Will is focusing on. Thus as you will to do more and more actions, your Intellect simultaneously gains broader and broader experience, not even by doing anything, but just by being there. This is called experiential knowledge: knowledge of *what* the Will is dealing with. If the Intellect wanted to, it could at any moment summarize what it knows, and say explicitly *that* something is the source and cause of something else lower. Knowledge *that* is the recognition of a connection of some subject to a lower quality (the predicate) present

Comment [A190]: Casting forth hypotheses is like spiritually casting forth seeds. In this way hypothesizing is very much like the functioning of one's lower reason (cf. Section 3.5.1). When one of the hypotheses 'sticks' and develops into a larger thesis, that is like the plant taking root, and growing.

Comment [A191]: /ti-thay-mee/

Comment [A192]: By "adequate" we don't mean that it is the ultimate, final, truly correct, and best explanation. We just mean that it has to 'hold its integrity' and show itself to be *a* logical explanation, either in a certain situation, or from a certain perspective.

Comment [A193]: We aren't talking here about Moral Law (e.g. God's law or a nation's laws which ordain what you should, or shouldn't do), but about physical laws inherent in natures.

Comment [A194]: For example, Newton's 2nd law of motion (F=ma) was shown to be false in the extreme situations described by quantum mechanics and General relativity, which are as-it-were a separate field from that of solid-state physics.

What has happened here is that an even *higher* first principle—*outside* of this entire science (with its own set of first principles/laws) and proper to an even higher science—has supervened and taken over.

Comment [A195]: Recall from Section 3.6.7 that a property is described by an A proposition.

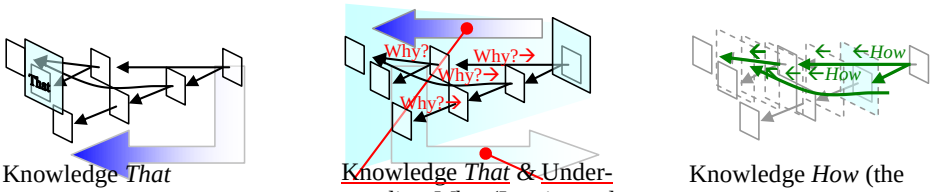
Comment [A196]: The difference between 'what' and 'that' is that what is a question penetrating into higher and more obscure matters, whereas that is a statement as it were bringing them to a head and summarizing them from the top down (cf. Diagram 3.73). Thus 'that' is downward-directed because the things themselves are by nature downward-directed. However, 'that' could also in a way be considered upward-directed (just like 'what') because it is sometimes used to talk of hazy possiblities (e.g. "that mysterious problem"), that are being uncovered from the ground up (cf. Diagram 3.68).

[163] Cf . Aristotle, *Analytica Posteriora*, I:2 (72a20).

within it.[164] Moreover, the more one willfully acts, the more one also gains experiential knowledge of connections of upward vertical connection: *Whys*. Why does this fact occur? Because of some other higher fact . . . a reason hidden 'behind' (or 'above') it. Having lots and lots of experiential knowledge enables one to know lots of connections about what-causes-what, and why. If we gain enough experience *why* something is the case, we can usually then take a stand upon those higher causes that we know and, reversing direction, explain *how* the lower comes about, or transpires. When we have complete knowledge what, why, and how, we then have total scientific knowledge (i.e. episteme), and we can summarize the whole framework from the top-down point-of-view of the teacher.[165]

Diagram 3.72

Experiential Knowledge — Scientific Knowledge



Knowledge *That* (motion to the left, knowledge of particulars)

Knowledge *That* & Understanding *Why* (Inquiry and Understanding to the right).

Knowledge *How* (the particular path(s) taken, motion to the left).

* *Note: Vertical is* →

Thus, as Aristotle says, there are four things that we seek to know, and these four are as many as the kinds of knowledge that we have:[166] We seek to know why something is the case, that something is the cause, if/whether it is the case, and how it is the case.

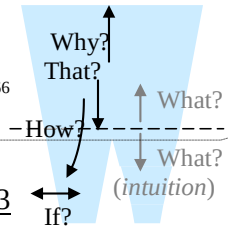


Diagram 3.73

Questions:

1. When might you have to turn to inductive methods of investigation? Ans: When you don't have the proper tools or point-of-view to enable you to clearly see what is going on at the deepest levels.
2. Is the newest theory that has come out usually an hypothesis, a thesis, or a law? Ans: Usually a thesis. An hypothesis is too uncertain and preliminary to be worthy of publishing, and it needs lots of confirmation before it can become a law.
3. What must a law be, that a thesis does not have to be? Ans: A law must

Comment [A197]: The Greek for why is διοτι, "di-[h]oti" or "through what" [dia "through" + 'oti "what"]. Thus when you ask "why," you are really asking "*Through what higher fact* [a 'oti' is a fact], or form, does this present fact exist?" Thus the Greeks were intuitively aware that everything—all causality—came from something above, or beyond, that was acting as a conduit or medium to convey being to them. Aristotle, *Analytica Posteriora*, II:2 (90a9-11).

Comment [A198]: Normally (in the spiritual realm), this reason has something directly to do with the fact presently under consideration, some identity of form with it; thus the fact presently under consideration is itself as-it-were, a lesser attribute or quality inside of that higher cause. This higher cause is then its formal cause, either wholely (if it is an autonomous generator), or in part, if it is one of two or more premises or situations that, in combining, resulted in it.

Comment [A199]: Wisdom is knowledge of the highest causes. (Aristotle, *Metaphysica*, I:2 (982a8ff); cf. Aquinas, *Summa*, I-II.57.2.c, II-II.45.1.c.).

Comment [A200]: Scientific Knowledge is absolutely certain knowledge. It is absolutely certain because you know what the truth is based upon, and that it cannot be otherwise. The ancient Gk. word for Scientific Knowledge is "episteme."

Comment [A201]: Ask the students how these correlate to other groups of four that they already know. [Ans: The 4 existential questions match the 4 propositions: If/whether? = An E situation [If No__can be __, then we want to know whether one—usually Being—is the case or whether the other—usually non-Being—is the case], Why? = An A situation [Because All __ is ___], That it is = an I situation [Some of __ subject is __ quality] , and How it is = an O situation [NOT this way, NOT that way, but Some of the time it is this way, some of the time it is that way, etc.].

Alternate answer: They could also be likened to the higher order operators, e.g. as shown in O above, where we're already using the NOT-operator. Then Why= If-Then; That = AND, If = XOR, How = NOT.

They also match the 4 kinds of causality: If = Material causality; How and What = Formal causality; That = Efficient causality; and Why = Final causality.]

[164] Aristotle, *Analytica Posteriora*, II:1 (89b24).
[165] Aristotle, *Metaphysica*, I:1 (981b8).
[166] Aristotle lists four questions, two questions about simple essences [using the 1st Act of the Intellect], and two questions about complex relations/statements [using the 2nd Act of the Intellect]. Of simple essences he says that we wish to know "If" (ει) it is [existential], and 'What' (τι) it is [essential]. Of complex statements we wish to know 'that' (οτι) something is the case, and 'why' (διοτι) it is the case. Diagram 3.73 does not concern these 4, but rather limits itself to just the simple essences. Thus although it asks "If" and "W[T]hat" it is, it adds in "Why," and "How,"

be universal (usually an A-proposition), and true always and everywhere within the science.

4. Are the following laws based on mathematical, entitative, or some other kind of necessity?
   a. Newton's 2nd Law of Thermodynamics. Ans: Some other kind, especially, since the universe didn't have to be made this way.
   b. Natural Law (written on one's heart) Ans: Entitative
   c. The Law of Independent Assortment (in Genetics) Ans: Entitative.
   d. The Law of Diminishing Returns (in Economics) Ans: Mathematical.
   e. The Law of Unintended Consequences: Either entitative or other (i.e. if one should argue that there is no real entity here, but rather just Sin—which is a lack or deficiency).
5. Is episteme *a priori* or *a posteriori*? Discuss. Ans: Episteme is infallible knowledge of a creature's lower characteristics, based on a higher understanding of its nature, and in this way it is *a priori*. However, episteme cannot be had unless one first thoroughly studies, apprehends, and understands the entire nature of the thing, and in this sense episteme is *a posteriori*. Episteme is then both *a posteriori* and *a priori*, but it is more *a priori* because the part of it that involves organizing the knowledge into a its proper structure and hierarchy—deciding *why* and *how*—is much greater (requiring one to be more thorough) and more comprehensive than the part of it that is *a posteriori*—i.e. merely gathering evidence *that*.
6. Receiving a doctorate (from Lat. *doctor*, "teacher") signifies that you are qualified to teach a subject. Why is this such a hard degree to attain? Ans: Many people often don't realize how thoroughly one must know something, in order to be able to teach it. Being a doctor signifies that you know not only everything that there is to know in the field, but also all the 'Why's and 'How's, that is, all the connections to other things. Only when you fully understand all the lines of causality in this way, are you ready to answer any question that might be raised about the matter.

Comment [A202]: If every law comes from an A-proposition, then every law must be necessary (cf. captions in Diagram 3.40a).

Comment [A203]: States that "the entropy of the universe is increasing."

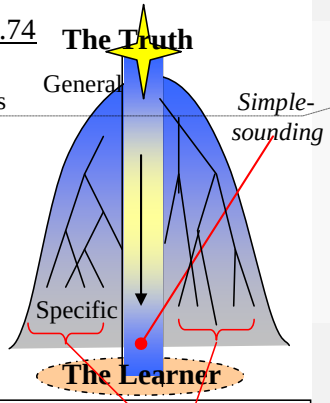
Comment [A204]: States that when genes divide in meiosis, the two similar, but slightly different copies of a given gene assort themselves—one in one gamete the other in the other gamete—independently of how other pairs of genes assort themselves. Thus just because one egg cell receives brown hair, and the other yellow hair, has nothing to do with whether it receives blue eyes, and the other hazel eyes, or it hazel eyes and the other blue eyes..

This is entitative necessity because it is caused by the being of the DNA, that the being of one chromosomal pair of DNA is unconnected to the being of the other 22 pairs.

Comment [A205]: States that as more and more goods of one type are produced, the amount for which you can sell each one decreases.

5. Teaching

Diagram 3.74



In teaching students a great truth, we do not digress or diverge or take the time to explicate and enumerate all its specific consequences. Rather, we feed it to them in its direct, most general, most simple-sounding form.

In teaching we should seek to impart 'broad' and universal concepts first, and more particular ones later, often only when they are inquired about. Thus in teaching, we teach from the top down. However, when we teach those first universal truths, even though they may have lots of ramifications, implications, and consequences, yet we should always seek to impart them in the simplest language possible. Such truth then appears simple (rather than far-reaching) because it is not 'fleshed-out' in all its consequences. Instead, we merely plant the seed of it within them—the formula that most concisely expresses it—and then leave the seed to slowly germinate and grow within them. Thus lessons are imparted in their most general, unspecific form into the hearer's comprehension.

After the students have learned all the broad, general truths—the first principles of the science—then they can begin to move on to more particular consequences. Oftentimes the students themselves should become proficient at deducing these secondary conclusions, since knowing *how* to reason is often more important than knowing that something is the case. A standard deduction is often called a theorem (from the Gk. "theoria" from Gk. "orao," to see), because when you know *how* to do something, then you can as-it-were 'see' (or imagine) your way through the necessary steps, to the desired outcome. Of course because of the nature of the science or the immaturity of the students, it may not always be possible to personally derive every conclusion, and then students must be content to learn the lower consequences simply by being told what is what.

After students have derived or learned all the major conclusions of the science, it is then possible to cross into the physical realm and justify certain essential truths with hands-on examples and experimentation. The goal here is to either 'prove' (if doubtable) or 'cement' (if far-reaching) a particular fact or set of conclusions into the child's memory, so that the child will have a particular vivid experience to refer to, when encountering this situation, or applying its principle in the future. When the goal of the science is especially for its physical consequences, then this stage can be the major part of the work. Thus after all the book-learning, doctors and engineers, and secondary-language-learners spend a long time learning to actually *do* and make use of what they know. We see then that the third step as-it-were exposes the science to the light of day, and sees how it actually functions in real life.

As we teach, we of course impart knowledge, and also show how to do things, but we should also periodically check for understanding: *why* something must be the case. Ideally, a student who knows *how* to do something, will also know *why* they do what they do (which is why in a two-column proof we require the students to list the "reasons"). However, what may seem intuitive to one student, may not always be explicit or clear to another, and so we must often put them on the spot and ask leading questions, to try to

Comment [A206]: We teach our children the most important lessons first, and we do it in the simplest language.

Comment [A207]: Do not confuse this word "theorem" with the word "thesis," because they come from two different Greek roots. "Thesis" means 'to put' [an act of putting]; "theorem" means 'to see' [an act of seeing]. Do not confuse it either with the word "theory," because they are two different things: Whereas a theorem is a discrete deductive proof (descending from first principles), a theory is an hypothesis or thesis (ascending toward becoming a law, or first principle).

Comment [A208]: Developing a good sense of intuition (one of the integral parts of Prudence) is often the key element in remembering how to go about deducing or proving something in a theorem. However if one's intuition is not likely to be able to remember how to go about it, then one should leave for oneself mental 'signposts' along the way to remind oneself how to go about doing it. These signposts can be found in things like mnemonic devices, acronyms, pre-visualized 'cheat-sheets' or 'flash-cards,' self-invented songs, or rhymes that contain the subject-matter, or simply in the firm resolve to remember that something is/goes one way, rather than another.

Comment [A209]: Obviously, hands-on experience cannot occur unless teaching has preceded it and reached a sufficient depth and specificity so as to have relevant, practical, experience-able consequences.

get them to ask these questions for themselves. Consequently testing and answering open-ended questions is a critical part of any learning-experience.

The goal in all of this teaching is twofold. On the one hand, it is to ultimately establish episteme in the learner—not so much episteme as an expert or teacher might possess, but enough for the learner to construct a loose framework or understanding out of the most important principles of the science (cf. Diagram 3.7-8). A good teacher keeps track of where his/her students are in the process, and doesn't feed them more than they can handle. Ideally, truths would be presented in so logical an order, that the learner would never feel that a new concept was out-of-context in relation to what came before. However, it isn't always possible to present things in so natural a way, and thus the teacher must make wise and prudent choices about when and where to regroup, 'change tracks' and start a whole new topic. The other goal is to cultivate a climate of inquiry and interest in the student, so that the student will want to seek *more*—either by applying it to real experiences out in the physical world, or interiorly in other fields of study. Indeed, the idea of a liberal art, is to train the mind into a method of investigation which will serve it throughout its whole life.

Questions:

1. Why do we impart universal truths in the simplest language? Ans: Partly because the universal truth is of its own nature simple, but mainly because the hearers themselves are not ready to hear all the consequences at once; thus we impart only the un-fleshed-out seed.
2. Which of the three parts of Diagram 3.72 do theorems have to do with? Ans: Explaining *how*.
3. Why is it often more important to know *how* than to know *that*? Ans: Because if you know how to reason, than if you should ever forget something, you will be able to re-deduce it from the first principles.
4. What are the three steps in teaching a science? Ans: (1) Learning the first principles, (2) deducing secondary conclusions, and (3) verifying select conclusions with direct, hands-on experience.
5. Why is it important to ask oneself 'leading' questions? Give an example in real life, where doing so could be important or beneficial. Ans: When things aren't going right (e.g. in a company structure), it often pays to ask oneself why. Oftentimes, it is one's own boss who is being negligent towards oneself. A proactive employee who demands to have clear answers and instructions, and who even goes to higher ranks in order to get them, will quickly either be fired (in which case the company itself is bad, and probably not worth working for anyways), or rise in the ranks.
6. What are the two goals in teaching? Ans: To establish episteme in the learner, and to inspire them to seek more.

Comment [A210]: Open-ended questions are normally essay questions (Why is it . . . ? / How do you . . .? / Explain . . .) which give no hint about what kind of an answer the questioner is looking for. Consequently to answer an open-ended question, the answerer must positively *show* what he/she knows. Multiple choice, Fill-in-the-blank, True-False and Matching are not open-ended questions.

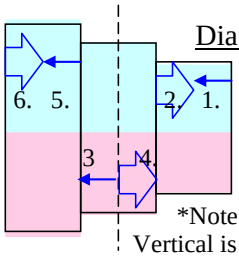
Comment [A211]: Students often admit that they learn the most when studying for (or taking) tests.

Comment [A212]: In effect, this ability to re-deduce is what long-term memory is (as we shall see in Section 5.1.4), except that those with long-term memory haven't necessarily yet forgotten. People with long-term memory have organized all their facts into a rational structure, so that they know particular truths *through* (i.e. as instances of) the more general truths that cause them. Thus as things fade, and memories become foggy, they remember and hold firmly to the few *key* things that are most important in that science, and from these they can remind or 'refresh' themselves about all the other things, whenever they need to. These "key things" are usually just the (1) first principles (laws), and (2) how to re-derive or 'think about' a handful of particularly important theorems, and maybe (3) a few general impressions about the scope or nature of the science.

Chapter IX. The Intellectual Faculties

Having studied the functioning of Intellect, we are now prepared to study the ways in which it actually occurs in human nature, and all throughout the Universe. To do this, we shall study the intellectual faculties. As shown at right, there are typically only two Intellectual faculties in each level. In the sensate layer, all four faculties have an intellectual component, but the most properly intellectual of them occur in the willful order. We will learn the explanation for why this is in Unit V, but for now it is sufficient to note that the most properly intellectual faculties are in fact Sight and Imagination, not Instinct and Action (although these are somewhat intellectual, too).

Diagram 3.75



*Note: Vertical is →

Faculties of Being . . . of Becoming

1. Knowledge
2. Understanding
3. Sight
4. Imagination
5. Force
6. Growth

1. The Rational Faculties

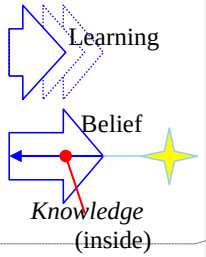
We have already extensively studied the rational faculties, and so only a brief review is necessary.

Knowledge

As stated earlier, knowledge is a statement that "[higher thing] is [lower thing]." The first is called the subject, the second the predicate. Usually the subject is some substance, and the predicate a quality. If the predict truly applies to the subject, we say that the sentence is "true." Thus in knowledge (and in all Intellect in general), truth occurs when the lower is suitable to the higher.

Understanding

Diagram 3.76



As earlier stated (cf. diagrams 3.7 and 3.26-28), understanding occurs by the construction of multiple statements together into a framework that is broad and also high. Whereas knowledge is a kind of Being at the rational level, Understanding is a kind of Becoming at the rational level. Thus we construct our understandings all throughout life. Understanding has three alternate forms: As it is in the process of coming-to-be it is known as Learning. When understanding exists with knowledge surely within it, it exists as Belief. There are many kinds of belief. In its

To believe is "to think with assent" (*Summa*, II-II.2.1). When we willfully 'force' our own assent to something we believe it.

Understanding's two alternate forms: Learning and Belief.

Comment [A213]: Understanding of any one causal relationship at any given moment is instantaneous and being. However, understanding "becomes" inasmuch as, over time, one construct's one's understanding into a bigger and bigger and more integrated framework of relationships.

fullness, Belief occurs when your Understanding has that rigor and certainty which belongs to Knowledge (a Being faculty).[167] Thus those who believe things understand what they believe, but they understand it not in a Becoming way, but in a sure, permanent, eternal way. Thus Belief is like the Being-component of Understanding. Since it is the Being-component of Understanding, all understanding has at least a preliminary or rudimentary kind of belief within it.[168] We need this temporary, contingent belief in order to grant what someone else says 'a hearing.' Belief (or faith) exists in this preliminary and rudimentary way, when you simply 'take someone's word for it.' Here it isn't implied that you actually believe them, that what they say is real, but only that it is hypothetically real, that it could be the case. Thus Belief can exist in the Hypothetical, but it reaches its perfection when it believes that something is *real*. Lastly, when Understanding attains to the level of understanding some higher principle (the star in Diagram 3.76) that one didn't understand before, but which now sheds a whole new light on everything within that genus, now you not only believe it, but also know and can explain it, and thus understanding becomes Episteme.

Questions:

1. Explain the three other forms of Understanding, classifying each one as a kind of Becoming or Being. Ans: Learning is understanding in the process of becoming. Belief is understanding based on some inner knowledge; since knowledge however is a kind of Being (not Becoming), belief is also a kind of Being, that is, it is Understanding as-it-were frozen in time. Lastly Episteme is also a kind of Being, since it includes and comes from a principle which is also frozen-in-time (as just what it is, in an eternal 'now.').
2. Recall: What are some ways or methods that one can learn new principles? Ans: Induction, Deduction, Dialectic, etc.
3. Recall: Why is ____ partly intellectual? Draw these into Diagram 3.75.
   a. Action Ans: Because it is seen in an exterior visible way.
   b. Instinct Ans: Because it is the response to intellectual values (e.g. the value of a tiger).

   In the students' drawings, Instinct should be located in the intellectual/spiritual quadrant of the sensate realm, and Action in the intellectual/physical quadrant, cf. Diagram 2.14. Instinct should be drawn as an ascending arrow of Being (i.e. a thin arrow), and Action as a descending arrow of Becoming (i.e. a thick arrow).
4. Does Belief also involve the Will? Hint: Think about what direction it is pointing in Diagram 3.76. Ans: Yes. Belief is "an act of the Intellect determined to one by the power of the Will" (*Summa*, II-II.2.1.ad3,II-II.2.2,II-II.2.9). This is why it is represented as pointing to the right (i.e. toward what is higher), in Diagram 3.76.

Comment [A214]: Every expression of Becoming must have a framework of Being within it, to hold it up, and around which to grow. As can be seen from Diagram 3.75, the Becoming and Being go in different directions: If the Becoming is growing up, the Being is compressing down.

Comment [A215]: There can be many kinds of faith based on who is revealing/teaching, and on what authority, or grounds. There can be divine faith (if you are believing God), there can be general faith in a large set of truths, or specific faith in some particular statement; there can also be active faith (a.k.a. trust) if it is triggering one's acts. There can also be merely natural faith, as when one has 'faith in oneself' or 'faith in one's best friend,' that he won't let you down. Also, belief doesn't have to be final belief, but can be just temporary or hypothetical belief, given only so that we can grant a 'hearing' to what someone is saying. This contingent or temporary kind of belief is an integral part of Apprehension.

Comment [A216]: As shown in the previous chapter, Belief *that* is different from knowledge *why*. Thus belief of the Fact (that), becomes knowledge of the reasoned fact (why), when you now also know the reasons for things. Thus natural epistematic understanding is added on after (or in addition to) belief, and embellishes it, but doesn't supplant or remove it. For instance people usually first believe that God exists, before they have a proof of it from natural reason. However, if they ever are shown this additional proof, it heartens them to have this further corroboration, but it doesn't reduce their justification or merit for having believed in the first place, nor for continuing to believe it anyhow, just as they did before. This is becuase supernatural belief and natural knowledge are different in kind, based on different motives, and thus do not directly influence or concern one another (i.e. you never have the two of them occur in the same argument). Thus subsequent natural understanding doesn't reduce the supernatural merit of also simultaneously believing it. Cf. Aquinas, *Summa*, II-II.2.10.c.

[167] Aquinas *Summa*, II-II.2.1.c.
[168] Cf. the first kind of belief/thought in ibid.

2. The Sensate Faculties

Of the sensate faculties, the two that are properly intellectual are Sight and Imagination. Just as Knowledge and Understanding were respectively Being and Becoming in the rational realm, so Sight and Imagination are Being and Becoming in the sensate realm. Because the two levels are metaphysically akin, rational Knowledge then works *thru* Sight, and rational Understanding exists with Imagination.

However, Sight and Imagination—though Intellectual—are located within the willful order (cf. Diagram 3.75), and so they also display willful characteristics. The eyes can be moved about from side-to-side and can focus far-off, or close-at-hand. Similarly, we see that in Imagination, brain-waves are continually circulating around the brain in a willful way, and—in humans—-under the Will's direction. We see then that the two intellectual faculties at the sensate level nevertheless have particularly willful natures.

Sight

Sight would just be an ordinary form of sensation—like touch, taste, or smell—except that the organs of Sight have developed willful abilities, as noted above. This however should not prejudice the fact that Sight itself is a properly intellectual occurrence. Scientifically, Sight occurs when energetic electrons in objects before us, 'blow off' their excess energy as photons, or packets of light. This light enters into our eyes, and is sensed when the chemical retinal within the rods and cones of our eyes, is hit by the photon and is knocked into a straight configuration thereby triggering a nerve signal. We see from this that Sight itself is fundamentally *apprehensive*: things are being *received* into the eyes. However, in a philosophical sense, the emission and reception of a light-packet is simultaneous in time, and thus it can be thought of as a connection of direct Being between the eyes and the thing seen. Consequently, one's consciousness is able to penetrate out of oneself and, traveling back down these incoming light rays, become aware of the objects at the other end of them. Thus despite its physically incoming nature, Sight itself (as a sensate act) is inherently out-going.

Because Sight is outgoing, one's sensate consciousness and rational Intellect are both able to pass through Sight and directly *know* (about) physical things out in the physical realm. For this reason then, Sight is intellectual, namely, that Intellect and knowledge pass *through* it on their way to knowing real things.

Imagination

How does Imagination occur? When we see an event transpiring before our eyes that we cannot control, it is natural to wish to control it. The brain has developed a way of forming its own imagery about things, and this imagery is formed using the faculty of Imagination. The Imagination is like the mind's inner eye: It is like a little 'movie' in

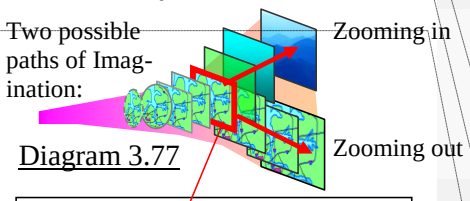


Diagram 3.77

Eventually, the Imagination becomes better at visualizing the elements or steps that lead up to the final outcome. It can even hold one particular images in stasis, and study it, and then decide where to take it or what to make of it.

Comment [A217]: Imagination causes or generates Understanding, because you often cannot understand a concept until you visualize it all the way through. This is why people use flow-charts, conceptual diagrams, and other visual aids.
Note that in the faculties of Being, the higher pre-exists the lower (Abstract Knowledge, prior in Being, preexists the Sight of a particular instance of it), but in the faculties of Becoming the lower triggers or occasions the higher (Imagination, prior in Becoming, occasions Understanding). Cf. Aristotle, *Analytica Posteroira*, I:2 (71b33-a5).

Comment [A218]: Time can only travel (or unfold) as fast as the speed of light: 300,000 km/hr. When a star emits some light, and it arrives at another planet which is 300,000 km away exactly one hour later, the two are for all *practical* purposes at the same moment in time. Why? Because there is a direct relationship of Being (i.e. the light-ray, which is traveling as fast as it can possibly go) between the one and the other, and so no other Becoming can possibly transpire in the meantime to alter or prevent the star's effect upon the planet. Thus time, as the rate of Becoming, ceases to exist when only Being is present.

Comment [A219]: In philosophical terminology, we would call such a connection of Being a "*per se* series" (as opposed to a "*per accidens* series"). People with a materialistic view of the world often deny that *per se* series even exist; it is fashionable to deny that the material world has any true substances (beings) at all, and to hold instead that matter is nothing but the aggregates or accumulations of infinitely divisible pieces of matter (i.e. that you can always get smaller and smaller). However the Bell Inequality shows that long-distance connections of Being do exist, because there is no way that information could be transmitted faster than the speed of light between two widely separated, but correlated electrons (e.g. in Rydberg states). Consequently, we must conclude instead to the only other possible explanation, namely, that the two electrons have a connection of direct Being between one another and are, for all practical purposes, *the same thing*.

Comment [A220]: Certain philosophers have described sight as two beams or headlights that come out of your eyes which travel around the room 'feeling' things at the other end of them.

Comment [A221]: Humans know them (in their substance); animals only know them in their sense-qualities—that they are there to begin with; and also that they are dangerous-looking, yummy, brown-and-furry, etc.)

Comment [A222]: Ask the students, "How or during what sort of act, do Intellect and Knoweldge pass through Sight?" [Ans: During *intuition* (of rational facts inside of and among those sensate images).]

the mind that is fully under the person's power to develop as (s)he wishes.

Where did the Imagination come from? It is likely that the Imagination developed as a kind of willful Sight. Many times we can imagine with our eyes fully open, imagining some desired action 'over top of' the image that we are in fact seeing. Judging from this, it is likely that Imagination evolved from the same nerve-pathways as Sight (i.e. the optic nerve), but in a reverse manner so that instead of taking in data (of the visible), it began spitting it back out (as the imaginary). In any case, Imagination has developed to the point where it is today a massive, circulating brain-wave with many capabilities. Of course the sense of Imagination can still be strengthened. Initially Imagination only deals with stationary, envisioned outcomes: the wanted parent; the piece of food; to sleep. However, the more children use their eyes (e.g. while manipulating toys in their hands), the more they indirectly also increase the strength of their Imagination, to the point where they can fully imagine doing in their mind, what they *would* do with their hand. What has happened here is that the Imagination has passed from merely watching and 'overlaying' in the physical mindset, to imaging in its own right in the spiritual:

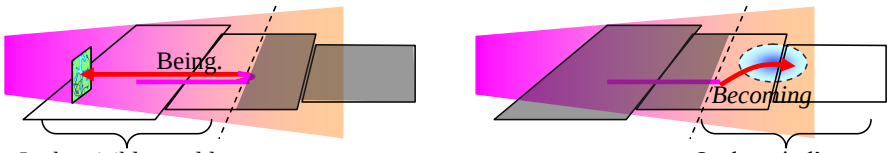


Diagram 3.78

As adults, the Imagination can become so strong that it can attain a clarity as if it were practically real: A person can manipulate an object or problem in their mind, as if it were virtual reality, turning it around and around in the mind, and then approaching it, from whatever angle it is most attackable. Thus the full and proper function of Imagination occurs in the spiritual mindset, even though it evolved from and is able to operate in the physical.

Comment [A223]: It is even possible—as in the case of people with photographic memory—that Imagination can become so 'real' and vivid, that you are really seeing the thing again.

Even though the Imagination has developed a high degree of willful control, it is still properly an intellectual faculty. This is seen by the fact that it evolved from Sight, and still deals in intellectually-knowable images. In fact these images are often the 'setting' into which intellectual concepts can be placed, and thus the Imagination is an important tool in mental Reasoning.

Comment [A224]: When one is reasoning, one often makes up a mental image as a 'carrier' into which to put one's concept, so that one can then move about and manipulate that mental image, rather than thinking in a dryly rational way (e.g. diagrams 3.9, 3.10, 3.23—cf. Diagram 3.50). Thus for instance, mathematicians and chess-masters visualize in imaginary terms their move-patterns and mathematical operations, remembering them as these image-patterns, rather than as brutally-rational step-by-step recipes, definitions, or formulas.

The other two sensate faculties—Instinct and Action—which are properly willful, nevertheless display Intellectual characteristics, as well. In particular, they trigger lower events at the physical level that are really knowable, and thus intellectual. Action is intellectual inasmuch as it causes real, externally knowable events; and Instinct is Intellectual inasmuch as it responds to particular, unique Intellectual values (e.g. the aura or idea of a tiger, which sends chills up one's spine).

Questions:

1. Describe: What is the difference between just looking, and looking with rational knowledge passing through it? Ans: Consciousness. The former is watching subconsciously, the latter consciously.
2. In what way is Sight willful, and in what way is it intellectual? Ans: Sight is willful inasmuch as one can manipulate it and move it around (e.g. Your eyeballs can rotate and focus far off or close-at-hand.); it is also willful inasmuch as electrons in the rods and cones of one's eyes are energized by Light, and bumped up to a higher energy level, with energy here being a willful phenomenon. However it is intellectual inasmuch as its receives seen, visible realities, that is, things that are really existing, knowable, and thus in the intellectual order.
3. In what way is Imagination willful, and in what way is it intellectual? Ans: Just like all Will, Imagination is a kind of circulation, as the brain-wave circles around the brain. Just like all Will, Imagination also has a center (like its heart) which is whatever it is concentrating and focused on. Imagination is intellectual inasmuch as it is triggered by Sight and then deals with seen, intellectually-knowable realities. Thus a human being can consciously imagine (with rational concepts passing through his/her imaginations), just as he/she consciously watches.
4. Is Imagination Being or Becoming? Ans: Becoming, but if it is overlaying on top of Sight then it is considering Being.
5. Is Sight Being or Becoming? Defend your answer. Why is this important? Ans: Sight is Being because the light particles that enter the eye are traveling at the speed of light, and thus causing an effective, practical simultaneity between the object and the eye. Consequently, no Becoming goes on between the time of the emission of the light-particle, and its recognition within the eye; rather, they are effectively at the same moment in time. This is important because the Intellect (a Being faculty) must be able to *reverse the direction* of things and pass back down the light beams to the objects that emitted them. The only way you can solidly and surely reverse direction like this is if there is a stationary connection of Being between the two. After all, if things were Becoming, and not Being, the images we see would be somewhat illusory, and different from the objects that had emitted them (and since changed while the image was still traveling to our eyes).

Comment [A225]: Tell the students to see if they can answer this question with just one word.

Comment [A226]: This is what is sometimes reputed to happen over super-galactic distances. If the light from certain stars was emitted 60 million light-years ago, then it might be supposed that maybe the whole universe is an illusion, and that the light was emitted "in transit," by some quirk of nature, or some great magician who is fooling us. However, since there is a connection of direct and timeless Being between the emitter and receiver, we can then be confident that our eyes are actually making contact with real *things*, and that there were *really-existent* far-off stars and galaxies that generated the light we are now seeing.

3. The Physical Faculties

At the physical level, the Being and Becoming functions that were formerly occurring in spiritual ways, now occur through physical media. Just as Knowledge and Sight were Being in the higher realms, Force is Being in the physical realm. Also, just as Understanding and Imagination were Becoming in the higher realms, now there is Growth in the physical realm. Just as the higher faculties often pass through one another (e.g. cf. bottom of Diagram 3.76), so also Force and Growth can—but don't have to—pass through one another. Force usually occurs outside matter, as can be seen in any one of the four Fundamental Forces. For instance, protons and electrons interact through the electro-magnetic force by *pulling* each other closer together. This pulling occurs across empty space, and so here we see Force existing by itself. However, force can also occur through matter, by pushing: When matter amasses up to a certain amount, then by the gravitational force, the higher parts of it forcefully push down upon the lower parts of it. Thus scientists can compute compressive forces pushing through columns, and soil types, and—at an extreme—even within collapsing stars. We see then that whenever we have Growth, we also necessarily have gravitational forces inside of it, just as all faculties of Becoming always require an interior faculty of Being for their support, around which to grow up.

The Four Fundamental Forces:
-The Strong Force.
-The Electromagnetic-Weak Force.[169]
-The Gravitational Force.
-The Pauli Exclusion Principle.

Gravity is not the only force in the spiritual realm. One can create an artificial gravity-like force simply by applying pressure to something. If you grab onto your desk with one hand, and push a chair toward it with the other, you have used two forces that together simulate a gravitational force. Here we have a pulling force—the electromagnetic-weak force—combining with a pushing force—the Pauli Exclusion Principle—to enable the chair to slide up to the table. We see then that force in general is a fundamental component of nature, not just gravity.

Questions:

1. Do animals use Force? If so, how? Ans: Yes! Any time an animal contracts its muscle, it is performing exactly the same thing as the chair-example, above. When a muscle contracts, there is both pulling and pushing going on. Animals trigger forces to occur using their sensate faculty of Action (cf. Diagram 2.16).
2. Give three examples of force occurring . . .
   a. in matter. Ans: The tensile (←→) or compressive (→←) forces passing through a bridge-member. The weight of a planet upon itself.
   b. outside of matter. Ans: The strong force occurring between quarks in the Nucleus; the Electromagnetic force occurring

Comment [A227]: By "Force," we mean force as understood by Newton's 2nd Law of Motion, which states that "Force =mass x acceleration" (F=ma).

Comment [A228]: Most people think that the four Fundamental Forces are the Strong, Weak, Electro-magnetic, and Gravitational. However the Electro-magnetic and Weak forces are really the same thing, and the 4th Force—the Pauli Exclusion Principle—is really a force that most people aren't aware of.

In particular the Pauli Exclusion Principle insists that no two electrons circling around an atom can have the same set of quantum numbers: In other words, no two electrons can be in the same place, performing the same job. The Pauli Exclusion Principle is responsible for repulsions and thus for preventing us from falling through the floor.

Comment [A229]: The pulling occurs through long chains of bio-molecules. These molecules alternate electrons and protons in such a way that a single electron is bound to both protons on either side of it (known as Covalent or Ionic bonding)

Comment [A230]: The pulling (or tensile force) occurs as each of the Myosin heads is attracted to 'grab' onto a new grip at a new place, farther down its adjoining Actin fiber. Pushing (or compressive force) then occurs as the Myosin head splits ATP into ADP + P, thereby blowing itself backward and pushing the Actin chain (to which it is still attached) past itself (Raven and Johnson, Biology, 971-975.

Comment [A231]: Technically, the only force that really occurs inside of matter, as matter, is the Pauli Exclusion Principle (and possibly the magnetic component of the Electromagnetic-Weak Force). The other forces are all pulling forces that occur across empty space. However these other forces can seem to occur in matter on a macroscopic scale. For instance the Strong Force occurs entirely within the nucleus, and so it can be thought of as being 'in matter.' However, it is really so tiny a force that it occurs within the empty spaces within the nucleus, attracting up and down quarks to one another. Thus from its own perspective the strong force is still occurring across empty space.

[169] I would like to thank my brother, Joseph D. Rudmin, a theoretical physicist, for correcting the common mis-notions that the Electro-magnetic and Weak forces are distinct fundamental forces (They're really the same thing!); and for pointing out to me that instead, the Pauli Exclusion Principle should be listed as a fundamental force.

between a proton and a nearby electron. The Gravity felt by something falling toward a black hole.

3.Research Project: Choose one of the four fundamental forces, and write a paragraph explaining how it functions.

Teachers' Comments (continued):

A84: understanding of the activity, it might then 'play' at it, until it fully got the 'feel' or 'hang' of it. Thus we see why sounds produced because of imaginative activity are truly names (i.e. intellectual, cf. Diagram 3.20), whereas sounds produced because of instinctive activities are merely signs (i.e. willful).

A228: example that categorization is primarily essential, not existential.

A14: A.]

Ask the students "What about 'All humans are brain-havers?'" Is brain-having an accident of being human? [Ans: No, it is a property, as signified by the word "All". Note however, that it converts to an I-proposition ("some brain-havers are humans"), just as an accident does. Thus if you put the accident or property first (in the subject), there is no way to tell whether it is really an accident or property. Rather always put the thing first, and the quality last, and then you will be able to tell whether it is an accident of that thing (by applying to "some" of it), or a property of that thing (by applying to "all" of it).]

A15: which are inherently unseemly, disproportionate, misaligned, or ironic, but still somehow good. If chimpanzees have learned to laugh, it is not because they sense the irony that creates laughter (something rational), but rather because they are simply imitating humans whom they've seen laughing, or maybe just 'blowing off' extra energy, in a frenzied sort of way.

If the students point out that God laughs too (e.g. Ps. 2:4), tell them that Yes, the one who is God the Son laughs, but only by means of or in his human nature, not by means of or in His Divine nature. Thus if God had never become man, and hadn't taken a human nature to himself, then God would never have had the experience of laughing. Any laughter would've been completely subsumed/swallowed/negated by one of His other divine qualities such as Holiness, Mercy, etc. We humans laugh only because we have 'more' than we know what to do with, and so it overflows as laughter. God never has more than He knows what to do with, because He is perfectly complete and Blessed in Himself.

We see from this that a property often applies "to one species only, and to all of that species," and this is indeed the standard and traditional—but narrower—definition of a property (J. Cuddeback, Notes from Philosophy 102 Logic class, 1/26/01). However, in this case although it is still a property, it is more precisely a *specific difference* (i.e. applying *primarily* to that species, and not to one of its higher genera).

Ask the students "Are all humans risible?" Ans: Yes! Point out to them the green area which shows that, at least in terms of numbers of individuals, risibilty covers the same extent as humanness. So however many individuals may be human, that number are also risible. You will never find a human that is not risible, and you will never find a risible thing that is not human.

Ask the students "Is Polishness a property of humanness?" Ans: No. It is a species (accident) of humanness, because even though all Polishness is Human, not all Humans are Polish—Only *some* humans are Polish. So if you pick something that is less universal than the group in question, it becomes a species, not a property.

A17: 4.33 of the four Will-acts, in Unit IV. The similarities found between these diagrams is a major conclusion/thesis of this course, and we assert that each one corroborates the truthfulness of the others.

A18: constituents of the universe. Reason (order, proportion, etc.) 'went into' the parts of the universe.

A29: Ask the students: "What does the word "bArbArA" tell you to do?" [Ans: Make all three lines/premises A-propositions.]

A30: but assuming that they do this, the cut-and-drop rule works well in the 1st Figure.

A55: represented as directionally upward, E-propositions as directionally sideways, I-propositions as directionally downward, and O-propositions as directionally angling-down. Thus if two things are "parallel" it is implied that they are identically the same kind of proposition (A, E, I or O). Of course, since each of the four parts of Diagram 3.53 is a generic representation of the whole figure, we can't really know what As, Es, I, or Os, will be included in it. Thus, the up/sideways/down/angled directions don't apply to Diagram 3.53.

A58: to that which is outside (e.g. the water in Diagram 3.54), than to that which is inside (the rickershading bullet)—cf. Diagram 3.45.

A59: denying it— eventually gets back up to what had been the *subject* of the pipe (i.e. the subject of the Major Premise)—denying that as well.

A62: now converting it), then the 4th Figure *should* become *Modus Ponens*, the most powerful of the four modes, and the only one which can make a true scientific advance (recall end of Section 3.6.4). However, the rule of not over-extending means that when something is converted it must always be equal to or less than what it was before (i.e. you can't get "All"—an A-proposition—from "some"—an I-proposition). Thus when something is converted it retains the character that it had before the conversion. Thus if we're going to get *Modus Ponens* and make a scientific advance from a *Modus Tollens*, it has to stay negative in its character. However it is a rule of logic that nothing ever follows from a negative. Just by deducing what something *is not*, cannot make you conclude that it *is*. Thus the 4th Figure doesn't really have the basis to make the conclusion that it does and, though it sounds convincing, ends up committing the existential fallacy (cf. Section 3.6.4).

A63: (4th Fig.); Ferio (1st Fig.) and Fesapo and Fresison (4th Figs.).

A81: that it is now contradicting. This is the idea of negation, and the "NOT" operator.

A83: don't have to have any essential connection to one another(e.g. "If You [S_1] roll the ball [P_1] THEN "The pins [S_2] are likely to fall/fallers [P_2]," in which no subject or predicate is the same as any other subject or predicate). In Diagram 3.57 we have illustrated the former situation, which is why one oval is directly over top of (and including) the other.

A84: If-then statement precisely because the former is formally dependent upon the latter.

A85: will cover later in the Chapter, in Diagram 3.62). Here in the spiritual realm, we are only considering If-then statements dealing with present situations of Being, not with physical chain-reactions. Thus in the spiritual realm, the 'then' is the (formal) cause, since we wouldn't be able to conclude to the 'then' with absolute surety unless it the "If" were somehow participating in it. Thus although the 'If' may occasion the 'then' in the order of efficient and physical causality, yet the 'then' causes the 'if' in the order of formal and spiritual causality. Thus the event of the clock striking 12 is *part of* the spell being broken (it is the accident-part of it that tells when it happens), not the spell being broken being *part of* the clock striking 12.

A93: playing field' between the two parts of an Either . . . OR statement.

A131: chord-progressions in music. Indeed, those who are spiritual and active, come to know much more than those who are slow and systematic.

A133: distinct: It is distinctive of Deduction that it can obtain new universal A-propositions, whereas Induction can never tell one anything that is absolutely universal. Rather, the alternative I- (and O-) propositions are more essential to induction, which tells us about particulars, and so an I-proposition is shown here.

A134: upward (in the same way as an A-proposition), and this is because deduction apprehends and comes to the understanding of universally true A-propositions.

A135: Induction occurs in the process of seeking to discover more, one who is inducing is often inclined to over-generalize, or overextend what he/she really knows, to what he/she doesn't really know. This is the complaint of Socrates in the *Apology*, 22c-e.

A137: represented as an upward arrow. If you first individually proved that (1) all acute triangles add to 180^{o}, (2) all right triangles add to 180^{o}, and (3) all obtuse triangles add to 180^{o}, then it would from there be an advance in scientific knowledge to make the step and universally assert that (4) *all* triangles add to 180^{o}.