eyes" or that he was very handsome; and that he invented such things as a pre-technological alarm clock ("When he went to bed he took a bronze ball in his hand and had a bronze dish below it, so that when the ball fell into the dish he would be awakened by the noise"). Heidegger, in a course on Aristotle, summarized the three things we know for certain about him: "He was born, he worked, he died."

The Ordering of All Knowledge

In the Middle Ages, each philosopher had a nickname. But Aristotle was known simply as "*The* Philosopher." He was also called "the master of those who know" because he was the master orderer, the outliner of all reality. The basic structure of that outline is as follows. Here is Aristotle's classification of the sciences ("science" in the broad, premodern sense of "rationally ordered knowledge"):

(Preliminary:) Instrumental knowledge
- A. Logic: using language for proof
- B. Rhetoric: using language for persuasion
- C. Poetics: using language for beauty

I. **Theoretical knowledge** (knowledge of the truth for its own sake)
- A. "Natural philosophy," or physics
  1. Chemistry
  2. Botany
  3. Zoology
  4. Anthropology
- B. Mathematics
- C. Metaphysics (the study of the universal laws of all reality)

II. **Practical knowledge** (knowledge for the sake of practice)
- A. Ethics
- B. Politics
- C. Economics

III. **Productive knowledge** (knowledge for producing, for making: "techne" or "know-how," from which we get the word "technology."

We seek knowledge for three reasons: truth, goodness, and beauty or utility. We think, act, and make. In other words, we seek knowledge

(I) for the knowledge itself. This is "theoretical" knowledge, from the Greek "theoria", which does *not* mean "uncertain, merely hypothetical" but "contemplative"; it is also called "speculative" knowledge from the Latin "speculum" which means "mirror."

(II) for its practical application in acting, in living. "Practical" does not mean only "useful" or "what works" or "what is a means to an end" but "for practice." The most

important question of ethics, in fact, is not about practical means but about the end: What is the final end or good of human life, to which everything else is a means?

(III) for its application in making or mending things, improving the material world around us, including our own bodies (medicine).

Our "techie" society ranks III the highest (we're certainly the best society in history at it), II next; and I last (we popularly call philosophy mere "theory" or speculation"); but Aristotle would say we have it exactly upside down. Practical knowledge should be more important to us than productive (technological) knowledge because it is closer to home: it perfects not our world but our lives. And for the same reason, theoretical knowledge should be ranked highest of all because it perfects our very essential selves, our souls, our minds: it expands our consciousness, not just our world or our behavior.

Logic

Aristotle discovered and formulated the basic rules of logic, in six books together entitled the *Organon* or "instrument." Until the 20th century, Aristotelian logic was the only deductive logic. Francis Bacon (17th century) and John Stuart Mill (19th century) added important advances in inductive logic. Modern symbolic logic is not so much an alternative to Aristotelian logic as an addition, a refined symbolization, a mathematicization, and a Nominalization (see Vol. II, page 109 on Nominalism) of parts of Aristotle's logic.

Aristotle's logic is perhaps the single most useful idea in the history of thought. For whatever we think about, we must think either logically or illogically about it. And whether we are seeking Heaven or hamburgers, we will much more likely get it if we think logically. i.e. clearly, truly, and reasonably.

These are the three things logic seeks: clarity, truth, and proof. For there are **three acts of the mind**, classified by Aristotle from a logical point of view:

(1) **conceiving** and understanding a concept, a term, a meaning (like "man" or "mortal"); this is not of itself either true or false;

(2) **judging** or predicating one concept of another in a declarative sentence or proposition (like "all men are mortal"); this is either true or false;

(3) **reasoning** from one or more propositions (premises, assumptions) to another (a conclusion); giving reasons (premises) for our beliefs (conclusions). This is done by either (a) **induction** (reasoning from many particular cases to a generalization—"he and he and she and she are mortal, therefore all are mortal" or (b) **deduction** (from a general principle to a particular conclusion: e.g. the syllogism "All men are mortal, and Socrates is a man, therefore Socrates is mortal"). Deduction yields certainty, induction only probability.

Deductive arguments thus have three check points to pass before they prove their conclusions true:

(1) Are the terms all clear and unambiguous?

(2) Are the premises all true?

(3) Is the logic valid? Does the conclusion logically follow from the premises? (Aristotle was the first to formulate the basic rules for deciding this.)

The Four Causes

Central to Aristotle's philosophy of nature, or physics, is his theory of the "four causes." Next to his logic, this is probably the single most useful idea in the history of human thought for understanding and classifying things—*any* things (e.g. for organizing term papers!).

There are only four kinds of questions anyone can ever ask about anything:

(1) What is it made of? What is its raw material, or contents? Aristotle called this **the "material cause."**

(2) What is it made into? What is its essential nature? Aristotle called this **the "formal cause."**

(3) What made it or changed it? Where did it come from? Aristotle called this the "**efficient cause**."

(4) Where is it going to? What is its (natural or artificial) end? Aristotle called this **the "final cause."**

For instance:

Thing or event	Material cause	Formal cause	Efficient cause	Final cause
draydle	clay	top	papa	child's play
desk	wood	desk	carpenter	to hold books, papers
chair	wood	chair	carpenter	to hold sitting persons
bust of Socrates	ivory	Socrates' face	sculptor	to remember Socrates
acorn	chemicals	oak seed	parent tree	mature tree
Socrates	animal body	rational soul	parents	wisdom
avalanche	9999 rocks	rock slide	gravity	ground
puppy	organs	poodle	parents	adult poodle
eating	food	ingestion	chewing	health
argument	premises	syllogism	mind	persuasion
virtue	habit	goodness	choice	happiness (perfection)
"Moby Dick"	words	novel	Melville	amusement & wisdom

The formal and material causes are the two *intrinsic* dimensions or aspects (we do not call them "causes" any more) and the efficient and final causes are the two *extrinsic* dimensions or aspects, of any thing or event. The word "cause" in Greek (*aition*) meant literally "responsibility for." It came from the law courts. A "cause" of x is anything that makes a difference to x, that makes it x rather than y, anything that accounts for and thus explains x. A full explanation of any x includes these four dimensions.

Aristotle arrived at this comprehensive idea by reading and learning from all his predecessors, Plato and the "pre-Socratics." As a result of this study Aristotle wrote the world's first history of philosophy, Book alpha of his *Metaphysics,* which showed that all previous philosophers had recognized no other causes than his four. It was obvious that these philosophers all gave many different answers, but Aristotle noted for the first time that they also were asking the same four questions:

Thales ("water"), Anaximander ("the indeterminate"), Anaximenes ("air"), Heraclitus ("fire"), Empedocles (the "four elements" earth, air, fire, and water), Anaxagoras ("seeds"), and Democritus ("atoms") had all asked "What is it *made of*"? This is the *material cause,* that out of which things come to be.

Pythagoras ("numbers"), Parmenides ("Being") and Plato (the "Forms") had asked "What *is* it? What is its essence, its essential nature? This is expressed in a definition, the thing Socrates was always after in his dialogs. This is the *formal cause.*

Empedocles ("love and hate") and Democritus (the motion of atoms) had asked "What moves or makes it?" This is the *efficient cause.*

Heraclitus ("Logos"), Anaxagoras ("Mind") and Plato ("The Good") had asked "What is its *design, purpose, or end*?" This is the *final cause.*

In his late dialog the *Timaeus* Plato had already brought together all four causes in his account of how the universe was formed: by a divine craftsman or "Demi-urge" (the efficient cause) imposing the Forms (the formal cause) on matter (which Plato identified with space and called the "Receptacle" of Forms) for the end of "The Good" (the final cause). Aristotle universalized and demythologized Plato's account.

The four causes can be applied to any subject. For instance, Aristotle's aesthetics and literary criticism classifies four dimensions of a good or bad narrative:

(1) Its efficient cause is its author expressing his idea.

(2) The material cause is the style, the actual words he uses.

(3) The formal cause is the story itself, the artistic point or truth of the narrative.

(4) The final cause is its effect on the audience.

Modern physical science does not deal with formal or final causes, for its "scientific method" (probably the single most important discovery in the entire history of science) gets its power from its narrow focus, like laser light: it deals only with measurable, quantifiable aspects of things, thus only with material and efficient causes. (In fact it does not even deal with material causes in Aristotle's sense, with *potentialities* for receiving form, for these are not empirically observable.)

Aristotle and his medieval followers often mistakenly tried to use formal and final causes in physical science, producing "fuzzy science." Modern philosophers, out of envy for the scientific method, often make the same mistake in reverse: refusing to use formal and final causes even in philosophy because these notions are not "scientific." Explaining gravity as love or computer cybernetics as personal human thought is bad science; but explaining love as merely gravity or personal human thought as merely computer cybernetics is bad philosophy.

Teleology (Final Causes)

The Greek word for "end" or "aim" or "purpose" is *telos*; thus the English word **"teleology"** means the "logos" of "telos," the science (explanation, reasoning) of ends. Teleology has a bad reputation in modern philosophy, and needs a defense.

The reason final causes are necessary is simple: both in nature and in human art, things move in determinate directions rather than randomly. They are generally predictable. There is a reason for everything (otherwise reality is simply unintelligible, and we had better abandon science as well as philosophy); therefore there must be a reason for this too, a reason for the fact that the efficient cause does not merely impose form on matter and make (or change) the form-matter compound (which Aristotle calls the "substance"), but it moves or changes it *in one determinate direction* rather than another.

The final cause is the most important of all because it is the cause of all the other causes. Only because the puppy is directed by its own nature to the end of becoming an adult dog does it, without thought or choice, get hungry, eat meat and grow. Only because the author wants to write a novel does he, by thought and choice, put pen to paper.

Partial explanations, without all four causes, are incomplete but perfectly valid. Aristotle would not be surprised that current biological science can successfully give a purely mechanical, material explanation of evolution by natural selection. He would say that such an explanation, while explaining the efficient mechanism of life's evolution, still leaves unexplained *why* life has evolved in this constant direction, toward increasing complexity and consciousness. The efficient cause shows us the car's engine but not the road map.

Aristotle's Solution to the Problem of Change: Hylomorphism

Aristotle defines nature in terms of change, as **"that whose principle [origin] of change is [at least partially] internal to itself."** Thus dogs, stars, and mouths are natural, while boats, wars, and pens are artificial, for they are made or manufactured by external agents.

Aristotle distinguishes four ways in which things change or happen: (1) by **nature** (e.g. being born), (2) by **art** (e.g. building a bridge), (3) by **violence**, against nature (e.g. arresting the fall of a stone), and (4) by **chance** (e.g. bumping into things).

The puzzle of change is: How can a thing change and yet remain itself? Heraclitus and Parmenides both said it could not; thus Heraclitus denied that things remained

themselves and Parmenides denied that things really changed. Plato solved the problem by distinguishing two worlds: the Forms, which retained their unchangeable identities, and changing material things. Aristotle brought Plato's two worlds together with his "**hylomorphism**" (literally, "matter-and-form-ism").

This is Aristotle's main difference from Plato, and main criticism of Plato: not the existence of the Forms but their "separation" (*chorismos*) from material and changing things, from Nature. The popular opposition between Plato and Aristotle as between idealist and realist, formalist and materialist, rationalist and. empiricist, mystic and scientist, is an oversimplification; the difference is more one of emphasis and method than content. As Augustine later took Plato's Ideas and gave them a new home, in the Mind of God, so Aristotle gave the Ideas a new home in the world of Nature. But both remained Platonists in the most basic sense: for both, the Platonic Forms or Ideas are not just ideas or ideals; they are real.

Potentiality and Actuality

Aristotle explains change by the composition of matter and form, which is also the composition of potency (potentiality) and act (actuality). So he also explains change as "**the actualization of potentiality**." Form and matter are the static aspects of change; actuality and potentiality are the dynamic aspects of change.

Aristotle's notion of change as the actualization of potentiality is really quite commonsensical, even though potentiality is not empirically observable. Only because there is potentiality in a thing, can it change. The only reason acorns grow into oak trees and tulip bulbs don't, the only reason human babies learn to talk and monkey babies don't, is that acorns and human babies already have those potentialites in them while tulip bulbs and monkey babies don't.

Potentiality comes from matter, actuality from form. Both words have changed their meaning. "**Form**" for Aristotle does not mean "external shape" but "internal essence, essential nature." It is visible to the intelligence, not the senses. And **"matter"** for Aristotle does not mean actual chemical elements, atoms or subatomic particles. These are already *formed*, into carbon or helium or electrons or *something*. "Matter" means something more like formless energy. It is potential rather than actual. You never see matter alone, without form. It is the principle (i.e. the source) of indeterminateness or indefiniteness in change. It is why the same piece of wood can be made into a desk *or* a chair. Matter is not a substance, a noun, an entity, but an adjective, an aspect, a principle.

And so is form (for Aristotle, though not for Plato). Form is the other principle, the limit of matter. But it is not just the *spatial* limit or *shape*; it is the specification of matter, the actualization of its potency to become this specific *kind* ("species") of thing (star, planet, chair, desk, rat, shrew).

Since everything in nature changes, everything in nature is composed of matter and form—except matter and form themselves.

Forms themselves do not change (redness is always redness), but *substances* change. (Here is another word that has changed its meaning. Aristotle means by **"substances"** not chemical elements or compounds but concrete things.) A tree, or a leaf, changes from green to red in the fall. Its matter gets new form. The tree is a substance and its color is an accident, so when it changes from green to red, its substance (which is composed of matter and substantial or essential form) gets a new accident, a new accidental form.

Prime Matter and Substantial Change

Aristotle distinguishes two kinds of change: **substantial (essential) change and accidental change.** Most changes are accidental: e.g. only in quality (e.g. color), quantity (e.g. size), place, time, activity, receptivity, or relationship to other things. But in birth (or rather conception) there is substantial change: a new substance comes into existence, a new organism from its parent organisms; and in death it goes out of existence. The birth and death, beginning and ending, of any thing are substantial changes. The number of substances (beings) in the universe changes when substantial change happens.

In the case of accidental change—e.g. a green leaf becoming red in the fall—the "hotel room" which the old guest (greenness) vacates and which the new guest (redness) enters is the substance (the leaf), which is composed of substantial (essential) form and matter (as well as many accidental forms). But when the leaf dies and becomes leaf mold, the "hotel room" from which the guest departs is not any actual, formed thing at all but matter, energy, or potentiality itself. This has no form or qualities: it is colorless, shapeless, tasteless, etc. (The only place you will find this kind of thing is in White Castle hamburgers.)

Prime matter (pure matter, mere matter, formless matter) does not exist alone but only as the potentiality for change from one essential form to another, e.g. from leaf to leaf mold. It makes the substantial changes of birth and death possible. Prime matter is the "substratum" (or enduring identity of the subject) for substantial change (birth or death), as the substance (e.g. a dog) is the "substratum" for accidental change (e.g. from puppy to adult, or dirty dog to clean dog). The substratum (dog) is like the hotel room, the old form (puppy, or dirty) is like the departing guest, while the new form (adult, or clean) is like the newly arriving guest in the room.

But the image of the hotel room is misleading for substantial change, since the "hotel room" (substratum) for substantial change is not any *thing* at all but matter (potentiality) as such, "prime matter." Unlike matter in the modern physical-chemical sense, this is not in principle observable by the senses, and therefore is not a possible object for physical science. Modern physical science rightly ignores it.

But modern science also rightly ignores, or abstracts from, such things as (1) the "I" or subject pole of consciousness, (2) love as a free choice (as distinct from animal lust), (3) the supernatural, (4) beauty, (5) holiness, (6) emotional qualities, (7) moral values, (8) life after death, (9) the fact that anything at all exists rather than nothing, and (10) a child's

affection for a dog. But that does not mean these things are unreal. Nor does science's rightful ignoring of the philosophical concept of prime matter mean that prime matter is unreal.

"Matter" means "potentiality" in Aristotle. Classical modern science does not use the non-empirical, metaphysical concept of matter as such, or "prime matter," or pure potentiality, only the empirical concept of quantitatively measurable material powers like kinetic energy or chemical bonding ability. But perhaps science does *not* totally ignore this Aristotelian concept; perhaps the concept of "energy" which is transformable into any form of matter *is* Aristotle's "prime matter."

Whether or not the philosophical concept of potentiality is necessary in modern science, it is certainly necessary in philosophy, for Aristotle, to explain substantial change. Parmenides denied the very existence of change because he did not have the concept of potentiality. Because he did not have the categories to explain the data (that things change), he denied the data. This is "rationalism" in the *worst* sense of the word. Aristotle's approach is "empiricism" in the *best* sense of the word. He begins by accepting the data and then deduces the categories necessary to explain it. The data here is substantial and accidental change. The categories needed to explain this data include potentiality.

Potentiality is neither actuality nor nothing. It is real, but not a real *thing*. For reality, for Aristotle, is not merely a zero-sum thing, "to be or not to be." And real change is also not a zero-sum thing, a simple either-or: one thing does not simply disappear and another simply appear. When A becomes B, A must have had in itself the potentiality to become B to begin with. That is why puppies can become dogs but not cats, why live cats can become dead cats but not stars, why stars can become Black Holes but not people, and why a sighted person can see the color purple but a blind person cannot. There are potentialities as well as actualities. And that means that things are more than what they appear to be. A has in it something more than the actuality of being A; it also has the potentiality for becoming B (and not C). There are more dimensions of reality than what we can see, perhaps even more than we can think. "There are more things in heaven and earth, Horatio . . ."

Categories

"Substances" and "accidents" are the two basic kinds of reality or ways of being real, according to Aristotle. A "substance" is not a chemical "substance" like helium, and an "accident" is not a car wreck. An unplanned baby is a "substance" and not an "accident"! A "substance" is an individual being, an entity, expressed in language by a noun. It "stands-under" (the meaning of "sub-stans" in Latin) its accidents, i.e. its attributes, which Aristotle listed as (1) qualities, (2) quantities, (3) times, (4) places, (5) relations, (6) actions, (7) passions (receptions, or being-acted-upon), (8) postures (the order of its parts), and (9) possessions. These nine "accidents" are real, but never real in themselves, like a substance. They exist only "in" some substance, as attributes of the substance.