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Detailed Explanation of the System of Human Knowledge

Physical beings act on the senses. The impressions of these beings stimulate perceptions of them in the understanding. The understanding is concerned with its perceptions in only three ways, according to its three principal faculties: memory, reason, and imagination. Either the understanding makes a pure and simple enumeration of its perceptions through memory, or it examines them, compares them, and digests them by means of reason; or it chooses to imitate them, and reproduce them through imagination. Whence results the apparently rather well-founded general distribution of human knowledge into *history*, which is related to *memory*; into *philosophy*, which emanates from *reason*; and into *poetry*, which arises from *imagination*.

Memory, from which comes History

History concerns *facts*, and facts concern either *God*, or *man*, or *nature*. The facts which concern God belong to *sacred history*. The facts which concern man belong to *civil history*, and the facts which concern nature belong with *natural history*.

History: I. Sacred. — II. Civil. — III. Natural.

I. *Sacred history* is divided into *sacred* or *ecclesiastical history*. The *history of prophecies*, where the account has preceded the event, is a branch of *sacred history*.

II. *Civil history*, that branch of universal history, *cujus fidei exempla majorum, vicissitudines rerum, fundamenta prudentiae civilis, hominum denique nomen et fama commissa sunt*, is divided, according to its object, into *civil history* proper and *literary history*.

The sciences are the work of the reflection and of the natural light of men. Chancellor Bacon was therefore justified in saying in his admirable work *De dignitate et augmento scientiarum* that the history of the world without the history of scholars is the statue of Polyphemus with his eye torn out.

Civil history proper can be subdivided into *memoirs*, *antiquities*, and *complete history*. If it is true that history is the portrayal of past times, *antiquities* are the sketches of it, which are almost always damaged, and *complete history* is a painting, for which *memoirs* are the studies.

III. The divisions of *natural history* derive from the existing diversity of the *facts* of nature, and the diversity of the facts of nature from the diversity of the *states* of nature. Either nature is uniform and follows a regular course, such as one notes generally in *celestial bodies*, *animals*, *vegetables*, etc.; or it seems forced and displaced from its ordinary course, as in *monsters*; or it is restrained and put to different uses, as in the *arts*. Nature does everything, either in its *ordinary and regular course*, or in its *deviations*, or in the *way it is employed*. *Uniformity of nature*: the first part of natural history. *Errors or deviations of nature*: the second part of natural history. *Uses of nature*: the third part of natural history.

It is useless to expand on the advantages of the *history of uniform nature*. But if we are asked what purpose the *history of a monstrous nature* can serve, we will answer: to pass from the prodigies of nature's *deviations* to the marvels of *art*; to lead nature further astray or to put it back on the right road; and above all to temper the boldness of general propositions, *ut axiomatum corrigatur iniquitas*.

As for the *history of nature applied to different uses*, one could make a branch of civil history of it; for art in general is human industry applied to the productions of Nature by virtue of man's needs or his

extravagance. Whichever it is, that application is made in only two ways: either in bringing natural bodies together or in separating them. Man can do something or can do nothing according to the possibility or impossibility of joining or separating natural bodies.

The *history of uniform nature* is divided, following its principal objects, into: *celestial history* or *history of the stars, of their movements, sensible appearances*, etc., without explaining their cause by systems, hypotheses, etc. (It is a matter here only of pure phenomena.) Into *meteorological history* such as *winds, rains, tempests, thunder, aurora borealis*, etc. Into the *history of the earth and the sea*, or of *mountains, rivers, streams, currents, tides, sands, soils, forests, islands, configurations of the earth, continents*, etc. Into *history of minerals*, into *history of vegetables*, into *history of animals*. Whence results a *history of the elements*, of the *apparent nature, sensible effects, movements*, etc., of *fire, air, earth*, and *water*.

The *history of monstrous nature* should follow the same division. Nature can perform prodigies in the heavens, in the atmosphere, on the surface of the earth, in the interior of the earth, at the bottom of the seas, etc., in everything and everywhere.

The *history of nature applied* is as extensive as the different uses that men make of her productions in the arts, trades, and manufactures. There is no result of the industry of man which cannot be related to some production of nature. The arts of the *minter*, of the *beater, spinner* and *drawer of gold*, of the *burnisher*, etc., can be related to the working of gold and silver and the use to which they are put; the arts of the *lapidary*, the *diamond cutter*, the *jeweler*, the *engraver of precious stones*, etc., to the working of precious stones and the use to which they are put; *iron forging, lock-making, edge-tool making*, the *manufacture of arms*, the *manufacture of small arms, cutlery-making*, etc., to the working of iron and the use to which it is put; *glassmaking, plate-glass making, mirror-making, glazing*, etc., to the working of glass and the use to which it is put; the arts of the *chamois-maker*, the *tanner*, the *skin dresser*, etc., to the working of skins and the use to which they are put; *extracting and milling of wool and silk*, the arts of the *drapers, trimming-makers, braid-makers, button-makers, workers in velvets, satins, damasks, brocaded materials, linenettes*, etc., to the working of wool and silk and the uses to which they are put; to the working and use of soil: *clay pottery, faience, porcelain*, etc.; to the working and use of stone: the mechanical functions of the *architect*, the *sculptor*, the *stucco-maker*, etc.; to the working and use of woods: *joinery, carpentry, inlaid work, toy-making*, etc.; and thus with all the other arts, which number more than two hundred. The Preliminary Discourse has shown how much we have proposed to treat each one.

Such is the whole *historical part* of human knowledge that is to be

related to the *memory*, and should be the primary material of the philosopher.

Reason, from which comes Philosophy

Philosophy, or the portion of human knowledge which should be related to reason, is very extensive. There is almost no object perceived by the senses which has not been transformed into a science by reflection. But in the multitude of these objects there are some which stand out by their importance, *quibus abscinditur infinitum*, and to which all the sciences can be related. These principal categories are God, to the knowledge of whom man is elevated by reflection on natural and sacred history; *man*, who is certain of his existence through internal sense or consciousness; *nature*, the history of which man has learned through the use of exterior senses. *God*, *man*, and *nature* will therefore furnish us with a general division of *philosophy* or of *science* (for these words are synonyms); and *philosophy* or *science* will be *science of God*, *science of man*, and *science of nature*.

Philosophy or Science: I. Science of God. — II. Science of Man. — III. Science of Nature.

I. The natural progress of the human mind is to rise from individuals to species, from species to genera, from closely related genera to distantly related ones, and to create a science at each step; or at least to add a new branch to some science already in existence. Thus the concept, which we meet in history and which sacred history announces to us, of an uncreated and infinite intelligence, etc., and that of the created, finite intelligence united to a body which we observe in man and which we suppose in the brute, have led us to the concept of a created, finite intelligence having no body; and from there to the general notion of the spirit. Moreover, since the general properties of beings, spiritual as well as corporeal, are *existence*, *possibility*, *duration*, *substance*, *attribute*, etc., these properties have been examined, and from them has been created *ontology*, or the *science of being in general*. Therefore, we have had, in an inverted order, first *ontology*; then the *science of the spirit*, or *pneumatology*, or what is commonly called *particular metaphysics*. And that science is divided into the *science of God* or *natural theology*, which it has pleased God to correct and to sanctify by *Revelation*, whence comes *religion* and *theology proper*; whence through abuse comes *superstition*. Into *doctrine of good and evil spirits*, or of *angels* and of *demons*; whence comes *divination* and the chimera of *black magic*. Into the *science of the soul*, which has been subdivided into *science of the reasonable soul*, which conceives, and *science of the feeling soul*, which is limited to sensations.

II. *Science of Man*. The divisions of the science of man are derived from the divisions of his faculties. The principal faculties of man are the

understanding and the *will*; the *understanding*, which it is necessary to direct toward *truth*; the *will*, which must be made to conform to *virtue*. The one is the object of *logic*, the other is that of *ethics*.

Logic can be divided into *art of thinking*, *art of remembering one's thoughts*, and *art of communicating them*.

The *art of thinking* has as many branches as the *understanding* has principal operations. But four principal operations are differentiated in the *understanding*: *apprehension*, *judgment*, *reasoning*, and *method*. One can relate to *apprehension*, the *doctrine of ideas* or *perceptions*; to *judgment*, that of *propositions*; to *reasoning* and to *method*, that of *induction* and of *demonstration*.

But in *demonstration*, either one goes back from the thing to be demonstrated to the first principles, or one descends from the first principles to the thing to be demonstrated; whence are born *analysis* and *synthesis*.

The *art of remembering* has two branches, the *science of memory itself*, and the *science of supplements to the memory*. Memory, which we have considered at first as a purely passive faculty and which we are considering here as an active power which reason can perfect is either *natural* or *artificial*. *Natural memory* is a reaction of the organs, *artificial memory* consists in *prenotion* and in *emblem*; *prenotion*, without which nothing in particular is present in the mind; *emblem*, by which the *imagination* is called to the aid of the memory.

Artificial representations are the *supplements of memory*. *Writing* is one of these representations; but one uses either *common characters* or *special characters* in writing. The collection of the first is called the *alphabet*; the others are called *cipher*. Whence are born the arts of *reading*, of *writing*, and of *deciphering*, and the science of *orthography*.

The *art of transmitting* divides into *science of the instrument of discourse* and *science of qualities of discourse*. The science of the instrument of discourse is called *grammar*; the science of the qualities of discourse, *rhetoric*.

Grammar is divided into a science of *signs*, of *pronunciation*, of *construction*, and of *syntax*. *Signs* are articulated sounds; *pronunciation* or *prosody*, the arts of articulating them; *syntax*, the art of applying them to different intentions of the mind, and *construction*, the knowledge of the order which they should have in discourse, founded on usage and on reflection. But there are signs of thought other than articulated sounds: namely, *gesture* and *characters*. *Characters* are either *ideograms*, or *hieroglyphics*, or *heraldic signs*. *Ideograms*, such as those of the Indians, which each indicate an idea and which it is consequently necessary to multiply as many times as there are real

beings. *Hieroglyphics*, which are the writing of the world in its infancy. *Heraldic signs*, which form that which we call the *science of heraldry*.

It is thus to the *art of transmitting* that *criticism*, *pedagogy*, and *philology* should be related. *Criticism*, which restores corrupted parts in the writing of authors, provides editions, etc. *Pedagogy*, which treats of the choice of studies, and of the manner of teaching. *Philology*, which is concerned with the knowledge of universal literature.

It is to the *art of embellishing discourse* that one should relate *versification*, or the *mechanical part* of poetry. We will omit the division of rhetoric into its different parts, because no science or art derives from it, if not perhaps *pantomime*, from gesture; and from gesture and from the voice, *declamation*.

Ethics, which we have made the second part of the *science of man*, is either *general* or *particular*. The latter is divided into *natural*, *economic*, and *political jurisprudence*. *Natural jurisprudence* is the science of the duties of man alone; *economic*, the science of the duties of a man as a member of a family; *political*, that of the duties of a man in society. But *ethics* would be incomplete if these factors were not preceded by that of the *reality of moral good and evil*; of the *necessity of fulfilling one's duties*, of being *good, just, virtuous*, etc. Such is the object of *general ethics*.

If one considers that societies are obliged to be virtuous no less than are individuals, one will see the birth of the duties of societies, which could be called the *natural jurisprudence* of a society; *economics* of a society; *interior and exterior commerce of land and sea*; and *politics* of a society.

III. *Science of Nature*. We will divide the science of nature into *physics* and *mathematics*. We again draw this division from reflection and from our tendency to generalize. Through the senses we have received the knowledge of real individual things: *sun, moon, Sirius*, etc., stars; *air, fire, earth, water*, etc., elements; *rain, snow, hail, thunder*, etc., weather; and so forth throughout the rest of natural history. We have at the same time received knowledge of abstractions, *color, sound, taste, odor, density, rarity, heat, coldness, softness, hardness, fluidity, solidity, rigidity, elasticity, weight, lightness*, etc.; *shape, distance, movement, repose, duration, extension, quantity, impenetrability*.

We have observed through reflection that some of these abstractions, such as *extension, movement, impenetrability*, etc., are applicable to all corporeal individuals. We have made them the object of *general physics*, or the metaphysics of bodies; and these same properties, considered in each individual thing in particular, with the varieties which differentiate them, such as *duration, resilience, fluidity*, etc., are the

object of *particular physics*.

Quantity, another more general property of bodies which supposes all the others, has formed the object of mathematics. We call *quantity* or *size* everything which can be augmented or diminished.

Quantity, the object of *mathematics*, could be considered either alone and independent of real and abstract individual things from which one gained knowledge of it, or it could be considered in these real and abstract beings, or it could be considered in their effects investigated according to real or supposed causes; this reflection leads to the division of *mathematics* into *pure mathematics*, *mixed mathematics*, *physicomathematics*.

Abstract quantity, the object of pure mathematics, is either *numerable* or *extended*. *Numerable abstract quantity* has become the object of *arithmetic*, and *extended abstract quantity*, that of *geometry*.

Arithmetic is divided into *numerical arithmetic* or *arithmetic by figures*, and *algebra*, or *universal arithmetic by letters*, which is nothing else but the calculation of magnitude in general, and whose operations are properly arithmetical operations indicated in an abridged manner; for, to speak precisely, there is no calculation except by numbers.

Algebra is *elementary*, or *infinitesimal*, according to the nature of the quantities to which one applies it. The *infinitesimal* is either the *differential* or *integral*: *differential*, if it is a matter of descending from the expression of a quantity which is finite, or considered as such, to the expression of its instantaneous increment or diminution; *integral*, if it is a matter of returning from that expression to the finite quantity itself.

Geometry either has for its original object the properties of the circle and straight line, or it embraces all types of curves in its speculations; which differentiates it into *elementary* and *transcendent*.

Mixed mathematics has as many divisions and subdivisions as there are real beings in which *quantity* can be considered. *Quantity* considered in bodies insofar as they are mobile or tend to move is the object of *mechanics*. *Mechanics* has two branches, *statics* and *dynamics*. *Statics* has for its object *quantity* considered in bodies in equilibrium, and only tending to move. *Dynamics* has for its object *quantity* considered in bodies in motion. *Statics* and *dynamics* each have two parts. *Statics* is divided into *statics proper*, which has for its object *quantity* considered in solid bodies in equilibrium and only tending to move; and into *hydrostatics*, which has for its object *quantity* considered in fluid bodies in equilibrium and only tending to move. *Dynamics* is divided into *dynamics proper*, which has for its object *quantity* considered in bodies in motion; and into *hydrodynamics*, which

has for its object *quantity* considered in fluid bodies in motion. But if *quantity* is considered in *waters* that are in motion, *hydrodynamics* takes then the name of *hydraulics*. *Navigation* can be related to hydrodynamics, and *ballistics* or the shooting of bombs, to mechanics.

Quantity considered in the movements of celestial bodies produces *geometric astronomy*; whence comes *cosmography*, or the *description of the universe*, which is divided into *uranography*, or the *description of the heavens*; into *hydrography* or the *description of waters*; and into *geography*; whence comes further *chronology*; and *gnominics*, or the *art of constructing dials*.

Quantity considered in light produces *optics*. And *quantity* considered in the movement of light produces the different branches of *optics*. Light moving in a direct line, *optics proper*; light reflected in one and the same medium, *catoptrics*; light broken up while passing from one medium to another; *dioptrics*. It is to *optics* that one should relate *perspective*.

Quantity considered in sound, in its vehemence, its movement, its degrees, its reflections, its velocity, etc., gives *acoustics*.

Quantity considered with respect to air, its weight, its movement, its condensation, rarefaction, etc., gives *pneumatics*.

Quantity considered in the possibility of events gives the *art of conjecturing*; whence is born the *analysis of games of chance*.

The object of the mathematical sciences being purely intellectual, we should not be surprised at the precision of its divisions.

Particular physics ought to follow the same divisions as natural history. From the history, perceived by the senses, of the *stars*, their *movements*, *sensible appearances*, etc., reflection has gone on to investigate their origin, the causes of their phenomena, etc., and has produced a science which is called *physical astronomy*, to which one should relate the *science of the influence of the stars*, which is called *astrology*; whence come *physical astrology* and the delusion of *judiciary astrology*. From the history, perceived by the senses, of *winds*, *rains*, *hail*, *thunder*, etc., reflection has gone on to investigate their origins, causes, effects, etc., and has produced the science which is called *meteorology*.

From the history, perceived by the senses, of the *sea*, *earth*, *rivers*, *streams*, *mountains*, *tides*, etc., reflection has turned to investigating their causes, origins, etc., and has given birth to *cosmology*, or *science of the universe*, which is divided into *uranology*, or *science of the heavens*; into *aerology*, or *science of the air*; into *geology*, or *science of the continents*; into *hydrology*, or the *science of waters*. From the

history of *mines*, perceived by the senses, reflection has gone on to investigate their formation, the working of them, etc., and has produced the science called *mineralogy*. From the history of *plants*, perceived by the senses, reflection has gone on to investigate their economy, propagation, culture, vegetation, etc., and has engendered *botany*, of which *agriculture* and *gardening* are two branches.

From the history of *animals*, perceived by the senses, reflection has gone on to investigate their preservation, propagation, use, organization, etc., and has produced the science which is called *zoology*; whence have come *medicine*, *veterinary medicine*, *horsemanship*, *hunting*, *fishing*, and *falconry*; *simple* and *comparative anatomy*. *Medicine* (according to the division of Boerhaave) is occupied either with the constitution of the human body and *reasons* concerning its anatomy, whence is born *physiology*; or it is occupied with the way of preventing illnesses, and is called *hygiene*; or it considers the sick body and treats of causes, of differences, and of symptoms of maladies, and is called *pathology*; or it has for its object the indications of life, of health, of *sicknesses*, their diagnosis and prognosis, and takes the name of *semiotics*; or it teaches the art of healing and is subdivided into *diet*, *pharmacy*, and *surgery*, the three branches of *therapeutics*.

Hygiene can be considered relative to the *health* of the body, to its *beauty*, or to its *strength*, and is subdivided into *hygiene proper*, *cosmetics*, and *athletics*. *Cosmetics* will give *orthopedics*, or the *art of procuring a good conformation for the members of the body*; and *athletics* will produce *gymnastics*, or the *art of exercising them*.

From the experimental knowledge or from the history, perceived by the senses, of *exterior qualities* which are *sensible*, *apparent*, etc. of *natural bodies*, reflection has led us to the artificial investigation of their interior and hidden properties; and this art is called *chemistry*.

Chemistry is the imitator and rival of nature: its object is almost as extensive as that of nature itself; either it *decomposes* beings, or it *re-compounds* them, or it *transforms* them, etc. *Chemistry* has given birth to *alchemy* and to *natural magic*. *Metallurgy*, or the *general art of treating metals*, is an important branch of *chemistry*. Further, one can relate *dyeing* to that art.

Nature has its deviations, and reason has its abuses. We have related *monsters* to the deviations of nature; and it is to the abuse of reason that one should relate all the sciences and all the arts which show only the greediness, the wickedness, and the superstition of man, and which dishonor him.

Such is the whole of the *philosophic part* of human knowledge which is to be related to reason.

Imagination, from which comes Poetry

History has for its object individual beings, which exist at present or which have existed in the past; and poetry has for its object imaginary individual beings, which are the imitation of historical beings. Therefore it should not be astonishing that poetry follows one of the divisions of history. But the different genres of poetry, and the difference of its subjects, offer us two very natural divisions. The subject of a poem is either *sacred*, or it is *profane*; either the poet speaks of past things, or he makes them present, putting them in action; or he gives body to abstract and intellectual beings. The first of these types of poetry will be *narrative*; the second, *dramatic*; the third, *parabolic*. The *epic poem*, the *madrigal*, the *epigram*, etc. are ordinarily *narrative poetry*. *Tragedy*, *comedy*, *opera*, *pastoral*, etc., are *dramatic poetry*; and *allegories*, etc., are *parabolic poetry*.

Poetry: I. Narrative. — II. Dramatic. — III. Parabolic.

We mean here by *poetry* only that which is fiction. As there can be versification without poetry, and poetry without versification, we have thought that we should regard *versification* as a quality of style, and consider it as belonging to the art of oratory. On the other hand, we will relate *architecture*, *music*, *painting*, *sculpture*, *engraving*, etc., to poetry, for it is no less true to say of a painter that he is a poet, than to say of a poet that he is a painter, and of a sculptor or an engraver that he is a painter in relief or in depth, than of a musician that he is a painter through his sounds. The *poet*, the *musician*, the *painter*, the *sculptor*, the *engraver*, etc., imitate and counterfeit nature; but one uses *discourse*, the other, *colors*, the third, *marble*, *bronze*, etc., and the last, the *musical instrument* or the *voice*. *Music is theoretical* or *practical*, *instrumental* or *vocal*. With regard to the *architect*, he imitates nature only imperfectly by the symmetry of his works. (See Preliminary Discourse.)

Poetry has its monsters as nature does. One should include in this number all the productions of the deranged imagination, and these productions can exist in all the genres.

Such is all the *poetical part* of human knowledge, which one can relate to *imagination*, and the end of our genealogical distribution (or, if you will, our world map) of the sciences and the arts, which we would fear perhaps we had made too detailed, were it not of the most fundamental importance to know well the object of an *ENCYCLOPEDIA* ourselves, and to expose it clearly to others.

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