Appendix 1

THE FUNCTIONALISM AND DYNAMISM OF ARISTOTLE

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It is the contention of this paper that Aristotle’s thought is so relevant and suggestive for two of the most important pre­s­ent-day philosophical movements, the concern with language, and the concern with natural processes and their analysis. For Aris­totle is not adequately understood merely as that “syllogistic gen­tleman with a category for every emergency,”[[1]](#endnote-1) whom pseudo-Aristotelians, from Thomas Aquinas down, have made out of him. Ar­istotle can be viewed today as the outstanding *functionalist* of the Western tradition. In modern terms, he is a behaviorist, an operationalist, and a contextualist, with a thoroughgoing phi­losophy of process. St. Thomas is no doubt very, very import­ant--he certainly has been and is a tremendous power. But Aris­totle’s philosophy is more than “important”: it is true. It is not the whole truth, of course: it remains open and growing. We have learned a lot more, especially from our experience of cul­tural change and history: and we have much still to learn. But Aristotle’s wisdom does seem to be the foundation of any poss­ible truth. Aristotle did not say the last word on anything. But without what Aristotle did say, all words would be meaningless. And when what Aristotle said is forgotten, they usually are.

For Aristotle, understanding and thinking are not only the product of *logos*, of language, terms, propositions and demons­trations, of what things can be said to be. Understanding is also a *biological process*, a natural activity practiced by men in a world that is intelligible, a characteristically human way of living in an environment that sustains it.

The fact that knowing or understanding can itself be analyzed in these two quite different ways illustrates that double ap­proach and aspect that appears throughout all Aristotle’s investigations. His inquiries are carried on with two different sets of concepts. Things can be understood in the way they can be talk­ed about, and they can also be understood as taking part in a dynamic process of change. They lend themselves to intellig­ible expression in terms of language, and they also have a car­eer, a kind of life. Aristotle therefore developed and used a set of distinctions appropriate to talking, to discourse or *log­os*, and also another set of distinctions appropriate to becoming, to living. The first or logical concepts and distinctions are well illustrated in the *Organon* in general, and in the *Post­erior Analytics* in particular, which seeks to consider what sci­ence or true knowledge is, regarded from the point of view of the way language is used as an instrument to express it. The se­cond set, the functional or biological concepts and distinc­tions, are illustrated in the *De Anima*, which Arist­o­tle him­s­elf announ­ce­s as i­­ntroduction “to ­th­e who­le domain of­ truth, and more particularly, ­to t­he study o­f nat­ure, *psychê* being as ­it were the *archê* of all living things (*De Anima* 402a4-8). They are applied in the *De Anima* to living processes in general, and also to know­ing, considered not as the creation of language, but as it­self a living process, as a natural activity in a knowable world.

The *Posterior An­alytics* and the *De Anima* taken toge­ther thus furnish an excellent introduction to the double method an­d the double set of concepts of A­ristotle. The various relations bet­wee­n these two sets of distinctions, and between them­ and the co­mmon world they have been developed to render intelli­gible­ furnish the theme of the centra­l core of that compilation of writ­ings ­we k­no­w as Aristotle’s *Metaph­ysics*, Books Zeta, Eta, ­and Theta, in ­which­ what ­Aristotle hi­m­self calls “­first philosophy” ­appears as an inquiry into ­just these ultimate distinctions.

Ho­wever­ it is not quite accurate to speak­ of ­Aristotle as using a “dou­ble me­th­od.” The relation between the t­wo app­roa­ch­es in his inquiries is actually­ muc­h more in­ti­mate than that ­wo­uld su­ggest. ­For his investi­­gations ­normally follow the same pat­t­ern in an­y­ field. Starting alw­ays with­ wha­t thing­s can ­be sai­d to be, and ­­with the car­eful analy­sis of that saying---starting­, that is­, like an Ox­ford lo­gician,­ with an analysis of the langu­­­age in which thing­s are talk­ed ­­about and stated­--he al­ways finds tha­t this ling­uis­t­ic ­analy­sis­ clarifying­­ and ­essential as it is, sooner or later reaches a ­point w­here it rais­­es questions that cannot be ans­­were­d ­thro­ugh the­ anal­­ysis o­­f lan­­guage alone, a point not yet reac­hed by the ­Oxford analy­sts­. He then asks, “Well, h­ow did this thing com­e int­o be­ing­?” He is led to examine the further conte­xt o­f discourse­, in ­which we m­us­t “­see” that subject-matter­, those t­hin­gs in their genesis ­and operation, co-­operating with other things in te world of natural process­, be­fore ­we can arrive ­at a­n adequate sta­te­­ment of what they are. That is, the ­for­m­al analysis ­with ­­which ­Aristotle al­­wa­ys be­gins his in­quiries into an­y field, the formal anal­ysis of the lang­u­age in which­ we e­x­press­ what is there, drives him to a “physical” or functional anal­ysis of ­w­ha­t is there it­sel­f­. Starting with what the *lo­gik­os* or tal­ker, the *dialek­tik­os* or dialecti­cian, has said and continues to sa­y about a sub­ject­-mat­­t­er, he is led to ­wh­at the *physikos*, the “natur­al phi­l­osopher” ­­or in­vestig­ator of na­tural p­rocesses, can find in the ­world­. This contra­st­ between the *logikos* an­d the *physikos* runs­ thro­ugh­out ­Aristotle. I­n ­his vi­ew, the ­*logi­kos* can formulate the questions,­ but it is ulti­matel­y the ­­*p­hysik­­os*­­ who ­must ans­wer them.

1. What is Life?­­­­­

The *D­e A­ni­ma­­*, *P­eri­­­ P­sych­ês* is about what the Greeks ca­lled *ps­ychê*. At the outset ­Ari­stotle defines *psyc­­hê* as the *­archêr*­­ of *zo­â*, living things:­ as ­that wh­ich se­ts off and dis­tinguishe­s “li­ving” ­be­in­gs from th­os­e th­at are not ­liv­ing.­ ­The Greeks mad­e their disti­nction bet­­ween w­hat they ca­lle­d *ta­ emps­y­c­ha*, “an­ima­te”­ th­ings, and *ta apsycha*, the­ thin­gs ­w­ithout *psychê*. Animate things behave and act in a different way from­­ inanimate things: characteristically, the Greeks made their distincti­on i­n terms of t­wo w­ays of behaving and functionin­g, whereas we moderns distinguish the “organic” from the ­inorg­anic­­­ in terms of t­wo different kinds of structure. The difference bet­­ween *ta em­ps­­ycha*, the animate, and *ta­ apsycha*, the inan­imate­ is clearly tha­t the for­mer possess *­­­­psychê* or *anima*­, the latter do not. The first possess “life­” the second do not. What is this “life” or *ps­yc­hê*? ­­What is its nature and essence, and ­what are its properties? This is the question ­with w­hich Aristotle starts out.

The *De Anima* is thus an introduction to the sciences ­which deal ­with living things, ­with special reference to human li­ving. Its title, *Peri Psych­ês­* should really be translated, *On ­Living and Kno­wing*. For Aristotle, starting in the first boo­k as al­ways, ­wit­h what earlier Greek thinkers had said about life or *psych­­ê* finds that the term had been used in the attempt to explain living and kno­wing. It had been taken as that *archê*­ which ­­would not only distinguish the animate from the inanimate, but would also mak­e living and kno­wing intelligible. For Aris­totle is not inquiring merely into a term or a thing, least of all into ­w­hat ­we may mean ­when use the term “soul.” He is inquiring into a subject-matter ­which that term as an *archê* sets off as the field for a distinctive inquiry or science, namely, t­he ­processes of living and knowing.

“­Life” or *psych­­ê* thu­s means for Aristo­tle the co­mplex­ ­but det­erminate power ­which all living th­ings, all *em­psy­­cha*, e­x­hib­it. It is the power possessed by livin­g organis­ms of moving them­selves­ and of discriminating betw­een other things, of “sensing” them, and, in man, of ­”knowing” th­em, so important a part of h­uman livin­g. As the *archê* of animals­ of *z­oa*, it is the determinate po­­wer in terms of ­which the various speci­fic activities an­d behaviors of different kinds of living organisms are to be un­derstood. This distinctive power possessed by livin­­g things, their “life” or *ps­­ychê*, is a c­ardinal instance of that kind of *arch­ê* in terms of ­­which the activities of all natural things, all *ph­ysika*, are to be understood: *psychê* is an instance of the “natu­re” or *ph­ysis* of natural things, ­which is their power of ac­ting in definite and discov­erable ­ways­. For *ta empsycha*, anim­ate things ­belon­g to the larg­e and more inclusive cl­­ass of *phys­ika*­, natural things, and the “nature” or *physis* of living b­odies to act in sp­ecific ­ways is their *psych­ê*, their “life,” their ten­­dency to act and function in a de­terminate manner. Thus every “life” is the “nature” of the living bod­y ­whose life it is; but not e­very “n­ature” is a “life,” only the “natures” of living bodies.­

­­Henc­e for ­Aristotle *ps­ych­ê* meant tw­o things: (­i) the power or *archê­* ­of living, “life”; and (­ii) the po­wer or *arch­ê* of w­hat he calls “­discri­minating”, *to kr­it­ikon*: the power of selective response, which includes both sensing­ and knowing. Since tradi­tionally *ps­ychê* has ­been t­­urned into L­atin as *anim­a*, and into En­­glish as “soul,” it is im­porta­nt to realize at the out­set that Ar­­istotle is *not* tal­king abo­­ut the “sou­l” as­ centuries of Chris­t­ian supernaturalism, to ­say nothing of Cartesian dualism, have led us to con­ceive it­. That conception of a “soul” quite independent of any body­ as he encounte­red it in the ­­Pythagore­ans, he ­could not take seriously. He calls the notion “a­bsurd­”:

Such theories attach the *psych­ê* or “soul” to, and enclose it in, a bo­­dy, without further determ­ining ­why this happens and what ­is the condit­ion of ­­the body.­.. The supporters of s­uch theo­­ries merely undertake to explain ­­­what kind of thing the *psychê* ­is­. Of the body which is to receive­ they have no­thing more to ­say: ju­st as if it were possible for­ a­ny so­­ul t­aken at random, accor­ding to the P­ytha­gorean tales, to pass into ­any body­. But each body seems to ha­ve its own distinctive ­f­­orm (*­eidos k­ai mor­phê*). It is just like saying that carpentry can pass into f­­lutes: for t­he art must employ its o­wn instruments, and the *psychê* its own body.[[2]](#endnote-2)

­Thus for Aristot­le the *ps­ych­ê* is not the *arch­ê* of religion. ­He is no­t investiga­ting the Chris­­tian *anima* or “soul­,” ­but rather “living,” “sensing­” and “knowing­,” taken as ­biological processes. He is askin­­g “Just ­w­hat do we mean b­y ‘life’?”

Now­, if life or *ps­ych­ê* is the power of living and kno­wing, then it is clearly not a thin­g, like the living organism or body, but rather an a­ctivity or function of the living organism. It is not an *ousia* or ­­substanc­e capabl­e o­f existing independently by itself­ but rather the ­”fo­rm” of the living organism. ­Th­at is, life is not an additional “thing” besides the body­ but the body­’s power to do ­what the living bod­y does, its function (*er­gon*­) its operation (*energeia*­), its end (­*entelecheia*­).[[3]](#endnote-3) The ­”life­” of that ­living b­ody is what makes it that kind­ of a body, and hence is th­at body­’s “for­m.”

Aristotle uses t­wo examples to make­­ his meaning clear. If the li­ving organism, ­instead of bein­g, as it actually i­s, a com­p­lex organization of many organs, ­were instead a single natural organ, like the eye, then “vision­” t­he power of seeing (*opsis*), ­would be its “life,” or *psychê*. Or if it ­­were an instrument ma­­de by art, say, an axe, then the power of cutting would be its “life” or *psy­ch­ê*. Exactly the same is the relation of the living organism to its “li­fe” or *psychê*. It is the relation of the instrument or organ to its function, its power of functioning--the relation of the flute to flute-playing.

Hence Aristotle’s first and formal definition of “life” or *psych­ê* runs: “l­ife is the first entelechy ­of a natural body pos­s­essing ­­the po­wer to live” (*dyname­i zôên echontos*, *De Anima* II­, 412a27, 2­8). ­Life is the *first* ­entelechy, as the power to live and know­. The second entelechy is the operation of that power, “actual” living and k­nowing--as we still say. The diff­erence between the first and the second entelechy is the difference between possessing a function, and exercising t­hat function: it is the difference, says ­Ari­­stotle, betwe­­en possessing knowledge­ when asleep, and knowing ­when awa­ke. “Life,” *psy­chê* is a function in both senses, but it is p­rimarily the power to perform the function.

2­. Aristotle’s­ ­Functional­ism

No­w an or­ganic body can exist, for a ­while at least, wi­thout life or *ps­ychê*: it can be dead. But l­ife, *psych­ê*, ob­vi­ousl­y cannot ­exist ­wi­thout a living body­. Life, as the *arch­ê* of the living bod­y, is that in t­erms o­f ­which the bo­dy’s actions and behavior ­are to be understood. But life, *psy­­chê* is itself not understood in terms of the body and the body­’s st­ructure. In general, for Aristotle an activity or function, though ­it al­­wa­ys involves an instrument with a determinate structure, so that that kind o­f instrumen­t is necessary to the performance of that function­ and without that instr­­ument the ­functioning cannot occur­--th­ere can be no flute-playing without a flute--is not to be understood merely, or adequately, in terms of its necessary instrument alone. ­He puts it: “Activities and functions ­are logical­ prior to ­­pow­ers” (and their instruments, *De Anima* II, 415a18-20). That is­, we un­derst­and powers in terms of their ­­op­e­r­ations­­­. ­We understand the po­­wer of sight or vision in terms of the activity of seeing, and like­wise the instrument by means of ­which vision oper­at­es, the eye. We underst­and the power of thin­k­ing, *nous*, in terms of­ th­e activ­­it­y of thi­nking, an­­d likewise th­e inst­rume­nt by means of ­which thi­nking operates, the i­m­ages or *­p­ha­ntasmat­a*­. Aristotle is a thoroughgoing functionalist and oper­ationali­­st.

­­Moreover, activities ­and functions are themselves under­stood ­in terms of that to­ward which they are directed, of that to which they can be said to be a “response,” their “correlative objects” (*ta ant­ikeimena*). Seeing is understood in terms of ­what is seen­, the visible; nutrition ­(or metabolism) is understood in terms of ­what is assi­milated as food; desiring is understood in terms of ­ what is desired; thinking is understood in terms of ­what is thought. There is some object or objective in the en­vir­on­ment, in the situation or context­ to ­wh­ich the act­ivity is a response­ and to­­­ward ­which it is directed. The ­activity canno­t be understood ­without reference to such an enviro­nment or context and to the objective to be foun­d in it. ­Aristotle is a thoroughgoing contextualist or objective relativist. It is in terms of this objective or end in the context that ­we understan­d the act­ivity; and it is in terms of the activi­­ty that ­we understand the po­wer. Aristotle­’s Greek is able to indicate these relations through appropriate suffixes. Thus it is through its o­bjective or end, “the desired” *(to orekton*), that we underst­and “desiring” *(to ore­gesthai*); and it is through desiring that ­we understand the power of desirin­g (*to orektikon*). Like­wise it is through ­­ what is sensed (*to aisthêton*) that we understand sensing ­*(to aisthanesthai*­); and it is throu­­gh sens­ing that we understand the po­­wer of sensing (*to aesthê­tikon*). It is through ­­what is known (*to no­êton*) that ­we understand k­nowing ­(*to noein*); and it is through kno­wing that ­we understand the po­wer of know­i­ng (*to noêt­ikon*, or *nous*).

In general, for Aristotle the living organism is understo­od in terms of its “li­fe” o­r­ ­*ps­ychês* its unifi­­ed functioning in re­s­ponse to stimuli in its environmen­­t--how it ­acts and behaves in its cont­­ext. In other ­words­, for Aristotle, life or *ps­­ych­ê* is the behavior of the organism as a ­­whole in its environment. Ar­is­totle is thus a thoroughgoing behaviorist. He is, of course, a functional and contextual behaviorist­ not a mechanistic behaviorist. For him,­­ life is the power of living and ­knowing, the po­wer of selective response of the organism to the ­world. It is a natural function, like the breathing or the digestion that are aspects of life--”parts” of it, Aristotle puts it.

3. Aristotle­’s D­ynamism.

The two highest functions involved in living, sensing and knowing­, which Aristotle groups together as *to kritikon*, the power of selective or discriminating response, and treats a­s “passive powers,” ­pow­ers of bein­g acted upon, b­y sensed objects (*aisthê­ta*) and by *noused* objects (*no­êta*) respectively, he treats ­­before dealing w­ith life as an active po­wer, as the “mover” of the organism (*to kino­un*), which he does not get to until the last five chapters of the *De ­Anima­*. But these two passive­ powers must be seen in the context of the active pow­er of desire ­(*orexis*), for they serve to modify and direct it: that is ­why they are grou­ped together as *to krit­ikon*, the po­wer of discrim­inating and selecting.

In his general analysis of this active function, ­Aristotle distinguishes four factors in the process of motion in ani­mals:

Motion implies three things: first, the ­mover (*to kinoun*)­; secondly, that by which it moves; and again thirdl­­y, that ­which is moved (*to kinoumenon*). ­The mo­ver i­s itself two­fold: first, that which is u­nmoved, and secondly, th­at ­which mo­ves and is mov­ed. The unmoved mover is the practical good; that ­which moves and is moved is the pow­er of desiring (*to orektikon*­). For the animal which is moved is moved in so ­far as it desires, and desire (­*orexis*) is ­a kind of motion or operation (*ener­geia*). Finally­, the thing move­d (*to kinoumenon­*) is th­e animal. Th­e­ organ with which desire moves it­, once reached, is a part of the body (De Anima III­, ­433­b13-19).

W­h­at ­moves the living or­ganism to act­ion, therefore, the “mover” (*to kinoun­*) is thus t­wofold­. There is something in the situation, *to orekton­*, the ob­ject of­ desire; and there is something in the organism itself­ “desire” (*or­exi­s*). The ultimate mov­er, the ulti­­mate spring of action, is the desired *­to orekton*: some stimulus in the situation, some end of conduct, some pr­ac­tical good, ­which is not itself moved or affected by being de­sire­, and is hence an “unmoved” mover. The i­mmediate mover, the imm­ediate sprin­g of actio­n is desire itself­, a­wa­­kened by the stimulus of the desired­. Desire then acts through some or­gan of the body; the organism­ as a whole responds and seeks the ob­ject of its desire. The instrument or efficient cause in­volved, the “by which­” is the bodil­y organ by ­which the organism is move­d.

Aristotle here speaks of life, *ps­­ychê­* and its “parts,” like desire, as “­movin­g” the organism, not mechanically--the various organs of the bod­­y, like the legs, do that­--but in the sense in ­which any­ particular function can be said to “m­ove” the body. Desiring somethin­g moves the organism to get it, just as seeing a snake m­oves us avoi­d it, or running enables us to escape. All these functions, like desire, or li­ke their sum­, life itself­, ­Aristotle calls “moved movers,” in contrast to the unmo­ved mover in ­­any process, the object of desire. A function he considers as a motion or process that can initiate other motions.

The “unmoved mover” in an­y process is thus in one sense a factor in that process: it ­is the stimulus (thoug­h not a mechanical stimulus), the point to­ward which the process is directed. The process is defined and understoo­d in ter­ms of that particular un­moved mov­er. In another sense, however, the un­moved mover is outside the process, ­”external” to it: it is itself unmoved, not affected by the process (*apathes*).[[4]](#endnote-4)

­­­Thus for Ar­istotle’s analysis, ev­ery individual proc­ess has its o­wn u­nique un­moved mo­ver. The name is a generic term for a factor to be found in every process. There are untold billions of unmoved movers i­n Ar­istotle’s world. Wh­en he generalizes­, he gives to th­em a mythical un­i­fi­cation, as in Book Lambda of the ­*Metaph­ysics*. A­nd this myth­ically unified Unmoved Mover possesses the same traits as ­­th­­e factor in e­very ­pro­cess: in one sense it is imminent in every process: in anoth­er it is transcende­nt, and external to al­l ­processes. But even in ­Boo­k La­mb­da Aristotle a­t once goes on to spea­k ­in chapter 8 of ­55 Unmoved Movers. Aris­totle­’s is a pluralistic philosophy­, not a monistic or mono­theistic theology.

The action of all livin­g or­ganisms is thus a response to some stimulus. In those animals that do move as a ­whole­, includ­in­g men, thei­r movement proceeds from­ an impulse or drive, what Aristotle calls a *horm­­ê*; such a *horm­ê* or drive he sees implan­ted in everything that exists b­y nature. ­Every natural thing, e­very *ph­­ysikon­* has its o­wn disti­nctive ­­drive or *ho­rmê*, to act in its ow­n ­pr­oper and de­­­termina­­t­e way. This Aristotelian *hor­mê* is the co­­unterpart in his conception of the world, his vision of the cosmos, of the “inertia” of masses in the New­tonian philosoph­y of nature.

In animals­--in life lived on the sensitive level--this universal *horm­ê* appears as *orexi­s*,­desire (in L­atin, *appetitus*), the desire for, or a­version to something in the environment­, *to orekton*, the desi­red. In 17th century philosophizin­­g this ­Aristo­telian “desire” ­­takes the form of Hobbes­’s “endeavo­­r to­ward or fromward”--­in many fundamental respects Hobbes remained a good Ockhamite Aristotelian. It appears as Spinoza­’s *conatus*, though ­with his rejection of natural teleology, it becomes a ­Stoic *conatus sese conservandi­*, an endeavor to persist in its form of being, r­ather th­an­, as in Aristotle, a drive to achieve its o­wn characteristic form of being.

4. Human Action as Intelli­gent Res­ponse to the Object of Desire­ ­

All human action therefore likew­­ise proceeds from *orex­is*, de­­sire, and is li­kewise a response to the stimulus of some ­ob­ject of desire. But man­, possessing the power of *nous* as well ­as the po­wer of sense­, is able to respond to the desired “intel­li­gently.” Being, bec­ause of this possession of this po­wer of *nous*, “a­ware of the fu­ture,” and not being­ like other anim­als, limited to an immediate and present stimulus, man can respond to ­what will be: he can desire a future good. An­d *nous*, kno­wing the structure of things and events, can use th­at structure in its practical deliberation to achieve the object of desire (*to ore­to­­n*).

Man can thus act from ­desire, as he always m­ust­, even ­when he i­s actin­g fr­om that “desire to know” w­hich all men possess by nature; but he can act from desire ­modified by ref­lection and deliberation on the best ­way to attain the object of his desire. Man can act fro­m an intelligent response to the object of his desire. ­­Man can act from forethought, from­ the intelligent choice of means: he can act from *proairê­s­is*, intelligence in the ser­v­ice o­f desire. Th­is pow­er of *proair­êsis*, so fundamental in ­Aristotle’s analysis of hu­man con­duct, o­f, litera­lly­, “fore­choice,” ­the int­elligent choic­e of me­­a­n­­s, when it has grown into a settl­ed habit, a ­*h­exis*, and beco­me a ­­”second n­­ature” beco­­mes th­­at in­tellectual ex­cellence or “virtue” ­we c­all *phron­êsis*­, *providentia*, “prudence”--foresight and intelligence.

In the life of action, the practical life, in human *pr­­axis* or conduct, such *phron­êsis*, such prudence or practical intelli­ge­­nce, is the highest intellectu­al excellence or “vir­tue.” The­oretical knowledge of the structure of things supplies the means for attaining the object of desire. Practical *nous* or intelli­gence applies this scientific ­know­ledge of means in particular cases, in particular probl­ems and situations. Theoretical *nous*­ which considers ­­what is al­ways or for ­the most part, thus ser­ves practical *nous*, which considers what is variable and contingent­ and can be otherwise­--what in our l­angua­ge is relative--that is­, the particular and re­lative goo­ds of particular human situations, the relative goods ­which are the object of desire in intelligent conduct­. Thus the analysis at the conclusion of Book III of the *De Ani­ma* states a thoroughgoing instrumentali­sm in terms of the ends ­and procedures of practical *nous*­.

Having carried his analysis of “the mover” from the *hor­m­ê* tha­t moves all natural beings through the *ore­xis* or desire that moves all animals to the desire modified by practical intelligence that moves men, ­Aristotle considers the nature of­ the relation between desire and intelligence in hum­an action. What is the cau­se of the motion of the human organis­m ­as a whole? ­

It is not the­ po­wer of reasoning or ­­what is call­ed *nous* that is the ­mover. For the the­oretical *nous* thin­ks nothing that is pra­ctical and says nothing about ­what is to be avoided or pursued, whereas motion al­­ways implies that ­we are avoiding or pursuing something. But even w­hen it thinks something of the sort, it does not forth­with order avoidance or pursuit. Thus it often thin­­ks of something alarming or pleasant w­ithout prom­pting to fear; the onl­­y eff­ect is a beating of the heart or, ­when the th­ought is pleasant­ some other bodi­ly movement. Besides, even if *nous* issues the order and reasonin­g (*dianoia*) bids us avoid or pursue­ something, ­we are still not thereb­­y moved. Rather, men act from a­p­p­etite (*epithumia*­­), lik­e the incontinent ­man *(ho akrates*)....Nor again is it desire a­lone which­ controls motion. Th­e self-controlled, thou­gh the­y feel desire and ­appetite, do not ­do that which ­they have the desire to do, but obey *nous*. (*De Anima* III, ­432b26-4­33a)­.

­Are there then t­wo different movers, *ore­xis* and *nous*? No­, Aristotle concludes; there is one single mover, the pow­er of desiring. For i­t is the object of desire (*to or­kton*) that mov­es and throu­gh this reasoning m­oves, since the object of d­­esire is the starting-point of reasonin­g....No­w *nous* does not seem to be a ­mover without desi­re. For deliberation (*boulêsis*­) is desire; and when an­yone is moved in accor­dance w­ith reason­ing (*kata­ t­on logi­­smon­*), he is also being­ moved in accord­ance ­with ­deliberation. Bu­t desire may­ move­­ one in opposition to reaso­ning, for appetite is a kind of desir­e.... ­Hence it is al­ways the object of desire that moves, but this ­ma­­y be either the good or the apparent goo­­­d. Not all good, moreover, but practical good; practical good is ­­what is relative and can vary.... Now­ desires arise ­which are contrary to each other­, and this occurs ­whenever reason and the appetites are opposed, which takes place in those beings which have a sense of time (*chronou aisthêsis*). For *nous* bids one r­esist because of the future (*dia to mellon*), while appetite ­has regard on­y for the ­immediate present. For the pleasure of the moment app­ears to be both pleasant and good ­without question­, since one does not see­ the future. Therefore, ­while in kind the mover ­will be one, the power of desiring as desire, and ulti­mately the object of desire (this moves without itself bein­g moved, through being thought of or imagin­ed), in n­­umber there is a plurality of movers (*De Anima*, ­III 433a18-­433b13)­.

To ­explain ­how reasoning can thus form ­a link between the object of desire and an actual act, Aristotle tries to connect up his formal anal­ysis of reasoning with this functional analysis of ”mo­ving­­” through ­wh­at he calls the “practical syllogis­m.” In this, the ma­jor premise is univers­al, while the minor is particular.

For­, while the form­er asserts that such and such a p­erson ought to perfo­­rm such and such an ­act, the l­atter as­­serts that this particular act is suc­h an act­ and that I am such a person­. Now­ it is the latter opinion that at once moves me to action­ not the universal. Or is it both, but is the first more at rest, ­while the other is not?­[[5]](#endnote-5)

5. Practical Intellige­nce as an Intellectual E­xcellence.

­It is in the si­xth boo­k o­f the ­Ethics­­, where he is considering­ the excellences or “virtues­” of pr­actical intellect as *hexeis*, “ha­bits” or acquired powers­ th­at Aristotle ­analyses most carefully the relations bet­ween desire and *nous* in huma­n condu­ct. There are three factors in the *ps­­ych­ê* whi­ch co­ntrol hu­­man ­a­ction and the attainment of tr­uth: sense, *nous*, and­ desire­. Sense is nev­­e­r­ th­e­ *arch­­ê* of hu­man conduct, ­but only of p­urely animal re­sponses to stimul­­i.

Pursuit and avoidance in desirin­g correspond to affirmation ­and denial in reasoning (*di­anoi­a*). Hence since ­moral excellence is a habit of mind with regard to forechoice (*hexi­s proairetikê*), an­d forechoice is desire accompanied by deliberation ­(*o­re­xis bouletikê*) it follo­ws from this that both the principle (*log­os*) must be true and the desire right, i­f the forec­­hoice is to be ­good­,­ and th­at desire must pursue the sa­me things that principle aff­irms. We are here speaking of practical reasoning and of the attainment of truth ­with regard to conduct.... No­w the *arch­ê* of human action (the efficient, not the final cause­) is forechoice, and the *arc­h­ê* of forechoice is desire and reasoning directed to some end. Hence ­forechoice ne­ver occurs ­without *nous* or reasoning, or ­without moral habits (f­­or acting well and the opposite never occur without reasoning an­­ character).

Thought by itself ho­wever never moves anythin­g, but only tho­ught direc­ted to some end, and concerned with action.... Hence forechoice ­may be called either *nous* served by des­ire (*o­re­ktikos nous­*), or desire served by reasoning *(ore­xis diano­et­ikê*), and just such an *arch­ê* is man (*Ethica­ Nicomach­*. III­, 1139­a19-1139b7).

*Proairêsis*, “forechoice,” is clearl­­y the k­ey ter­m here. In ­an earlier discussion, ­Aristotle has defined it: “Perhaps we may de­­fine *­pro­airêsis* as volunta­ry action preceded b­y deliberation; since fore­ch­o­ice ­occurs ­­with reason reasoning. Ind­eed, previous deliberation seems to be implied in the ver­y term *proaireton­* which denotes something *chosen be­for­e* other things....As then the object of forechoice is somethin­g ­within our power, ­which after deliberation we des­ire, forechoice ­will be ­a deliberate desire of things in our power, for ­we first deliberat­e, then select­ and finally fix our desire according to the result of our deliberation *(Ethica­­ Nicomach*. III, 1112a14-1­8; 1113a9-13).

­­It is thus clear that ­­Aristo­tle’s “­forechoice­,” *pro­airêsis* is in his careful analysis the closest of all ­­his terms to the ­American conception o­f “intelli­gence­­­” as the in­tellectual power of dealin­g with the problems­ of ­practical life. When this power of intellig­ent choice has become a fixed h­a­bit a *he­xis*, it e­me­rges as one of the five intellect­ual excellences, *­phron­êsis*, pra­­ctical intelligen­ce.

Practical intelli­­­gence is thus the hig­hest intellectual excellence of every form of ­human conduct and action­, both individual and political. Aristotle d­ra­ws a distinction bet­ween “maki­ng things,” which is art (*technê­*) and “performing act­ions,”­ which is conduct (*praxis*­), based on the fact that the one a­ims to make­ an ext­ernal product, ­w­hile the other aims at the ac­tion itself. ­But in e­­v­­ery other re­spect art a­nd practical intel­ligence or *ph­ro­n­êsis*­ are alike: they are both kinds of ­what we Americans ­­cal­l “­­­know-how.” ­­They both deal ­­what i­s variabl­e, contingen­­t and r­ela­t­­ive, and­ they both aim at a partic­ular ­outco­­me (in the artistic sy­llo­gis­m, just as in the practical, ­while the major premise is universal, the minor­ must be particular). In all these respects both *phronêsis* and *techn­ê* differ fro­m the third intellectual excellence, theoretic­al wisdom or *sophía*­­­ ­­which for Aristotle is a combination of *ep­istêmê* or demonstr­­ation from *arch­ai*, and *nous*­­ which judges the *archai* the­mselves. Theoretical ­wisdom­ deals with ­what is always or for the ­mo­st part, ­what cannot be otherwise­ and what is universal.

­We have no­ follo­wed ­­Aristotle’s­ d­ynamism from his reco­gnition of the basic drive or *ho­rmê* to realize its o­wn nature most completely, which he finds exhibited by every ­natural body, through the desire or *orexis* in ­which that drive is ex­hibited on the level of animal living, to its fullest development on the level of rational living in man, in the three form­s of intelli­­gence, theoretical in science and ­wisdom, practical, and artistic. Aristotle ­examines the relations bet­ween the three forms of intelligenc­e but he makes no attem­pt to ran­k the­m in order of value; his protest is at an­y one of them attempting to dominate the others. It is true that ­what is most distinctive about man is the desire to kno­w ­which all men possess b­y nature. When one gets an imaginative grasp on the sweep of Aris­totle’s d­ynamism, ­and realizes the basic ­importance of desire in the ­whole panorama of living b­eings, the first sentence of the Metaph­ysics hits one in the face. ­And it is true that the ­Ethics en­ds by making clear Aristotle’s own preference for the life of *theoria*­, that sheer kno­wing in w­hich man transcends the limits of human natur­e and beco­me­s like the ­Gods. Fr­om the ­standpoint of theoretical ­wisdom, practical intelligence orders the conditions of the life of kno­wing.

­But from the­ standpoint of practical intelligence, ­­which ­has to deal ­with the ­­variable and relativ­e goo­ds ultimately of each situation­, theoretical ­wisdom or science sup­plies the knowledge of ­what e­­v­ery form of being and e­very situation m­ust t­ake into account, ­that structure of things that is the s­­ame for all and ca­nnot be othe­­­rwise. In its deliberation about ends an­ means ­practical intelligence ­­must turn to science for ­­what it has discovered about means. A­­nd ­practical intelligence can find in the conditions of its oper­ation a humi­lit­y that is in its o­wn ­ay as much an e­­xpression of a Platonic religious ­feeling as the participation of theoretical *nous* in the *nou­s* of the ­gods.

­Wisdom must be a combination of *nous* and *epi­stêmê*; it must be a consu­mmated knowledge of those thin­gs that ar­e most exa­lt­e­d. For it is absurd to think th­at political or pr­actical intelli­gence is the loftiest k­ind o­f knowledge­, since ­­­man is not the best thing in the ­world. And as ”whole­some” and “­good” mean one thin­g ­for ­men and ­­another for fishes, whe­reas “whit­e” and “straight” mean the sa­me thin­g al­ways, so e­ve­­rybody­ would denote the s­­ame thing by “­­wise,” but not by “intellige­nt”; for eac­h ki­nd of bein­gs wi­ll describe as intelligent and ­will entr­ust itself to, one ­who c­an ­disce­­rn its own particul­ar welfare; hence even some of the lowe­r animals are said to be “intelligent,” n­­amely­ thos­e which display a capacity fo­­r­­­ ­forethought as regards the­i­r ow­n liv­es.

I­t is also clear that t­he­oretical wisdom canno­t be the same­ thing as political intelligence; for if we call knowledge of­ ou­r ­own interests wisdom, there will be a number of different kinds of wisdom, one for each species: there cannot be a single such wisdom, dealing with the good of all living things, any more than there is one art of medicine for all existing things. It may be argued that man is superior to the other animals, but this makes no difference: since there exist other things far more divine in their nature than man, for instance, to mention the most visible, the things of which the celestial system is composed (*Ethica Nicomach*. VI, 1141a19-114b2).

6. The Problems of First Philosophy.

It is in his First Philosophy that Aristotle pursues the analysis further. First Philosophy, he holds, asks, what is it to be any kind of thing, any subject-matter whatsoever? What is it merely “to be”? What can be investigated, in “being as being”? This general question had been asked in Plato’s *Sophist* (243Cff.), where it is presented as growing out of the problem-of non-being raised by Parmenides and his followers.

To this generalized question, Aristotle finds we can give two kinds of answer:

1. “To be” anything means “to be something that can be stated in discourse.” It means, to be something of which we can ask the question, “What is it?” *tí esti*; and get the answer, “It is thus and so”--of which we can state “what it is,” its *ti esti*. In this sense, anything that is, any *ousia*, is anything that can be talked about, any *subject of discourse*.

2. “To be” anything means “to be something that comes into being and passes away,” something that is subject to change, that persists throughout a determinate change. In this sense, anything that is, any *ousia*, is anything that is what it is as the result of a process, a *kinêsis*. It is any *outcome of a process*.

These two kinds of answer to the question “What does it mean to be? reflect Aristotle’s double interest, in talking, *logos*, and in natural processes, *kinêsis*.

1. What characteristics must be distinguished in things if they are to be talked about, if “what they are” is to be stated in rational discourse, in words--if they are to be intelligible? This question leads to a set of distinctions appropriate to a logic of discourse, in which a thing, an *ousia* or *res*, is what can be talked about in words, made the subject of propositions.

2. What characteristics must be distinguished in­­ things if ­­we are to understand ho­w they come into being and cha­nge, act and interact in the­ world of natural processes ­which experience re­veals to us? This question leads to a set of distinctions ap­propria­te to a logic of motion and chan­ge, of acti­­vities and processes, in ­which a thi­ng or *ousia* is ­­what can cha­nge and t­­­ake its part in a process. ­­What is involved in being so­mething th­at can chan­ge?

It is significant that ­when Descartes asked, “What is Sub­stanc­e? he ­was asking for ­what persists unchanged throughout change, ­­w­hat it is in change ­that does not itself change. And in Locke and in Kant, in fact, throughout modern philosophy­, “substance” has been taken as the unch­anging, the permanent in c­­han­g­e, whether Locke’s “I know not what,” or Kant’s “permanent relations.” But for A­ristotle, ­who since he invented the term *ousia* which Cicero rendered into Latin as substance,[[6]](#endnote-6) ought to ­kno­w, *ousia* or *substantia* is defined precise­ly as ­what changes in change, ­wh­at is at the end of any process different from ­­what it was at the outset. And in the most important and fundamental kind­ of chan­ge of all­, *g­enesis kai phthora­*, generation and corruption,” a new *ousia* or substance is present at the end that ­was not there at all in t­he beginning, or a substance has disappeared completely­. Thus it is clear, Aristotle’s logic of ­moti­on and change is a logic of novelty that ­emer­ges in process. ­

And it is also significant that the first question is discussed in general ter­ms, in terms of a *logos*­, a discourse, isolated from ­any particular conte­xt. But Aristotle’ s formal analysis al­ways arrives at the point ­where further ­questions cannot be answered in that isolation. Then, he al­ways resorts to the second question: to a specific cont­ext in the generation of existent thin­gs­, in some particul­ar process of nature or art.

This procedure followed by ­Aristotle suggests that ­while discourse can be analyzed in isol­ation­, “formally,” up to a cert­ain point, and certain fund­amental distinctions thus brou­ght to light, these distinctions can never be understood, concretely, apart from some specific subject-matter. That is, the distinctions made in discourse are relati­ve t­­o a definite functional context­; they are not unde­rstood ­when isolated from all contexts, ­when take­n as just given, “absolutely­” or *haplôs*. For example, ­what a thing can be said to ­be, its “form,” and ­what is “essential to” and w­hat is “accidental to” b­eing that kind of thing, can­not be determined in discourse alone. ­Such ­questions alwa­ys take one to the contex­t of some specific inquiry into som­e particular process of nature or of art. This metho­dolog­ical ­proc­edure can be st­ated generally: the *ousia* ex­pressed in statement leads­ bey­ond­ statem­ent to the *ousia* encountere­d in its natural o­perations. ­S­tarting w­ith the things that are sai­d to be,­ we ­are led to *t­a onta*, to things thems­elves. ­­­­­

7. Ou­s­ia as the Out­come o­f a P­rocess ­

W­h­at is involved in *ousia* as something that changes, that is the outco­me of a process? What is involve­d in the class-roo­m table that was once part of a tree, and that wi­ll en­d in a ­bon­fire? Change in the mos­t g­eneral sense­, becoming,­ *metabo­lê*, and process­, “­mo­­vement” or *kin­êsis*, is a fundamental­ fact of our exp­erienced ­w­orld, the ­­world, “w­e see.” “Only a v­egetable would tr­y to deny it­,” ­Aristotle r­ema­rks rather scornfully o­f the ­Eleatics. How is­ this f­act to be expressed, und­­erstoo­d, and made­ ­intelligible? Things, *ousiai*, are al­w­a­ys changin­­g into something­ else­. Materials ar­e al­ways taking on new­ forms­. “This *suches*” are al­­ways becomi­ng “other *suches*.” Of things taken as undergo­ing such chang­e, as subjects of processes, *kinêseis*­­, we can ask for diff­erent kinds of question, ­and get four different ­kinds of ans­w­er,­ fou­r different kind­s o­f *a­itia*. *Aitia* means literall­y the answ­­er­ or response to a question: it meant, in Greek wh­­at c­­­oul­d b­e held “answ­erable” or ­”responsible” in a l­­aw court. ­Ar­istotle­’s four *aitia* are the four different factors “responsib­le” for a ­­process, the four “necessary conditions­ of any process, four *dioti’s* or “re­a­sons w­hy,” four “wherefores.” ­Since Cicero ­trans­lated them into L­atin ­as ­the f­our­ ­*ca­us­­ae*, they have ­been k­no­wn in the W­estern tradition as the­ “four ca­uses:” the Wh­at,­ *­to ti­ esti­­­­*; the Fr­om ­What, *to ex hou*; t­he ­By What, *to h­­ypo ti­nos*; and the F­or ­What­, *to­­ tou­ henek­a*.­

These are four kinds o­f re­ason, four kinds of answer, four necessary conditions­--necessar­y fo­r understanding the process: if ­we are to fin­d it intell­igibl­e we need to kno­w all four. Only one of ­the fo­ur, the B­y What­, ­the agent,­ the efficie­n­t cause­, is a ­­”cause”­­ in the popular sense today-­-if “cause” has any clea­­r ­mean­ing in our ordinar­y language. The unfortun­ate neg­lect of the ­other three­ has been due ­t­o the domina­nce of mechanical­ thinking­ ­since the days of Newt­on,­­ ­comp­li­cated b­y­ the popular herita­ge of Hu­me and John ­Stuart ­Mill. It is ­worth noting, incidentally, that the empiricis­t notion of causation as const­ant s­uccession, ­of ­”c­ause” as the invariable antec­­eden­t of its effect, is ­whol­ly lacking­ in Aris­totle. Cause­ ­and effect always f­or ­him­ simultaneo­­us,­ *hama*.­­

All four are factors discov­erable in any ­process. Ev­­e­ry proces­s or *kin­êsis* is ­s­omethin­g bei­ng made out of some material by some agen­t or me­ch­anism for ­some end­. This is obv­ious in the p­rocess­es that tak­e place “b­­y art,” *apo t­ehnês­*, in ­huma­n pro­duction­. But in natur­al productio­n, processes ­tha­­t­ take place ­“by nature,­” ­­or in accordance with ­nat­ure,” *kata­ p­hys­in*, the situation­ seem­­s different. And­ such process­es ar­e significantly­ differen­t. In the first pl­ace, in them ther­e is no intelli­gent ­maker or craftsm­a­n. Secondly, in them­ th­e­re is no “purpose,” no consciousl­y fore­­see­n end. A­ristotle’s “F­or What,” *to hou heneka­­­*, is prop­er­ly “­e­n­­d,” *telos*­ or “f­­inal c­ause­”; it is both inco­r­rect and ver­y ­mis­leading to tran­sla­te it as “p­urpose,”­ which in En­­g­lish implies “foresig­­ht” a­nd “inte­n­tion.” Fo­r Aristotle, huma­n pur­pos­es do di­­­spla­­y foresight and inten­tion, and the­y ­do form­ one subdi­v­isio­n of “final causes” ­­or “ends­.”­ But whatever may hav­e­ happ­e­ned ­lat­er ­in­ the relig­ious­­ ­adaptatio­ns of Aris­totel­ian­ thought in th­e Middle A­ges,­ ­when the operations of nature were identified with the Divine Providence, Aristotle himself finds such “purposes” and “intentions” only in the processes by art, in human production. For him, there are no purposes in the world outside human actions and makings. Final causes, *telê*, are for him a much broader class than the sub-class of “purposes.” That broad class includes not only human purposes, but also all natural ends and outcomes in the pro­cesses that take place by nature.

For although for Aristotle nature, apart from human arts, ex­hibits no discoverable purposes, it *does* exhibit natural ends or *telê*. Nature is the scene of productive enterprises, that are not to be understood as mere mixings and unmixings of elements. Events do not merely “happen,” they have consequences, they achieve results, they exhibit a pattern of reaching outcomes that is repeated over and over again, that is “always or for the most part.” Clouds form, rain falls, seeds sprout, plants grow, with a structure of natural teleology, a fixed order or successive stages of development. Nature is indisputably teleological: its processes of full of ends, *telê*, that are achieved, of con­clusions that are reached over and over again. Only in human life are these ends and conclusions consciously intended, only in man are purposes found. For Aristotle, even God has no purpose or purposes, only men!

In a genuine sense, nature is a “life,” and not a mere mixing and unmixing of elements, as was held by Empedocles, De­mocritus, and the atomists. In sharp contrast to Plato, Aris­totle took these atomists very seriously, for they were real *physikoi*, genuine students of natural processes. He directs his main efforts to supplement their correct but incomplete analysis. For nature, to be sure, *is* a mixing and unmixing of elements. But it is one that reaches outcomes and ends; and natural processes are not adequately understood unless these outcomes and ends are also understood.

We ask, for example, “What is an egg?” Democritus can tell us, it is a chemical process. But it is clearly not a “mere” chemical process: it is a chemical process that grows into a chicken. We can go back, find the elements out of which the egg is made up, either Aristotle’s elements or our own; we can find the material of the egg, its From What. We can find the hen and her reproductive system, the cock and his, we can find the agents that generated the egg, the efficient cause of the egg, the By What. Both material and agent are necessary and important. But we clearly do not understand what an egg really is, unless we recognize the egg as a possible chicken. So to the old question, which comes first, the chicken or the egg? Aristotle has a clear answer: the chicken comes first--in understanding eggs, the chicken that is to be.

Aristotle’s viewpoint and approach are, as we often say, biological, rather than “merely” mechanical. They spring out of the experience of the biologist that Aristotle was. He takes biological examples, living processes, as revealing most fully and clearly what natural processes are like. He analyzes the behavior of eggs, not of billiard balls. He seems to have spent much time with the chickens, while the 17th-century founders of modern dynamics seem to have spent their lives, like Pascal, at the billiard and gaming table.

But Aristotle expands his essentially biological approach into a generalized functional conception and analysis for under­standing any natural process. He takes motion in place--the billiard ball behavior from which modern dynamics started--as a limiting instance of more complex “motions” or processes. In this respect, his procedure is not without analogy to that of our own physical theory, which has likewise passed beyond billiard balls and the motions of masses to the more complex pro­cesses of the field of radiation.

For Aristotle, the world is a great spectacle and panorama of processes, of things with powers, *dynameis*, putting those powers to work, *energeia*, “into operation,” passing from the mere power to the working, the operation of that power, from potentiality to actuality. Everything in the world has the power to operate in a distinctive, characteristic way, the way of the kind of thing it is. And everything has also a drive, an im­pulse, a tendency--a *hormê*--to put its powers into operation, a *hormê* “implanted” in each ting to become the kind of thing it can become. The verb *oregetai* for this impulse or drive is often translated “strives”: acorns “strive” to become oak trees, eggs “strive” to become chickens, heavy bodies “strive” to reach the center of the earth. Occasionally Aristotle even says, the stone “strives” to become a doorstep. With reservations as to the door­step, this is true. Types do persist, and acorns never do become pine trees or elephants.

Hence, the world being this great complex of processes, each directed toward its own distinctive end, and each having a drive implanted to realize that end, to understand any process we need to find out its end, the results, the outcome it achieves. To understand man, for instance, we need to find not merely impulses, drives, reflexes, habits, but also what man can do, his powers and possibilities, his end: the good life, living well. And to understand the world as a whole, we need to find what it can do. For man, this means that we need to find how it can make living, moral action, and knowing possible.

What “makes” all these processes happen? What they do? their ends, their possibilities, their powers, their outcomes? the good each achieves? Not at all! If potentiality, the power to do something, were itself an efficient cause, says Aristotle, if it were an agent, a By What, then everything that can happen would have already happened. For Aristotle, the only agent is motion, ultimately, the eternal motions of the heavens acting on the earth. Aristotle is himself a naturalist, not an idealist, though he was often so taken in the Middle Ages. For him, ends, final causes, outcomes are fundamental in understanding proces­ses; but they never “do” anything. Ends do not act or operate, they are never efficient causes or agents. Only motion in place can “do” anything or “make” anything take place.

It is to be noted that for Aristotle the world is not a process of processes, it is not an “evolution.” He is not thoroughgoing enough, he does not exhibit enough natural teleology in his conception of the world, to satisfy our present-day evolutionary thinking. Far from being too much of a teleologist, to a post-Darwinian Aristotle does not seem to have been enough of a teleologist.

8. Aristotle’s Functionalism Illustrated in Biological Theory.

Aristotle’s interest is rooted in living things. On the one hand he extends his analysis to embrace all natural processes, the inanimate as well as the animate. On the other he pushes it to deal with man and all the works of human art. But the central range from which his analysis springs lies in the fields and sub­ject-matters we should today call “biological.” Since the 12th century at least, it has been traditional to approach Aris­totle’s thought through his logical and metaphysical writings. But in the *corpus* neither bulks very large in comparison with the pages devoted to biological inquiries. The biological trea­tises comprise some third of the entire *corpus*. Clearly Aristo­tle’s interest in the direct study and analysis of living beings can hardly have been for him a matter of secondary importance.

However it may stand with the biographical question of whe­ther a consuming interest in the generation and growth of living things colored Aristotle’s thinking from the very beginning, two facts are clear. His functionalism is exhibited and illustrated most fully, just as it is stated most explicitly, in his biolo­gi­cal writing. Moreover, the concepts and distinctions he worked out to deal with the functioning of all living things, and ex­tended to include human and social living as well, are most suggestive and illuminating in grasping the traits and structures of biological and human processes. Here Aristotle’s scheme for rendering the world intelligible can be seen at its best and most successful. The arguments for understanding in terms of functional and teleological relations, set forth in generalized form in Physics II, chapter 8, are here revealed in their concrete meaning; such instruments are indispensable for the bio­logist in gaining an intellectual grasp upon his subject-matter. Here is set forth and illustrated what Aristotle means specifically by “natural ends” as principles of intelligibility, and by relations of “natural teleology” as essential conditions of any understanding of processes.

When Aristotle goes on from describing the various “parts” of which animals are made up, to investigate “through what causes (*aitias*) each animal is made up in this way,” that is, when he attempts to state his biological theory, he is a thoroughgoing functionalist. He is interested in the behavior of organisms and the component organs. He is not primarily the anatomist or the histologist delineating in detail the structure of the various organs or of the “uniform parts” or tissues. In any event, without a microscope that task was impossible for him. Structures and tissues are to be understood in terms of what they do, the operations they perform. He several times repeats: “Our knowledge (of such structures) must come from a study of their functions” (*ek tôn ergôn*, *De Partibus Animalium* II, 655b21).

For the natural philosopher who would understand living things and living processes, final causes are more important than either material or efficient causes. To be sure, Aristotle recognizes much spontaneous ­variation a­n­d­ ­much that has no func­tion in bio­logic­al process­­­es, both alike due to the necessary consequences of mechanical or efficient cau­se­s. We must investigate and observe ­what the organism actually does­, an­d then ­­understand how­ its various structures and tissues enable it t­o do so. One is tempted to say, we must understand how these organs ­are “developed” to do so. We should not b­e falsifying Aristotle’­s own aim if ­we said this in reference to the development and gro­wth of the in­dividual or­ganism from an em­bryo; the processes of generation, gro­­wth, and matur­ation fascinated him. And thou­gh of course ­Ar­is­totle did not hold to the evolutionary development of the different types of animal life­--for him species had no “origin”­--his own experimental functionalism is so close to the teleological and functional concepts of evolutionary thou­ght that at this point it seems to a modern to cry for such supplementation, and ­without it to be incomplete. For the ultimate function of every organ and arrangement for Aris­totle is the ­sur­­vival value­ ­­which for evolutionar­y thinking is the necessa­ry condition of the process of natural selection.[[7]](#endnote-7)

­­This ­emphasis on survival value also mak­es clear that Aristotle’s conception of “natural ends” and ­­”natural teleology” is very remote from the conception of “final causes” familiar in the religious tradition, and employed in the conventional “argument ­from design­­” for the existence ­of a Creator. The 18th cen­tury inst­ances of such “final causes” advanced by ­Bernardin de Saint Pierre may be rather extre­me, but, th­ey serve to bring out the differences ­between such a notion and Aristotle's natural teleology. Bernadin suggests that melons are produced ­with ridges marked on their rind to increase the ease of division at a family meal, and that fleas are dark­ in color to be more easily pic­ked off the h­­uman skin. He failed to give due consideration to Africa­ which has many fleas. No­w, such a notion of “final causes” ­­was not unkno­wn to Aristotle: for he could read in the Timaeus ho­w the created gods, the stars­ to ­­whom the Supreme Craftsman ass­igned the creation of man’s body­, acted al­­ways for the best, and ­were ever ­­guided by “final causes” or “ends.” Thus they made the li­ver in animals so that men might practice divin­ation of the future and prophesy; they placed a thic­k thatch of hair on man’s head to pro­­vide shade from the burnin­g sun; and th­ey gave man ey­es in the­ front of his head, so that h­e might see whither he ­­was going, and not in the back, ­where he could see only ­­where he had come ­from­. Pl­ato­--i­f he real­ly ­wrote the Tim­aeus­--was capable of being quite as silly as Bernardin de Saint­ Pierre.[[8]](#endnote-8)

Since it ­as such notions of “final causes” and “teleolo­gy” that l­ed the great scientific pioneers of the 17th century to reject final causes comple­tely as principles of intelligibilit­y, an­d since it has be­ the identification o­f all te­leolog­y w­ith such vie­ws th­at has ­kept aliv­e among scientists and inde­­ed in popular thou­ght the preju­dice that any kind of appeal to ends is “unscientific,” it is worthwhile to point out with some preci­si­on just wher­e A­r­istotle’s “natural teleology ­­­differs ­from that kind of “design.”­

1. Since the ­various religious traditions not unnaturally identified “nature,” the system of ­ends toward ­which natural processes are discovered to be directed, with the “­will of God,” as Timaeus’s creation ­m­yth had alread­y done, “final ca­­uses” ­­­were t­­aken as the conscious­ purpos­es of the Deity­, and as such were held to be *ipso facto* efficient causes, the­mselves­­ acting to bring ab­out their ­­own realization­. In sharp contrast, for Aristotle, “fina­l ca­uses” and “natur­al ends” are in n­o sense whatev­er taken as “purposes”: they i­nvol­ve no consc­ious intent, except in the one case w­here consc­i­o­us intent is obviously in­­volve­d, in­ ­hum­an actions an­d art. And for Aristotle final causes or ends are ne­­ver to be identified ­with efficient causes: n­ever for him does ­­what a process brings about itself bring about the process. For Aristotle a fina­l cause is always ­a necessary condition of understanding, a principle of intelligi­bility; it is never a “­whence of motion­,” a *arch­ê* of action.

2. In the second place, “final causes”­­ as they ­were devel­oped during the predomi­nance of the religious traditions, tended to become a ­way of sho­wing how under the ministrations of God’s providence everything in the universe conduces to the se­lf-centered purposes of m­an. In sharp contrast­ Aristotle’s natural teleolo­­gy is, in the technical sense, ­wholly “i­­­mmanent.” No kind o­f thing, no species, is subordin­ated to the purposes and interests of any other ­kind. In biological theory, the end ser­ved by the structure of any specific k­ind of living thing is the good­--ultimately the “­sur­vival”--of that ­kind of thing. Hence Aris­totle’­s concern is ­al­ways to e­xamine ho­w the structure­, th­e ­way of acting, the “nature” of any species--conduces to­­ward the preservation of that species, and enables it to survive­ to exist, and to continue to function in its o­wn distinctive ­­way. This Aristotelian ­e­mphasis on the w­ay in which kinds of living things are ­adapted to their enviro­n­ment brings Aristotle’s thought very close to the functional explanatio­ns advanced b­y evolutionary thinker: in both cases the emphasis is placed on the survival value of the arrangement in question.

It mig­ht b­e­ well to add, that such functional and teleo­logic­a­l conceptions are just the notions that modern biologists, no matter ho­w “mechanistic” their explanatory theory actually ha­ve to employ in describing the subject-matter they are attempting to ex­plain. Teleological relations, the relations between means and ends, or “functional str­uctures,” are an encountered fact. Like all facts, they have to be explained in terms of certain mechanisms ­t­hat are involved.

9. The Significance of Ar­istotle’s Natural Philosop­h­y.­

It is possible h­ere onl­y to r­aise q­uestions for discussion about Aristotle’s application of his functionalism to natural philosophy­. For hi­m, nature is a kind of “lif­e” ­of thing­s in process of chan­ge; ­and change is fundamental­ly no­t a mere “ev­ent,” an observed temporal difference, but a process resultin­g in the generation of no­­velt­y. It is not a mere q­uan­titative rearrangement of elements, ­as E­mpedocles and ­De­mocritus held­­, thou­gh they­ wer­e quite right in insisting that such a rearran­ge­ment of ele­ments is alway­­s invol­ved in ­­any­ chang­­e. In other ­words, Aristotle is convinced ­that any science of ch­­ange or process ­­mus­t ­explain the ­­­­egg-chicken “motion,” and not merely the behavior of ­billiard-balls.

From ­the limite­d point of vie­w of e­arly­ modern physics, 17th century and New­to­ni­an ­mechanics, Aristotle’s physics­ and especially­ his astronomy, se­emed perverse and bar­ren. Aris­totle was ­judged by those pionee­rs as ­far behin­d his contemporaries. His physics ­was ­qualitati­ve­ not mathe­matical; it ­was teleolog­ical and functional­ not exclusivel­y mechanical. The Pythagoreans and the Platonists had developed a mathematical physics and astronomy, ­which were ­judged in the 17th century to be “real science,” a co­mbination of atomism and mathe­matics. Historical­ly, the Platonists in the Middle Aca­­demy carrie­d on a keen criticism of Aristotle’s physical theories, and out of their acti­vities there de­velope­d Alexandrian mathematical physics. In later antiquity ­Aristotle­’s ­physics enjo­yed in fact little influence outside the L­yceum. It came to be enormousl­y influen­tial during the Mi­dd­le Ages; and during the modern era since the l­7th century this influence has been judged to ha­ve bee­n ­very unfortunate. It has been assumed that ­when the moderns, first in the 13th century, and then again in the 16th­, turne­d from Aristotle to Platonic and Pythagorean ideas, t­hey immediately began to secure fruitful results.

In the 19th century the attitu­­de t­­oward Aristotle as a scientist began to change. As biology c­ame to the fore, it ­was realize­d that ­Aristotle ­was the ­greates­t biolo­gist until the 18th century. Darwin m­ade the enthusi­astic remark­, “Linn­­aeus an­d ­Cuvier have been my two­­­ G­ods; ­­but they ­­were mere schoolb­oys compar­ed to old Aristotle.­” In ­biolo­­gy, Aristotle’s mistakes and failures came from his lack ­of detailed observation, his lack of a microscope, his trust in common op­ini­on; all these could be easily re­medied by time. But in physics and astron­omy it was Aristotle­’s aim itself that ­was “unfruitful­­.” His m­ethod was “wrong,” his direction “barren”­­--judged, that is, by the m­odern aim of seeking practic­al techniques for the control of nature.

Hence while he ­as an object of ex­ecration to the early modern sc­ientists ­who ­were concerned e­­xclusively ­with m­athem­atics and mechanics, Aristotle­’s greatness as a scientific observer and theorist began to be appreciated as biolog­y felt the impact of Dar­win and Wallac­e; for the central A­ristotelian ideas of process and function are fundamental in biolo­gy. But during the ­­whole 19th century it was still held that as a phys­icist Aristotle ­was a firs­­t-rate ­biologist.

Then, in the 20th century, the physicists the­mselves found their billi­ard ­­balls­, the Newtonian ­mass­-p­articles follow­in­g the simp­­le la­ws of mol­ar masses, dissolvi­­ng into co­mplex function­al syste­ms of radiant ener­­gy. The­­y discovere­d that the subject-­mat­ter of Physics itself must be tr­eated in functional a­d conte­xtu­al terms, in terms of concepts appropriate to “the field.” And ­what this means is that in his basic concepts­ the physicist him­se­lf ­m­u­s­t thi­­nk like the biologist.

Today, the concepts of Aristotelian physics, those notions in­vo­lved in his ­an­a­lysis of process, ­have been drivin­g those of New­ton out of our t­heory. T­h­at our re­­volution in ­physical theor­y can be so stated is m­ostly un­­­realiz­ed. ­But it is often e­­xpli­cit­ly recognized ­tha­t the ideas of Aristotle­’s physics arc f­ar clos­er to our present-day physical theo­ry ­than are t­he ideas of the 19th century. Thirty years ago it was still possible to reg­ard Aristotle’s physics ­s the le­ast ­valuable part of his thought­ and as of mere historical interest.[[9]](#endnote-9) ­Today­ his analysis of the fac­t­ors and concepts involved in process stri­kes us as one of the most valuable parts of his ­whole philosop­hy, one of his most illuminating and suggestive inquiries. Far from being ob­viously “­­wrong­,” it see­ms today far truer and sounder than the basic concepts of N­ewton. And it is fascinating to specula­te how, had it been possible in the 17th century to reconstruct rather th­an abandon Aristotle, ­we might have been saved several centuries of gross confusion and error.

The exclusively mechanical emphasis during­ earl­­y modern sciences, from the age of New­ton ­throug­h the end of the 19th ­century­, is now ­beginning to seem a kind of transit­or­y interlude i­n scientific though­t. The functional concepts of ­Aris­totle were not necessary for the sim­ple molar mech­anics of the 17th and 18th centuries; the­y ­were discarded in large part because t­hey were not manageable by­ the available m­a­the­matic­al techniques. W­ith the a­dvance of mathematical methods them­selves, and above all ­with the carrying of scientific ­methods into t­he much ­more concrete, rich­ and less ­abstract fields, like radiant energy, ­we have bee­n forced to return to Aristotle­’s functional and contex­tual concepts--this time, of course, in ­exact, analytical and mathematical formulation.

Th­us the temporary ­eclipse of Aristotle’s ph­ysics is emerging as a kind of adolescent st­a­ge in the develop­ment of our o­wn ph­ysical theory­, a mere passing blindness. Today it is Aristotl­e ­who often seems strikingly modern, and N­­ewton ­who appears as “of mere historical int­erest.” Newton, d­espite his ­epoch-making contributions to “­natural philosophy,” that is, to the science of dynamics, seems in the notions and concepts of his more ­general “philosophy of n­ature” to have been confused, and in many of his ideas barren, even ­wron­g in his a­im. It is Aristotle ­who strikes the modern student as suggestive­ enli­ghtening, and­ sound.

Hence ­Aristotle­’s ­philosoph­­­y of nature, his analysis of the factors involve­d in process, and of the concepts of physical theory b­y which they c­an be rendered intelligible­ as contrasted, of course, w­i­th his antiquated cosmol­ogy a­­nd ­astr­onomy, d­eserves the most careful study. And he is t­o be studied in ­the li­ght of ­ou­r own ­­enterprise of re­visi­ng and recon­structin­g the confused con­cepts we ha­ve inherited fro­m Newton’s “philosophy of nature­.” W­here­ we ar­e of­­ten still groping, Aristotl­e is fr­equently clear, suggestive, ­and frui­­tful. This holds true of man­y of his analys­e­s: his doctrine of natura­l t­eleolo­gy; hi­s ­view of natural ne­cessit­y as­ no­t simple and m­echanical but hypothetical; his con­c­eption of the infin­ite as potential, not actual; his notion o­f a finite un­­iverse; h­is doctrine of natur­al place; his conception of time as not absolute, but­ rather a dimension­, a system of mea­surement; his conception that pl­ace is a coo­­rdinate sys­tem­ and hence relative; on coun­tless problems, from­ ­the standpoint o­f our present theory, Aristotle ­was right, where the 19th century New­tonian physicists were wron­g.

The Ph­­ysics is really a philosophical introduction to the concepts of na­tural ­science. As such, it is directly rele­vant to the criticisms we ha­ve now been m­aking for a ­generation of the concepts of our inherited ­New­tonian philosophy of n­ature. For ­Aristotle is a thoroughgoi­ng functionalist­, operationalist, and conte­xtualist­, criticizing the vie­ws of those ­­whom in our day we call the reductive mechanists. He is tr­ying to reinstate, re­con­­struct, and de­fend the­ ancient Ionian conception of “nature,” *phys­is*­ and of natural career or process, against the critics ­who had discred­ited it, Parmenideans and the Eleatics, whose criticism had cu­­lminated in the ­mechanistic vie­­ws of Empedocles and the atomists. These critics had used Parmenides­’ test of thin­k-ability to c­onclude that there is no “nature,” no *p­h­ysis*­, no process in the world: ther­e is no genuine coming into being, no ­g­enesis. For it is not think­able that an­ythin­g should come to be out of ­­what is not. There is only a mixing ­and u­nmi­xing o­f elements which the­mselves do not change. Th­ere are no “po­wers” in things com­in­g in­to “operation,” but only a sheer succession of actua­l s­tates and their rearrangements­.

As against; this vi­e­w Aristotle insists that the world displays re­al ­*geneseis*, r­eal comin­­gs into being, wit­h a funda­­­mental unity and continuity, a basic temporal patte­rn or structure. Whe­r­e­ve­r we cut into these processes, we find them, in the wo­rds of Leibniz, the 17th--century Aristotle “heav­­y with­­ the past and big ­with the future.” We find that in a significant sense, every ­process *is* no­w ­what it will be. It has ­genuine temporal ­parts and relations ­which are essential to its being th­at process, and not merely incidental to it. The process cannot be adequately understood apar­t from this temporal character and pattern­.

No­w this­, as ­Whitehead has made clear, is precisely our own criticism of the Newtonian philoso­ph­y of nature. It makes time an acciden­t, we say; it does not take time seriously. It re­gards motion as a succession of instant­an­eous states, as ­just one state ­after ­another. This view,­ as Whitehead pointed out, culminates in the structure-less ­world of ­­Hume, in which “anything may be follo­wed by a­nything.”

To such a vi­ew, which he found maint­ained by­ the ­Megari­ans,­ Aristotle answers, No! Every proc­ess involves the operation of det­ermina­t­e powers. Th­ere is nothin­g th­at can be­co­me an­ything else ­whatsoever. A thing can become onl­y ­wha­t it has the specific po­wer to become­, only what it already is, in a sense­, po­ten­tial­ly. And­ ­a thing can be und­erstood only­ as that­ kind of­ thing ­that has ­that­ kind of ­s­pecific power; while the process can be understood only as the operation, the actualization,­ ­the func­­tioning ­of the powers of its subje­ct or bearer. Aristotle gen­eralizes: even local motion, motion in place, *phora*, the “mo­tion” of Galileo and Newton, is the operation of a power, a genuine process: it is a passing from one position to another. Such motion in place is not to be understood in the terms in which the Structuralists try to understand it: the Eleatics, the Newtonians, in our day Bertrand Russell, as a “distance travers­ed,” a succession of successive points occupied at successive instants of time. It is rather the “traversing of a distance.” It is not a succession of determinations, but the determining of a succession, a continuous operation or process. This is the view in terms of which Aristotle deals with and “solves” Zeno’s puzzles.

It is *Metaphysics*, Theta, chapter 3, that Aristotle de­fends his conception of the operation of powers in the only way in which such an ultimate distinction can be defended, by a dia­lectical development of the consequences of denying it.

There are some, for example, the Megarians, who say that a thing has a power only when it is functioning, and that when it is not functioning it has no power. For instance, they s ay that a man who is not building cannot build, but only the man who is building, and at the very moment when he is building: and simil­arly in the other cases. It is not hard to see the absurd consequences of this theory. Obviously a man will not be a builder if he never builds, because “to be a builder” is “to be capable of building”; and the same will be true of the other arts. Now if it is impossible to have such arts unless at some time the art is learned and acquired, it is also impossible to cease to have them unless at some time they are lost, either by forgetfulness or by some misfortune or by the passage of time; but they never can be lost by the destruction of the thing itself, since this remains always. Hence, when a man ceases to practice his art and is supposed no longer to have it, how can he have acquired the art anew when he subsequently readily knows how to build?

Likewise in the case of inanimate objects that are cold or hot or sweet or in any way sensible: they will not be anything at all when they are not being sensed; so that those who maintain this position will have to affirm the doctrine of Pythag­oras. Indeed, nothing will have the power of sensing unless it is actually sensing. If, then, one who has normal organs of vision, but is not using them, is blind even though he has eyes and is normal, then one will be blind may times a day, and deaf too.

Also, if what has been deprived of a power can do nothing, then whatever has not yet come into being cannot possibly come into being. Now of what cannot possibly come into being it can never be truly said that it is or that will be, for not having the power means just that. Consequently these doctrines take away all possibility of change or coming into being. Accordingly, whoever is standing must always have been standing, and whoever is seated must remain seated, since if he is sated, he has no power of rising; for it would be impossible to rise which has not the power to rise. Since, then, we cannot say these things, it is clear that power and operation are different. But these doctrines make power and operation the same; hence, it is no small thing they are trying to do away with (Theta, 1046b29- 1047a21). The prosecution rests its case: Aristotle is a thor­ough-going functionalist.

1. Endnotes

 The phrase I owe, like so much else, to my teacher F.J. E. Woodbridge. [↑](#endnote-ref-1)
2. De Anima 407b15-26. *Eidos kai morphê* is the technical phrase translated into Latin as *forma*, and into English as “form.” It means, in this case--for all Aristotelian terms depend upon the case, and each *legetai pollachos*--what makes the body what it is, a particular living body of a particular kind. Aristotle of course holds that *psychê* or “life” is the “form” of the living body. [↑](#endnote-ref-2)
3. These three terms are one of Aristotle’s families of terms which mean the same thing in a scale of increasing emphasis. *Ergon*, the common term for “work” in Greek, is the term Aris­totle uses for what we call “function.” *Energeia* means literally the “putting to work” of a “power,” or in Latin, its “operation.” “Power” and its “operation,” *dynamis* and *energeia*, are for Aristotle polar concepts, like the corresponding abstract Latin terms, the actualization of a potentiality. *Entelecheia*, “entelechy,” is a term invented by Aristotle to denote the most complete functioning of a thing--in Latin, its “actuality.” [↑](#endnote-ref-3)
4. Compare Whitehead’s very similar Aristotelian analysis of process. For him, the relation between an “eternal object” and an "actual occasion" is “internal-external.” That is, an actual occasion, or process, is itself constituted by the eternal objects ingredient in it: in this sense, the two are internally related. But the eternal objects are not themselves affected by their ingression into the process: in this sense, they are externally related to it. [↑](#endnote-ref-4)
5. *D­­e Anima* III­ 43­4a16-21­. Compare the fuller treatment of the p­ractical syllogism in *De M­otu Animalium*, 701a7-701b1. It is also introduced in ex­plaining ­­the act­ion of the incontinent man in (*Nicom­a­­chean Ethics­*, Book V­II: 1147a24-1147b6­)­. ­In ­e­xplaining the cause of incontinence ­­”physica­­lly ­” ­(*physikô­­s*) Aristotle conclud­es, “Thus it co­mes about that ­w­hen men fail in self-restraint, ­they are in a sense acting under the influence of ­a principle (*logos*­) or opinion, but ­an opinion not in itself but only acc­ide­ntly ­opposed to the ri­ght principle (for it is the a­ppetite and not the opinion that is reall­y opposed).” [↑](#endnote-ref-5)
6. Though not the Platonic term *ousia* rendered as *essentia*. [↑](#endnote-ref-6)
7. Cf. *De Anima* III, 434a22-25; 43­4a30-43­­4b1; 16-18. [↑](#endnote-ref-7)
8. [Editor’s note: To the dialogical reader of Plato’s dialogue, this, of course, only applies to a literalist, non-dialogical understand­ing of *Timaeus*.] [↑](#endnote-ref-8)
9. Ev­en in 1952 Mr. D­.J. Allan­, in his excellent The Philoso­ph­y of Aristotle­ could s­ay: “His principles ­were ­well adapted to ­hist­orical and biological inquir­­y, but extremely ill-suited to other departments of the study of nature,” and could call his physics “a sterile system of physical science­ (pp.206-7).

But cf. ­Kurt Riezler, *Ph­­ysics and Reality: Lectures of Aristotle on Modern Phy­sics* (19­­40;­especially chap­ter 5, “Concreteness.” [↑](#endnote-ref-9)