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VITAL ORGANIZATION AND THE PSYCHIC FACTOR

RALPH S. LILLIE

If we may rely for our evidence on simple observation, it would appear that the tendency of random or unguided activity in external nature is opposed to the development of complex organization and favorable to structural simplicity—in the sense of uniformity in the distribution of elements. This anti-organizing trend of purely physical processes is illustrated in ordinary large-scale mixing and stirring operations, as well as in the automatic increase of entropy with time in systems subject to the laws of thermodynamics (material or molecular systems in general). It is common experience that complex systems which are the seat of physical activity tend to become simpler when left to themselves, *i.e.*, they lose organization. Recently Eddington has given the whole matter an admirably clear expression: "Entropy may most conveniently be described as the measure of disorganization of a system. . . . We can see chance creeping in where formerly it was excluded."¹ Unless counteracted by directive action the casual or random element in nature tends to increase. If things are left to chance, not only does organization of any high degree of complexity fail to develop, but what organization there is tends to lapse or disappear. Hence in those cases, such as living organisms, where the existence and activity of the system depend on a special and complex organization, it appears necessary to assume the continued operation of a stable directive influence or factor which pervades the whole system and excludes or compensates casual factors as far as possible. The presence of this factor is what makes possible the development and maintenance of the organization required for vital activity.

From these general considerations we may conclude that in any highly organized and physically active system a perfect balance or equilibrium (such that the system retains its characters for an indefinite time), depending solely on random factors and their interplay, is not possible. In the living system we see free energy directly applied in such a way as to further the increased concentration of the incorporated materials together with their chemical transformation and distribution in correspondence with a definite type of organization.² This is true not only with regard to the synthesis of the system in development and growth, but also with regard to its maintenance; both equally require directive action. The same holds true for complex artificial machines; in all systems of this type various safeguards and regulative devices are introduced by the designer, their purpose being to promote stability and to prevent casual (and hence disorganizing) conditions from gaining the upper hand (automatic controls of boiler pressure, of speed, temperature, lubrication, electrical potential, etc.). But all such devices, although they may work well for a certain time without special attention, require sooner or later to be adjusted or repaired, and this can be done

¹ "New Pathways in Science" (Macmillans, 1935), p. 55.

² Cf. my recent paper, "Living and Non-living Systems", this Journal, Vol. 9, 1942, p. 307; especially pages 308–10.

only by conscious directive action. The psychic factor must enter correctively, otherwise the special properties of the system are soon lost. The analogy with the living organism is clear enough in some ways, while unclear in others. The organism is sometimes described as an automatically self-regulating piece of mechanism³—a verbal formula which states accurately some of the conditions of vital activity but is far from “solving” the essential biological problem. What is self-regulation? and what are its factors? The regulative devices in a piece of machinery may be made as automatic as possible, nevertheless not only is the original construction of the system the outcome of conscious intelligence, but its activity, smooth-running as it may be for a time, is sooner or later subject to derangement by the inevitable random factors; hence there is always the need of supplementation or counteraction at intervals by directive action. In addition to the automatic regulative devices, all highly complex mechanical or electrical installations are furnished with a system of automatic signals which call “attention” to local conditions like overheating, leakage, breakdown, etc., which can be corrected only by purposive action. These may be compared with the psychic danger signals in the animal organism, like pain, which call forth conscious corrective effort. Random or unguided factors are based, like all purely physical action, on probability factors, and such factors cannot by themselves—except occasionally by rare good luck—correct the deviations of highly organized systems from their normal state; such correction can be accomplished only by activity which is directive, *i.e.*, controlled by psychic aim or purpose. Such activity has the special quality of not being stereotyped (like purely physical action) and can adjust itself to non-routine or novel situations as they arise.

It is generally agreed that all physical action contains within itself an element of randomness, in correspondence with the part played in such action by probability factors (statistical conditions), as contrasted with directive or individually controlled (integrated) factors. In any system consisting of mechanical parts (parts having inertia) the general effect of random agitation is to distribute *more uniformly* the movable components, which at the outset have their definite positions in the system; this effect is equivalent to a decrease of the spatial differentiation which is an essential feature of any physical organization. A simple experiment will illustrate; if we place a layer of pure water above a strong sugar solution in a vessel, the two layers remain distinguishable for a long time, provided the system is not agitated; but stirring soon destroys its differentiation, and the sooner the more rapidly it is stirred; the effect is characteristically irreversible. Similarly the effect of introducing sand into the bearings of a machine is slight if the system is at rest; but if it is in motion, injury (*i.e.*, disorganization) follows, at a rate depending on activity. These examples show that a disorganization resulting from chance factors is more likely to occur in a system which is *active* than in one which is at rest. In the living system a high degree of

³ For example, Jacques Loeb considers living organisms as “chemical machines, consisting essentially of colloidal material, which possess the peculiarities of automatically developing, preserving and reproducing themselves” (*The Dynamics of Living Matter*, Columbia University Press, 1906, p. 1.)

physical and chemical activity is the normal state, since the continued existence of the system is directly dependent on a flux of material and energy, and this flux must be stable—giving a balanced condition or steady state (Ostwald's stationary equilibrium)—if the vital organization and activity are to be maintained. Correspondingly the effects of physical randomness must not be allowed to accumulate; *i.e.*, chance deviations from the normal must be corrected before they reach the stage of deranging the system. We have already seen that automatic regulations of this kind are a universal feature of living organisms. Consider, for example, the ability of living cells and organisms to repair mechanical injury (wound-healing, regeneration); one of the effects of local injury is to set in motion counter-processes of reconstruction which in due course restore the original condition. But if this regulative effort is insufficient, disorganization becomes progressive, and this is more likely to happen if the organism maintains or increases its normal activity than if it remains at rest. Hence the importance of rest in medical or surgical treatment: the *vis medicatrix naturæ* is then less effectively opposed by random or other anti-organizing factors. These consist chiefly of the purely physical factors, which typically have a non-directive quality in correspondence with their dependence on probability factors or statistical conditions. In correlation with this general natural condition, we find that in many animals (especially the less prolific) the process of development is carried out under conditions of isolation (egg-cases, nests, uterine development) where random interference from the surroundings is reduced to a minimum. In general we may say that casual and vital activities are opposed to one another in their essential nature and tendency; this opposition expresses itself in many features of vital organization.

The building-up of a complex organization in the development of an animal or plant is a process of concrescence, combined with integration. Development, as well as the maintenance of organization once it is synthesized, is itself evidence of the existence of some specifically biological type of process which corrects or compensates the disorganizing influence of random factors. All the observable activities of the organism, as viewed externally, appear as physical; the fundamental activities of growth and maintenance require the chemical transformation and shifting of material, and these processes occur in accordance with definite physical laws, as experiment shows. The material which is synthesized and deposited to form organized structure shows the same general physical properties as the material which is "non-living"; it also exhibits those special properties which it possesses by virtue of being "living," *i.e.*, having its special place and activity in the vital organization. But in addition the entire organism, besides exhibiting such properties, acts as if it were the field of a specifically vital unifying agency or factor, which also has constant properties but whose activity is not random but directive in character. This factor pervades the living system in all of its parts and in some way compensates the purely physical tendency to disorganization. The nature of this factor may now be considered more fully.

In our experience of natural processes, the presence of an integrative and directive factor, having control over an extensive field of activity, is most readily

observed in voluntary action carried out in pursuit of a purpose. Here "psychic aim" becomes dominant, and determines the special direction of what happens in the physical field. Obviously, voluntary action is not independent of physical factors but is carried out in intimate conjunction with them; the normally acting neuromuscular system is a physical system having definite and constant properties without which the action would not be possible. The significant fact, however, is that the precise form which action takes is dependent not only on this physical organization but also on the motives and aim in the conscious mind of the agent. In some unknown manner the psychic aim determines that events take one special course, rather than one of many others which are equally possible in the physical sense; in other words, there is a selection out of a wide range of possibilities. We have no physical observation of how this is done, but certain general conditions may be assumed. In order that the psychic aim should have this effect, it must have persistence, and it must modify in some asymmetrical manner the field in which the physical action is taking place. The analogy of a gravitational field seems apposite here; in the absence of such a field bodies free in empty space pursue straight paths, and a casual assemblage of such bodies (differing in their directions and velocity) soon becomes dissipated. But inside a sufficient gravitational field (arising *e.g.* from the preponderant mass of one body) the path of each body becomes curved, *i.e.* asymmetrical in relation to the whole volume occupied by the field; and under certain conditions (as of not too high relative velocities) the whole group form a coherent and stable system, as illustrated (*e.g.*) by the solar system. In the living organism the conditions are widely different, but for the purpose of the present comparison we may regard the gravitational integration as a simplified model of the more complex vital integration where, as in voluntary action, it is effected under the influence of psychic aim and effort. At least such a comparison of the simple with the complex illustrates how a non-material structural (stable) condition or field pervading all parts of a system may modify in a directive and integrative manner the total course of activity within the system.

The stability of the living organism is known to be determined largely or mainly by physiological (*i.e.* physical) conditions; even the duration of the individual lifetime is inherited. But in the human being we observe that the physical stability is paralleled by another kind of stability: this is the psychical stability above referred to, as expressed in the fundamental psychological character of the person. A large part of the coherence and integration shown by the individual human being in his aspect as a physical system is demonstrably a function of his psychical character; and the relations of the psychical character to the physical character are largely open to scientific investigation. The problem is, how are we to conceive scientifically the nature of the psychical field and its relations to the physical field?⁴

Biological theory usually refers the stability of an organic species to the

⁴ The term "field" is used both in physics and biology in the sense of an area or volume pervaded by a single persistent influence of some definite kind (gravitational, magnetic, electrical, inductive, developmental, etc.), and it is used here in a similar general sense.

stability of its germinal determinants or genes; the special properties of these units are again referred to special stable features of physical and chemical constitution. Given a constancy in the characters of these units, constancy in the transformations occurring under their influence is to be expected, according to the accepted scientific principle of uniformity of process under uniformity of causal and other conditions. Nevertheless we cannot help being impressed with the exactitude of hereditary repetition in pure genetic strains of animals or plants developing under normal external conditions, especially when we bear in mind the extreme complexity of the physical detail. In human strains this exactitude is most striking in persons of the same genetic constitution, such as identical twins or quintuplets; in these cases the psychical uniformity is as remarkable as the physical uniformity. In general, we observe that the psychical characteristics of a person show the same stability as his physical characteristics, with which they are in close correlation. Mutuality of psychophysical influence appears to be a general biological condition or fact; in human beings it is well shown in the familiar effects of habit, education and practice, which modify simultaneously both the physical and the psychical characters. Psychical factors are observed to act as partial determinants of physical characters during a man's personal lifetime; modern genetics, however, tends to restrict this psychical determination to the fully developed individual, and does not admit psychical factors as playing any part in embryonic development.⁵ Yet it is well known that in the postnatal development of the child hereditary psychological traits, often asserting themselves in very early years (such as special talents, interests or aptitudes), play an essential determinative part.⁶ In this sense the psychical influence is a demonstrable factor in physical as well as in psychical development.

The organismic constancy, as maintained (e.g.) in a human being during the greater part of a long lifetime, is clear evidence of the existence of a stable directive and unifying factor or influence which pervades the organism and keeps its characters and activities, physical and psychical, integrated and true to form. This factor not only corrects chance deviations from the physical norm which is characteristic of the species and individual, but also expresses itself in the consistency of psychical character shown throughout life. Yet the nature of this unifying influence is still conceived by most biologists as purely physical. There is a scientific impasse here, and the problem is how to overcome it in a manner which is consistent both with scientific principle and the special facts of the case. The only concrete model or analogy which seems at all serviceable is that of the complex artificial machine, already discussed in part. Any such system in its present existence is purely physical, yet to account for its origin and its stability of operation during the period of use unavoidable reference must be made to psychic factors. A system of mass-production, once brought into existence, acts automatically, but only provided a certain intelligent supervision and control are

⁵ *I.e.*, experimental evidence of such influence is lacking. If the existence of Lamarckian influence is admitted at all by the modern geneticist, it is in a highly modified form.

⁶ The evidence for this general statement is familiar to all observers of family traits. Galton's book on Hereditary Genius gives many examples from biography and history.

exercised. All existing systems of this kind have reached their present development through a process of evolution, initiated and guided by inventive intelligence and continually tested by trial and error. The parallel to biological evolution appears complete—except that modern physical biology seems committed to ruling out as unimportant or non-existent any factors of psychical initiation and control in the processes of development. The variations which furnish the material for evolution are regarded as chance variations determined by purely physical (or physiological) factors. Many biologists feel the insufficiency of this conception, but so long as it appears consistent with the prevailing state of knowledge and criticism it is likely to hold its own; there is always the hope that further advances in experiment and analysis will remove the chief difficulties. Obviously any criticism must be based on realistic grounds, *i.e.* on direct observation and experiment so far as possible; but nothing is to be gained by a refusal to regard other than physical factors as effective in the activities of the organism when all observation shows the latter to be a psychophysical system. In our human experience we find that whenever novel or difficult situations have to be met, physical routine is insufficient; only the psychic factor is capable of furnishing the required novelty of action, and such action on occasion may be both unifying and creative. Under the psychical influence special direction is imparted to activities which otherwise would be determined by purely physical conditions, subject in the long run to statistical or probability factors rather than individual (integrated) factors. The contrast between a consciously voluntary action and an action determined by long established habit brings out clearly the special part played by the psychic factor. In the fully conscious human being the presence of this factor is felt as a pervasive controlling influence which supplements or reinforces the constantly present physical (physiological) factors, whenever these, acting by themselves, are insufficient to meet the novel demands of a situation. In those natural systems which we recognize as living the physical and the psychical factors are to be regarded as continually influencing one another reciprocally: as biological factors they supplement or reinforce one another. Routine, a universal fact of nature, is physical in its basis and character; this physical side of activity includes the ordinary automatic functions and habits of the organism. When the psychical influence intervenes, as a factor modifying the physical, the intervention is typically in the interest of novelty, integration or creation.⁷ It is true that the adult animal or man is subject to psychical as well as physical habit, but experiment shows this to be based on physical (physiological) conditions. The constancy of psychical character shown by a human being during his lifetime has its correlate in a constancy of physical character, as seen in his anatomical structure, physiological “temperament,” facial expression, habits, and so on. Many such characters, although now physically stable and visible to an external observer, are the index of an inner psychical control, exercised constantly or intermittently over long periods of time.

It is well known that a large part of the physical constancy of the adult animal requires for its maintenance the activity of a directive psychic factor; this is per-

⁷ Cf. my recent paper, “The Psychic Factor in Living Organisms”, *Philosophy of Science*, 1943, Vol. 10, p. 262.

haps best seen in the case of any highly developed human skill or aptitude; without conscious attention and practice the powers needed for any difficult accomplishment, physical or mental, soon decline; they are kept at a high level only through continual psychical activity. Mere physical practice is not enough, although it may be essential; a creative worker or artist in any field requires to be vividly conscious of what he is doing, otherwise his work loses originality and "vitality." Any such accomplishment presupposes a complex physical structure of habit, but this can be built up only by conscious direction during the period of training or education, and its maintenance demands constant attention and exercise. If the psychical direction lapses, the correlative physical substructure (regarded as having its chief seat in the nervous system) lapses also; the closely integrated psychophysical organization suffers decline. Facts of this kind are a well-known part of the general psychology of learning, but their fundamental biological significance is not always recognized.

The living body is a deposit from the past; observation shows it to be produced by the accumulation of materials which originally were distributed at random in the external world. In each life-history this accumulation begins at an organizing centre or germ which physically is part of the parent body; in animals the fertilized egg is the earliest stage of the developmental cycle, but a similar selective accumulation and working-over of materials into an organization are necessary activities at all stages. Since the organism is a physical aggregate (in this general sense), it has physicochemical properties of a kind common to all such aggregates; hence whatever happens within it is subject to physical control and physical restriction. To the physiologist this physical determination may seem to furnish a complete explanation of vital activity, and this impression needs to be corrected by a study of the psychical influence, as this expresses itself in voluntary and other activity, especially of a directive or integrative kind. While it is obvious that the psychic factor always acts in association with physical factors, its special property of selection and directiveness, implying independence of or opposition to merely random action, gives it a natural status which is definitely contrasted with that of the purely physical factors. A complete science of animal behaviour will draw its facts from the observable psychical as well as physical activities of the organism; both, together with their interrelations, are to be taken equally into account in forming its theoretical conceptions. The same may be said of general biology, an observational natural science having reference to the characters common to all living organisms.

At this point attention should be drawn to another closely related consideration. The observed efficacy of the psychical in the determination of human and animal behaviour shows that factors derived *from the past* are not the only ones to be considered in accounting for natural activity in the present. There exist also natural factors which have their origination and effective existence only in the present, and unique among these are the psychic factors. No one need deny the existence of non-psychic factors which also have their existence and activity in the present; these would be the stable or routine factors which have passed unchanged from the past into the present—in other words, the purely physical factors. Apart from the general interdependence known as causality, there is a

special relation (or contrast) between past and present natural activities which may be briefly expressed as follows. The present differs from the past in being that part of the temporal field of nature in which its freely active, innovational or creative side is in a position to assert itself. Spontaneous or novel action derives its special character from present rather than past conditions,⁸ and the chief⁹ source of novelty or creation in the present is the psychic factor. Whatever causal independence the present is capable of achieving comes from the psychic factor working within it; only this factor can overcome the incubus of the past. This metaphor emphasizes the *inertia* of past conditions; inertia is primarily a physical property, a correlate of the conservation which is a recognized characteristic of the physical as physical. In contrast, the psychical, being a factor of novelty, is the anti-conservative property in nature: to use another metaphor—it leavens the lump. Leaven, it will be noted, is a living organism; in all living organisms the element of novelty or origination, which always enters in some degree into present activity, is indispensable, even if it exhibits itself only in preventing the physical tendency of the highly differentiated (yet largely fluid) living system to lapse (*e.g.* by diffusion) into a less differentiated state. We may say therefore that the entrance of this anti-conservative factor as an effective determinant in present activity is what distinguishes the living from the non-living systems of nature. The continued existence of the living organism depends on its capacity for synthetic activity, and in its essential character synthesis is activity leading to emergence or novelty. Originative (as contrasted with routine) action assumes greater importance in the organism as the psychic factor enters more completely into control.

It may sound like a truism to say that the psychic factor—the special factor associated with immediate consciousness—has its activity and influence only in the present (as distinguished from the past); but if we regard that part of nature which is in past time as having a real existence, this distinction seems necessary. Present time would then be defined as the time occupied by that part of the natural process which is the seat of novel or originative activity, as distinguished from simple persistence, routine or inertia. Routine and inertia are closely similar if not identical features of natural action, as may be appreciated when we consider the motion of a body in empty space free from gravitational or other influence; its state of motion at any instant is unequivocally determined by (quantitatively the same as) its motion at the preceding instant,—and so back into the past: there is nothing *physically* peculiar about the present as present. The past corresponds to the fixed or permanent (established) part of nature; and since it is continuous with the present it furnishes a large part, but not all, of the

⁸ We may note that this conclusion is in agreement with the philosophical doctrine that reality is not completely contained in history. In Professor Boodin's recent paper on "Analysis and Wholism" in this Journal (Vol. 10, p. 213) he makes brief allusion to this doctrine (p. 228).

⁹ I say "chief" here, because chance factors can never be entirely ruled out in natural events, and may themselves at times lead to novel conjunctions.

conditions determining activity in the present. The future (not yet existent nature) is shaped not only by past and conservative conditions but also by whatever conditions may originate in the present; and unique among the latter conditions is psychical action.

We may now summarize our general point of view briefly as follows. In the living organism those factors which either were originally (primordially) stable, or have achieved physical stability as a result of past activity or evolution (completed or constant factors), act in close association with psychical factors which have their existence in the present. In these latter factors there is always some element of indetermination or spontaneity; under the control of psychic aim this spontaneity may become directive and in conjunction with the stable factors always present may achieve novel or creative results, as seen in the development of organization. In the absence of this directiveness the automatic trend of natural processes is typically toward a less differentiated or more uniform state; this is seen in the general effect of random or casual activity, as illustrated in stirring or mixing operations, molar as well as molecular. Accordingly in the long run any complex system which is psychically uncontrolled suffers a decline or loss of organization. The natural condition described in the law of dissipation (second law of thermodynamics) is an example, on the cosmic scale, of this effect, which always results from long-continued unguided activity.

In the natural world we observe a widespread counteraction of the purely physical tendency to uniform distribution of matter and energy. Even non-living nature is highly diversified, but this counteraction is most strikingly exemplified in living organisms; here it is effected through the intermediary of an organization of highly special type, the product of long-continued evolution. Apparently within this organization the psychic factor can act without being opposed by too great physical difficulties. There are of course limits to what vital activity can accomplish in building up and maintaining an organization. Nature, however, has taken good care that we do not forget the dependence of life on material and physical conditions. The living organism, as a deposit from the past, to which continual additions are being made, experiences during its individual lifetime a progressive alteration of physical properties. Part of the material incorporated in the organism appears to resist removal by the excretory processes, or destruction by oxidative or other metabolism, and remains within the system as foreign or otherwise refractory substance; as a consequence the organism undergoes a gradual decline in its ability to preserve its normal physiological balance and its adjustment to the environment. By degrees a larger and larger part of its organization takes on the character of a purely physical or routinized system, which accordingly becomes less and less responsive to the integrative psychic factor. This is the process known as senescence. The psychic factor finds itself in course of time less capable of modifying and controlling to its purposes the structure of routine and habit which has been built up during the physical lifetime. Eventually the purely physical processes, including especially the random or unguided processes which make for decline of organiza-

tion (disintegration), gain the upper hand and the organism dies. Its materials then come under the control of purely physical factors, and these effect a random redistribution of its components,—one, that is, occurring in accordance with simple probability factors, such as those which express themselves in the law of entropy. The non-directive element, always present in a physical system, is no longer adequately compensated by the directive psychical element, and vital integration is no longer possible.

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