

The Concept of Biological Function for Mental Functions

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Abstract

The concept of biological function is central to medical practice and to the distinction between health and disease. In this essay, I argue that most notions of biological function pay exclusive attention to species survival. A notion of biological function based only on species survival is insufficient for adequate conceptualization of many mental functions and dysfunctions. For psychiatry, the concept of biological function must encompass both survival and thriving.

Keywords: Biological Function; Mental Health; Survival; Proper Function



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Introduction

Psychiatry is a medical discipline; its practice is rooted in biology. Being a medical specialty entails that psychiatry must view the issues at hand in terms of pathology and disease. Distinguishing between health and disease is a core competency required of a psychiatrist. But on what grounds is this distinction made? The latest edition of Diagnostic and Statistical Manual of Mental Disorders (DS-M-5-TR) relies heavily on distress and disability caused by biological dysfunction to make this distinction. Other accounts rely solely on biological dysfunction. In this essay, I argue that most notions of biological function and dysfunction pay exclusive attention to species survival. The goal of this work is to argue that reliance on survival and reproduction alone limits the concept of biological function. I argue that limiting the concept of biological function to species survival only is an example of reduction. Doing so ignores many emergent biological actions which are quite relevant to pathology and medicine in general, and psychiatry in particular. Psychiatry needs an account of biological function that can go beyond species survival and accommodate concepts such as self, suffering, and well-being.

What is a Function?

Words originate when objects are coded into language. These objects can represent mass, energy, action, or metaphysical entities. By action is meant any physical or energetic change in an object. Function does not represent mass or energy. It could represent an action. But what kind of action qualifies as a function? Before that, what kinds of actions are available to choose from? At a very fundamental level, physical objects exist. Is existence a function of physical objects? At a subatomic particle level, fermions have a certain spin motion to form other particles. Is spin motion a function of fermions? Is particle formation a function of fermions? Uranium gets converted to Thorium in nuclear reaction. Oxygen can be bonded with hydrogen to create a water molecule. Is the function of Uranium to be radioactive? Is water synthesis a function of oxygen? If, supposedly, these are functions, then the notion of function is reduced to any action performed by an object.

Yet it is not common to use the word “function”

interchangeably with action in communications. Take the example of a car. The function of a car is faster and easier transportation. However, this is not the only action performed by the car. Oftentimes it functions as an indicator of wealth and lifestyle. Sometimes it functions as a source of livelihood. Other times, it functions as a place to sleep. But if one is asked about the function of a car, transportation invariably comes to mind. Because that’s what it was created for. Therefore, function of an object can be thought of as that intended action for which it was created by its creator.

This type of function statement always holds true for artefacts. There is a general agreement on the functions of hammer, light bulb, wheel, car, clock, key, and other artefacts. It can also be inferred from this function statement that it’s not the specificity of action that makes it a function but the intention of creator to make the action happen. It is also possible that the desired action of an object may change from its creator to its possessor. A hammer created for focused hitting may be placed on a shelf for aesthetic. Even though the desired action changes, the intention to make an action happen remains.

Intention implies a kind of conscious agency and freedom to manipulate nature. In the example of hammer functioning as an aesthetic, there must be an idea or imagination of how hammer will act when placed on a shelf. Then there must be an intention and action from the agent to place the hammer on the shelf to get the desired action. Change of desired action puts the possessor at par with creator. Therefore, function of an object can be thought of as that intended action for which it was created by its creator or used by its possessor(s).

Species Survival and Biological Function

However, this type of function statement has not been widely accepted. Works on functional analysis by Neander, Milikan, Griffiths, and Godfrey-Smith have only regarded those biological actions as functions which led to the selection of objects performing them [1-4]. Their functional analysis, called the selected effects account, views functions as effects for which traits were selected by natural selection. These functions are often called proper functions to highlight the distinction between how an object can function and what the object is created for. The latter implies

that the purpose of the object's existence is to perform that specific action. As Milikan writes: "Having a proper function is a matter of having been "designed to" or of being "supposed to" (impersonal) perform a certain function" [2].

Neander defines proper function as:

"It is a/the proper function of an item (X) of an organism (O) to do that which items of X's type did to contribute to the inclusive fitness of O's ancestors and which caused the genotype of which X is the phenotypic expression (or which may be X itself where X is the genotype) to increase proportionally in the gene pool" [1].

Similarly, Milikans defines "proper" function as:

"The definition of "proper function" is recursive. Putting things very roughly, for an item A to have a function F as a "proper function", it is necessary (and close to sufficient) that one of these two conditions should hold. (1) A originated as a "reproduction" (to give one example, as a copy, or a copy of a copy) of some prior item or items that, due in part to possession of the properties reproduced, have actually performed F in the past, and A exists because (causally historically because) of this or these performances. (2) A originated as the product of some prior device that, given its circumstances, had performance of F as a proper function and that, under those circumstances, normally causes F to be performed by means of producing an item like A" [2].

A similar but distinct approach called the life chances approach sees functions as effects that enhance the life chances of their bearers [5-9]. Unlike the selected effects account which sees the functions determined by past trait selection, propensity theory sees functions as determinants of future trait selection. For Wakefield, the biological function of a trait is the one for which it was naturally selected in an evolutionary sense [10]. Biological dysfunction is the failure of biological apparatus to perform its biological proper function. However, Wakefield considers biological dysfunction a biological disorder only when it is considered "harmful" by the society [10].

For Boorse, the basic notion of a function is of a contribution to a goal [11, 12]. His characterization of function aligns with those of Sommerhoff, Braithwaite, and

Nagel [13-15]. He specifies survival and reproduction as the two apical goals of the hierarchical goal-directed system. He reiterates in his "A Rebuttal on Health":

"A function was a causal contribution to a goal, and the actual goals of organisms were defined in the manner of Sommerhoff (1950). An organism or its part is directed to goal G when disposed, throughout a range of environmental variation, to modify its behavior in the way required for G. (I proposed a slight change to accommodate goal-directedness to currently impossible goals, as when a cat stalks a nonexistent mouse.) On this analysis of goal-directedness, most behavior of organisms seems to contribute too many goals at once: "individual survival, individual reproductive competence, survival of the species, survival of the genes, ecological equilibrium, and so forth" (Hre, p. 556). I suggested that different subfields of biology may use different goals as the focus of their function statements. But since physiology was the subfield on which somatic medicine relies, medical functional normality was presumably relative to the goals physiologists seem to assume, viz, individual survival and reproduction." [12]

Survival as the Purposeful Goal of Biological Objects?

Central too many function statements is a focus on survival and reproduction. Survival itself means continued existence. Whatever exists today is because of its capacity to survive through time and space. Different objects have different systems, or as Cummins would call them: subcapacities [16] that give objects the capacity to survive. In this sense, an amoeba is no different than a stone. Both survive but have different subcapacities to attain this capacity. For a stone, it is the physical structure and high chemical energy requirement for chemical reactions. For amoeba, its subcapacities of mitosis, phosphorylation, membrane stability, binary fission and many more organize to bestow the capacity of survival. Yet one is inclined to think that the ultimate goal of amoeba is to survive while it seems odd to think the same for a stone. One may argue that the meaning of survival is different for living and non-living objects. For living objects, it's the survival of life, the replication and maintenance of the organic order. But why is it that the maintenance of organic order draws more attention than the main-

tenance of inorganic order? One may argue that amoeba's survival is important because it's purposeful while a stone's survival is purposeless. Boorse refers to the following excerpt from Sommerhoff's "Analytical Biology":

"[Except for borderline cases of life,] it would be hard to find any level of organic activity which does not invite us to think of vital activities as being somehow purposive, as being subject to tendencies which are directed towards the fulfillment of specific and mutually interrelated ends. On the phenomenal level from which all science must proceed, life is nothing if not just this manifestation of apparent purposiveness and organic order in material systems. In the last analysis, the beast is not distinguishable from its dung save by the end-serving and integrating activities which unite it into an ordered, self-regulating, and single whole, and impart to the individual whole that unique independence from the vicissitudes of the environment and that unique power to hold its own by making internal adjustments, which all living organisms possess in some degree (Sommerhoff, 1950, p. 6; italics added)" [12]

But why is it that a biological object has purposeful survival and a non-living object such as stone has purposeless survival? In my view, this discrimination in attribution happens because of teleological thinking and difference in the method of study. Teleological thinking is self-evident as the biological object is being related to the purpose. If one abandons teleological thinking, then a biological object does not have a purpose of survival; then survival is merely a causation. The second reason, i.e., the difference in the method of study, leads to various frameworks within which the object is studied.

Objects have designs of varying complexity, and a certain method of study is oftentimes necessitated due to the complexity of design. A stone is visibly static and has a simple design. It can be studied through structural analysis. When the design becomes complex and confers actions, it can be studied through functional analysis. In a functional analysis, the goal is to explain the intrinsic organization of an object and how the design leads to certain actions in the system. In this way, the behaviors or outputs of objects can be explained in terms of the causes by which they arise.

Sometimes objects are designed in such a complex

way that the outputs of objects appear to make the causes happen by which they arise. Such objects are termed goal-directed systems as their design confers on them a tendency to achieve and maintain a goal state [17]. A machine designed to have a purpose of picking up clutter will elicit actions directed toward the achievement of the goal. A lion attacks with the purpose of preying. Such goal directed systems can be studied through cybernetics. This is the framework in which biological objects are purposefully directed to achieve and maintain the goal of survival in the face of external and internal perturbations. This purposiveness is intrinsic and conferred by the design of the object. Similar purposive statements can be made for a stone if it is studied through a systems approach. One could say that the minerals in the stone are naturally designed to achieve and maintain the goal state of survival in the face of external and internal perturbations. In fact, stones are much more successful in maintaining the goal of survival. Their survival function is so ubiquitous that it does not come to attention.

Survival as the Only Goal of Biological Function?

Even if biological objects are purposefully goal-directed toward species survival within the framework of cybernetics, restricting the concept of biological function to survival implies that all biological activity is geared toward this end. There is no doubt that life is what distinguishes a cell from a crystal and human from a mannequin. That living objects from cells to species are naturally designed to maintain the state of life. And that natural selection leads to optimization of this design and subsequent maintenance of the goal state. At the same time, there is also no doubt that living objects do more than just surviving. An amoeba may have purposeless movements in water. Elephants have tears in their eyes after the death of an elephant. There is a thrill in bungee jumping and there is joy in dancing. One may quote countless actions where survival does not appear to be the goal. Yet a naturalist is not concerned because these goals are secondary to survival. For a naturalist, many biological actions only falsely appear to be irrelevant to survival. Amoeboid movements, as a whole, directly contribute to survival. Dancing is not for the sake of joy but a social behavior contributing to survival. Curiosity, risk-taking, and exploratory behavior all have survival benefits. For some, grief is the price paid for attachment while for others, the

adaptive function of grief is to ensure group cohesiveness in species where a social form of existence is necessary for survival [18, 19].

To further clarify this restriction, living objects are not like artefacts. Artefacts may have various goals. A vending machine has the goal of vending, but it is also made for the goal of money making. Transportation is only one of the goals of a luxury car. There is hardly any artefact which has survival or self-sustainability as the only goal. But for a strict naturalist, survival is the only goal for biological objects. For example, love and self-knowing do exist but they serve an underlying natural goal. And since natural biological activity is goal-directed toward species survival only, goals such as to love and be loved are not independent goals but secondary to survival. All other goals must be natural and secondary to species survival.

Subsuming every other goal into the goal of survival is a case of reduction. The meaning of reduction here is the same as explained by Nagel in the structure of science, i.e. "The explanation of a theory or a set of experimental laws established in one area of inquiry, by a theory usually though not invariably formulated for some other domain" [15]. Nagel describes two types of reductions. One type of reduction establishes deductive relations between two sets of theories or laws that employ a homogeneous vocabulary. For example, Galileo's laws were absorbed into Newtonian mechanics and gravitational theory. Geometric theorems can be explained in terms of algebraic methods. Theories and laws discovered from studying a prokaryotic organism can also be applied to human cells. Nagel is not concerned with these 'homogeneous' reductions as they are commonly accepted as phases in the normal development of a science and give rise to few misconceptions as to what a scientific theory achieves [15].

The second type of reduction is the problematic one where statements, theories, or laws from one science are reduced to statements, theories, or laws of a different science using different vocabulary and descriptive terminology. In this type of reduction, it is difficult to utilize both sciences in the same context or conversation. Nagel gives the example of temperature which is conceptualized differently in common usage, thermodynamics, and mechanics. Reduc-

tion of mind to brain is an attempt at this type of reduction. There was a time when such reduction was thought of as impossible; to the extent that Rene Descartes explicitly proposed the mind-brain duality [20]. Psychiatrists such as Thomas Szasz believed that mental illness was a myth [21]; something that had nothing to do with brain lesions or biology. But times have changed now. Even though the reduction is not complete, there is confidence in its eventual completion [22, 23]. Cartesian dualism is not the mainstream position when it comes to explaining the mind-brain connection. Consciousness and subjective phenomena are not the causes but the effects of physical causations. A case is made for metaphysical naturalism [24]. This philosophical position implies that metaphysical objects such as language, ideas, logic, and values are not "objects within themselves" but objects emerging from the interactions of physical objects. Language could be reduced to a pattern of muscle movements and firing of neurons. Fear could be reduced to activation of certain parts of the brain. Even concepts like logic, abstract reasoning, spirituality, and morality could be reduced to a specific structure and function of the brain. Such reduction is no more wishful thinking as decades of neuroscience research, clinical evidence from brain lesions and the discovery and use of psychopharmacological agents to heal subjective phenomena have strongly, if not fully, grounded the mind into brain and thus biology [25].

Yet perplexities are encountered in this type of reduction as the subject matter of brain is qualitatively discontinuous with that of mind. The brain is natural while the mind deals with metaphysical. It is difficult to grasp the idea that, since mental functions emerge from biological processes which are goal-directed toward survival, the hidden purpose of all mental functions is species survival. For a lot of brain functions such as respiratory, endocrine, sensory, and motor functions, it is relatively easier to establish a contribution to survival. But it is not the case for many other brain functions. Take examples of self-esteem and ego. These concepts are so far away that many connections, if they do exist, will need to be made for their linkage with survival.

Biological function and dysfunction have existed long before any attempts at their definitions. Diseases existed long before the knowledge of pathology and theory of evolution. At one point, diseases were defined based on

symptoms. Later, it became evident that a definition based on pathology or biological dysfunction was more accurate at explaining the disease process. Biological dysfunction, in turn, is defined based on real-time or predicted failure of those biological processes which contribute to survival. Hypertension and diabetes mellitus can be diagnosed without symptoms because a direct chain of explanations exists which links these conditions with death of cells, tissues, and living organism. In fact, a definition of biological function/dysfunction based solely on species survival is adequate for most medical diseases. One can give countless examples where one genetic mutation leads to dysfunction at all the hierarchical levels of protein, organelle, cell, tissue, organ, and body.

Yet the use of survival is limited in explaining mental functions. A psychologist pays no attention to survival because the framework of psychology begins with subjective experience. No effort is made to ascertain whether the mental functions under consideration are part of the hierarchy, at the top of which lies survival and reproduction. Even if an effort is made, it becomes apparent that in some cases, it's the so called "mental dysfunction" that contributes to species survival [26, 27]. Take the example of aggression. Aggressive behavior has an adaptive benefit which led to natural selection of the neural apparatus performing this function [28]. Yet it is also a presenting complaint for many psychiatric visits. It is treated with medications. One could point out the adaptive mis-fitness of aggressive behavior in certain natural environments that makes it a biological dysfunction. Yet this adaptive mis-fitness is often construed upon social norms. Genghiz Khan wiped out whole societies and escaped the diagnosis of mental disorder while mere yelling and cursing of wife has been regarded as mental disorder. Take a counterexample of depression. The classical psychodynamic theory of depression is "aggression turned-inwards" [29]. In this sense, depression has an adaptive benefit as it prevents aggression and signals yielding in a hierarchy conflict. It also prevents disengagement in fruitless efforts and saves resources. Depression can also be viewed in the context of pathogen host defense hypothesis [30]. Yet, it is considered a biological dysfunction, diagnosed, and treated. Grief, on the other hand, despite having many similarities with depression, is viewed as an adaptation to loss, and thus biological function [18].

Attention-deficit hyperactivity disorder is characterized by inattention and hyperactivity. However, individuals with this disorder are not completely devoid of attention or inactivity. They go about living their lives normally until there is consideration of academics, sitting long hours in classrooms, and working long hours in offices. Three centuries ago, there was no academic pressure and no expectation to graduate from college. Therefore, most quantities of attention and activity were normal functions. Again, one can point out the adaptive mis-fitness here but this mis-fitness is not a threat to survival in the same sense as the adaptive mis-fitness of primate respiratory system is to a primate in marine environment. The threat posed by this type of mis-fitness is to personal and social functioning, both of which cannot be reduced to species survival. In this sense, a definition of biological function based on species survival cannot distinguish between normal and abnormal at a personal and social functioning level.

The Concept of Biological Function for Mental Function

To reiterate, the argument is not against basing the concept of biological function on survival but against restricting the base to survival only. There is no denying that living objects are naturally goal-directed toward survival and most biological research and practice of medicine is geared toward maintaining this state of survival. However, it is also apparent that during this goal-directed journey toward survival, some other goals have emerged which cannot be reduced to the goal of survival. The doctrine of emergence states that simpler properties and forms of organization give birth to more complex and "irreducibly novel" traits and structures [15]. Life is an example of such an emergence from the organization of organic matter. It cannot be reduced to an assembly of proteins, carbohydrates, and nucleic acids. Similarly, subjective experience is an emergent phenomenon which cannot be reduced to an organization of neurons. Subjective experience is so distant from objective biology that it is rare to come across a comment on the evolutionary benefit of subjective experience. Ross Buck has invoked Gibsonian ecological perceptual theory to argue that subjective affective experience can be regarded as direct knowledge of an internal reality an internal ecology of the body [31]. This direct knowledge is then help-

ful in self-regulation of bodily processes. However, the use of subjective experience goes far beyond this self-regulation. Without subjective experience, there would be no self-concept or self-esteem. There would be no psychology or psychiatry. Maslow's hierarchy of needs would end at the level of physiology. It is because of subjective experience that goals, other than physical survival, have emerged for human beings. Abraham Maslow refers to these goals in his theory of human motivation. These goals can be also found in the theories of Piaget and Erik Erikson. Above all, problems in achieving these goals often lead individuals to seek help from healers.

Take the example of cosmetic surgeries. Individuals who visit the surgeon don't complain of the threat to survival but are in need of an intervention from surgeon to achieve their body-image goal. Hirsutism is another example where there is a problem in achieving the body-image goal. Most psychiatric visits are focused on fulfilment of self-goals that help individuals in their journey toward self-actualization. Individuals with anxiety disorders are in pursuit of confident fearless selves. Individuals with obsessive-compulsive disorders want to get rid of thoughts which don't attest to their selves. Many cases of depression are reactions to failures in achieving self-goals such as success, intimacy, love, or productivity. Individuals with gender identity disorder continue to struggle with psychiatric symptoms until there is good enough alignment between the externally perceived and actual self-identity. Individuals with ADHD struggle with their academic and occupational goals. Sometimes, self-goals come at odds with the goal of survival. Individuals with eating disorders prioritize their body-image goal over survival. Some people sacrifice their lives for a greater cause. Abortion is a common practice which is done to fulfil personal goals.

Neither evolution nor any theory based on fitness or survival advantage can provide a framework for conceptualizing such functions and dysfunctions. The only choice is to broaden the definition of biological function to encompass those mental actions which contribute to self-goals. There is no need for a new analysis of function as Cummins' account of function accommodates those functions which fulfil self-needs. Similarly, Boorse's notion of function can also accommodate self-goals.

For psychiatry, the concept of biological function must encompass both survival and thrival. Take the example of audition. The auditory system was selected because of its survival advantage. It performs many survival functions such as startle reflex. It also plays a part in thrival. We also use our hearing in listening to music. Most of us have musical tastes, something that is an aspect of self. Loss of music perception is a mental illness worthy of treatment. Vision has a survival advantage but also serves as a system for esthetic experience. Language is for communication, but we also use language apparatus for poetry, sermons, and acting. Motor system is for movement but being muscular and athletic is also a goal for some. Being a dancer is a goal for some. Appetite, smell, and taste have uses beyond nutrition. Libido is for reproduction, but we don't just have the goal of sexual intercourse; terms like romance, dating, relationship, love, partnership, wedding, and family reflect other needs. We utilize our cognitive capacities to fulfil our diverse goals in academics, careers, occupations, and society. Attachment and social behaviors have survival value but marriage, friendships, parenting, and contribution to society are goals on their own. All these goals have emerged from a biological substrate which was selected because of its contribution to survival. Yet these self-goals cannot be reduced to the goal of survival, at least for individual self-who is motivated by these goals.

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