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Review

Psycho-physiologic emergentism; four minds in a body

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Abstract

The mind-body problem represents one of the most debated topics in the neurosciences. From a psychological standpoint, abstract/non-material data are an intrinsic part of the mind, intervening to a large extent in reasoning and decision making processes. Imaging studies also show a strong correlation between higher cognitive functions (such as working memory) and specific cerebral brain regions (a fronto-parietal network of interacting left and right brain areas). In contrast, the physical/material brain would be unable to interact with abstract-immaterial data, such that the psychological processing of abstract data (processes such as thinking, reasoning, and judgment) is attributed to the mind, with the mind representing a distinct entity interposed between the brain and abstract-immaterial data.

Recent data suggest that the mind-body problem may simply be an artifact of human experience/ understanding, as the brain actually represents actually an intrinsic part of the mind. Even if the physical brain is not able to interact with abstract mental data, the brain still could process abstract data through a dynamic association between the abstract data and cerebral stimuli/ impulses. This form of processing without interaction defines the mind as a complex neurobiological structure, with the unconscious part of the mind processing abstract-immaterial data in a conscious/ mental format.

In this overview, important concepts of psycho-physiologic emergentism, including internal mental reality, internal mental existence, internal mental interaction, and structural and informational dichotomies of the brain, are iterated. Such concepts/properties represent a neuro-informational support system capable of generating four distinct minds within the single brain. Future studies should further develop the dynamic and immaterial-material nature of the mind, as a possible premise for a scientific definition and understanding of mental events like affectivity, emotions, soul, etc.

Keywords: psycho-physiologic, emergentism, abstract, concrete, mind, structural, informational, brain, dichotomy, four minds

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Introduction

The nature of the "mind" is still a poorly understood and highly debated topic, being defined more as the sum of psychological abilities/ faculties (consciousness, perception, thinking, judgment, memory) than as a unified concept/ entity (1). Beyond the abilities listed above, the mind appears much more complex, being able, for example, to engage in abstract capabilities such as imagination, appreciation, and processing emotions and feelings, which themselves may lead to attitudes and actions (2). Some psychologists consider that only rational ("superior") intellectual functions such as reason and memory comprise the mind, while emotions (love, joy, hate, fear), being more primitive, are to be distinguished from the mind (3, 4). Other authors posit that all rational and emotional (either conscious or unconscious) mental events should be viewed as parts of the mind (5).

From a psycho-physiological perspective, the existing relationship between the mind and the brain (known as the mind–body problem) is far from being understood (6). Thus, it is yet unknown how the abstract mind (abstract ideas or thoughts) functions within a physical brain, from whence it intervenes not only in the decision making process but also in the elaboration/ coordination of several motor responses, some of which are abstract in nature (e.g., abstract-based gestures). With these psycho-physiological processes yet unelaborated, the interrelationship and interdependence between the mind and the concrete (physical) brain evokes the debate regarding monism (7) vs. dualism (8).

Dualism maintains that both the mind and the brain exist, each being independent of the other. Thus, the mind is considered either an independently existing substance (substance dualism), or a group of independent properties that emerge from the brain (and that cannot be reduced to the brain) (8).

M**onism**, on the other hand, posits the existence of only one component of the mind-body equation, either in the form of materialism (nothing exists apart from the material world, with mental phenomena being reducible to neuronal phenomena), or as idealism (only the mind exists, the physical objects and events being reducible to mental properties and events) (7).

Recently a new conceptualization has been advanced as an alternative to monism and dualism, in the form of *psycho-physiologic emergentism* (9, 10). According to this new concept, the mind incorporates both abstract data and a neurobiological substrate.This new concept has gathered no critics thus far, perhaps due to the fact that its foundation draws from incontestable psychological and clinical events. Thus, on the one hand, the mind is psychologically able to receive and process abstract data, elaborating abstract responses (this being an incontestable event). On the other hand the mind's function depends on the brain, with medical drugs capable of interfering with cerebral neurophysiology (general anesthetics, caffeine, etc.) and thus able to activate or suppress mental events (also an incontestable fact).To increase the credibility of the psycho-physiologic emergentism approach, it is necessary not only to present its particularities, but also to explain the erroneous thinking behind the monistic and dualistic approaches.

The erroneous approaches of monism and dualism begin from the observation that the *material* brain is unable to interact with abstract-*immaterial data***,** the brain being therefore unable to process abstract data. As a consequence, monism tries to reduce immaterial data to material data, or vice versa. This approach is mistaken because abstract data (abstract concepts and information) not only exist separately from physical matter, but also, abstract data can participate to a great extent in our

decision making processes and physical actions. Dualism assumes that the mind and brain exist separately, the brain being unable to process abstract data which is processed by mind as a distinct entity. But this is a false perspective, because an incompatibility between the brain and abstract data would imply not only the incapacity of the brain to process abstract data, but also the incapacity of abstract data (like music, for example) to intervene/ act upon the brain in a manner that elicits coordinated/ abstract motor responses (such as might occur with dance).

Psycho-physiologic emergentism maintains that there is actually no mind-body dilemma. There is in fact only a material brain capable of processing abstract data, through a dynamic association and without interaction between the physical brain and immaterial data (such dynamic association between the brain and abstract data composing together the mind) (11, 12). Two distinct observations need to be highlighted here.

First, from the perspective of psycho-physiologic emergentism, a more fruitful approach is to examine and elucidate the existing affinity between the material brain and abstract data, as it makes less sense to try to investigate a possible relation between the entire mind (brain + abstract data) and a subcomponent of the mind (brain). Second, the part of the brain supporting mental processes is a complex structure (distinct and interrelated neuronal subunits), performing through emergentism a new mental/ psychophysiological function that is able to process abstract data and that is distinctive from classical neuro-physiological mechanisms (13).

This paper presents the idea that the neurobiological support of mental events is represented by the brain, which could generate (due to structural and informational dichotomies) four distinct neuro-informational patterns/ minds in a single body (14, 15).

Discussion

Internal mental reality and internal mental existence composing the mind

External visual stimuli are represented by electromagnetic waves (that interact with cone cells of the eyes), external auditory stimuli are represented by air vibrations (that interact with the eardrum /ear), external gustative and olfactory stimuli are represented by chemical compounds (acids, bases, etc. interacting with lingual papillae/ olfactory epithelium), and so on. There are no colors, sounds, tastes and smells existing as part of the external medium. All these conscious stimuli exist only in our minds, and represent an internal projection of the external stimuli/ reality which is then reconstructed within the brain as a distinctive internal mental reality. Accordingly, the mind implies or "is aware" only through this **internal (mental) reality**, having no direct access to the external (physical, chemical) reality(12).

Even without direct access to the external reality which is physical/ chemical in nature (in the form of acids, bases, etc.), we are, however, able to interact with the surrounding reality and, furthermore, to be conscious about it. This means that the conscious-surrounding reality is actually mental in nature, being represented by an internal mental reality/ stimuli (in the form of sour, bitter, colors, sounds, abstract representations, etc.). This internal mental reality therefore has the role of acting as the database surrounding (presenting information for) an **internal mental existence** (the "I" or the person him/herself) (16). This mental existence has intentionality towards the surrounding conscious/internal reality (through attentional focus and the decision making process), and autonomy from the physical body and reality. As an example, the internal mental existence has specific/ psychological needs and preoccupations (about social image and influence, political or cultural

activities, etc.), which often are more important than the physiological needs of the body.

In parallel with **environmental interaction**—between external stimuli and the body, there is an **internal mental interaction**—between the internal mental existence and the internal mental reality. Environmental interaction is ensured by the somatic nervous system (through the classical neuro-physiological mechanisms), while internal mental interaction is a complex psychophysiological mechanism supported by both somatic and autonomic nervous systems (9) (Figure 1).

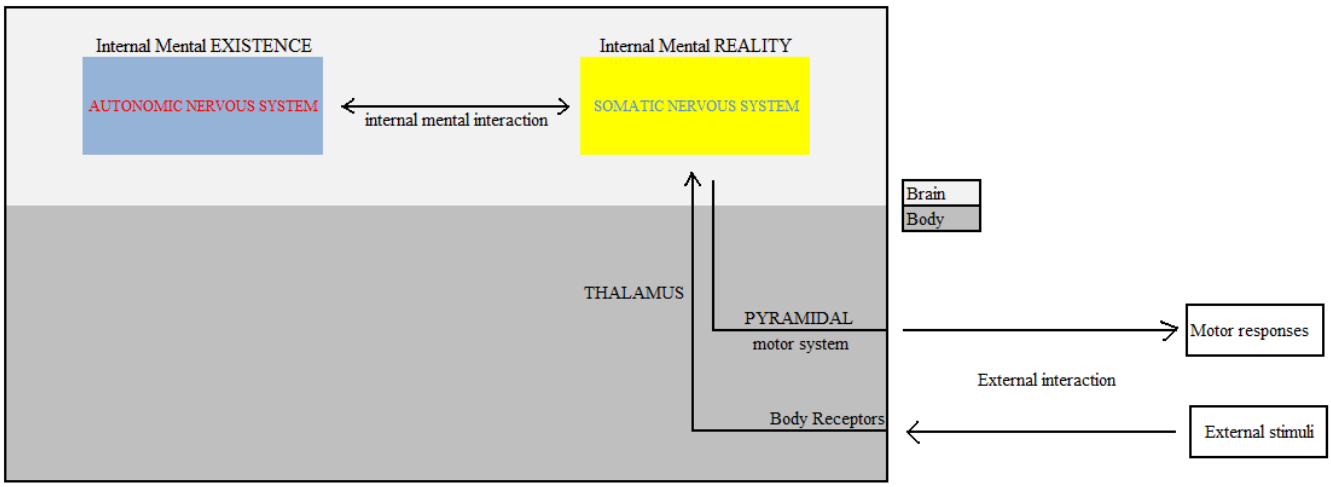

Figure 1. Internal Mental Interaction, and External (physical/ chemical) Interaction

Three important observations must be highlighted here, exemplified for the concrete mind.

First, psychological experiences such as one's internal mental existence and internal mental reality would have dedicated neurobiological structures (somatic nervous system supporting internal mental reality, and autonomic nervous systems supporting internal mental existence). The internal mental existence and internal mental reality represent the conscious domain of the mind, while the neurobiological (somatic/ autonomic) support would represent its unconscious part (that is, the mind is unaware of these processes).

Second, these two distinct psycho-physiologic entities have synergistic action, with the internal somatic-reality being responsible for data exposure/ presentation and the internal autonomic-existence selecting (via attentional focus) the information/data to be analyzed/processed. From a psycho-physiological perspective, internal mental interaction would therefore occur between two distinct psycho-physiologic (neuro-informational) entities, complementing one another and generating together (through emergentism) the mind (as an immaterial-material entity) (12). This means that the physical brain by itself would be unable to generate the mind (not having abstract data) through emergentism. Transmission of abstract data between these two neuro-informational entities with no physical interaction is possible through the annexation of abstract data to the nervous/ physical stimuli, additional explanations of this psycho-physiologic mechanism of the mind being presented in a separate paper (12).

Third, the psycho-physiological mechanisms ensuring internal mental interaction (between internal somatic-reality and internal autonomic-existence) are relatively similar to computer functioning, which is the basis of computational neurosciences (interaction

between distinct subunits) (5). These mental/ psycho-physiological mechanisms are incompatible with the classical neuro-physiological mechanisms ensuring external interaction (between the body and the physical/ chemical environment). As a consequence, these two (psycho-physiological and physiological) mechanisms are connected only partially through the process of data transfer, which is possible through the conversion of information from a physiological format (specific to external interaction) to a mental format (specific to internal interaction). In some pathological situations (such as autism disorder), internal mental interaction is disconnected to a large extent from external interaction, with subjects living in their own (internal) world/ reality (17). On the other hand, the relative independence/ autonomy of internal mental interaction from external interaction/ stimuli leads to a relative subjectivism/ relativity of our mental appreciations and judgments (18).

Abstract and concrete minds

The process of data transfer from an external medium to the mind takes places through conversion of information from a physiological format (specific for primary sensory cortex) to a mental format (generated by secondary somatosensory cortex) (19). Somato-sensory cortex generates colors, sounds, tastes, smells, etc., (a mental/ conscious format of data), even though there are no `color pigments` in the brain. Such conscious/ mental impressions like blue, yellow, sour, etc. represent in fact the conscious form of data appreciation, namely an internal autonomic-existence recognizing mental data received from internal somatic-reality. This circuit belongs to the dorsal system of attention, with external information/ inputs being transmitted to the thalamus, to the somatic cortex of internal mental reality (to generate data in a mental format), and, further, to the autonomic cerebral system of the internal mental existence for recognition and processing. Efferent motor responses are ensured by the pyramidal motor system. These `concrete` afferents, cerebral centers and efferents together make up the **concrete mind** (20).

Recent literature data suggest that the human brain is able to support not only the concrete mind, but also a dissimilar **abstract mind** (20, 21). This abstract mind could receive external information through a parallel/ ventral system of attention (the ventral hypothalamic input route), sending data first towards the autonomic nervous system of the brain (that generates the internal mental reality), and afterwards to the somatic nervous system of the brain (generating internal mental existence) (22).

As a clinically-relevant example of **the concrete mind**, the dorsal system of attention first sends data to the internal mental reality of somatic nervous system, which then reconstructs the data into a mental sense/ format. From this point, the mental data are forwarded to the internal mental existence of the autonomic nervous system, which receives/ recognizes it (becomes aware about it). In addition to these mental messages from the surrounding/ internal mental reality, in an abnormal situation we (our concrete mind) can also receive aberrant stimuli from the ventral system of attention. Such signals cannot be recognized/ interpreted by us/ our internal mental existence as messages, as they bypass the internal mental reality and therefore lack a mental format. Aberrant (not mental) stimuli can reach either the parasympathetic or sympathetic components of the autonomic component of concrete mind, such that our mental existence experiences either an unexplainable (free-floating) anxiety (unjustified by mental data), or low mood and behavior/ aversion to activity in the form of depression (23, 24).

Four minds in a body

The dual functioning of the brain creates two opposing neural circuits (task positive network and

default mode network) supporting two distinct psycho-physiological patterns (22). Thus, in generating the abstract and concrete minds, the brain functions in a dichotomous manner. But the human brain can also be characterized as having an anatomical dichotomy, in the form of right and left cerebral hemispheres/ hemibrains. Thus, it would be worthwhile to investigate whether the two (abstract and concrete) minds exist in both (left and right) hemibrains, being anatomically dichotomized and thereby generating four distinct psycho-physiological profiles (20, 21).

This question could be clarified at least in part by understandingthe necessity of somatic-autonomic coordination within the brain. From a physiologic perspective, the anatomic distribution of the somatic nervous system ensures environmental interaction of the body, while the autonomic nervous system controls the functioning of internal organs. Sexual function would suppose a somatic-autonomic synergism within the brain, because it implies not only environmental interaction (with, for example, a sexual partner) but also autonomic organs and responses (testicles/ seminal vesicles, lubrication, vasodilatation for erection, tachycardia, etc.) that must communicate within the body (10).

To avoid monopolization of somatic-environmental interaction by sexual processing (to make therefore possible both sexual and non-sexual environmental interactions, even if alternating), it would be necessary to decouple the autonomic nervous system from the somatic nervous system, or to decouple the entire (somatic-autonomic) brain from environmental interaction. Connection between autonomic nervous system and somatic nervous system is made via sexual pheromones for the abstract brain, and via sexual hormones for the concrete brain. Although this chemical connection is not voluntary, the human mind supposes a degree of control/ choice between sexual and non-sexual commitments (insofar as processing and responding). Accordingly, it has been suggested that the somatic-autonomic complex of the brain is partly disconnected from external environmental interaction, in the form of an internal/ independent operator (the mind) that is capable of supporting both cognition (as an autonomic process) and sexuality (as a conscious event) (20, 21).

Evidence from the literature suggests that sexual pheromones would activate the hypothalamic brain (left hemibrain for male pheromones, and right hemibrain for female pheromones), while sexual hormones activate the thalamic brain (androgens for left hemibrain, and estrogens for right hemibrain). There are thus four distinct psycho-sexual profiles described in humans, generated by the structural and informational dichotomies of the brain (11, 14, 15). But the cerebral (somatic-autonomic) operator is common for both cognition and sexuality, all sexual events being conscious (as libido and sexual arousal). This suggests that structural and informational dichotomies of the brain would actually generate four distinct minds, which act to coordinate both cognition and sexuality. Psychological peculiarities/ delineations between these four distinct minds will represent the topic of a forthcoming paper.

Conclusions

Abstract and concrete minds are different, from both physiologic-cerebral and informational-psychological perspectives. Accordingly, the effects of psychotropic drugs differ from person to person, such that some hypnotics have unexpected/ opposite-excitatory effects in certain individuals. In pathological situations like

persistent vegetative state, zopidem for example (a sedative drug used for trouble sleeping) has an unexpected arousing effect during the period of drug action. Such phenomena articulate the fact that not all persons/ minds are alike, some being even antagonistic/ opposite in their processing of information. The understanding of this psycho-physiological variation may represent a critical advance toward future medicine based on a more individualized psychology, psychiatry, and sexuality.

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