Emergent Evolutionism and the Brain-Mind Problem

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What is emergent evolutionism?
What does it do with other philosophical approaches?
What does it do with the brain and the human mind?
Emergent evolutionism as a classical doctrine

David Hume (1711-1776)
* Treatise of Human Nature* (1739)
Concept of causation

John Stuart Mill (1806-1873)
* Logic* (1843)
Inductive reasoning

George Henry Lewes (1817-1878)
* The Problems of Life and Mind*
**First Series: The Foundations of a Creed** (1875)
**Second Series: The Physical Basis of Mind** (1877)
**Third Series: Mind as a Function of Organism** (1879)
The concept of emergence
The basic concepts of emergentism

1. Level

“A level is a defined portion of the world that is marked by a set of closely related characteristics peculiar to it and emergent from other levels that existed previously.”
(T. A. Goudge, 1967)

“A group of entities that are exemplares of the same set of specific laws.”
(H. C. Brown, 1926)

“A level is a class of structures or processes which are distinguishable from others as being either higher or lower.”
(G. P. Conger, 1925)

“Grades in a static scale or stages in a process.”
(M. Bunge, 1960)

“A local maximum of predictability and regularity in Nature”
(W. C. Wimsatt, 1977)
The basic concepts of emergentism

2. Hierarchy of levels

Deity
Mind
Life
Secondary qualities
Matter
Primary qualities
Space-time

Deity
Mind
Life
Matter

Social groups
Multicellular organisms
Cells
Molecules
Atoms
Elementary particples

Ontological?  Epistemiological?
3. Emergence

“The emergence of a new quality from any level of existence means that at all level there comes into being a certain constellation or collocation of the motions belonging to that level and possessing the quality appropriate to it, and this collocation possesses a new quality distinctive of the higher complex.

The higher quality emerges from the lower level of existence and has its roots therein, but it emerges therefrom, and it does not belong to that lower level, but constitutes its possessor a new order of existent with its special laws of behaviour.”

(S. Alexander, 1920)

Three kinds of change: chance occurrence – shift – emergence

Emergence: “Certain characteristics supersede other characteristics and these characteristics are adequate to explain the occurrence of their level.”

“What emerges are not laws, but what the laws describe.”

(S. Pepper, 1926)
The basic concepts of emergentism

4. The attributes of emergence

1. Unpredictability

“That the antecedent phases of an emergent evolution do not permit of the prediction of the subsequent phases is axiomatic.”

(R. Ablowitz, 1939)

“A being who knew only mechanical and chemical action could not predict life; he must wait till life emerged with the course of Time. “

(S. Alexander, 1929)
4. The attributes of emergence

2. Novelty

“To say that an emergent characteristic is novel means that (1) it is not simply a rearrangement of pre-existing elements, although such a rearrangement may be one of its determining conditions; (2) the characteristic is qualitatively, unlike anything that existed before in cosmic history; and (3) it was unpredictable not only on the basis of the knowledge available prior to its emergence but even on the basis of ideally complete knowledge of the state of the cosmos prior to its emergence.”

(T. A. Goudge, 1967)
The basic concepts of emergentism

5. What makes emergents emerge?

1. External sources outside Nature?

Basically ALL emergent theories EXCLUDE the influence of an “outer source”!
(E.g. First Cause, God, Elan, etc.)

2. Internal sources in Nature?

**God as an internal source**

S. Alexander (1920): **God is an internal source** as a part of the hierarchically organised Universe. “Nisus” is the “cosmic impetus” which is the causally effective influence of God at every stage of the progressive advance.

C. Lloyd Morgan (1923): Spinoza’s Conatus = Alexander’s Nisus

**Other internal sources in Nature**

A. Huxley: **idea of epigenis** (the internal source of energy for progress)

H. Driesch (1926): “supernatural phylogenetic entelechy”

...
The criticism of classical emergentism

Logical?  Ontological?  Epistemioological?

It is a form of epiphenomenalism (S. Pepper)

It is representing the boundaries of our semantic analysis (A. Pap)

Novelty for us ≠ novelty for the world (W. M. Malisoff)

Lack of explanative power (Lovejoy’s critique on his critiques)

“There cannot be more in the effect than there is in the cause” (R. Descartes)

“Emergentism camouflages the real problems of evolution behind an appealing metaphore” (M. Delbrück)

Regards “unpredictability” as a dogma which cannot be touched upon.
Take an break and ask questions as a natural scientist...

Are there hierarchical levels in Nature?

Are there evolutionary changes in Nature?

Is there a connection between evolutionary changes, emergence and hierarchical levels in Nature?
Is there a connection between evolutionary changes, emergence and hierarchical levels in Nature?

Modern natural science since Ockham and Bacon

Deductive reasoning (premises → conclusion)

Mathesis universalis

Connection between hierarchical levels, change and emergence: +

The supreme task is to arrive at those universal elementary laws from which the cosmos can be built up by pure deduction. There is no logical path to these laws. Only intuition, resting on sympathetic understanding of experience, can reach them... (A. Einstein)
The Big Bang
Level D

Interface C-D

Level C

Interface B-C

Level B

Interface A-B

Level A

Laws of levels

Common

Specific

Conservation laws or Transformation laws

Laws of interfaces

Common

Specific
Symmetry = Invariancy

Conservation laws

Asymmetry = Variancy

Transformation laws
Dynamics of large scale systems

Causality
(distinction between future and past = broken symmetry)

Irreversibility
Entropy

Dissipative structures

Evolutionary feedback

Threshold
Instability through fluctuations
Increased dissipation

Flow of matter and energy, building up function and structure

I. Prigogine, From Being to Becoming, 1980.
### Views on the brain-mind problem

<table>
<thead>
<tr>
<th></th>
<th>Everything is the mind alone</th>
<th>Mind and brain are independent entities</th>
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<tbody>
<tr>
<td>Idealism</td>
<td></td>
<td></td>
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<tr>
<td>Neutral monism</td>
<td>Mental and physical are manifestations of unknown substance</td>
<td>Mind and brain activities are synchronous / harmonious</td>
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<tr>
<td>Eliminative materialism</td>
<td>Only brain, no mind</td>
<td>Physical causes (“secretes”) mental</td>
</tr>
<tr>
<td>Reductive materialism</td>
<td>Mind = set of physical states</td>
<td>Mind controls brain; mental controls physical</td>
</tr>
<tr>
<td>Emergent materialism</td>
<td>Mind = set of emergent bio-activities</td>
<td>Mind and brain interact</td>
</tr>
<tr>
<td>Logical behaviourism</td>
<td>Mental and behavioural are only semantic duplicity; all is physical</td>
<td>Mind and brain interact, but this is unbalanced (B&gt;M or M&gt;B)</td>
</tr>
<tr>
<td>Psychophysical identity</td>
<td>Mental = a subset of physical processes</td>
<td>Both brain and mind exist; the mind is an emergent entity based on brain activity; it can interact with its brain</td>
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After Bunge, 1980.
And now again, the question of neuroscientists infected by philosophy:

Can we understand the human brain and, consequently, the human mind?

A few obstacles ahead of us!
1. Mathematical: The Gödel’s incompleteness theorems

1. Any effectively generated theory capable of expressing elementary arithmetic cannot be both consistent and complete. In particular, for any consistent and effectively generated formal theory that proves certain basic arithmetic truths, there is an arithmetical statement that is true, but not provable in the theory. Consequently, any consistent effective formal system that includes enough of the theory of the natural numbers is incomplete: there are true statements expressible in its language that are unprovable within the system.

2. For any formal effectively generated theory including basic arithmetical truths and also certain truths about formal provability, if the theory includes a statement of its own consistency then the theory is inconsistent.

The human brain cannot explain the human brain
2. Philosophical: The nature of subjective experience – the “qualia”

“The sensation of colour cannot be accounted for by the physicist's objective picture of light-waves. Could the physiologist account for it, if he had fuller knowledge than he has of the processes in the retina and the nervous processes set up by them in the optical nerve bundles and in the brain? I do not think so.”

Consciousness has essential to it a **subjective character**, a **what it is like** aspect

**Qualia** is "an unfamiliar term for something that could not be more familiar to each of us: the ways things seem to us. Ineffable, intrinsic, private, directly apprehensible in consciousness.

*The human conscious experience cannot be explain in objective terms*

“... In that Empire the Art of Cartography attained such Perfection that the map of a single Province occupied the entirety of a City, and the map of the Empire, the entirety of a Province. In time, those Unconscionable Maps no longer satisfied, and the Cartographers Guilds struck a Map of the Empire whose size was that of the Empire, and which coincided point for point with it.”

A “perfect” map of the human brain is not the human brain and it cannot explain its functions.
Challenges

4. Downward causation?

Roger W. Sperry (1913-1994)

Donald T. Campbell (1916-1996)

János Szentágothai (1912-1994)

Some criteria for a general brain theory – according to Edelman and Szentágothai

1. The theory must be consistent with neuroanatomical, embryological and neurophysiological information.

2. It must account for the distributive properties of memory and learning, for associative recall, as well as for the temporal properties and temporal “scale” of recall.

3. It must permit updating of memory (internal models of the outer world) to accord with current inputs.

4. It must reflect the main functions of higher brain systems as mediators between action and experience.

5. It must provide the necessary, if not sufficient, conditions of awareness (including the “capacity to distinguish self from non-self” = “self-awareness”).

6. It must not violate the basic laws of nature (for example thermodynamics).

7. Among others, it should be able to explain “downward causation”.
Neural correlates of perception?
Neural correlates of mental states?
Neural correlates of thinking?
Neural correlates of consciousness?
Neural correlates of “the mind”?  

1. The Mountcastle – Szentágothai – Edelman “line”

(1) Cortical neurons are organised in cortical columns or moduls.  
(2) Cortical moduls are the basis of neuronal organisations.  
(3) Neuron networks are self organising networks.  
(4) Self organising neuron networks are carriers of information.  
(5) The great many cortical moduls provide the possibility of an everlasting dynamic pattern formation in the CNS.  
(6) Reentrant signalling is a key component in maintaining the dynamic activity patterns.  
(7) The dynamic structures are maintained by the interaction between the system and its environment.  
(8) The system is an open thermodynamic system that can strive for order and stability far from equilibrium states and, consequently, it exhibits self-organising properties.

Neural correlates of “the mind”?  

2. The von der Malsburg – Singer – Buzsáki ”line”

The oscillatory patterning of neuronal activity and the associated synchronization of discharges serve important functions for the computations performed by neuronal networks. Oscillatory patterning may answer questions on (i) how the computations occurring simultaneously in spatially segregated processing areas are coordinated and bound together to give rise to coherent percepts and actions, (ii) how signals are selected and routed from sensory to executive structures without being confounded, and (iii) how information about the relatedness of contents is encoded. One of the coordinating mechanisms appears to be the synchronization of neuronal activity by phase locking of self-generated network oscillations.

von der Malsburg, 1981; Singer and associates, since mid-1980; Buzsáki and associates, since the late 80ies.
3. The Changeux – Dehane “line”

The global neuronal workspace model contains two main computational spaces: (1) a unique global workspace composed of distributed and heavily interconnected neurons with long-range axons, and (2) a set of specialized and modular perceptual, motor, memory, evaluative, and attentional processors. Workspace neurons are mobilized in effortful tasks for which the specialized processors do not suffice. They selectively mobilize or suppress, through descending connections, the contribution of specific processor neurons. In the course of task performance, workspace neurons become spontaneously coactivated, forming discrete though variable spatio-temporal patterns subject to modulation by vigilance signals and to selection by reward signals. A computer simulation of the Stroop task shows workspace activation to increase during acquisition of a novel task, effortful execution, and after errors.
Neural correlates of “the mind”? 

4. A working hypothesis – by Gulyás & Szathmáry

Cortical mods form the cortex and perform the basic operations in the cortical circuitry.

The basic perceptual, motor and memory functions occupy large areas, but there are “free areas” with “luxury mods” & “luxury circuits”

Evolutionary novel and “successful” functions – e.g. language or music – hijack the luxury circuits: The “amoeba hypothesis”

Columnar / Modular organisations

Neural circuits
Thank you