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## Mind-Body Problem

Information philosophy views the mind as the *immaterial* information in the brain, which is seen as a biological information processor. *Mind is software in the brain's hardware.*

The “stuff” of mind is pure information. Information is neither matter nor energy, though it needs matter for its embodiment and energy for its communication.

In traditional philosophy, mind and body form one of the classic *dualisms*, like *idealism* versus *materialism*, the problem of the one (monism) or the many (pluralism), the distinction between essence and existence, between universals and particulars, and between the eternal and the ephemeral.

When mind and body are viewed today as a dualism, the emphasis is on the mind, that is to say the information, being fundamentally different from the material brain. Since the universe is continuously creating new information, by rearranging existing matter, this is an important and understandable difference. Matter (and energy) is conserved, a constant of the universe. Information is not conserved, it is the source of genuine novelty over time.

Mind in a mind-body dualism coincides with Plato's “ideas” as pure form. Its ontology is different from that of matter. The ancients asked about the existential status of Platonic Ideas. On the other hand, monists can see the mind-body distinction as pure physicalism, since information embodied in matter corresponds to a mere reorganization of the matter. This was Aristotle's more practical view. For him, Plato's Ideas were mere abstractions generalized from many existent particulars.

Mind-body as a “problem” is generally traced to RENÉ DESCARTES, who asked how the *immaterial* mind (or soul) could influence the material body. Would not the interaction between the two have to partake somehow of the character of both? Descartes famously identified the tiny pineal gland as the point of contact between mind and body.



Descartes made the mind the locus of freedom. For him, the body is a mechanical system of tiny fibres causing movements in the brain (the afferent sensations), which then can pull on other fibres to activate the muscles (the efferent nerve impulses). This is the basis of stimulus and response theory in modern physiology (sometimes called reflexology).

The popular idea of animals as machines included the notion that man too is a machine - the body obeying strictly deterministic causal law. But man may have a soul or spirit that is exempt from determinism and thus from what is known today as “causal closure.” But how can the mind both cause something physical to happen and yet itself be exempt from lower-level causal chains?

### The Problem of Mental Causation

Philosophers who accept the idea that all laws of nature are deterministic and that the world is causally closed still cannot understand how an *immaterial* mind can be the cause of an action. On this view, every physical event is reducible to the microscopic motions of physical particles. The laws of biology are reducible to those of physics and chemistry. The mind is reducible to the brain, with no remainder.

For these philosophers of mind, essentially no progress has been made on the problem of mental causation since Descartes. “Reductionists” who accept “causal closure” think that every brain event must have been determined by causes coming “bottom-up” from the brain’s atoms and molecules. Any additional mental cause would be extraneous, according to JAEGWON KIM.

Since the early twentieth century, quantum mechanics adds the possibility that some physical processes are indeterministic, but random quantum-mechanical events have generally been thought to be unhelpful by philosophers of mind. They think adding indeterminism to mental events would only make our actions random and our desires the product of pure chance. If our willed actions are not determined by anything, they say, we are neither morally responsible nor truly free. Whether mental events are reducible to physical events, or whether mental events can be physical events



without such a reduction, the interposition of indeterministic quantum processes apparently adds no explanatory power. And of course if mental events are epiphenomenal, they are not causally related to bodily actions. Epiphenomenal access to quantum physics would not help.

Mental causation is a special case of the more general problem of downward causation, for example the downward control of the motions of a cell's atoms and molecules by supervening biological macromolecules. Is the molecular biology of a cell reducible to the laws governing the motions of its component molecules, or are there emergent laws governing motions at the cellular level, still different laws at the organ level, at the organism level up to the mental level?

Emergent properties or laws at the higher levels of a physical-chemical-based biological system would have to prevent those higher levels from being reduced to the properties and laws of the base physical level? These emergent properties are not a new kind of "stuff," but they are nevertheless often described as an emergent dualism, specifically a property dualism.

Is it illogical to deny reductionist ideas of bottom-up causation (because of indeterministic quantum noise) and yet to defend adequately determined downward causation (because quantum effects are averaged out by macroscopic objects)? The arguments are subtle and depend on the complementary roles of determinism (Schrödinger evolution of the wave function) and indeterminism (wave-function collapse) in quantum physics.

Perhaps the most critically important emergent law of all is the abstract idea of determinism itself. Determinism in the macroscopic world emerges from the indeterministic microscopic quantum world by averaging over vast numbers of atoms and molecules. Even before quantum mechanics, LUDWIG BOLTZMANN knew that the macroscopic gas laws were only adequately determined by the average motions of extremely large numbers of molecules. He thought that significant fluctuations away from thermodynamic equilibrium are statistically quite possible.



## Mind as an Experience Recorder and Reproducer

Our specific mind model grows out of the question of what sort of “mind” would provide the greatest survival value for the lowest (or the first) organisms that evolved mind-like capabilities.

We propose a primitive mind that can “play back” experiences, reproducing the entire complex of the sensations experienced, together with the emotional response to the original experience (pleasure, pain, fear, etc.).

Our *experience recorder and reproducer* (ERR) model for the mind stands in contrast to the popular cognitive science or “computational” model of a mind as a digital computer with a “central processor” or even “parallel processors.” No algorithms or stored programs are needed for the ERR model.

The physically realizable equivalent is a non-linear random-access data recorder, where data is stored using “content-addressable” memory (the memory address - a string of bits in a digital computer - is the data content itself).

Much simpler than a computer with stored algorithms, a better technological metaphor for ERR might be a multi-channel, multi-track analog video and sound recorder, enhanced with the ability to record smells, tastes, touches, and most important, feelings. Imagine one channel for each sense, one track for each neuron. But of course machines currently cannot smell or taste and have no feelings so could not reproduce them (although Gerald Edelman’s neural network learning computers have some reward/punishment systems designed in).

The biological basis is very straightforward. We assume that neurons wire together (strengthening synapses) during an organism’s experiences, in multiple sensory and limbic systems. Later firing of even a part of those wired-together neurons can stimulate firing of all or part of the original complex, thus “playing back” the original experience (including the reaction to the experience and whether it was a useful reaction).



Related experiences are likely stored nearby (in the many “dimensions” of visual cortex, hearing pathways, olfactory nerves, etc., etc., plus the amygdala).

The ERR model might then explain the philosophical notion of association of ideas. If it is neighboring neurons that fire, they will likely be closely related in some way (since they were stored based on the fundamental pattern of information in the original experience). Similar experiences are likely stored in adjacent neurons. Note that a particular smell could cause the recall of experiences where that smell was present, and similarly for other senses.

Neuroscientists are investigating how diverse signals from multiple pathways can be unified in the brain. We offer no specific insight into this “binding” problem. Nor can we shed much light on the question of philosophical “meaning” of any given information structure, beyond the obvious relevance (survival value) for the organism of remembering past experiences.

In modern times some philosophers and scientists have proposed interactionist models and have also attempted to locate specific parts of the brain, for example at the synapses between neurons, where quantum effects might be important. The neuroscientist JOHN ECCLES and philosopher KARL POPPER considered such interactionist models in their articles and books over many years.

All the attempts to use the mysterious properties of quantum mechanics to explain the mysterious problems of consciousness and psycho-physical relations between mind and body have been just that, explaining one mystery with another mystery.

Many philosophers, most psychologists, and most neuroscientists, *identify* the mind with the brain.

Information philosophy identifies the (immaterial) mind with the incredible biological information processing going on in the brain. This processing operates on two levels.

At the macroscopic level, the mind/brain is adequately determined to make its decisions and resulting actions in ways that are causally connected with the agent’s character and values. It is everything that determinist or compatibilist philosopher expects it to be.



At the microscopic level, the mind/brain leaves itself open to significant thermal and quantal noise in its retrieval of past experiences. This noise generates creative and unpredictable alternative possibilities for thought and action. This is our best hope for a measure of freedom from the causal chains of predeterminism.

Our mind/brain model emphasizes the abstract information content of the mind. Information is neither matter nor energy, yet it needs matter for its concrete embodiment and energy for its communication. Information is the modern spirit, the ghost in the machine.

Because it is embodied in the brain, this mind can control the actions of a body that is macroscopic and is normally unaffected by its own quantum level uncertainty (excepting when we want to be creative and unpredictable).

Thus our mind/body model explains how a relatively immaterial, “free,” unpredictable, and creative mind can control the adequately determined material body through the self-determinative and responsible actions selected by the will from an agenda of alternative possibilities.

Moreover, some “mental events” are large enough information structures to be adequately determined, these mental events can act causally on lower biological and physical levels in the hierarchy, in particular, the mind can move the body and all its contained physical particles, thus solving the mind-body problem.

A specific example of the mind causing an action, while not itself being caused by antecedent events is the following. Faced with a decision of what to do next, the mind considers several possible alternatives, at least some of which are creatively invented based on random ideas that just “come to mind.” Other possible alternatives might be familiar options, even habits, that have frequently been done in earlier similar situations.

All these mental alternatives show up as “neural correlates of consciousness” - brain neurons firing. When the alternatives are evaluated and one is selected, the selected action results in still other neurons firing, some of which connect to the motor cortex that signals muscles to move the body.



Apart from the occasional indeterministic generation of creative new alternative ideas, the “free creations of the human mind,” as ALBERT EINSTEIN called them, this whole causal process is adequately determined and it is downwardly causal. Mental events, pure ideas, abstract thoughts, immaterial information, are the causes of physical body events.

### Consciousness a Property of Mind

Consciousness can be defined in information terms as a property of an entity that reacts to the information (particularly to changes in the information) in its environment, including its own body.

Considering the mind as the information in the brain, we can define this as *information consciousness*. It is information in the environment that is being communicated as information to the mind.

Thus an animal in a deep sleep is not conscious, because it ignores changes in its environment. And robots may be conscious in our sense. Even the lowliest control system using negative feedback (a thermostat, for example) is in a minimal sense conscious of (aware of, exchanging information about) changes in its environment.

Where DONALD HEBB famously argued that “neurons that fire together wire together,” our experience recorder and reproducer ERR model simply assumes that “neurons that have been wired together will fire together.”

Being conscious of an experience is this secondary firing of neurons playing back associated experiences. If there are no secondary firings of associated experiences, we suggest that the mind is not aware of any *meaning* in the experience.

Of course, some experiences may initiate secondary firings that are built-in as instincts acquired genetically. Many animals thus “know” the “meanings” of many experiences at the first occurrence. Human knowledge can be understood as the number of associated experiences played back by the ERR. Human intelligence may then be the mind’s ability to focus attention on the most relevant of all the past experiences that are playing back subconsciously in what WILLIAM JAMES called a “blooming, buzzing confusion.”

