

Mind and the Mental

Abstract

Mind has processes, properties, states, and spatial and temporal attributes. Mental processes are thinking, reasoning, having feelings, being aware, experiencing, having conscience, believing, fantasizing, dreaming, seeing, hearing, tasting, smelling, and feeling temperatures and touches. Mental properties are analytic or synthetic, continuous, immediate, transparent, incorrigible, ineffable, intrinsic, private, privileged, and subjective. Mental states are awake, asleep, stuporous, or comatose, and can be natural or impaired. Mental states have no physical causation. Mental states are non-local. Mind may be a process, property, state, structure, or substance. Mind has specific time and space intervals. Mind-body theories are emergence, epiphenomenalism, realism, naturalism, operationalism, self-reference, supervenience, reductionism, functionalism, representationalism, symbolism, computation, connectionism, monism, materialism, dualism, and interactionism.

Keywords

analytic, asleep, awake, comatose, computation, connectionism, continuous, dualism, emergence, epiphenomenalism, experience, functionalism, immediate, incorrigible, ineffable, interactionism, intrinsic, materialism, mental, mind, monism, naturalism, non-reductionism, operationalism, perception, private, privileged, process, property, realism, reductionism, representationalism, self-reference, sensation, sentience, state, structure, stuporous, subjective, substance, supervenience, symbolism, synthetic, transparent

1. Sentience

People have mind and experiences {sentience}. Sentience requires sensation, perception, awareness, mind, and experience. Sentience is a state, not a process, and requires no thoughts. Perhaps only humans are sentient.

2. Mind

Mental states, structures, and processes are thinking, reasoning, having feelings, being aware, experiencing, having conscience, believing, fantasizing, dreaming, seeing, hearing, tasting, smelling, and feeling temperatures and touches {mind}. For example, people have mental images of environment around them (cognitive map) [Järvilehto, 2000] and of their physical dimensions (body image). Mental things are in three-dimensional space.

Different from brain, mind is not physical structure, has no physical properties, and does not obey physical laws. Mind has no space extension. Mind has no time interval. Mind is indivisible into units and relations, but it does have mental structures. Minds are purposive, goal-oriented systems. Perhaps mammals have something like mind.

During human brain growth and development, physical perceptions from perceptual experiences become abstract sensations and then mental processes and states. Mental processes combine functional elements to build abstract concepts and sensations.

3. Mental properties

Sensations may be independent and unmixed (analytic), like sounds, or dependent and mixed (synthetic), like colors, or both, like touches, smells, and tastes.

Sensations seem continuous, with no discontinuities, no gaps, and no units [VanRullen and Koch, 2003], perhaps because inputs from small and large regions, and short and long times, integrate over space and time [Dainton, 2000].

Sensations are immediate, and so not affected by activity, reasoning, or will [Botero, 1999]. Subjective experiences seem not to be ignorable and have self-intimation.

Sensations are transparent, with no intermediates [Kind, 2003].

Sensations are incorrigible, and so not correctable or improvable by activity, reasoning, or will. Sensations always feel indubitable. Sensations seem unerring and infallible. Sensations always feel irrevocable.

Sensations are ineffable, with no description except their own existence. Subject experience is not directly communicable, because it has no units with which to measure.

Sensations are intrinsic, with no dependence on external processes [Harman, 1990].

Sensations are private, and so not available for others' observation or measurement. Sensations are privileged, and so not possible to observe except from the first-person viewpoint [Alston, 1971].

Sensations are subjective, and so intrinsic, private, privileged, and not objective [Kriegel, 2005] [Nagel, 1979] [Tye, 1986]. Subject experience belongs only to subject.

3.1. Non-locality

Physical events happen locally and instantaneously. Sensations characteristically relate two or more physically separated points, within one psychologically simultaneous time interval, and so are non-local. Mind requires time to gather and integrate information from separated locations. Mind requires space to gather and integrate information from separated times, memories, and perceptions. Sensations unify local sense processing about separate features, objects, and events. Mind unifies separate things into substances, structures, states, properties, functions, and processes.

4. Mental states

People can be awake, asleep, stuporous, or comatose, or have other whole-brain physiological states {mental state} {state of mind}. Mental states are processing states. Mental states are not physical states, because same mental state can have different physical forms. Mental states have no oscillation, growth, or decay.

Mental state is mainly about consciousness level. Mental state depends on arousal level and awareness level.

4.1. Natural mental states

Natural mental states include awakeness, drowsiness, light sleep, dreaming, REM sleep, and deep sleep. Awakeness has high arousal and high awareness. Drowsiness has medium arousal and medium awareness. Light sleep has low arousal and low awareness. Dreaming has low arousal and high awareness. REM sleep has low arousal and medium awareness. Deep sleep has very low arousal and very low awareness.

4.2. Impaired mental states

Damage, disease, and drugs cause impaired mental states. Impaired mental states include coma, vegetative state, minimally conscious state, and locked-in syndrome. Coma has no arousal and no awareness. Vegetative state has high arousal and no awareness. Minimally conscious state has high arousal and low awareness. Locked-in syndrome has high arousal and high awareness. Drug mental states include coma and anesthesia. Anesthesia has almost no arousal and almost no awareness.

4.3. Exceptional and altered mental states

Exceptional circumstances cause altered mental states. Exceptional mental states include hypnosis, sleepwalking, near-death experiences, and mystical experiences.

4.4. Consciousness

Mental states can be conscious and experienced, and result in experience, pain, sensations, emotions, and moods. Mental states {cognitive state} can involve subjective experiences {phenomenal judgment}. Mental states can evaluate, categorize, and report perceptions, arousal

level, emotion type, success or failure, and pleasure or pain. Conscious mental states can be similar, such as seeing red and seeing orange, or different, such as seeing blue and seeing red or seeing and hearing.

Mental states can have consciousness but no thought {anoesis}.

Mental states can be pre-conscious or below awareness threshold.

Mental states {subdoxastic state} can be inaccessible to consciousness and unavailable for use in propositions. For example, people unconsciously compare pupil size using low-level features, during sense pre-processing. Cerebellum computational processes use low-level features.

5. Contents of mind

Minds have motivations {conation}.

Minds have emotions {affect}.

Minds have beliefs, hopes, fears, ideas, and other symbol collections {intention} that are about something else. Physical objects cannot themselves be about something else. Conscious sense qualities and subjective experiences can be intentions. Intentions do not have to be conscious, because mental states, linguistic representations, and non-linguistic representations can be about something else but are not necessarily conscious. Conscious states, such as moods, can be not intentional. Lowest-level parts are intentional, so higher levels do not explain intentionality.

6. Causation

Sensations can have no physical effects, because physical laws are enough causes for perceptions {problem of phenomenal causation} {phenomenal causation problem}. Sensations cause no force or energy.

Mental things can affect only mental things. Phenomenal qualities must be causal, because people can know they have had experience [Seager, 1999].

7. Mental theories

Mind may be process, property, state, structure, or substance. However, phenomena are insubstantial, cannot change state, have no structure, do not belong to objects or events, and are results not processes.

7.1. Property theories of mind

Perhaps consciousness is a property. Physical-substance properties are features or variables that have values. Properties are stimulus type, frequency range, intensity or concentration range, comparison method, surface location, surface size, surface orientation, sensor and processing location, detection type, and comparison with other sense systems.

7.2. State theories of mind

Perhaps consciousness is a state. Physical-substance states are part and energy configurations, with positions and momenta or energies and times.

7.3. Structure theories of mind

Perhaps consciousness is a structure. Physical-substance structures are part arrangements with patterns and relations. Brain regions are structures. Mental structure has non-physical parts and relations. If structure is non-physical, it must still have physical means to move physical things. Physical means must follow physical laws.

Perhaps, hidden natural non-logical structure {hidden structure} mediates between mental and physical. Hidden structure allows physical and mental to interact.

7.4. Substance theories of mind

Perhaps, consciousness is a substance. Mind does not "look at" sense qualities but "is" sense qualities.

Perhaps consciousness is special non-physical substance, such as soul, Ideal, or Form. New substances can explain complex or mysterious phenomena by having needed properties. For example, people noticed that the main difference between living and non-living things was that living things move parts and bodies, so they imagined a new substance, *élan vital*, that could animate non-living things. In the same way, people experienced sense qualities and noticed that only humans can reason, have moral feelings, use language, and/or have subjective experiences. Perhaps a new substance, soul or conscience, could inhabit body and provide it with consciousness. However, non-physical substances must work using non-biological, non-chemical, and non-physical processes. People can learn nothing more about them and cannot test them, so they do not provide satisfactory explanations.

Perhaps consciousness is a new physical substance type. New substances can explain complex or mysterious phenomena by having needed properties. New physical substance types can work through ordinary biological, chemical, and physical processes or new biological, chemical, and physical processes. For example, people felt warmth and noticed that it flows from cooler object to warmer object, so they imagined a new substance, phlogiston, that can flow. People sleep and notice that people become sleepy, so they imagined a new chemical, the dormant principle, that can induce sleep when released in brain. Other invented physical substances include electrons, quarks, and Higgs particles. For physical substances, experiments can reveal physical, chemical, and biological properties.

7.5. Process theories of mind

Perhaps, consciousness is a process. Physical processes are events that transform input to output. Processes involve energy or information and flows or transformations. Processes can be top-down or bottom-up.

Processes can be algorithms, such as finding square roots, which take input, transform it, and make output. Iterative algorithms can be slow.

Brain can use non-algorithmic procedures. Vectors and matrices are containers. Point graphs and edge graphs are container adapters. Matrices and graphs represent tables, polynomials, and object properties. Comparing numbers or strings, sorting, and generating random numbers are direct functions. File manipulations include renaming, moving, copying, and making directories.

Brains with enough mass and complexity have neural circuits and energy to run them. Circuits are loops that allow continuous flow, which brain can modulate and augment. Circuits can have input and output branches. Circuits can interact. Circuits have different lengths, axon numbers, and synapse numbers.

Brains with enough mass and complexity have pathways and energy to make flows. Pathways carry different intensities, which brain can modulate and augment. Flows have different speeds. Flows can accumulate or dissipate energy or information, over time and space, in registers or other containers. Pathways have different lengths, axon numbers, and synapse numbers. Pathways can branch.

7.6. Phenomenal unity

Perhaps phenomenal states unify by higher-order sense or awareness, which is conscious. However, then higher sense is another conscious object.

Perhaps experiences unify by higher-order thought, which is not conscious.

Perhaps phenomenal states are only wholes {subsumption}, with no separable parts.

8. Time and sensations

Physical processes use gravitational and/or electromagnetic forces and so very short times. Mental processes are about information flows and have longer times. Low-level mental

processes occur over 20-millisecond to 200-millisecond intervals. High-level mental processes occur over hours. Time allows neuron-assembly activity-pattern integration and expression.

9. Space and sensations

Physical processes use atoms and molecules and so very small distances and sizes. Mental processes gather and integrate information over neurons and have larger distances and sizes. Low-level mental processes occur over micrometer to millimeter intervals. High-level mental processes occur over centimeter to decimeter intervals. Space allows neuron-assembly activity-pattern integration and expression.

10. Mind-body theories

How do physical and mental relate {mind-body problem}? Mind-body theories are emergence, epiphenomenalism, realism, naturalism, operationalism, self-reference, supervenience, reductionism, functionalism, representationalism, symbolism, computation, connectionism, monism, materialism, dualism, and interactionism.

Perhaps, new properties can arise {emergence} that system units and relations cannot predict. Perhaps, consciousness is an emergent, self-regulatory, goal-directed brain-state or brain-process property, rather than brain faculties or structures. Higher existences or processes form from lower existences or processes [Beckerman et al., 1992]. Complex systems have new causation types {emergent causation}. Perhaps, higher principles can describe complex systems too complex to allow predictions {benign emergence}. Perhaps, complex systems can create entirely new objects, events, structures, or functions {radical emergence}. Minds can be new things with new properties, derived from brain-part relations and combinations. Brains have components, and mind is the whole, with laws and phenomena that are not explainable just from brain parts and properties. Like music from instruments, mind comes from brain but is not like brain. If instruments break, they can make no music, just as minds depend on functioning brains. Music resonates in instruments but does not actually affect music production, just as mind resonates in brain but does not affect brain function.

Perhaps, conscious experience associates with, is supervenient upon, or is a property of physical objects and events, but mind does not affect body or brain {epiphenomena} {epiphenomenalism}. Body and brain can act upon, control, and result in mind, consciousness, and conscious experience, or mind can be a byproduct. Perhaps, mental and conscious events have no physical or mental effects {methodological epiphenomenalism}, because the physical world can have no outside causes. Perhaps, conscious experiences have effects in the mental world. People can report on their consciousness. Sense qualities do not correspond to physical objects or events: Senses have different logic for representing physical properties, such as for sound and light wavelengths [Ramachandran, 2004].

Perhaps, external physical world exists, and people perceive it as it truly is {naive realism}.

Perhaps, reality is neither mind nor matter {new realism}. Mental and physical events have different causal laws. Mind and matter differences are only different arrangements or organizations of same fundamental constituents.

Perhaps, external physical world exists, and people perceive it as it truly is {objectivism}. Alternatively, physical world has properties or events that directly cause experience. For example, surfaces can have properties that always cause red sense qualities.

Perhaps, mental events exist and have effects, but science cannot study effects {naturalism}. Naturalistic terms can explain consciousness, but concepts like consciousness, qualia, and subjectivity are unhelpful {eliminativist naturalism}. Naturalistic terms can explain consciousness, and concepts like consciousness, qualia, and subjectivity are helpful

{constructive naturalism}. Naturalistic terms can explain consciousness, but people can never find explanation {anticonstructive naturalism} [Dretske, 1995].

Perhaps, what consciously happened is whatever people remember to have happened {operationalism}. Operationalism requires belief or memory. In conscious experience, the "for me" {für mich} and the "in itself" {an sich} are same thing.

Perhaps, consciousness requires self-reference {self-referentialist theory} {self-reference} {self-representational theory} {self-representation} [Hofstadter, 2007]. Conscious mental states represent in a specific way and have a specific brain representation. Besides having sensations, conscious mental states can refer to themselves. Consciousness indirectly includes some self-consciousness. Perhaps, subjects' conscious mental states also represent those conscious mental states. Perhaps, subjects' conscious mental states include unconscious thoughts about the mental states. Perhaps, by extrinsic higher-order theory, subjects that have conscious mental states must have unconscious mental states that represent the conscious mental states. Besides having sensations, conscious mental states can refer to conscious subject/person/self/soul, which can have no or some self-sensations. Besides having sensations, conscious mental states can have associated unconscious thoughts about the sensations or self.

Perhaps, mental changes or states have changes or states at lower, physical levels, but physical changes and states do not necessarily always subserve mental changes or states {supervenience} {realization}. The physical determines the mental in general ways. Conscious processes are supplementary effects in complex causal neural networks. Because mental events supervene on physical events, mental events are reducible to physical causes. Similarities and differences among experiences affect behavior and so have functions [Kim, 2005]. Intentional states have functions, can be behavior causes, and are reducible to physical explanations. However, phenomenal states do not have to have functions or affect behavior.

10.1. Functionalism

Perhaps, mental states are brain functions {functionalism}. Consciousness is inputs, processing, and outputs about stimuli, behaviors, beliefs, goals, and algorithms. Functionalism uses input-output relations to explain physical and biological processes. If mental states are conscious, they have special functions [Churchland, 2002]. The same functional process can have different physical representations. The same physical state can represent different functions. Mental states do not necessarily correspond to anatomy or physiology, but are like software and algorithms. Mental states are internal, with no public behavior. Mental states are objective, with no need for subjective feelings. Phenomena can cause behavior by translating stimuli into goals, energies, or actions. Different physical states can have same phenomena. Perhaps, having conscious experience is mental functioning, and having particular experience is neurophysiological {physicalist-functionalism}. Perhaps, mental properties are identical to functional properties {psychofunctionalism}. Perhaps, conscious system must have functions, selected for in the past {reductive teleofunctionalism}. Perhaps, both conscious and unconscious mental capacities are for adaptation {teleological functionalism}. Perhaps, functional brain parts can explain mind {decompositional functionalism}. Perhaps, mind can be computer programs {computation-representation functionalism}. Perhaps, mental states can be functional states {metaphysical functionalism}, based on input, output, and causal relations.

Perhaps, mental states represent ideas and cause linguistic responses. Mental states, which can be conscious or unconscious, are about similarities or relations, and relations determine linguistic-response patterns, which are conscious. Language reports mental states using signs. Because mental states vary widely, natural occurrences have incompatible linguistic

explanations. People react to natural occurrences to establish conscious linguistic responses {causal theory of reference} [Putnam, 1992].

Perhaps, consciousness is an executive system that focuses attention, issues reports, and guides actions.

Perhaps, brain agents compete for expression and control {cognitive pandemonium}. Local and global winners emerge. Global winner becomes conscious [Dennett, 1991].

Perhaps, consciousness and subjective experience are viewpoint-specific functions in thalamocortical complex {global workspace} [Baars, 2002]. Consciousness is shared workspace, representation system, or working memory that communicates with brain modules/agents that perform unconscious functions. Global workspace allows information exchange and coordination. Brain algorithms get information from global workspace, broadcast their information there, compete and cooperate to place information there, and interact in global workspace to resolve uncertainties in interpretation and action. Unconscious parallel processing uses large memory. Eventually, global workspace reaches consensus, makes output, and stores representation or will in long-term memory. Attention systems make global workspace contents known to consciousness, so global-workspace information is consciousness contents. Consciousness involves information exchange. Conscious processing integrates unconscious processing. Brains have beliefs, goals, and consciousness {self-concept}. Self-concept is consciousness contents. Programs {Intelligent Distribution Agent} {intelligent distribution} based on global-workspace architecture can assign jobs to sailors [Franklin et al., 1998].

10.2. Representationalism

Perhaps, phenomenal properties are representational properties {representationalism}. Stimuli make sense-data. Perception sense-data, ideas, and impression are mental internal representations. Representations are mental states and are like phenomena. Alternatively, people need no stimuli, only intentional statements. Intentions and representations are about external things or possible external things. Intentions can make representations but are not mental states. Representations are not like phenomena but are coded information. Something can represent something else by being similar to it. Similarity is reciprocal. Something can represent something else using representational functions. Conscious phenomena appear in environment {externalism} or in mind {internalism}. If consciousness is a mental state, representations can project {projectivism} onto external surfaces.

Perhaps, mental outputs become conscious when they are available for concepts/thoughts {first-order representational theory}. However, all brain system outputs are similar in physiology and can travel indirectly to all brain regions.

Perhaps, representational mental states can be "perceived" by higher-level mental abilities {representational theory} {higher-order perception}. Consciousness links perceptions, in occipital lobe, to concepts, emotions, plans, memories, and values, in frontal, temporal, and parietal lobes. Perhaps, consciousness is natural representations. However, some conscious states have no perception [Dretske, 1995].

Perhaps, conscious states are higher-level perceptions about lower-level perceptions {higher-order sense theory} {inner-sense theory}. Brain has a faculty that works on sense perceptions to make perception about perception. Perceptions do not have intentions/concepts and are analogs. Perceptions can be non-conscious, and no perceptions are necessarily conscious. Higher-order sense is a representational theory.

Perhaps, conscious states are higher-level thoughts about lower-level states {higher-order thought theory} {higher order monitoring theory}. Perhaps, conscious states are mental states

about which people have higher-level beliefs that people have mental states. Perceptions do not have intentions, but thoughts have intentions. Consciousness can link current perceptions in occipital and other lobes to concepts, emotions, plans, memories and values in frontal, temporal, and parietal lobes. Only mental states can be conscious. People can be, but are not typically, conscious of beliefs. Perceptions can be non-conscious. Higher-order thought is a representational theory. However, conscious states can have no thought [Rosenthal, 1991].

10.3. Symbolism

Perhaps, matter and energy predate mind and consciousness. Brain evolved to create symbols {symbolism} to make representations used for action. Mind is distinct from matter, because complex organization brought forth new properties. Mind forms matter and energy representations from matter and energy. Representations use matter and energy structures, just as music is physical-energy patterns, electrochemical-signal patterns, and mental experience. Because mental states are complex matter-and-energy patterns, they can act on matter at all levels. People cannot be conscious of symbol creation, use, or representation processes.

Symbol manipulation causes thoughts. Symbols represent high-level concepts and directly relate to knowledge structures. Symbols can be complex wholes, whose meanings depend on pattern parts. Symbols in combination make propositions. Computational manipulations follow language syntax. Syntax and symbol meaning can give overall meaning. However, symbols cannot represent images, tastes, sounds, touch, and smell. Symbols do not have magnitude or certainty. They have no partial effects or gradations {brittleness}. They do not have meaningful parts or units. They do not have formation or development process. They do not receive more certainty by repetition or conjunction. Small symbol changes typically greatly change meaning or accuracy.

10.4. Computation

Perhaps, brains are computers with fixed code, registers, and programs {instructionism}. Coded brain input, from environment and body, makes coded brain output.

Perhaps, machines can mimic mental functions in logic and language, using symbols and rules {symbolicism} {Good Old-Fashioned Artificial Intelligence} (GOF AI) {rule-and-symbol AI} [Barr and Feigenbaum, 1981]. Perhaps, computers with complex enough programs have minds {strong AI}. Perhaps, computers with complex enough programs simulate mental functions {weak AI}.

Perhaps, consciousness is information integration {information integration theory} [Tononi, 2004]. More integration makes more consciousness. Integrating different neuron types and modules makes more consciousness. Different integration types make different consciousness types. Thalamocortical region integrates information from various and many neurons and modules, whereas other brain regions have smaller integration. Effective information passed from system part to system part measures integration. Systems that integrate enough information are conscious.

Perhaps, visual sensory information goes to many brain places, where dendrites detect spectral and time information about perceptions. Brains can later extract and transform stored information to give conscious awareness {holographic brain theory} {holonomic theory}. Holograms can change {holonomy}. People cannot know both spectral and time values exactly. Neurons minimize information loss by reorganizing their structures to have minimum entropy and maximum information. Consciousness is experiencing stored spectral-information transformation. No one or thing views holographic images [Pribram, 1991].

10.5. Connectionism

Simple unit interconnections can receive input and make output {connectionism} {connectionism theory} {parallel distributed processing} {neural net}. Connectionist systems have no symbols, concepts, or representations [Arbib, 1995] [Bechtel and Abrahamsen, 1991] [Hinton, 1992]. Input can be nodes or node sets, with different weights. Connectionism can dynamically use constraint satisfaction, energy minimization, or pattern recognition. Intermediate nodes process representations in parallel. Network nodes can have multiple functions and contribute to many representations or processes. Connections and/or node patterns can contain information. Representations are vectors in space. Distributed information allows parallel processing, increasing learning, and continuous variables. Neural nets do not have programs or operations. Many units code each representation {distributed representation}.

Software models use three layers of neuron-like units for pattern-matching. First layer receives input pattern. Units in second and third layers typically receive input from all units in previous layer. Third layer outputs display or file. Units can be On or Off. If total input to unit is above threshold, unit is On.

Inputs can have adjustable weights. Experimenters set weights, or programs adjust weights based on matching between "training" input patterns and their output patterns. Controllers go from layer to layer, processing all units simultaneously, by parallel processing.

Systems can start with random weights, input training pattern, compare output to input, slightly reduce weights on units that are too high and slightly increase weights on units that are too low, and repeat {backpropagation} {backward error propagation}. For example, after neural networks have processed input and sent output, teacher circuits signal node differences from expected values and correct weighting. System performs process again. As process repeats, total error decreases.

In unsupervised neural networks {Helmholtz machine} {wake-sleep algorithm} with recurrent connections, first information comes from inputs to outputs and affects recurrent strengths. Then information comes from outputs to inputs {output generation} and affects original strengths.

Outputs are vectors, possibly with many dimensions. Outputs statistically derive from inputs. All outputs have equal weight. Similar outputs have similar coordinates. Output regions define category examples. Average or optimum examples define categories. Region boundaries change with new examples. Outputs can distribute among nodes {distributed output}. Outputs can be nodes {localist output}. Outputs can perform functions {activation function}.

Neural nets can distinguish more than one pattern, using the same weights. Neural nets can recognize similar patterns and in this way appear to generalize.

Distributed information tolerates degradation. Neural nets can still detect patterns if some units fail and so are more robust than algorithms.

10.6. Monism

Perhaps, reality has only one substance: matter, mind, or God {monism}. Mind and brain are the same. However, monism is untrue, because no mechanism can describe purely mental and purely physiological functions [Stich, 1991].

Perhaps, reality is neither mind nor matter {neutral monism}. Mental and physical events have different causal laws. Mind and matter differences are only different organizations of same fundamental constituents. Physical, non-physical, or other substance can include both brain and mind. However, matter and brain units do not correspond to mind, consciousness, or sense-quality units.

10.6.1. Mind

Perhaps, only mind exists, and matter does not exist {mentalism} {cognitivism} {psychical monism} {spiritualism}.

Perhaps, consciousness is only about sense qualities and concepts {immanentism} and gives no physical-object knowledge.

Perhaps, mental properties and events are not explicable by physical properties and events {anomalous monism}. Mental states are token-identical to physical states. Naturalistic terms cannot explain consciousness {non-naturalism}.

Perhaps, accessing perceptions renders them conscious, people have this ability, and consciousness is real but is not object and is not in space {transcendentalism}. Consciousness is an act or process that makes phenomena [Rowlands, 2001].

Perhaps, all physical things have mental or subjective parts, aspects, or properties, typically in different degrees, or are consciousness parts {panpsychism}. It is not clear how such combinations/interactions make high-level consciousness or stay unified. However, all things then have relations between physical and mental inside them. Perhaps, electrons, quarks, and virtual particles have consciousness [Nagel, 1988].

Perhaps, physical objects are "permanent possibilities of sensation" {phenomenalism}. Mental phenomena statements are equivalent to empirical statements or mathematical laws. However, mental-phenomena statements depend on physical environment and perceiver state.

Perhaps, mind has conscious processes and states, which people can study {phenomenology} without necessarily considering body or world [Stevens, 2000]. People can train themselves to try to suspend all judgments and hypotheses while they attend to subjective experiences. Mind cannot know things in themselves but can experience appearances or representations, as sense qualities or thoughts {phenomena}. Phenomena are perspectives on objects. Perspectives hint at object essences. All conscious perspectives, working together, are indirectly object essence. If essences are conscious acts, objects exist. In particular, consciousness becomes itself from all perspectives on all objects. Subject and object of consciousness become the same, because no object is without consciousness, and no subject is without objects and relations. Consciousness is a circular, self-referencing concept: it is a phenomenon and makes phenomena.

Perhaps, internal brain agents {little man} {homunculus} explain psychological properties {homunculus fallacy} [Attneave, 1961].

10.6.2. Identity

Perhaps, mind and brain are identical {psychophysical identity} {mind-brain identity theory}. The same property can be both mental and physical. They are like two names for same thing. Mind and brain can unify by relating both descriptions. (In the possibility argument, philosophical zombies cannot exist, because they must have the mental state if they have the brain state.)

Perhaps, mental states correspond to neural states {central-state identity}.

Perhaps, mental states are factually identical with brain states but do not have to be logically identical {mind-brain correspondence}.

Perhaps, sense qualities are objective non-relational physical-object properties or are the same as brain electrochemical, biophysical, and relational events {physicalism} [Baker, 1987].

Perhaps, particular mental states, such as pain, are identical to particular brain states, such as nerve firing, but they are not necessarily identical in general {token-identity theory} {token-identity thesis} {token physicalism}. Because mental events can have different neural

pathways, they can be instances, not types. Mental events have physical events. Mental states include beliefs and pains.

Perhaps, neural states are state types that only brains can have {type-identity theory} {type-identity thesis} {identity theory} {type physicalism}. Mental states, such as pain in general, and brain states, such as nerve fiber firing, are identical in type but are not necessarily identical in particular instances. Mental variables have physical variables.

Perhaps, brain and mind share a third substance or property, to provide underlying unity. For example, signals entering, or inside, brain can be sense data that can combine into physical objects or into mental objects. Alternatively, physical objects can have mental essences. People can imagine that no physical world exists, and the physical world is only sense qualities in the mental world. People can imagine that no mental world exists, and the mental world can be disposition to perform certain behaviors in certain circumstances. The mental world can be physical mind state, making physical mind.

However, brain-state and mental-state identity has no plausible mechanism or meaningful connection [McGinn, 2004] [Nagel, 1988]. They only seem different, because different language is for objective and subjective descriptions.

10.6.3. Materialism

Perhaps, mind is only material {materialism}. All existing substance is material or physical. (Materialistic explanations are simple. They have always worked before, are consistent with science, do not have to explain how physical and non-physical interact, fit with evolutionary theory, explain all mental phenomena, explain complex systems, and match all evidence.)

Perhaps, mental states are both experiences and brain states. For example, temperature is also average random kinetic energy. However, you can measure temperature, in degrees, without measuring average random kinetic energy, in joules. You can use temperature values in many ways separate from their energy values. If mental states are physical states, they can have physical effects without violating physical law. Brain states can be physical or physiological properties. Brain states can be structural properties, like software, caused by something physical and causing something physical {functional materialism}. Machines can simulate human intelligence, so objective language and behavior can be similar. (However, machine parts and motions seemingly affect perception, behavior, and consciousness.)

Perhaps, mind is complex behaviors exhibited in matter structures {peripheralist behaviorism}.

Perhaps, conscious and unconscious mental event types have representations in nervous system {neuroscientific realization theory}.

Perhaps, sense qualities correspond to cerebral processes and change brain {network thesis}. Identical sense qualities cannot recur, because brain changes at first sense qualities.

Perhaps, physical forces act on molecules over time under physical laws and cause thoughts {dynamical systems theory} {dynamical hypothesis}. Dynamics does not involve computation or representation. All events are deterministic and coupled. Systems described by equation systems change over time.

Perhaps, mental processes are identical with physical central-nervous-system processes {centralism}.

Perhaps, mental processes are brain states and interact causally with body {central-state materialism}.

Perhaps, brain locations manifest consciousness by code type or other property {Cartesian materialism} [Dennett, 1991].

Perhaps, only organisms can be conscious, because consciousness depends on complex biological structures and movements {biological materialism}.

Perhaps, mind is interaction among brain processing, body, and environment {action consciousness} {behavior-based robotics} {enactive consciousness} {enactive cognition} {embodied cognition} {radical embodiment} {sensorimotor consciousness} {situated cognition} {situated robotics}. Consciousness depends on action. Simple rules can result in complex behaviors [Clark, 1997] [Varela et al., 1991].

Psychological properties are identical to physical-property conjunctions. Psychological properties depend on physical properties but are not material {non-reductive materialism}. There are no phenomena, just ideas, beliefs, or feelings.

Perhaps, there are no psychological concepts {eliminative materialism}, and intentions and mental states do not correspond to physical brain states.

10.6.3.1. Selectionism

Perhaps, in neuron sets, neurons directly or indirectly interact with all other neurons and themselves. Neuronal groups vary, compete, and undergo selection {neuronal group selection} {neural Darwinism} {somatic evolution} {selectionism} {theory of neuronal group selection} (TNGS). Neuron groups make stimuli into responses and so have input and output. They are functional groups. During development, brain makes various neuron groups by protein regulation, cell division, cell migration, cell connection, myelination, and synapse changes, in response to developmental signals and environment. Brain has many neuron groups for each input-output task {degeneracy}. Neuron groups vary in processing. Neuron groups have regulatory mechanisms and can adapt.

In response to input, brain compares results and prunes neuron groups by making cells die, disconnecting synapses, and reducing synapse strength. Feedback, feedforward, reward, punishment, regulation, and integration make optimum neuronal-group configurations. Selection strengthens connections that aid survival. Brain uses selection, not logic. During brain development, synapse pruning based on experience reduces overgrowth {developmental selection}. Later, experience strengthens or weakens synapses {experiential selection}. Reciprocal neuron connections use signal reentry feedback to coordinate neural events over space and time. Error-correcting control systems are in neuronal groups. Interaction times are typically hundreds of milliseconds. Interactions involve all neurons. Input-output results depend on body morphology, hormones, emotions, memory, and existing brain structures. A functional group {dynamic core} is for consciousness and is dynamic, unified, private, and complex. Brains are not computers, because they receive ambiguous input, have variable structures, have reciprocal connections {reentry}, and have complex output that integrates sense modalities [Edelman and Tononi, 2000].

10.6.3.2 Reductionism

Perhaps, particle positions and momenta completely define physical systems {reductionism}. Knowing particle times and energies is equivalent to knowing positions and momenta. Position and momentum information can predict all future positions and momenta. Under reductionism, brain-particle and environment-object positions and momenta completely define future brain states. Perhaps, physical information can specify non-physical things, properties, or relations. Sentences about non-physical can derive from physical description. Mental processes are explainable by physical brain structures and functions. Facts about people and oneself can use more-elementary terms, without persons or first person. For example, people can be animals with physical and chemical processes.

Pylyshyn [Pylyshyn, 1984] imagined that chips can replace neurons one by one {silicon chip replacement}.

Putnam [Putnam, 1992] imagined worlds {twin Earth} in which people and things were identical except that water had different chemical composition. Thought difference depends only on environment. However, different thoughts make twins different.

10.7. Dualism

Perhaps, minds and brains are separate substances or properties {dualism}. Perhaps, physical objects have non-physical or mental properties, like essence or sense qualities. Perhaps, objects and events have this property in different amounts, levels, or qualities. Perhaps, brains are special organs for mind or soul knowledge. Perhaps, brains have reached complex forms that can generate mental states. Mind influences brain [Eccles, 1994] [Libet, 1993].

Perhaps, mind and brain are two separate and distinct substances {substance dualism}.

Perhaps, individual mental processes succeed each other and are non-physical, but physical world exists {bundle dualism}.

Perhaps, bodies are extended material substance, and minds are unextended spiritual substance {Cartesian dualism} [Descartes, 1641].

Perhaps, mental ideas and images are copies of physical sense data or objects {epistemological dualism}.

Objective, physical objects and events cannot explain subjective, non-physical states and events {explanatory gap}. Perhaps, subjective, non-physical qualities are irreducible. Concepts used for one cannot be concepts used for the other [Levine, 2001]. Perhaps, some physical qualities are subjective and irreducible {explanatory gap analysis}. Perhaps, more knowledge will allow physical connections. Perhaps, more knowledge allows physical connections, but people cannot know them. Perhaps, no connection exists, but reason is only phenomenal concepts. For example, phenomenal concepts are only indexes or are special in another way. However, both physical objects and events and non-physical states and events have states and events, so objective and subjective certainly overlap.

However, dualism has no method to show how mental and physiological substances affect each other deterministically, which all observations require. Dualism does not state why substances have two different property types, or only two property types.

10.7.1. Mental Property

Perhaps, psychological properties depend on physical properties but are not material {non-reductive materialism}.

Perhaps, mind and body are two aspects of one basic reality, and neither is derivable from the other {double aspect} {property dualism}. Conscious properties are pains, emotions, and sense qualities. Consciousness is not a different substance.

Brain processes have physical and non-physical properties {attribute theory} {dual-attribute theory}. The non-physical properties make mental processes.

Experiences have perceivable properties or events {experience events} {adverbial theory} {adverbial analysis}. There are no mental objects. Experience only happens in special ways, such as bluely. Appearances present real objects to mind, but they have no qualities.

10.7.2. Interaction

Perhaps, mind and brain are two separate substances, or properties expressed at different levels, which can affect each other, directly or indirectly {interactionism}. Effects can be one-way or two-way. Components influence whole, or whole influences components. Mind can move brain matter and cause and control neural and chemical events by high-level patterns and

processes but not interact with matter at lower levels, just as organisms controls atoms by overall movements, not direct interactions.

Perhaps, neural objects and events and psychophysical objects and events do not have same structures and functions but are necessary and sufficient to each other {logical equivalence}.

Perhaps, mind and brain are separate and do not interact but synchronize and work in parallel, because they closely coordinate {parallelism}. Laws of God or nature keep them parallel.

Perhaps, mind and brain interact through some third object, substance, or function {pluralism}, such as God.

However, interactionism is not true, because it has no method for deterministically describing mental functions in terms of physiological functions, or physical functions in terms of mental functions, because only physical things can affect physical things.

Bibliography

Arbib, Michael A. (ed.) (2003) *The Handbook of Brain Theory and Neural Networks*, 2nd edn. Cambridge, MA: MIT Press.

Alston, William P. (1971) Varieties of privileged access. *American Philosophical Quarterly*, 8, 223-241.

Attneave, Fred (1961) In defense of homunculi. In: Walter A. Rosenblith (ed.), *Sensory Communication*, 777-782. New York/Cambridge, MA: Wiley/MIT Press.

Baars, Bernard J. (2002) The conscious access hypothesis: Origins and recent evidence. *Trends in Cognitive Sciences*, 6(1), 47-52.

Baker, Lynne (1987) *Saving Belief: A Critique of Physicalism*. Princeton: Princeton University Press.

Barr, Avron; and Feigenbaum, Edward A. (1981) *The Handbook of Artificial Intelligence*. Los Altos, CA: Kaufman.

Bechtel, William; and Abrahamsen, Adele (1991) *Connectionism and the Mind: An Introduction to Parallel Processing in Networks*. Oxford: Blackwell.

Beckermann, Ansgar; Flohr, Hans; and Kim, Jaegwon (ed.) (1992) *Emergence or Reduction? Essays on the Prospects of Nonreductive Physicalism*. Berlin: De Gruyter.

Botero, Juan-José (1999) The immediately given as ground and background. In: Jean Petitot, Francisco J. Varela, Bernard Pachoud, and Jean-Michel Roy (ed.), *Naturalizing Phenomenology: Issues in Contemporary Phenomenology and Cognitive Science*, 440-463. Stanford, CA: Stanford University Press.

Churchland, Patricia S. (2002) *Brain-Wise: Studies in Neurophilosophy*. Cambridge, MA: MIT Press.

Clark, Austen (1997) *Being There: Putting Brain, Body, and World Together Again*. Cambridge, MA: MIT Press.

Dainton, Barry (2005) *Stream of Consciousness: Unity and Continuity in Conscious Experience*, 2nd edn. London: Routledge.

Dennett, Daniel C. (1991) *Consciousness Explained*. Boston: Little, Brown.

Descartes, René (1641/1901) *Meditationes De Prima Philosophia or Meditations on First Philosophy*. Translated by John Veitch. Paris/New York: Classical Library.

Dretske, Fred I. (1995) *Naturalizing the Mind*. Cambridge, MA: MIT Press.

Eccles, John C. (1994) *How the Self Controls Its Brain*. Secaucus, NJ: Springer Telos.

- Edelman, Gerald M.; and Tononi, Giulio (2000) *A Universe of Consciousness: How Matter Becomes Imagination*. New York: Basic Books.
- Franklin, Stan; Kelemen, Arpad; and McCauley, Lee (1998) IDA: A Cognitive Agent Architecture. In: *Proceedings of the IEEE Conference on Systems, Man and Cybernetics*. New York: IEEE Press.
- Harman, Gilbert (1990) The intrinsic quality of experience. In: James Tomberlin (ed.), *Philosophical Perspectives, vol. 4: Action, Theory and Philosophy of Mind*, 31-52. Atascadero, CA: Ridgeview.
- Hinton, Gregory E. (1992) How neural networks learn from experience. *Scientific American*, 267(3), 144-151.
- Hofstadter, Douglas (2007) *I Am a Strange Loop*. New York: Basic.
- Järvillehto, Timo (2000) The theory of the organism-environment system: IV. The problem of mental activity and consciousness. *Integrative Physiological and Behavioral Science*, 35, 35-57.
- Kim, Jaegwon (2005) *Physicalism or Something Near Enough*. Princeton: Princeton University Press.
- Kind, Amy (2003) What's so transparent about transparency? *Philosophical Studies*, 115, 2225-2244.
- Kriegel, Uriah (2005) Naturalizing subjective character. *Philosophy and Phenomenological Research*, 71, 23-57.
- Levine, Joseph (2001) *Purple Haze: The Puzzle of Conscious Experience*. Cambridge, MA/New York: MIT Press/Oxford University Press.
- Libet, Benjamin (1993) *Neurophysiology of Consciousness: Selected Papers and New Essays*. Boston: Birkhäuser.
- McGinn, Colin (2004) *Consciousness and its Objects*. New York: Oxford University Press.
- Nagel, Thomas (1979) Subjective and objective. In: Thomas Nagel (ed.), *Mortal Questions*, 196-214. Cambridge, UK: Cambridge University Press.
- Nagel, Thomas (1988) Panpsychism. In: Thomas Nagel (ed.), *Mortal Questions*, 181-195. Cambridge, UK: Cambridge University Press.
- Pribram, Karl H. (1991) *Brain and Perception*. Hillsdale, NJ: Erlbaum.
- Putnam, Hilary (1992) *Renewing Philosophy*. Cambridge, MA: Harvard University Press.
- Pylyshyn, Zenon W. (1984) *Computation and Cognition*. Cambridge, MA: MIT Press.
- Ramachandran, Vilayanur S. (2004) *Brief Tour of Human Consciousness*. New York: Pi Press.
- Rosenthal, David M. (1991) The independence of consciousness and sensory quality. In: Enrique Villanueva (ed.), *Philosophical Issues, vol. 1: Consciousness*, 15-36. Atascadero, CA: Ridgeview.
- Rowlands, Mark (2001) *The Nature of Consciousness*. Cambridge, UK: Cambridge University Press.
- Seager, William E. (1999) *Theories of Consciousness: An Introduction and Assessment*. London/New York: Routledge.
- Stevens, Richard (2000) Phenomenological approaches to the study of conscious awareness. In: Max Velmans (ed.), *Investigating Phenomenal Consciousness*, 99-120. Amsterdam: John Benjamins.

Stich, Stephen P. (1991) *From Folk Psychology to Cognitive Sciences*. Cambridge, MA: MIT Press.

Tononi, Giulio (2004) An information integration theory of consciousness. *BMC Neuroscience*, 5, 42-42.

Tye, Michael (1986) The subjective qualities of experience. *Mind*, 95, 1-17.

VanRullen, Rufin; and Koch, Christof (2003) Is perception discrete or continuous? *Trends in Cognitive Sciences*, 7, 207-213.

Varela, Francisco J.; Thompson, Evan; and Rosch, Eleanor (1991) *The Embodied Mind: Cognitive Science and Human Experience*. London: MIT Press.

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