Introductory Lectures: The Nature and History of Cognitive Science

Chapter 2: Philosophy, Ontological Frameworks, and the Concept of Mind

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Chapter Outline

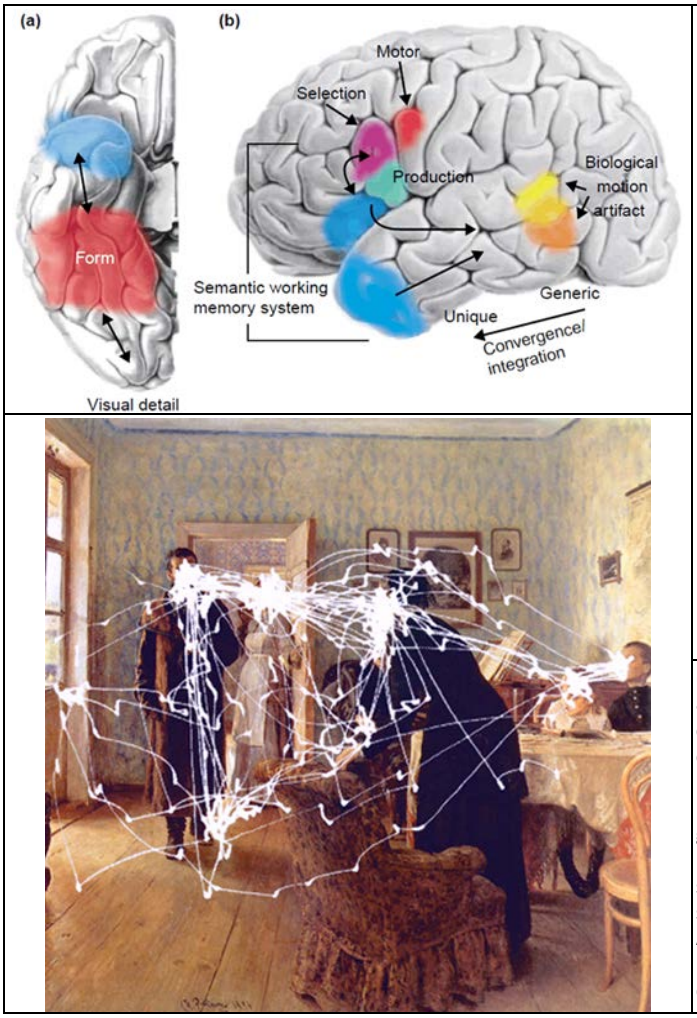
2.1 Introduction

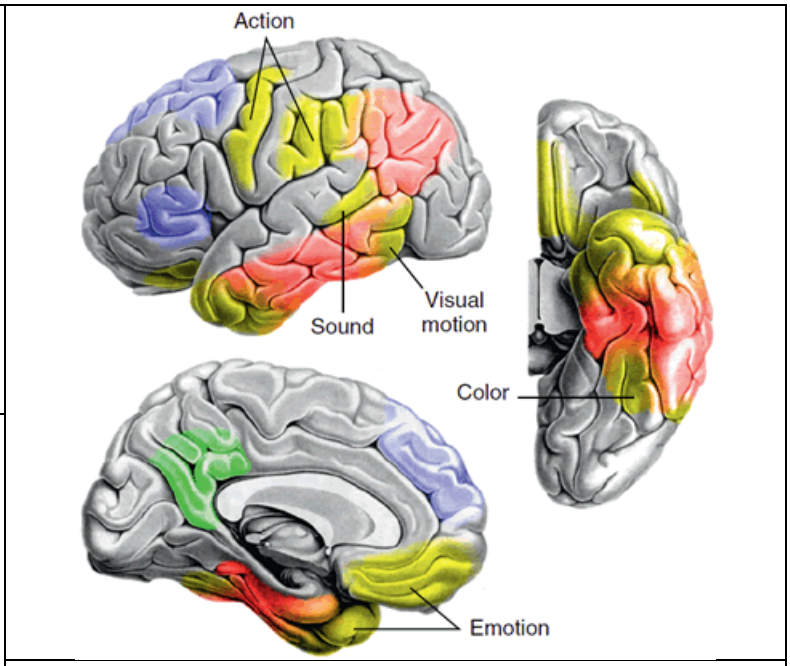
The discussion of the historical development of the philosophical treatment of the mind falls into two convenient narratives. On the one hand, the history of philosophy illustrates the development of the concept of mind and of that concepts development within competing ontological frameworks. This chapter presents that narrative. On the other hand, beginning roughly at the start of the 20th century one can see the

convergence of philosophy—or at least part of philosophy—towards a physicalist ontological framework and ultimately towards the computational explanation of cognition. This narrative, along with the attempts to understand physicalism and its relationship to "ordinary" conceptions of the mind waits until the fourth chapter. In opening this chapter, therefore, I return to the notion of an ontological framework.

2.2 The Biological Basis of Categorization and the Mental/Non-mental Distinction

Recall that the first chapter and lectures on scientific treatments of physical domains began by differentiating two phases/components in the development of a scientific treatment of a given domain. The chapter and lectures called that first phase/component an ontological framework. In the case of the mental, the basic outlines of this domain emerge long before human inquiry—probably even before humans. Humans naturally





(**Top left**) A diagram from Martin and Chao depicting the approximate brain regions associated with semantic memory storage and retrevial for object form, motion and object-use-associated motor patterns. (**Above**) Diagram from Binder and Desai depicting one model of semantic processing. Yellow indicates modality-specific systems providing input into higher-level convergence areas (in red) responsible for abstract representations events and entities. Blue areas depict brain areas assocaited with the goal-directed activation of stored information. Finally, green areas indicate brain region hypothesized to to mediate semantic storage areas and the hippocampal memory system, possibly facilitating the creation of episodic memories. (**Bottom Left**)The visual saccade path during "free" or undirected scanning imposed upon the painting. Sasha Archibald, after Alfred Yarbus, after Ilya Repin, They Did Not Expect Him (aka An Unexpected Visitor, 1884) Notice that the faces receive the greatest number of saccades during the viewing period. From: Observations on Film Art .

differentiate objects and phenomena in the world into the categories of living from non-living entities and related phenomena. Indeed, people can develop a deficit for naming non-living things, while remaining relatively unimpaired in naming living things. Likewise, the very structure of the brain's semantic memory provides the basis for some of this asymmetry.[1-4] Humans, moreover, appear to manifest an innate disposition to categorize objects and phenomena into mental and non-mental entities and/or phenomena.[5-20] This disposition to think about the world in terms of mental and non-mental entities occurs even in early, automatic, unconscious perceptual processing. It likewise drives behavior and manifests itself early in

development. For instance, as illustrated in the painting above, faces strongly attract visual attention (saccades). The white lines on the painting trace the movements of a subject's eyes as they viewed that painting. Notice how often the saccades return to the face of the people in the painting. The human visual system's preference for faces occurs at the very earliest stages of scene perception when the brain selects objects to which to attend. This preference for faces manifests itself by 3 months in human infants—suggesting an innate disposition to find faces visually salient.[21-24] Likewise, humans automatically and unconsciously process information regarding the emotional states and motor intentions of other people during vision. Indeed, "mind blindness" is one of the most significant pathologies associated with autistic spectrum disorder.[5-17] Humans likewise monitor and interact with other people using a vast array of automatic and unconscious processes.[20, 25-27] In short, the human disposition to categorize the world into mental and non-mental results—at least partially--from a variety of innate, automatic, and unconscious cognitive processes. Our biology has primed us to differentiate mental phenomena from other phenomena.

Philosophical and scientific theories of the mind throughout history attempt to understand and to either affirm or deny the real-world basis of these innate tendencies of human categorization. Do the categories of mental and non-mental cut the world at a joint? That is, does the distinction marked by the mental versus non-mental categorization correspond to a real and important distinction in the world? Must any adequate theory of the number and nature of the universe's basic kinds recognize the existence of mental and non-mental objects, properties, etc.? Within the framework of specific answers to such questions philosophers and scientists strive to systematically formulate, observe, and theorize about mental phenomena and entities as well as to characterize the place of mental phenomena and entities in relationship to physical phenomena and entities. In other words, if these categories mark a fundamental and real distinction between kinds, what relationship do these kinds have to one another? In this chapter I utilize the notion of an ontological framework to outline the development of the common notion of mind. As will emerge in this chapter and associated lectures, despite our innate tendency to differentiate mental from non-mental phenomena the contemporary commonsense notion of the mind is a theoretic construction centuries in the making. Furthermore, this notion plays a role in quite different competing ontological frameworks.

2.3 Ontological Frameworks Revisited

Cooperative investigation and theorizing requires formulating and agreeing upon basic ideological and methodological constraints within which researchers conduct inquiry. Such constraints serve to focus investigation and provide much of the framework with which to construct theories. For instance, most people do not think that logically impossible situations can serve as counterexamples to a theory. As a general rule, in the earliest stages of inquiry researchers tend to debate such ideological and methodological constraints extensively and explicitly. While debates over ideological and methodological constraints appear extensively in discussions and writings at the beginning of inquiries, these constraints tend to have a looser connection to observation and methodology. As inquiry develops, researchers spend less time explicitly discussing these more general fundamental constraints and focus much more on refining and rigorously implementing domain-specific categories, techniques, and methods. All of the thinkers in this text and in course attempt conduct their inquiry within the context of one of the most basic early constraints on inquiry, what I'll call an ontological framework. An ontological framework articulates a hypothesis regarding number and often the nature of the fundamental categories for some domain. Fundamental categories consist of the set of categories considered essential and ineliminable in any adequate account of the phenomena in some domain.

These categories further constrain the sorts of attributions and dynamical interactions theorists can utilize. Indeed, a great deal of the theoretical discussion within the philosophy of mind concerns the proper ontological framework within which to understand the mind. Specifically, the debate centers on the nature and number of fundamental kinds of stuff. Do the mental and non-mental categories both exist within a single overarching category—say, material substance? Or, do the mental and non-mental categories constitute two fundamental kinds of stuff—say, mental substance and physical substance? Moreover, theorizing regarding the nature, properties, and operations of the mind occurs within an ontological framework. For instance, if the categories of mental and non-mental pick out fundamentally different kinds of stuff, what relationships can these kinds have with one another? On the other hand, if the categories of mental and non-mental do not pick out fundamentally different kinds of stuff, how and when do mental kinds become physical kinds? As we will see throughout the term, philosophers and scientists have developed a baffling array of answers to such questions.

Inquiries into the nature of the mind and its relationship to the non-mental world do not represent a unique case. All inquiries begin by formulating ontological frameworks. Without basic categories, one cannot even describe the phenomena of a domain or articulate the relationships between elements of the domain. For example, the ontological framework of modern physics includes the fundamental category of force. All change and many cases of stasis must ultimately result from the actions of one or more forces. Without the supposition of forces, physicists would have no means of explaining change. Thus, modern physicists claim that adequate theories of physical phenomena must include the category of forces. For the most part, this supposition of an ontological framework fades into the background once theorists reach a general consensus as to its elements. However, it continues to exist and to guide the efforts of researchers even once they no longer actively propose and debate candidate frameworks. Moreover, small and large changes can a do occur in ontological frameworks as theories, methods, and evidence accumulate. Sometimes in the face of accumulating difficulties researchers will even abandon one ontological framework in favor of another. For instance, prior to general relativity physicists consider space and time to be distinct elements of the universe. After general relativity, space and time become a single element space/time.

Finally, as this chapter will emphasize, one important feature of ontological frameworks is the looseness of the ties to between their categorizations, attributions, and relations and the phenomena. That is, categorizations often exhibit significant vagueness when applied to phenomena; often ontological frameworks exhibit few if any systematic and/or intersubjective methods or rules for applying their categories to phenomena. As the the chapter and lectures emphasize, this looseness of fit between the categories, attributions, and relationships in ontological frameworks impedes progress by masking or minimizing problems within the framework. One significant example of such difficulties is labeled “tenuous dualism.” Thus, one of the more significant factors in the development of a scientific treatment of a domain occurs when researchers develop and refine operationalizations.

2.3.a Fundamental Categories, Dynamical Interactions, and Attributions

The category of forces illustrates some important potential aspects of an ontological framework. First, some of the elements of an ontological framework prove less central than, even dependent upon, other elements. The relationships between various categorizations within an ontological relationship can serve to constrain the manner in which theorists describe and predict the phenomena within a given domain. Indeed, recall that

modern physics recognizes two general categories of forces. On the one hand, physicists appeal to "contact forces." Contact forces transfer energy by direct mechanical contact. For example, friction is such a force. On the other hand, physicists also posit the category of "fundamental forces." Fundamental forces (sometimes called field forces or interactive forces) constitute the current hypothesis as to the number and nature of essential and ineliminable forces in modern physics. Thus, contact forces prove dependent upon fundamental forces in that all contact forces ultimately result from fundamental forces acting on objects. For example, friction at the pivot of a pendulum results from the surfaces dragging against one another during the swing of the pendulum (see diagram on left). The swing itself as well as the contact pressure that results in the drag (the frictional contact force) comes from gravitation (a fundamental force).

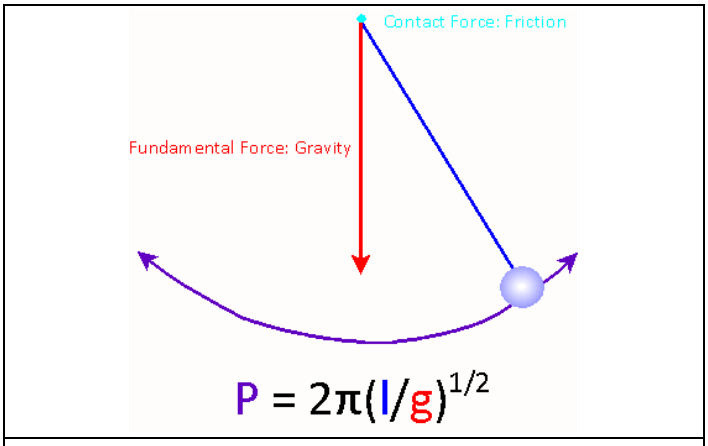


Diagram illustrating how both contact and fundamental forces operate in pendulums. Since all contact forces result from fundamental forces acting on objects, the pendulum's swing as well as the contact pressure that results in the drag at the arm pivot result from the fundamental force of gravitation (in red). The contact force, friction (in light blue), operates at the pendulum arm pivot resulting from the surface drag during the swing of the pendulum.

2.2.b Ontological Frameworks Evolve and Change

Fundamental forces illustrate a second important point regarding ontological frameworks; the elements and properties of an ontological framework can change as inquiry progresses. Theorists can alter the nature, number, or relationship between fundamental categories during the course of inquiry. During periods of relatively unproblematic progress ontological frameworks fall into the background, often not appearing at all in discussions by researchers. However, when problems arise in the development of a science, small and large adjustments to an ontological framework—even abandonment—can occur. During periods in which theorists grapple with difficulties in inquiry ontological frameworks often reemerge in their discussions. The discussions may center on specific changes or theorists may consider more global changes to an ontological framework.

2.3.c Ontological Frameworks and the Mind

In summary, ontological frameworks provide structure and constraints upon inquiry—especially early inquiry--by forwarding a hypothesis regarding number and nature of the fundamental categories for some domain. Fundamental categories serve in an ontological framework as the essential and ineliminable elements in any adequate account of the phenomena in some domain. Fundamental categories also constrain the sorts of attributions and dynamical interactions theorists can utilize to explain phenomena. Thus, force serves as a fundamental category in physics. Forces function as the only means by which change can occur in physics. As the example of forces in physics illustrates, an ontological framework can specify not only the elements of a given domain, but the role that those elements can play within that domain. Thus, forces function in physics as the sole cause of change. Additionally, some of the elements of an ontological framework prove less central, even dependent upon, other elements. As inquiry begins to get traction, the role of ontological frameworks becomes less obvious and they tend to fall into the background. During such periods an ontological framework functions like a set of background assumptions regarding the domain. During the course of inquiry, however, difficulties may arise that lead theorists to reconsider their ontological frameworks. For example, the nature and number of elements of an ontological framework can change as inquiry progresses.

2.4 Greek Metaphysical Speculation

It may seem odd to the contemporary thinker to suppose that people did not always have a clear conception of the mind and of mental phenomena. Nevertheless, like most contemporary western concepts the development of the notion of the mind and of mental phenomena actually occurs over the course of centuries. Indeed, the development of the notion of "the mind" arguably traces back to the development of the Greek notion of the soul. For most of Greek history the conception of the soul bears little resemblance to its contemporary western counterpart. In fact, the Greeks develop their notion of the soul as part of the development of general ontological frameworks for scientific and metaphysical speculation. Three features of the development of the Greek notion of the soul figure prominently in this rather superficial history. First, the development of the Greek notion of the soul represents a slow accretion of properties and processes associated with three different contemporary distinctions into a single ontological entity; living vs non-living, animate vs inanimate, and mental vs non-mental. Second, as the soul becomes more distinct both in its nature and in its functions, the Greeks begin to more actively debate whether the soul constitutes a fundamental kind of stuff (a distinct substance) or merely one of many permutations of more fundamental kinds of stuff (substances). For instance, early Greek thinkers often supposed that the universe consists of various permutations of one or more fundamental elements. Thus, these thinkers do not tend to classify the soul as fundamentally different from those elements that compose the material world. Third, with the notable exception of Descartes, thinkers from Thales through the British Empiricists tend to allow themselves a considerable degree of ambiguity within their explanatory and theoretic frameworks as regards the nature of the soul and its relationship to (place in) their respective overarching ontological frameworks. Later I refer to this ambiguity regarding the exact position of the mind within the various ontological frameworks as tenuous dualism. The tenuous dualist seems to treat the mind (or soul) differently than other elements of their ontological framework. More specifically, tenuous dualists tend to think of the mind (or soul) as having properties or relationships that prove inconsistent with the categories and categorical relationships of their ontological framework. For instance, Aristotle seems to adopt a monistic physicalist (see below) ontological framework in which physical objects are a union of matter and form. However, he seems to violate that framework when discussing the soul (see below).

2.4.a Monism and Pluralism

In this and future chapters I use the terms "monism," "dualism," and "pluralism" in a slightly different fashion than they are normally employed in the philosophy of mind. Before introducing my idiosyncratic use, I'll briefly outline the standard uses of these terms. In the philosophy of mind the terms monism and dualism tend to apply to the fundamental category of substance and derivatively to the properties of substances. Specifically, substance monism holds that only one type of substance exists--there is only one kind of entity in the universe. According to substance monism all of the universe's phenomena-- both mental and physical phenomena--result from some sort of modification or permutation of a single kind of entity. The two most common versions of substance monism are monistic physicalism (also called physicalism or materialism) and monistic idealism (also called idealism). Monistic idealism holds that mental substance constitutes the only entity in the universe. Monistic physicalism holds that physical substance constitutes the only entity in the universe. Philosophers of mind normally contrast substance monism with substance dualism. Substance dualism posits the existence of two fundamental kinds of substance-- mental substance and physical substance. In general, substance dualists assert the existence of two fundamental kinds of substances on the grounds that a single substance cannot explain both mental and physical phenomenon. Thus, substance

dualists claim that all mental phenomena result from modifications or permutations of mental substance. All physical phenomenon, in contrast, result from modifications or permutations of physical substance. Importantly, substance dualism holds that mental substance and physical substance are irreducible to one another. The monistic physicalist faces the challenge of explaining how *prima facie* non-physical mental phenomena result from modifications or permutations of physical substance. Similarly, in the monistic idealist faces the challenge of explaining how *prima facie* non-mental physical phenomena result from modifications or permutations of mental substance. The substance dualist, on the other hand, remains free to explain mental phenomena as permutations or modifications of a mental substance and physical phenomena as permutations or modifications of a physical substance. However, the dualist must explain the *prima facie* causal interaction between mental and physical phenomena given that mental substance cannot cause or bring about physical phenomena and physical substance cannot cause or bring about mental phenomena.

In this text I'll use the term "monism" to refer to the supposition within an ontological framework of a single fundamental category to fill a specific role. Thus, monistic physicalism and monistic idealism count as monism in that they posit a single kind of entity within an ontological framework. I'll use the term "dualism" to refer to the supposition within an ontological framework of exactly two fundamental categories to fill a specific role. Substance dualism, as a result, counts as a dualism. I'll use the term "pluralism" to refer to the supposition within an ontological framework of more than two fundamental categories to fill a specific role. Examples of pluralism include forces in physics and that contemporary physics posits the existence of four fundamental forces; gravitation,[28] electromagnetism,[29] strong nuclear force,[30] and weak nuclear force.[31] An unconventional consequence of this specific application of the terminology comes when one considers properties. On the conventional interpretation property dualists assert two fundamental kinds of properties--mental properties and physical properties. Property dualists hold that mental and physical properties are irreducible to one another despite the fact that both categories of properties are properties of a single underlying substance. On my view, all philosophers of mind are property pluralists in that they posit the existence of more than two fundamental kinds of properties. For instance, substance dualists posit the existence of at least three fundamental categories of mental properties--belief, desire, and qualitative conscious experiences--in addition to positing any number of fundamental categories of physical properties. Monistic physicalists deny fundamental categories of mental properties, asserting that mental properties reduce to physical properties. Nevertheless, monistic physicalists posit the existence of multiple fundamental categories of physical properties and thus count as property pluralists in my nomenclature.

Students who find the above discussion confusing can rest assured that these specific positions will emerge repeatedly throughout the discussion in this chapter. Furthermore, I have included a glossary at the end of this chapter to further facilitate student in understanding of these terms.

2.4.b The Development of Two Greek Ontological Frameworks

Two main ontological frameworks emerge early on in Greek thought; monistic physicalism and what I call oppositional dualism. Monistic physicalism holds that all objects, properties, processes, etc., including those associated with the mind and life, belong to a single kind of substance, physical substance. As a result, all theories within the monistic physicalist framework categorize their target phenomena using physicalistic categories and construct theories for phenomena from those physicalistic categories. For instance, Thales proposes that water is the basic element and seeks to explain how all other objects, properties, processes, etc. result from water and its properties. Dualism (or more generically, pluralism) asserts that there are two (or

more) fundamental kinds of substance, and that each substance has its own characteristic properties. For instance, Anaxagoras[32](500-428 BCE) of Clazomenae (an area in Turkey in Asia Minor) appears as the ultimate pluralist. Anaxagoras holds that all types of materials—from milk to gold—constitute distinct eternally existing substances with their respective characteristics.[33-35] Empedocles[36](490-430 BCE) of Agrigentum (now known as the city of Agrigento in Sicily) appears likewise to adopt a pluralism. Empedocles posits the existence of the basic four elements (earth, air, fire, and water) together with two forces, love for combining and strife for separating these elements to create other materials. [33, 37]

Substance dualists and other pluralists assert the existence of two or more distinct kinds of substance. Each kind of substance has an ineliminable role in explaining some class or classes of objects, properties, processes, etc.. I use the term oppositional substance dualism to refer to those dualisms that assign opposite or fundamentally different properties to each kind of substance. For instance, the Greek philosopher Plato articulates an oppositional dualism of forms and sensible objects. Plato supposes that forms do not change and admit of no parts. Sensible objects, in contrast, change and can have parts. The most famous oppositional dualism is mind-body substance dualism or mind-body dualism. Mind-body substance dualism supposes that to understand and explain minds, their properties, processes, etc. requires the supposition of a mental substance having only mental properties. Likewise, to understand and explain physical objects, properties, processes, etc. the mind-body substance dualist requires the supposition of a physical substance having only physical properties.

Additionally, the development of the Greek notion of the soul illustrates a common dilemma that theorists have faced throughout the historical development of theories of mind: (D1) Monistic physicalist theories face the difficulty of formulating physical mechanisms that plausibly explain various mental properties and processes. In contemporary times many researchers allege that, qualitative consciousness (viz., conscious experiences of red) represents such a mental process. For instance, David Chalmers argues that qualitative conscious experiences resist explanation by known physical mechanisms. [38-40] He tells readers that, [38]

> The really hard problem of consciousness is the problem of *experience*. When we think and perceive, there is a whir of information-processing, but there is also a subjective aspect. … It is undeniable that some organisms are subjects of experience. But the question of how it is that these systems are subjects of experience is perplexing. Why is it that when our cognitive systems engage in visual and auditory information-processing, we have visual or auditory experience: the quality of deep blue, the sensation of middle C? How can we explain why there is something it is like to entertain a mental image, or to experience an emotion? It is widely agreed that experience arises from a physical basis, but we have no good explanation of why and how it so arises. Why should physical processing give rise to a rich inner life at all? It seems objectively unreasonable that it should, and yet it does. (¶ 8 &9)

In contrast, (D2) dualist oppositional theories like mind-body substance dualism face the difficulty of formulating accounts of how two fundamentally different types of objects could possibly interact in such a seemingly continuous and seamless fashion. Mind-body substance dualist theories generally face difficulties in explaining mental functioning in that, by its very nature, mental substance does not obviously have any mechanistic or causal elements. Indeed, many of the marks by which we identify causation are absent in mental substance. Mental substance lacks spatial dimensions (thus spatial proximity) and has no parts on most accounts (having no spatial dimensions). Hence, one cannot explain the actions of minds by the interaction of the component elements of their mental substance. Even temporal coordination can seem

sketchy: Did one's desire for that candy bar cause one's going to the store, or did the two events have a common cause, say the candy bar. Perhaps the two phenomena merely prove temporally coextensive, without any direct causal interaction at all, just as the times on people's watches remain coordinated without causally interacting with one another.

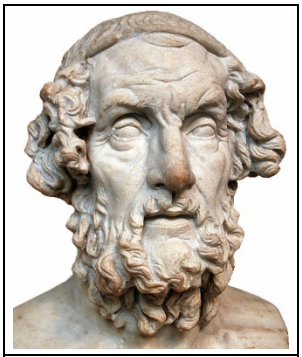
2.4.c The Greek Notion of the Soul During the Presocratic Period

The outline of the narrative regarding the Greek notion of the soul goes as follows: The idea of a single unified thing—the mind--emerges over time from the notion of the soul. In order for the notion of the mind to emerge, theorists must come to a general consensus regarding two issues: (1) Theorists must come to suppose that the diverse set of phenomena scientists now consider mental processes and properties form a common, interrelated set of phenomena—a domain. Call this the domain hypothesis. (2) Theorists must come to suppose that those interrelated processes and properties have a common locus—that there is a single thing that has mental properties and where mental processes occur. Call this supposition the common locus hypothesis. This chapter chronicles the evolution of a consensus with regard to the domain and common locus hypotheses. People often express surprise upon discovering the relative recency and lack of ubiquity of the notion of a single entity responsible for all the phenomena we associate with mentality. However, the mind is, in fact, a relatively recent invention. For example, Fyodor Dostoyevsky's underground man gives a common alternative explanation for his temperament—a mental property--in the opening passage of *Notes From the Underground*: "I AM A SICK MAN.... I am a spiteful man. I am an unattractive man. I believe my liver is diseased." [41] The underground man's explanation of his spitefulness by reference to liver disease was a common mode of explanation at the time. Likewise, the early Greek philosophers often did not associate processes and properties now commonly considered mental with the mind, nor did they offer particularly mentalistic explanations for these processes and properties.

In short, the soul does not begin in Greek thought as a single entity having mental properties and where mental processes occur. The soul begins as the locus of the distinction between living and non-living things. Living things have a soul, whereas non-living things are bereft of souls. As Greek thinkers continue to reflect upon the nature of the soul one sees these thinkers start to associate the soul with the distinction between animate and inanimate things. Specifically, possession of a soul comes to differentiate those things capable of exhibiting self-generated movements from those things incapable of such movements. Early Greeks distinguish animate from inanimate things in that animate things generate movement whereas inanimate things move only as a result of the transmission of motion, e.x., when a moving ball transmits its motion to another ball with which it collides. Eventually, Greek thinkers come to envision the soul as the common locus of mental processes and properties. By the time Plato and Aristotle pen their works, the core processes of the contemporary notion of the mind—reasoning, sensation, perception, ambulance, and emotion—all plausibly reside within the human soul. However, the Platonic and Aristotelian souls still form the basis for the distinctions between living and non-living as well as the more basic Greek notion of animate and inanimate. Thinkers in the Hellenistic period, like Epicurus and the Stoics, move towards conceiving of the soul as the locus of mentality, differentiating mentality from other aspects of life and alternative causes of motion. However, the association between mentality and mortality—or often immortality—persists even today. Thus, the development of the notion of a mind involves the association of various properties and processes as having a common nature (the domain hypothesis) as well as the association of those properties and processes

within a single entity (the common locus hypothesis). Additionally, theorist must also disentangle other properties and processes from that entity. Call this the mental distillation hypothesis.

The notion of the soul first enters into existent Greek literature in the epic poems of the famous Greek poet Homer.[42, 43] These poems, the *Iliad*[43] and the *Odyssey*,[42] exert a strong influence on early Greek culture. Scholars commonly suppose that Homer lived and wrote in the 8th or 9th century BCE, though speculation has placed his life as far back as the 12th century BCE. In the *Iliad* and the *Odyssey* Homer refers to the soul as an entity unique to humans. This entity gives life with its presence and death with its absence. The soul leaves the body at death, continuing to exist in the underworld as a shade or image of the person. In fact, as late as the 5th century BCE the most common Greek words for soul, thumos (θυμός) and psyche (ψυχά) translate as alive, breath, and spirit.[42-45]



Idealized bust of the Greek poet Homer in the British Museum. From: Wikipedia

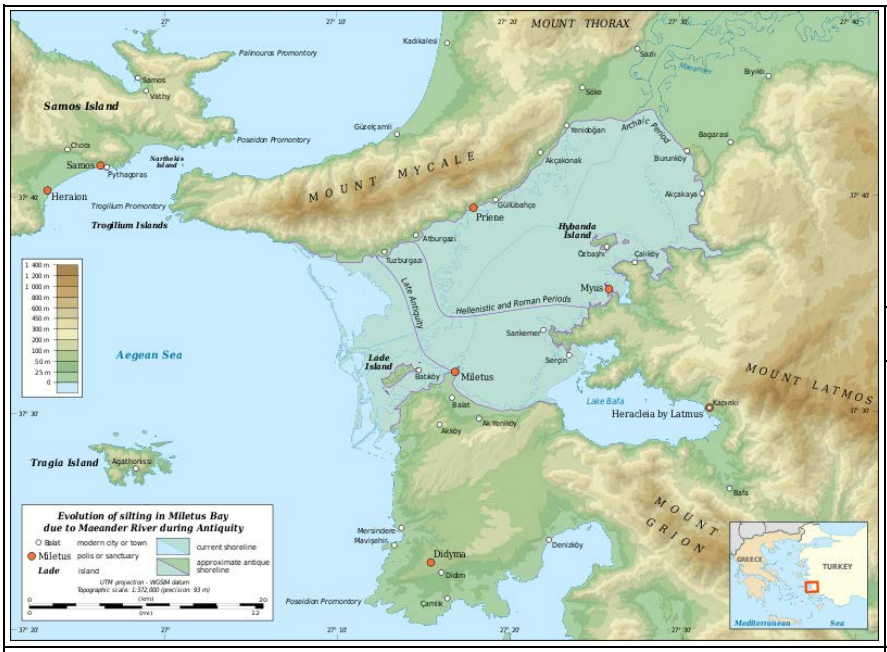
Many ordinary Greeks and religious thinkers of the time likely believe in immortal souls, just as people today. Indeed, a 2009 Harris online poll found that 71% of the survey subjects indicate belief in a soul that continues to exist after death. Only 10% profess disbelief in such a soul. In contrast, only 45% express belief in evolution.[46] For the Greeks in Homer's time the soul is a uniquely human, quasi-physical entity the presence or absence of which marks the distinction between life and death in humans. During the centuries that follow Homer's writings, the Greek notion of the soul undergoes an expansion: both in terms of the sorts of entities that can possess souls and in terms of the functions that Greek's attribute to the soul.

Discussion of the soul continues in early Greek philosophy, though few Greek philosophical texts exist today. Most of what contemporary scholars know about the early Greek philosophers comes from surviving fragments of their writings and reports of their views in the works of later writers. For example, scholars often identify Thales of Miletus (624-546 BC) as the first philosopher in the western tradition, and Miletus (a city on the coast of present-day Turkey) as western philosophy's point of origin. Scholarly knowledge of Thales comes from doxographic evidence, i.e., discussions of his views in other writers. The primary source of information about Thales comes from the Greek philosopher Aristotle.[33, 44, 47-49]

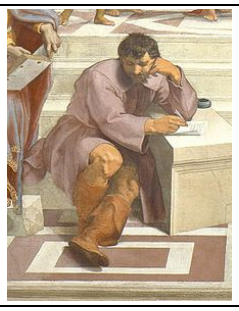
Early Greek philosophy tends not to distinguish strongly between different areas of inquiry. For instance, early Greek philosophers do not distinguish philosophy from what one now thinks of as science and mathematics. Indeed, Thales' thought seems to include aspects of observation-based astronomy as well as more abstract "philosophical" theoretical speculation. To wit, Thales reportedly predicts a solar eclipse in 585BCE, an accomplishment that moves many researchers to identify Thales's work as marking the beginning of western science in addition to philosophy.[44, 47]

Thales, like many of the earliest (Presocratic) Greek philosophers, adopts a monistic physicalistic ontological framework. Thales provides a model for other early Greek philosophers in that he articulates a general theoretic framework for understanding all phenomena within monistic physicalism. Specifically, this early Greek ontological framework seeks to understand and explain all phenomena—objects, properties, processes, etc.—by positing one or more basic elements and explaining all phenomena as manifestations of that (those) element(s). Thales forwards the hypothesis that water is the basic element and seeks to explain how all other objects, properties, processes, etc. result from water. Thus, one can understand Thales and the other early

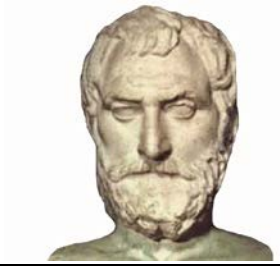
Greek thinkers as attempting to develop a general monistic ontological framework for understanding the world. Thales and most of the early Greek philosophers are physicalists (materialists), holding that all that exists is matter and the void. As a result, Presocratic theories about the soul presuppose its physical nature. For instance, Aristotle reports in *De Anima*[50] that "Thales, too, to judge from what is recorded about him, seems to have held soul to be a motive force, since he said that the magnet has a soul in it because it moves the iron."(Book 1, Part 2, Paragraph 14)[50] Thales thus expands the function of the soul to include causing movement, specifically self-generated movement, as well as expanding the kinds of potentially ensouled the entities. However, one must distinguish animation from ambulation and other sorts of motor movements in



Map showing Miletus from http://commons.wikimedia.org/wiki/File:Miletus_Bay_silting_evolution_map-en.svg



Painting of Heraclitus from
Raphael's School of Athens



Bust of Thales (624-546BCE) from
http://www.daviddarling.info/encyclopedia/T/Thales.html

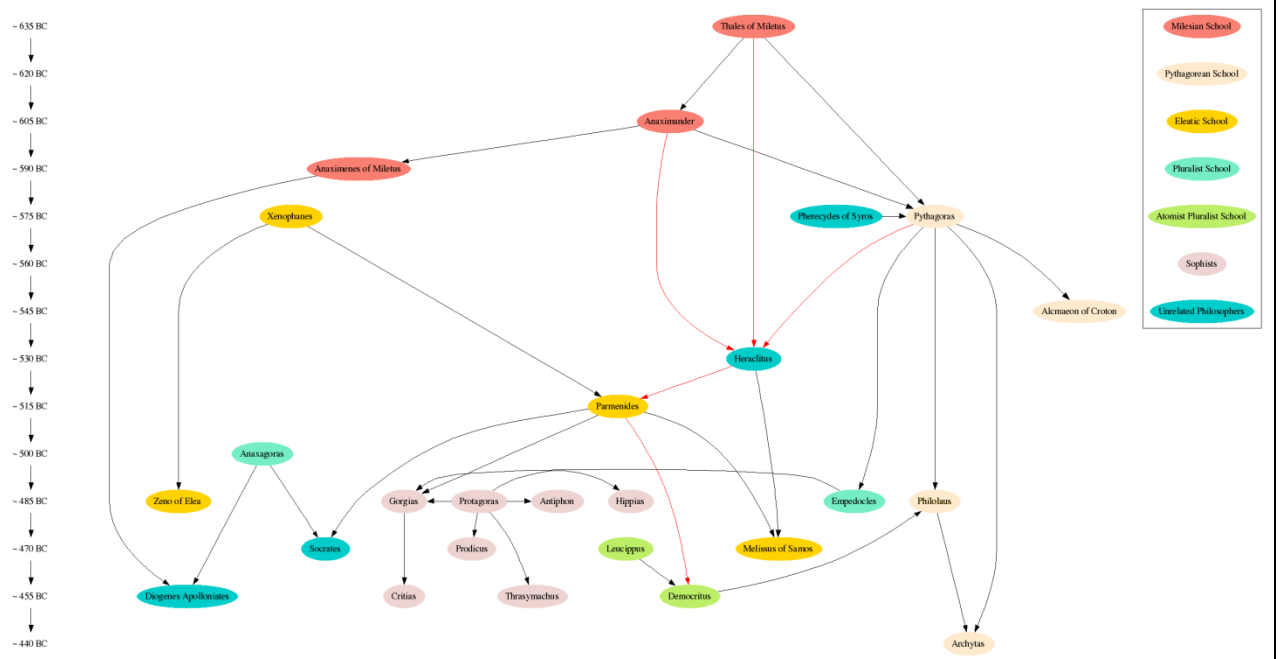


Diagram depicting the timeline as well as the interrelationships between the various pre-Socratic Greek philosophers and their schools. From:
http://upload.wikimedia.org/wikipedia/en/e/e2/Presocratic_graph.png

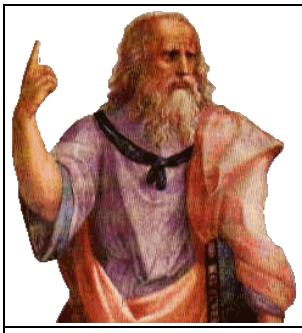
early Greek thought. Animation applies to all seemingly self-generated movements. For instance, the Greeks

think of the planets as animate objects. In contrast, ambulation refers to self-generated movements resulting from motor skills and intent—like walking. Thales does not seem to suppose that magnets have the ability to ambulate, though they do count as animated for him.

Similarly, Heraclitus (535 to 475 BCE) of Ephesus proposes fire as the most basic element. He speculates that the soul consists of fire or air. Heraclitus also suggests that control of motor functions emanates from the soul and follows Pythagoras (570 to 490 BCE) in linking wisdom to the soul. Thus, for Heraclitus the fiery nature of the soul means that mental and motor functions deteriorate if the soul becomes wet; "A dry soul is wisest and best. … A man when he is drunk is led by an unfledged boy, stumbling and not knowing where he goes, having his soul moist." (Fragments 230 & 231, p.203)[51] Likewise, for Pythagoras (570 to 490 BCE)[51, 52], Anaxagoras (500-428 BCE)[34, 35], Empedocles (490-430 BCE)[37], and Democritus (460-370 BCE)[53, 54] plants and animals as well as humans have souls. Thus, by the end of the 5th century BCE the Greek notion of the soul consists in a physical, albeit rarified, entity that serves to explain the difference between living and non-living things. The soul likewise causes self-generated motion, emotional responses, and thought.

2.4.d Specialized Greek Philosophy Tracts Emerge and Dualism Becomes Less Tenuous

Around 400 BCE philosophers who have grown up within the general Presocratic monistic ontological framework for understanding the world, like Plato (427-347BCE) and Aristotle (400-320BCE), begin to write works covering more or less specific areas of inquiry. They also spend significant time considering investigative methodology. Both of Plato and Aristotle contribute to the development of two general areas of inquiry that dominate thought about the mind for the next several centuries: Epistemology (a sub-discipline of philosophy exploring the nature, sources, & limits of knowledge) & Philosophy of Mind (the sub-discipline exploring the nature of the mind). Plato, writes the *Meno* [55] and later the *Theatetus* [56], both of which prove influential in epistemology. In writing works addressing specific topics, he alters the status quo by offering entire works on a single philosophical topic or sub-specialty. Though the various lootings and burnings of the library of Athens result in the destruction of most of Aristotle's actual texts, *Nicomachean Ethics*, shows a similar topical focus.[57]



Plato (427-347BCE)

Aristotle (400-320BCE)

2.4.e Epistemology Multiplies Ontology

Epistemic ruminations date back to the Presocratics and continue today. However, the reflections of the Presocratics upon epistemology appear as part of more general discussions. In Plato's corpus one starts to see texts with specific topical foci and the emergence of two general types of epistemological questions: On the one hand, one can ask how one can (or ought to) go about generating knowledge or evaluating knowledge claims about some topic. For instance, there are two general epistemic questions in the philosophy of mind: (A) How, and to what extent, can one know about one's own mentality? Theorists often call this the problem of self-consciousness or the problem of self-knowledge. (B) How, and to what extent, can one know about the mentality of others? Theorists often call this the problem of other minds. For the purposes of this class one can think of the first type of epistemic questions--questions regarding the sources of various kinds of knowledge about the mind--as seeking to understand and/or clarify how one might come to know of the

existence and nature of mental functioning. Answers to these questions provide a framework through which theorists attempt to gather evidence in order to better understand the nature of the mind and its functioning.

On the other hand, one can ask questions about the nature of knowledge and what distinguishes knowing from other states. One can think of these questions as concerned primarily with the nature and function of knowledge in cognition. Plato primarily seeks answers to the most central of this second class of epistemological questions; "How can creatures come to know about the nature of the world?" Indeed, all of Plato's works are informed by his answer to the above epistemic question: Plato supposes that creatures come to know the nature of the world via knowledge of another kind of world—the intelligible world. For Plato, the sensible world is inherently flawed insofar as the objects of the sensible world appear to retain their identity despite changing their properties over time and in relation to one another. Indeed, for Plato the most despicable feature of objects of the sensible world lies in their ability to admit of contradictory properties. For instance, in the *Theaetetus* Socrates suggests that the same wine can seem sweet to a healthy sommelier and bitter when that same sommelier becomes sick. Yet, he asserts, the same entity cannot be both bitter and sweet because sweetness and bitterness contradict each other. In order to make sense of knowledge, Plato supposes that knowledge comes from recognizing the constancy amidst the ever-changing flux of the sensible world—the reality under the diverse and seemingly inconsistent sensations.

For Plato constancy comes from the entities in the intelligible world, i.e., the forms. Unlike the changeable entities of the sensible world, the changeless forms admit of no contradictions either over time or in relation to one another. Objects of the sensible world remain constant insofar as they "partake" of the forms. Thus, the sensible wine partakes of the form of wine and so remains constant as wine and the sommelier can know it as wine. But the wine only "partakes" or "participates" in the form of wine, making it imperfectly wine. This imperfection allows the sensible wine to seem both bitter and sweet to different people or to the same person at different times.

Beginning as early as the *Phaedo* [58], Plato outlines a theoretical framework that construes the sensible world and the intelligible world as fundamentally distinct. He characterizes entities in the former as perceptible, changeable, and destructible aggregates, while the entities of the latter realm prove imperceptible, changeless, and indestructible unities. (¶77-81)[58] Though Plato does not equate the soul with the forms, he does tell readers that, "…the soul commands, the body serves: in this respect too the soul is akin to the divine, and the body to the mortal." (¶80) [58] Thus, Plato's dichotomy between the sensible and the intelligible introduces a much more robust dualism than that of the Presocratics—a dualism of ontological kinds sharing no essential properties—an oppositional dualism. Nevertheless, one still sees Plato exhibit a considerable laxness when it comes to locating the soul within his dualist framework.

2.4.f Theoretical Explanations of Mental Functions

In *The Republic* [59], a work he devotes primarily to political philosophy, Plato introduces yet another highly influential view--the tripartite division of the soul. The doctrine of the tripartite division of the soul builds upon the expansion of the soul's functions in the works of the Presocratics and informs a great deal of future thought regarding the nature of the mind and its operations. According to Plato the soul has three parts; the appetitive soul, the spirit or passionate soul, & the thinking or rational soul. Each element of the soul has its own characteristic desires. The good for humans consists in the subjugation of the appetitive soul to the passionate soul, which is in turn subjugated to the rational soul. Thus, reason, emotion, and appetite become

separate in Plato. One might argue that this represents the first attempt to understand the mind in terms of constitutive elements of the mind, the functions they perform, and the relationships that emerge. Interestingly, this theory of the soul supposes that the soul has properties that the forms cannot possess. Specifically, the forms are changeless and indivisible while Plato's tripartite soul proves both changeable and divisible. Thus, Plato also exhibits a version of tenuous dualism with regard to the soul.

Plato's tenuous dualism results from the difficulties Plato has in accommodating the soul as he understands it within the categories of this ontological framework. Plato's ontological framework consists of an oppositional dualism between the objects of the sensible realm and the objects of the intelligible realm. Plato supposes that in order to understand the sensible world one must suppose that two fundamental categories of entities exist-- sensible objects and forms. Though the sensible objects partake of the forms their central properties contradict the central properties of the forms. Thus, sensible objects admitted division whereas the forms do not. Sensible objects change whereas the forms remained changeless.

When Plato contemplates the soul within the context of his oppositional dualism, his inclination is to place the soul within the fundamental category of the forms. However, in order to understand the operations of the soul Plato supposes that the soul has parts and that these parts interact (i.e. change). As a result, Plato categorizes the soul as a form yet attributes to the soul many of the properties definitive of the category of sensible objects. Since the soul does not fit well into either of the fundamental categories of Plato's ontological framework, Plato's treatment of the soul seems to implicitly or tenuously place it into a third, different fundamental category.

2.4.g Aristotle

In *De Anima* [50], Aristotle considers human mentality and the human soul. But, he also considers the nature of the souls of all living creatures. Indeed, *De Anima* includes discussions on methodology, the senses, as well as thought and reasoning. Aristotle seems to return to the materialistic framework of the Presocratics in that he denies that the form of an object constitutes a distinct entity. Rather the form "blends" with matter to create an individual entity having those characteristic properties and capacities resulting from the blending of form and matter. However, in *De Anima* Aristotle appears to make an exception for the soul within his overall theory of form and matter.[50]

> Therefore, since everything is a possible object of thought, mind in order, as Anaxagoras says, to dominate, that is, to know, must be pure from all admixture; for the co-presence of what is alien to its nature is a hindrance and a block: it follows that it too, like the sensitive part, can have no nature of its own, other than that of having a certain capacity. Thus that in the soul which is called mind (by mind I mean that whereby the soul thinks and judges) is, before it thinks, not actually any real thing. For this reason it cannot reasonably be regarded as blended with the body: if so, it would acquire some quality, e.g. warmth or cold, or even have an organ like the sensitive faculty: as it is, it has none. It was a good idea to call the soul 'the place of forms', though (1) this description holds only of the intellective soul, and (2) even this is the forms only potentially, not actually. (Book III, part 4, paragraph 3)

Aristotle describes the soul, not as informed, but as 'the place of forms', making the soul unlike other individual entities (e.x., the body). This designation seems to qualify Aristotle as a tenuous dualist in that the soul appears to fall outside the framework of his monistic physicalism. That is, Aristotle treats the soul in a way that makes it the one thing within his ontological framework that is neither matter, form, nor informed matter. Aristotle's tenuous dualism results from a difficulty that emerges again and again for monistic

physicalist theories of the mind and its functions, namely the difficulty in formulating a monistic physical theory that seems to explain mental functioning. As with many of the Presocratic philosophers, Aristotle holds that plants possess souls, allowing them to gain nourishment and reproduce. Animal souls have the additional capacities of sense perception and ambulation. However, only human souls have the capacity for intelligence, and only the intelligent aspects of the soul are immortal for Aristotle.

2.4.h Summary of Early Greek Speculation

The chapter thus far pursues two expository goals. On the one hand, the chapter builds upon the notion of an ontological framework given in Chapter 1. Specifically, this chapter introduces various ontological frameworks based upon different fundamental categories of substance. On the other hand, the chapter develops a sketch of how the Greek notion of the soul evolves into an entity from which one can extract the contemporary notion of the mind. The development of the Greek notion of the soul into something that closely resembles the contemporary notion of the mind involves the tacit formulation and affirmation of three distinct hypotheses. First, Greek thinkers began to tacitly formulate and affirm what I call the domain hypothesis. In accordance with the domain hypothesis the Presocratic philosophers began to associate properties and processes of the contemporary notion of the mind with the soul. This slow accretion of properties results in a tacit recognition that mental processes and properties form a common, interrelated set of phenomena—a domain. The Presocratic philosophers likewise come to formulate and affirm what I call the common locus hypothesis. In accordance with the common locus hypothesis Greek theorists ultimately come to suppose that there is a single entity—the soul—that has mental properties and in which mental processes occur. The process of property and process accretion, however, leads to a conception of the soul that includes properties and processes associated with the living/nonliving and animate/inanimate distinctions. Thus, the final stage in the evolution of the Greek notion of the soul involves distilling the notion of the soul into three distinct notions; living, animate, and mental. I call this the mental distillation hypothesis. One sees the beginnings of this process of disentanglement in Aristotle. For example, Aristotle distinguishes between the souls of humans, animals, and plants. The latter represent living creatures, animals represent the animate, and human souls come to be associated with intelligence and the mind. Philosophers like Aristotle and the early Stoics begin to tacitly formulate and affirm the mental distillation hypothesis. However, concepts and categories can exhibit a sort of intellectual inertia, resisting even direct efforts to modify them for significant periods of time. Even today many people associate the mind with the soul and immortality.

2.5 Galen, Euclid, and the March Towards the 20th Century

In discussing early Greek metaphysical speculation I employ the concept of an ontological framework to structure the exposition of individual Greek's notion of the soul, and to structure the account of how the Greek notion of the soul evolves from the Presocratic philosophers through Plato and Aristotle. Specifically, the domain hypothesis refers to the often tacit theoretical supposition that a *prima facie* diverse set of phenomena form a common set of interrelated phenomena (i.e., a domain). The common locus hypothesis refers to the often tacit supposition that a set of interrelated processes and properties have a common locus—a single kind of thing that possesses the properties and in which the processes occur. Finally, insofar as the process of property accretion proceeds in an indirect and somewhat indiscriminate fashion, theorists often must tacitly or explicitly formulate and affirm what I call the mental distillation hypothesis. Thus, Aristotle and the stoics begin to conceive of mental phenomenon as comprising a simple integrated domain, associated with a single kind of ontological entity.

Three developments shape much of the thinking about the mind and its relationship to the physical world from the time of Aristotle through the beginning of the 20th century. The first influential development comes in the form of an increasingly sophisticated understanding of human physiology[60] and anatomy.[61] Anatomists study the structure of organisms, including cells, organs, and organ systems (e.x., the digestive system includes several organs) and organisms. In contrast, physiologists study the functions of cells, organs, organ systems (e.x., the digestive tract functions to breakdown food and absorb the nutrients), and organisms. The slow but steady development and refinement of human physiological and anatomical knowledge ultimately acts to render the tensions between alternative ontological frameworks with ever-increasing starkness and rigor. In particular, greater familiarity with the structures and functions of the human nervous system begins approximately around 300 BCE and continues throughout this time period. Improvements in physiological and anatomical knowledge result in increasingly sophisticated mechanistic theories of mind/body interaction. The second influential development comes with the publication and subsequent influence of Euclid's geometric text, *The Elements*.[62] Euclid's text exerts a profound influence upon, not just mathematics, but conceptions of knowledge, inference, and psychological functioning. The third influential development comes with the advent of the European Renaissance[63] (c14th to 17th centuries) and the scientific revolution[64] (c15th to 18th centuries), which fuel ever more sophisticated theoretical approaches to the mind and its relationship to the physical world.

Ultimately, these three influential developments combine to produce two general results. First, within philosophy one sees an ever increasing intensity of debate regarding ontological frameworks. For the most part the philosophical debate centers on monistic physicalism versus oppositional substance dualism. This philosophical debate continues throughout the 20th century and even into the 21st century, though the scope of the phenomena narrows dramatically. Descartes argues for an oppositional substance dualism wherein all mental properties and processes reside in mental substance and its modifications. By the end of the 20th century few philosophers advocate a separate mental substance. Instead, most argue against the adequacy of current physical science to explain a much smaller set of properties and processes—namely, qualitative conscious experiences and conscious mental processes.[39, 40, 65-73] Second, an increasing body of empirical evidence, improvements in investigative methodology, and greater theoretical sophistication gives rise to organized empirical science as well as the doctrine of mechanistic determinism.[74] In essence, mechanistic determinism asserts that each prior state of the universe determines exactly and completely the next state of the universe in accordance with universal and necessary physical laws. Throughout this period, the scope, pace, and sophistication of scientific progress accelerates. Investigations into psychology and neuroscience lag significantly behind work in physics, chemistry, and even biology until well into the 20th century. Nevertheless, one sees an increase in the amount of intersubjective empirical data available in psychology and neuroscience. Moreover, the progress in such disciplines as physics and chemistry inspire monistic physicalists and provide analogical support for continued investigations into neurophysiology and neuroanatomy as well as psychology. Beginning with Descartes (as well as the British Empiricists) philosophers in ever-greater numbers seek to ground their thinking regarding the mind in scientific terms or using methodologies inspired by the sciences.

2.5.a Galen and the Beginnings of Neurophysiology

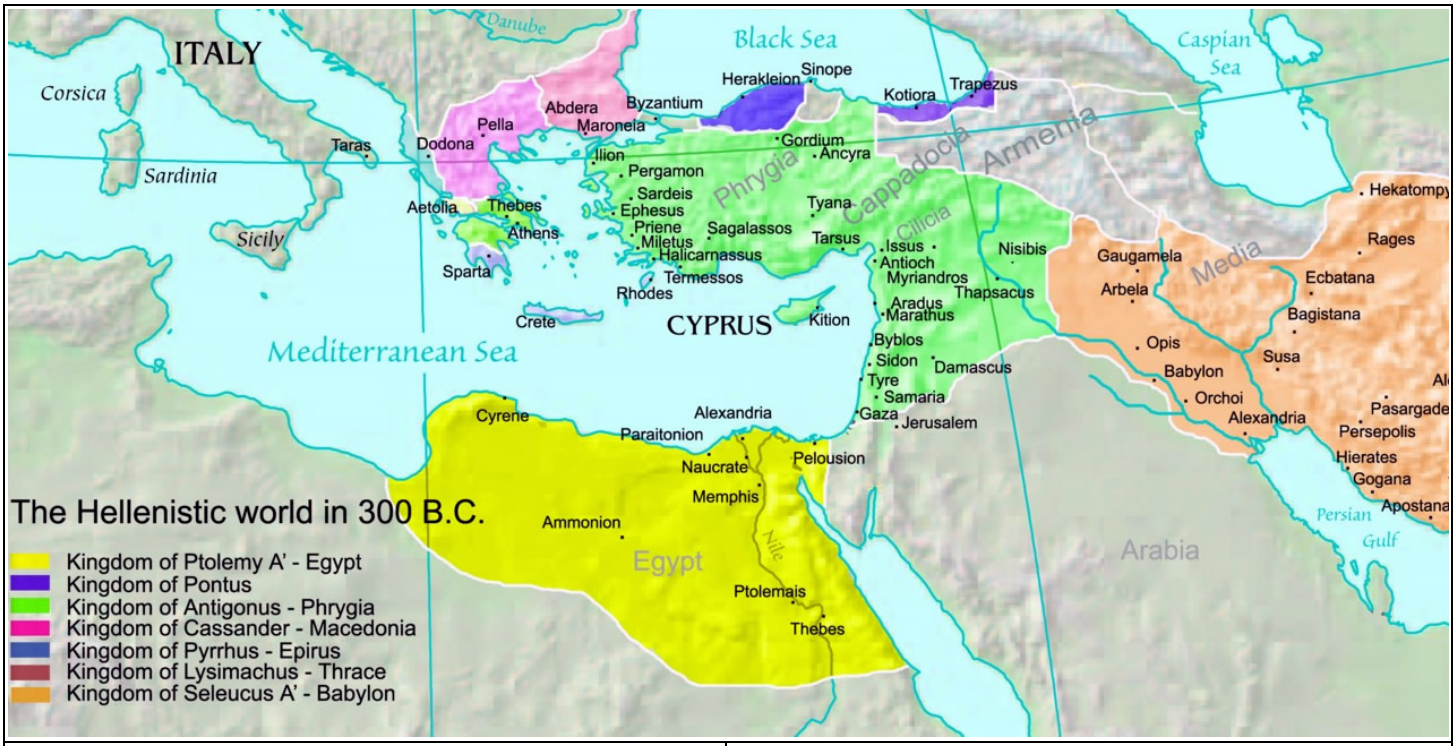
The slow accumulation of knowledge regarding the anatomy and physiology of the human nervous system contributes to the rise of well-articulated ontological frameworks and ultimately the leads to the beginnings of

the scientific study of the mind. As we'll see, knowledge of even the gross anatomical structures of the nervous system and their function eludes theorists throughout most of history. This ignorance has two sources. First, prohibitions and/or stigma around the dissection of human corpses prevent systematic empirical investigation, rendering the scant documentation of even the gross human anatomical structures incomplete and inaccurate for a significant part of the history of western civilization. Second, a lack of valid empirical and experimental methodology provides for only a very limited understanding of the corresponding functions and functional organization of gross anatomical structures. For example, it isn't until William Harvey's publication in 1623 of his *Exercitatio Anatomica de Motu Cordis et Sanguinis in Animalibus*[75] that systematic experimental evidence supports a widespread acceptance of the hypothesis of the circulation of blood.

Many discussions of the history of human physiology and anatomy refer to Hippocrates of Cos[76] (c460BCE–c370 BCE) as the earliest human anatomist. Researchers often make this attribution on the basis of a collection of ancient Greek medical manuscripts called *The Hippocratic Corpus*.[77] Some of the texts included in *The Hippocratic Corpus* show a basic familiarity with musculoskeletal anatomy as well as with a few organs. However, none of the texts in the corpus have a demonstrable origin with Hippocrates himself. Researchers have speculated that as many as 19 different authors contribute to the collection (none of whom are actually Hippocrates) over a time period ranging from the end of the 5th century BCE to the 2nd century CE.[78, 79] The earliest known work dealing with human physiology and anatomy dates to 1600 BCE. The Edwin Smith Surgical Papyrus[80] discusses the structure of the heart, liver, spleen, kidneys, hypothalamus, uterus, and bladder along with the blood vessels that emanate from the heart. The Ebers Papyrus[81] dating back to approximately 1550 BCE also discusses the heart.[80-82] However, much of the Egyptian knowledge of human anatomy and physiology appears to have faded from the flow of historical knowledge.

The widespread legal and moral barriers to the dissection of human cadavers further compound the loss of Egyptian physiological and anatomical knowledge. Even in the most enlightened areas during the most enlightened period of Greek civilization, the practice of dissecting human cadavers to study human anatomy and physiology carries a significant stigma. In most areas of the Macedonian and Hellenistic Greek world such practices remain illegal. For the most part, during the periods between 300 BCE and the 16th century physicians look primarily to the dissection of animals to gain knowledge of the human anatomy. Indeed, over 1200 years after the Egyptians and their anatomical works, Aristotle relies primarily upon dissections of animals to gain anatomical knowledge. His anatomical studies lead him to view the brain primarily as a radiator for the heart, with the later generating sensations and emotions in 335 BCE. In *Parts of Animals*[83] Aristotle claims that "...the brain cannot be the cause of any of the sensations, seeing that it is itself as utterly without feeling as any one of the excretions." (Part 10, ¶2)

The Egyptian toleration of human anatomical study and dissection does seem to have continued into the rise of the Greek civilization. The Greek physicians Herophilus of Chalcedon[84] and Erasistratus of Chios[85] perform relatively systematic human dissections around 300 BCE in the Egyptian city of Alexandria (then under Greek control). Herophilus, for example, earns a reputation for his careful anatomical studies. Herophilus distinguishes between motor and sensory nerves, describes many of the cranial nerves, and recognizes the division between the cerebellum and the cerebrum. Herophilus also appears as the first anatomists to suggest that the seat of mentality resides in the ventricles of the human brain. Specifically, Herophilus identifies the *calamus scriptorius* (the floor of the fourth ventricle) as the seat of the human soul.[84, 86, 87]



(Top) Map of the Kingdoms of the Hellenistic Period. Adapted from: Greek Thesaurus **(Bottom Right)** Plates vi & vii of the Edwin Smith Surgical Papyrus at the Rare Book Room, New York Academy of Medicine. Image and description from: Wikipedia **(Bottom Left)** Vaticanus graecus 277, 10v-11r: Table of contents in a fourteenth-century Hippocratic Corpus manuscript. Marcus Fabius Calvus owned this manuscript, transcribed it in his own hand, and used it in the preparation of his 1525 Latin translation. Image and description from: Wikipedia

After the time of Herophilus and Erasistratus progress in human physiology and anatomy slows to a crawl for nearly 500 years. The Greek-born Roman physician Galen of Pergamum, also known as Claudius Galenus or simply as Galen[88](129BCE-c200-217CE), delivers a series of lectures in 177CE arguing that the brain--not the ventricles-- serves as the seat of human mentality.

(Above) Claudius Galenus (129BCE-c200-217CE) From: Listverse **(Right)** Map of the Roman Empire showing Pergamum circa 117CE. Modified from: Fragments and Reflections

Galen lives in in the city of Pergamon[89] located in Asia Minor. Scholars often describe Galen as the greatest medical researcher of the Roman period. Galen makes significant contributions to medicine, anatomy, and physiology as well as logic and philosophy. He continues to shape thought in these areas for centuries. Roman law, like Greek law before it, forbids dissection and autopsy of the human body, so Galen is unable learn from the dissection of human cadavers. Galen does dissect the bodies of the Barbary Macaque and other primates, transferring what he learns on the assumption that primate and human anatomies are basically the same. However, Galen does have an advantage that most anatomists do not—Galen serves as a physician to gladiators. In his role as a physician to Gladiators, Galen has many occasions to view the internal organs of their bodies. In his work, *On the Usefulness of the Parts of the Body*,[90] Galen describes the ventricles and pineal gland. He argues against the idea--apparently widely espoused at the time--that the ventricles are filled with "psychic pneuma," the airy or vaporous substance supposed to interact with both body and mind. He also argues against the idea that the movements of the pineal gland act to regulate the flow of these pneuma within the ventricle. Despite Galen's singular status, his arguments fail to prevent ventricular theories of mind-body interaction from continuing to dominate thinking about the nature of the mind throughout the middle ages.

2.5.b Euclid's Axiomatic Treatment of Geometry as a Model for Knowledge and Reason

Euclid of Alexandria (325-265 BCE) stands out as one of the most underappreciated figures considered in this text. Euclid's text shapes the western notions of mathematics, philosophy, science, rationality and mentality for literally thousands of years after its creation. Euclid is a Greek mathematician, who likely receives his training in geometry in Athens from students of Plato before moving to Alexandria. In *The Elements* [91] (approximately 300BCE), Euclid's only known work, he systematically and rigorously organizes geometrical knowledge in terms of indubitable axioms from which he deduces all other known truths by careful proof. *The Elements* also includes a treatment of basic number theory. *The Elements* provides readers with a comprehensive collection of geometrical theorems and proofs developed by earlier mathematicians such as Thales, Pythagoras, Plato, Eudoxus,[92] Aristotle, and Menaechmus.[93] Euclid's accomplishment in *The Elements*

does not consist in the book's content, per se, but the organization and rigor of its presentation. Indeed, academics use Euclid's book as a mathematics text as late as the beginning of the 20th century. Euclid's rigorous (for the time) axiomatization creates a model for mathematics that remains influential today. Moreover, its influence extends to other disciplines such as philosophy and science, where it comes to serve as the dominant model for rational thought and knowledge for many, many thinkers.

Indeed, Euclid's geometry influences great thinkers holding very different theories about the nature of the mind. For instance, Thomas Hobbes (1588–1679) advocates a hard-bitten mechanistic monistic physicalism. Hobbes views all things, including politics and the mind, in terms of mechanistic operations upon physical matter. Hobbes speculates in his *Elements of Philosophy* [94] that

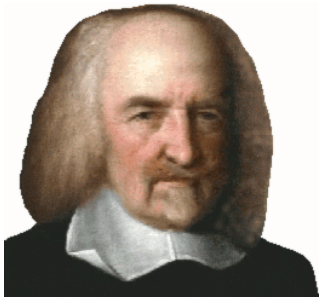
> PHILOSOPHY is such knowledge of effects or appearances, as we acquire by true ratiocination from the knowledge we have first of their causes or generation: And again, of such causes or generations as may be from knowing first their effects. … By ratiocination [reasoning], I mean computation. (pp. 6-7)

Hobbes views computation as analogous to simple arithmetical operations upon words, where words come to signify the objects of our experiences stored memory. As we will see below, René Descartes[95] (1596–1650) models both his epistemology and his scientific method on Euclid, though he famously holds--in contrast to Hobbes--that the mind is immaterial. Baruch de Spinoza[96] (1632–1677) writes his famous, posthumously published work, *Ethics (or Ethica Ordine Geometrico Demonstrata)*[97] in an axiomatic format. In the *Ethics* Spinoza argues that the universe consists of one infinite, necessary, and deterministic substance that he seems to equate with both God and nature as well as with both mind and body. So, despite the diverse nature of their views, all these thinkers portray one's knowledge--and one's rationale belief corpus--as having (or as needing) an organizational structure and genesis comparable to the Euclidian geometry of *The Elements*. Specifically, all of one's knowledge flows from careful arguments based upon premises (axioms), where one's evidence for the truth of those premises (axioms) consists in their manifest intuitive obviousness—i.e., one's inability to doubt them. Deductive reasoning transmits the certainty and truth of one's initial principles—these axioms--to all other beliefs one forms.

Thus, the impact of Euclid consists in providing a paradigmatic instance of intellectual synthesis and accomplishment. Euclid's work serves as a model for the nature and structure of knowledge, for reasoning, and for the nature and operations of the mind. In this Euclidian-inspired vision of the mind, thought consists in deductive operations on statements. Each statement traces its origin back either to the certainty of immediate experience, to a set of statements held to be certain and indubitable, or some combination of the two. That is, one explains one's beliefs in terms of logical operations on truth-functional representations (i.e., representations that can be true or false). One cannot underestimate the impact of this conception of reason, knowledge, and mentality upon our theoretical musings regarding rational inquiry, reason, and the mind.

Whereas the increasing anatomical and physiological knowledge fuels mechanistic theories of mind-body interaction, the theoretical structure of axiomatic geometry fuel theories of scientific methodology, knowledge, and human reasoning processes. However, the increase in wealth and commerce resulting from European Renaissance proves the crucial factor that gives rise to the scientific revolution and to an explosion of empirical research and theory.

Euclid of Alexandria
(325BCE-265BCE)



Thomas Hobbes
(1588–1679)

Baruch de Spinoza
(1632–1677)

René Descartes
(1596-1650)

Euclid's Axioms

1.) To draw a straight line from any point to any other.
2.) To produce a finite straight line continuously in a straight line.
3.) To describe a circle with any centre and distance.
4.) That all right angles are equal to each other.
5.) That, if a straight line falling on two straight lines make the interior angles on the same side less than two right angles, if produced indefinitely, meet on that side on which are the angles less than the two right angles.

One of the oldest surviving fragments of Euclid's *Elements*, found at Oxyrhynchus and dated to circa AD 100. The diagram accompanies Book II, Proposition 5. From Wikipedia

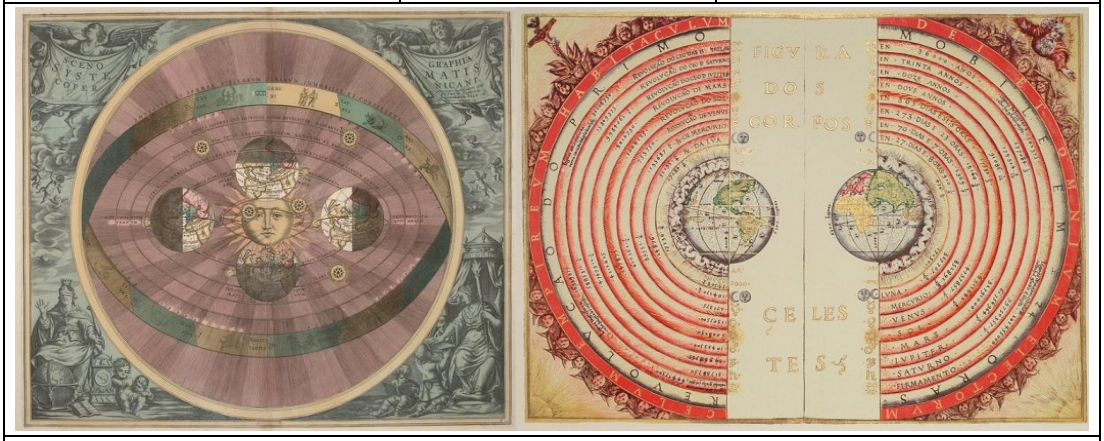
2.6 Descartes and Substance Dualism

Descartes' life and work provide a microcosm of the changes and challenges wrought by the important intellectual, social, and economic developments that characterize the European Renaissance and the scientific revolution. Scholars generally hold that the European Renaissance began in the 14th century city state of Florence located in Tuscany, Italy. The increase in commerce, artistic, and religious activity associated with the period from the 14th to the 17th century also brought increased scientific activity that eventually lead to what historians call the scientific revolution. Historians generally associate the beginning of the scientific revolution with the publication of two important works: Shortly before Nicolaus Copernicus'[98] (1474-1543) death in 1543, Johannes Petreis, a German publishing firm in Nuremburg, publishes Copernicus' privately circulated manuscript called *Commentariolus* (Little Commentary) under the title *De Revolutionibus Orbium Coelestium* (*On the Revolutions of the Heavenly Spheres*, published in 1543).[99] The physician Andreas Vesalius[100](1514-1564) publishes his seven volume text on anatomy called *De Humani Corporis Fabrica* (*On the Fabric of the Human Body*) in 1555.[101] Both works challenge traditional theories and authority figures in their respective areas.

Nicolaus Copernicus (1474-1543)
From: CNS News

Ptolemy (c. 90-168CE)
From: Wikipedia

Andreas Vesalius (1474-1543)
From: Compton History



(Above left) Andreas Cellarius's illustration of the Copernican system, from the *Harmonia Macrocosmica* (1660). Caption and diagram from: Wikipedia **(Above right)** Diagram depicting the Ptolemaic geocentric system from Bartolomeu Velbo's *Figura dos Corpos Celestes (Four Heavenly Bodies*, 1568). From: Slaw.ca

Copernicus forwards the heliocentric conception of the universe in contrast to Roman astronomer Ptolemy[102] (c.90-168CE). The Copernican or heliocentric astronomy places the Sun--as opposed to the Earth--at the center of the universe, challenging orthodox doctrine dating back to the ancient Greeks and codified by Ptolemy in his astronomical system.

Dissection of human cadavers, while not without a certain stigma, begins again in 13th century Europe. The first anatomy textbook published in Europe is *Anothomia*[103] written by the Italian physician Mondino de'Luzzi[104] (c.1265-1326). Though de'Luzzi completes the text in 1316 while at the University of Bologna, it is not published until after his death in 1478 at Padua. The work is based upon de'Luzzi's own dissections, though most of the errors in Galen are repeated. Between the 13th and 15th century dissection increasingly becomes accepted at universities throughout Europe, together with an increasing interest in, and knowledge of anatomy. Interest in the brain remains centered upon the ventricles. For instance, Leonardo da Vinci[105] (1452-1519) creates a cast of the human ventricles in 1504. In 1536 the Italian Niccolò Massa (1485–1569) argues that the ventricles are filled with fluid (liquor cerebro-spinalis) in his anatomy textbook, *Anatomiae Libri Introductorius*.

Andreas Vesalius'[100] publication of his seven volume text on anatomy called *De Humani Corporis Fabrica*[101] (*On the Fabric of the Human body)* in 1555 marks the beginnings of the fruition of the reemerge of active studying of anatomy and physiology. Like Copernicus, Vesalius challenges many aspects of the then orthodox anatomical teachings of the famous physician Galen[88](129BCE-c200-217CE). The works of Copernicus and Vesalius as well as many others serve to create a tradition of mechanistic determinism in science. The growing tradition of mechanistic determinism increasingly motivates scientists to seek a unified understanding of all phenomena--mental and physical. Such an account of the scientific enterprise envisages a set of universal and necessary physical laws discovered through controlled empirical experimentation through which scientists could explain and predict all of the workings of the universe--even those phenomena definitive of life and the mind.

Thus, the tension between the religious or immaterial worldview and this hard-bitten deterministic monistic physicalism builds as the European Renaissance and scientific revolution gain momentum. But, it is not until one hundred years later that a scientist, René Descartes[95] (1596-1650) brings these tensions into clear relief with his publication of his *Meditations on First Philosophy* (or *Meditationes de prima philosophia, in qua Dei existentia et animæ immortalitas demonstratur*) [106] in 1641. Like all thinkers of the time, the French philosopher, physicist, mathematician, and anatomist ascribes to a mind-body dualism. However, Descartes' work represents perhaps the clearest, most systematic presentation of what philosophers now understand as mind-body or substance dualism and what I call oppositional substance dualism. Indeed, Descartes' mediations prove profoundly influential in philosophy and science--in part because Descartes paints the tension between the spiritual (or immaterial) world view and the mechanistic physical world view in explicit and stark terms.

2.6.a Descartes' Early Life

Descartes comes to science rather indirectly: He attends a Jesuit school located at La Flèche, France called Collège Royal Henry-Le-Grand in 1607. His graduation from Henry-Le-Grand sees him earn his degree and license in Law at the University of Poitiers in 1616. However, Descartes chafes under the yoke of an academia dominated by the scholastic[107] approach to intellectual research. Indeed, in much of his work Descartes seeks to undermine scholasticism and create intellectual space for the newly burgeoning empirical sciences.

Scholasticism emerges during the Medieval Period[108] (also known as the middle ages) names a historical period in Europe beginning roughly 500CE with the collapse of the Western Roman Empire and ending between 1500CE and 1600CE with the spread of the Italian Renaissance from Florence, Italy through much of Western Europe. Scholasticism develops as an intellectual and academic movement spanning from approximately 1100CE to 1500CE. Researchers divide scholastic philosophy into three philosophical periods usually known as the pre-scholastic or early scholastic, the scholastic or high scholastic, and the late scholastic periods. The late scholastic period commonly refers to the time period from approximately 1350 to 1650, and includes such figures as William of Ockham (1285- 1349) and Duns Scotus (1266-1308). Early or pre-scholastics include most notably St. Anselm (1033-1109) and runs approximately from Anselm's birth until about 1250. Classic, high, etc. scholasticism runs from 1250-1350 and includes such figures as Thomas Aquinas and Anselm.

As a movement, scholasticism embodies the interests, influences, and methodologies primarily of educated religious figures. Universities began to be founded in the 1200s, but were staffed and attended primarily by clergy for much of the period. The subject matter of the schools consists of Latin translations (from Greek or Arabic into Latin) of Aristotle's writings, commentaries, thereon, and miscellaneous other closely related texts. One of scholasticism's main methodologies involves analysis of existent scholarly opinions on a question or set of questions with the goal of creating clear lines of argumentation representing different opinions and exploring their contradictions and potential for reconciliation.

The scholastic approach to learning and research favors appeal to authority over evidence and dialectic over discovery. Thus, rather than pursuing intellectual research, Descartes joins the army of the Dutch Republic for a brief time in 1618. During his time in the Dutch army, Descartes meets the Dutch philosopher and scientist Isaac Beeckman.[109] Beeckman reignites Descartes' interest in physics and mathematics. Descartes claims to have dreams shortly thereafter which he interprets as a divine sign that he should found a unified science of

nature based upon mathematics. Most of Descartes's work from the time between 1618 and 1637 remains unpublished until after his death. These works articulate Descartes' theory of scientific method and contain Descartes' earliest theoretical tracks on music, terrestrial mechanics, and the nature of the mind. The period between 1637 and 1641, in contrast, results in the publication of *Discours de la méthode*[110](*Discourse on the Method*, 1637),[111] *La Géométrie* (*Geometry*, 1637),[112] *Meditationes de prima philosophia*[113] (*Meditations on First Philosophy*,[106] 1641). Each of these works represents a highly influential contribution to their respective areas.

2.6.b The *Meditiations* and Their Impact

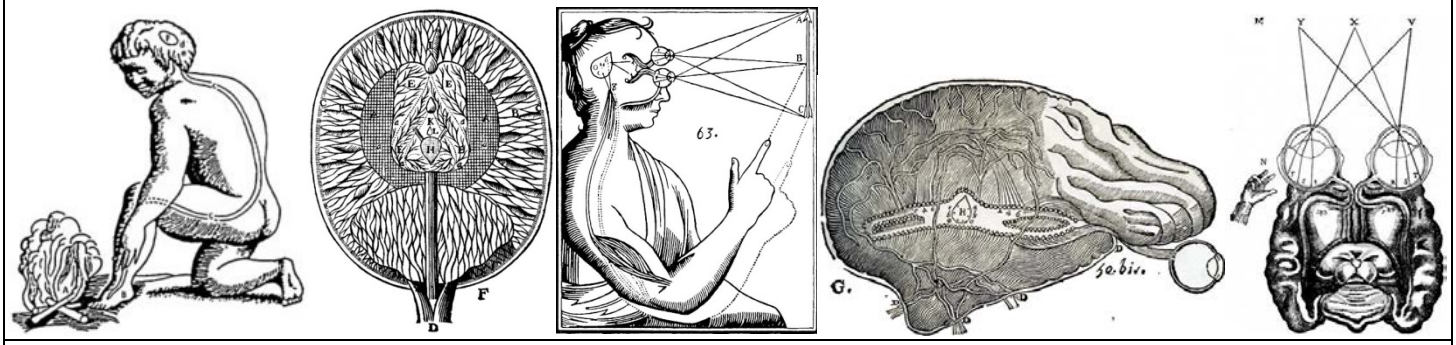
The *Meditations on First Philosophy*, proves important in the development of the philosophy of mind for many reasons. For instance, Descartes' view proves important, in part, because it and Descartes himself become very influential in the intellectual circles of Europe. However, the discussion in this chapter focuses upon two ideological reasons for the influence of Cartesianism: First, Descartes brings his scientific and mathematical interests to philosophical speculation regarding the mind. More precisely, Descartes brings the goal of scientific explanation together with an emphasis on rigorous methodology to philosophical ruminations regarding the mind. One ought not to suppose that these features are exclusive to Descartes' works. Rather, he exemplifies a growing movement. Importantly, his emphasis on rigorous methodology in the development of theories and explanations leads Descartes to seek an account of why only some kinds of physical entities appear to have minds or the potential for mentality.

Though a substance and property dualist, Descartes makes some of the first steps towards a materialistic, scientific psychology and neuroscience. Descartes maintains a very strong, long-term interest in the workings of the physical body, and spends a great deal of time dissecting cadavers. In 1637 Descartes publishes *La Dioptrique*[114] as one of three appendices to his *Discourse on Method*.[111] In each appendix, Descartes offers an example illustrating the method he outlines in *Discourse on Method*. *Dioptrique* is a treatise on optics. Though not particularly original in its results from optics, it articulates the corpuscular theory of light and suggests for the first time that the retina projects directly onto brain (in Descartes view, onto the walls of the ventricles). Though *Dioptrique* represents Descartes first publication on the topic of mind-body interaction, Descartes' exposition in *Dioptrique* reflects theoretical speculation from a work he began long before, *Traite de l'homme*[115] (Treatise on Man, published 1648, written 1637).

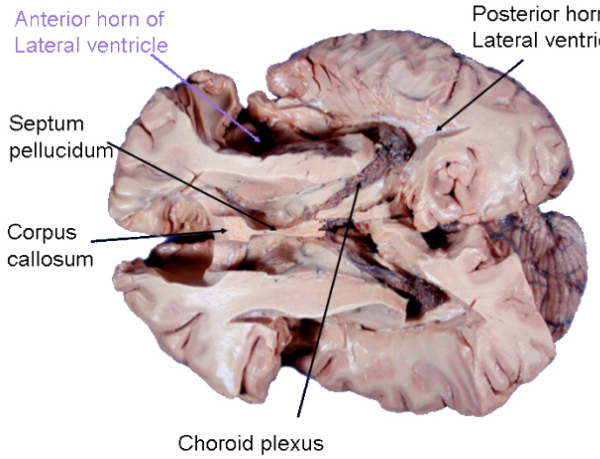
Descartes bases his theory of mind-body interaction upon his knowledge of gross neuroanatomy. Specifically, (A) Descartes posits the pineal gland as the "seat" of mind-body interaction. As early as his first work, *Treatise of Man* (written 1637, published 1662) Descartes hypothesizes, contra Galen, that the pineal gland plays a role in sensation, imagination, memory and the causation of bodily movements.[116] Thus, the pineal gland serves as the principle organ for *sensus communis*--the communication between the body and the soul. Both the soul and the body's animal spirits can affect the pineal gland by literally moving it, thereby allowing each to act on the other. Additionally, (B) Descartes adopts Galen's hypothesis that the nerves are hollow tubes that contain "…a certain very subtle wind, or rather a very lively and pure flame, which is called 'animal spirits'."[116](p.19) Ironically, though Descartes advocates a substance dualism, he actually furthers the mechanistic picture in that he views the body as an elaborate machine. Moreover, he takes pride in his claim to have furthered mechanistic explanation of human and animal behaviors.

So, the *Meditations*' importance in the development of science and the evolution of philosophical theories of mind results, in part, from its basis in physiology and anatomy. Though Descartes' account of the pineal gland and related neuroanatomy and neurophysiology suffers from numerous inaccuracies, he articulates and argues for a view of the body as a machine capable of some autonomous action. Descartes thereby indirectly furthers physical explanations of the mind and mental processes. Indeed, Descartes notes that,[116]

> …it is not necessary to conceive of this machine as having any vegetative or sensitive soul or other principle of movement and life, apart from its blood and its spirits, which are agitated by the heat of the fire burning continuously in its heart—a fire which has the same nature as all the fires that occur in inanimate bodies. (p.113)



Left to Right: From *L'homme de René Descartes*[117] Transmission of painful stimuli **(p.25);** Diagram section of brain **(p.52);** Diagram of the pineal gland facilitating visual-motor function **(p.72);** Diagram of optic nerve running directly to the ventricles. **(p.95);** Diagram depicting visual processing from *La Dioptrique*[118] **(p.128).**



Annotated picture indicating the position of the ventricles in a cross-section of a human brain. From: Medlearn

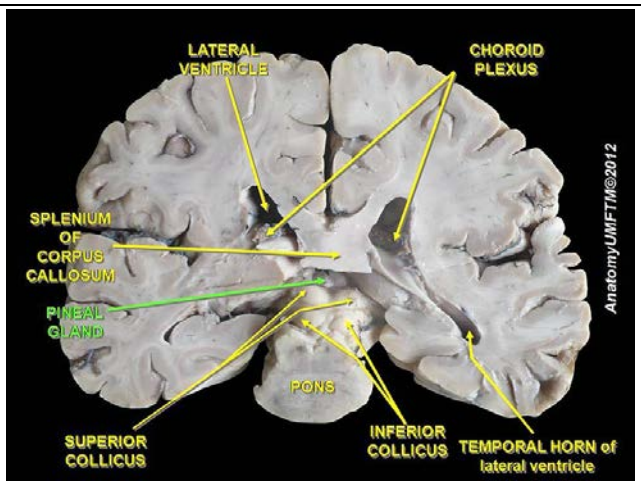
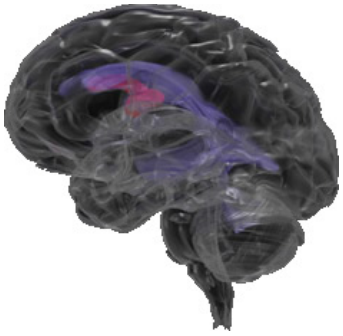
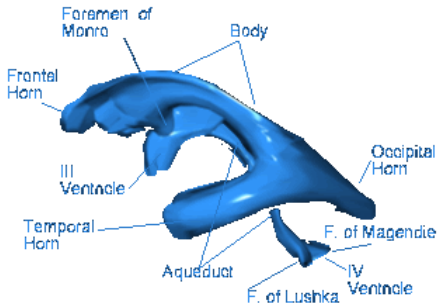


Diagram indicating the position of the pineal gland in a cross-section of a human brain. Modified From: Wikipedia





(Above Left) Computer generated graphic showing the relative position of the ventricles in the human brain. **(Above Right)** Computer generated graphic depicting the shape of the overall ventricle system. Both diagrams from: Neuroanimations.com

In addition to the goal of understanding the mental and its relationship to the physical, the same epistemic concerns that motivate Plato also drive Descartes' theorizing. For instance, in the *Mediations* Descartes asks readers to [106]

> Take, for example, this piece of wax; it is quite fresh, having been but recently taken from the beehive; it has not yet lost the sweetness of the honey it contained; it still retains somewhat of the odor of the flowers from which it was gathered; its color, figure, size, are apparent (to the sight); it is hard, cold, easily handled; and sounds when struck upon with the finger. In fine, all that contributes to make a body as distinctly known as possible, is found in the one before us. But, while I am speaking, let it be placed near the fire--what remained of the taste exhales, the smell evaporates, the color changes, its figure is destroyed, its size increases, it becomes liquid, it grows hot, it can hardly be handled, and, although struck upon, it emits no sound. Does the same wax still remain after this change? It must be admitted that it does remain; no one doubts it, or judges otherwise. What, then, was it I knew with so much distinctness in the piece of wax? Assuredly, it could be nothing of all that I observed by means of the senses, since all the things that fell under taste, smell, sight, touch, and hearing are changed, and yet the same wax remains. (M II, ¶12)

As a result, Descartes seeks to explain both how people can come to know (and fail to know) about the world in the face of perceptual flux as well as how there could be a distinction of kind between physical objects and minds. To explain these facts, Descartes sketches an explicit and clear oppositional substance dualism. Specifically, Descartes hypothesizes that the mental and the physical constitute distinct substances having opposing essential properties. Indeed, both Plato's form vs sensible object dualism and Descartes' substance vs matter dualism rely essentially upon the supposition of irreducible differences between their respective ontological posits. Like Plato, Descartes defines mental and physical substance through a cluster of essential properties. Unlike Plato, however, Descartes frames his oppositional substance dualism with the specific goal of further articulating the sorts of properties and causal connections that ought to underlie any explanation of the mental. Descartes characterizes mental substance as a non-extended, thinking substance manifesting mental properties like consciousness and belief. As Descartes tells his readers, mental substance "…is a thing that doubts, understands, [conceives], affirms, denies, wills, refuses; that imagines also, and perceives." (M2, ¶8) [106] In other words, Descartes rejects the tenuous dualism of earlier thinkers. Unlike Plato and Aristotle, Descartes crafts his ontological framework with the specific goal of unambiguously subsuming mental phenomena within its categories, properties, and relations. Unlike most thinkers from Herophilus through the scholastic scholars, Descartes defines the category of mental substance so that it shares none of the properties of physical substance, thereby avoiding the tenuous dualism whereby such thinkers imbue the mental with quasi-physical properties. For Descartes, mental substance constitutes an ontological category characterized exclusively by mental properties. Descartes sees his oppositional substance dualism as providing the best explanation—both for mental phenomena and for the seeming irreducibility between the mental and the physical. In contrast, Descartes defines physical substance as essentially extended, having properties of shape, size, position, and number. Thus, for Descartes physical substance has no mental properties either. In effect, Descartes' ontological categories explain the perceived difference between mental and physical phenomena through stipulative definition. However, Descartes does not wish to simply dispel theoretical problems with arbitrary stipulative definitions. He views his ontological categories as having, intuitive, methodological, and empirical motivations.

Like Plato, Descartes locates knowledge—not in the physical object or sensations caused by physical objects—but in mental judgment regarding sensations. Error occurs because sensation cannot provide knowledge without the proper exercise of judgment. Knowledge occurs in so far as the mind judges properly regarding the import of sensations. In short, Descartes explains the seeming difference between physical bodies that can have minds and bodies that cannot have minds by proposing that the world has two ontological kinds. He adopts something akin Plato's solution to Plato's epistemic dilemma. Descartes explains the limitations of human knowledge and human failures to know by reference to the speculative nature of inferences. Indeed, thinkers must judge the import of sensations with regard to the physical; nothing intrinsic to the interaction between these two fundamentally different sorts of ontological kinds provides a guarantee that the sensations of physical objects, properties, and events resemble or otherwise bear veridical information of those objects. Descartes explains human knowledge by appealing to the innate, God-given reliability of human judgment abilities when properly employed.

So, Descartes' *Mediations* proves influential in that it brings his scientific and mathematical interests to philosophical speculation regarding the mind. Ironically, the second reason for the influence of Descartes' *Mediations* lies in its failure to offer an adequate scientific explanation of the relationship between the mind and the body. Descartes oppositional substance dualism paints mental and physical substance as utterly unlike one another. Thus, his dilemma regarding their interaction again illustrates the daunting challenges of understanding and explaining mind/body interaction. In everyday life humans experience a seamless interaction between physical events and mental events. When one hits one's thumb, instead of a nail, that physical event immediately and predictably results in the mental phenomenon of pain. The challenge for Descartes's oppositional substance dualism lies in articulating a plausible theoretical account whereby these two opposite ontological kinds, mental substance and physical substance, could possibly interact in the seemingly fluid and highly integrated way one observes in one's everyday life. Thus, because of his dualist conception of the mind, and because of his scientific slant on philosophy, the *Meditations* together with his *Les Passions De L'ame* (Passions of the Soul) [119] and *Traite de l'homme* (Treatise on Man) [116] lay the groundwork for a switch in emphasis in the philosophy of mind. Whereas philosophical speculation regarding the mind exhibits a stronger epistemic and functional emphasis before Descartes, the emphasis turns somewhat away from epistemology and towards ontology after Descartes. That is, philosophers become increasing interested one of two theoretic projects: (1) Some thinkers seek to understand if/how the mind could be physical in nature and explained through science. (2) Other thinkers seek to explain the apparent seamless integration of the mental and the physical within an oppositional dualist framework. These interests, at least the former, continue today and lead to the explicit formulation of a variety of theories regarding the nature of the mind and its relationship to the physical world.

2.7 Science, Representations, and Ideas

Ironically, the increasing emphasis upon science, observation, and physicalism inspires still another tenuous dualistic posit—the idea. John Locke (1632-1704) writes his *An Essay Concerning Human Understanding* [120](1690) to flush out the corpuscularian philosophy[121] (essentially the hypothesis that the physical world is composed of atoms and "the void"—a doctrine he learns from the great chemist Robert Boyle) with regard to the mind. Like all British Empiricists, Locke seeks to understand the mind in order to more accurately understand and theorize about the nature, limits, and sources of knowledge.

David Hume (1711-1776), shares Locke's project of understanding the nature of the mind in order to understand the nature, sources, and limits of knowledge. However, reflection upon observational evidence--as opposed to a particular ontological picture--drive Hume's theorizing in works like, *A Treatise of Human Nature* [122] (1739-40) and *An Enquiry concerning Human Understanding* [123] (1748). Hume's speculations famously lead him to the conclusion that empiricist theories of mind undermine one's claim to knowledge of physical objects and causality. Locke and Hume both outline theories of mind that have representations and operations on those representations. Unlike Hobbes--but like Descartes--Locke's and Hume's model for ideas, the medium of mental representations, is pictures. Locke and Hume both seek to explain the functioning of mental processes underlying thought and reasoning in terms of ideas and operations upon ideas. Of particular significance, Hume views human reasoning about experience as resulting from operations of association rather than by deduction. Hume proposes that cause and effect reasoning results from habitual associations between ideas because of their constant conjunction in experience. In the work, *An Abstract of a Book lately Published: Entitled A Treatise of Human Nature etc.* [124] tells readers that,

> Tis evident that all reasonings concerning matter of fact are founded on the relation of cause and effect, and that we can never infer the existence of one object from another, unless they be connected together, either mediately or immediately... Here is a billiard ball lying on the table, and another ball moving toward it with rapidity. They strike; and the ball which was formerly at rest now acquires a motion. This is as perfect an instance of the relation of cause and effect as any which we know, either by sensation or reflection. (¶8-9)

The third famous British Empiricist, George Berkeley (1685-1753), differs from Locke and Hume in that his work emphasizes ontological issues. Indeed, in his works, *A Treatise Concerning the Principles of Human Knowledge, Part I* (1710) [125] and *Three Dialogues Between Hylas and Philonous* (1713), [126] Berkeley argues against monistic physicalism and in favor of monistic idealism. For Berkeley, nothing exists but minds, God, and ideas. All phenomena--mental and physical--consist exclusively of a series of ideas coming into in passing from one's mind. It is in Berkeley's hands that the indefinite ontological status of ideas comes fully into view.

John Locke (1632-1704) | David Hume (1711-1776)

George Berkeley (1685-1753) | Immanuel Kant (1724-1804) | Thomas Reid (1710-1796)

Thus, with Berkeley one sees the third of three major ontological frameworks regarding the nature of the mind and body. First, monistic physicalism (reductive materialism or materialism) posits only one type of substance, material substance. The mind and all mental properties result from modifications of the same substance--physical substance, i.e., the mind = the body. Second, oppositional substance dualism (substance dualism or mind-body dualism) posits two distinct kinds of substance, mental substance and physical substance. The mental substance underlies minds and mental properties, while physical substance underlies all physical objects and physical properties. Finally, monistic substance

idealism (idealism or mentalism) posits only one kind of substance, mental substance. All seemingly physical objects and physical properties actually consist of ideas and their properties. These basic ontological frameworks have many permutations.

Similarly, the line of development outlined in this text does not exhaust the rich theoretic permutations in the historical record. For instance, Thomas Reid (1710-1796) rigorously rejects the notion of a representational mind at about the same time that people read Hume's and Locke's representational theories. Another sort of objection, this time to scientific psychology comes from Immanuel Kant (1724-1804). Kant, a physicist and philosopher, adopts the same general project as Hume--understanding the nature of the mind in order to further epistemological theorizing. However, in his book, *The Critique of Pure Reason* [127](Kemp Smith's English translation 1929), Kant wants to counter Hume's skeptical conclusions. Kant argues that much of our knowledge flows from the innate presuppositions necessary for experience itself. Interestingly, though Kant rejects the notion of a scientific psychology, he nevertheless develops and draws heavily upon a theory of the mind in his work. These two positions are not necessarily at odds with one another; Kant argues for the impossibility of a science of the mind, i.e., he argues against a particular conception of scientific psychology, because the field cannot be mathematized.

2.8 Substance Dualism in the Twentieth Century

Despite Kant's skepticism scientific psychology eventually begins to develop. From Descartes through the first part of 20th century, philosophers focus primarily on the debate over ontological frameworks. By the second half of the twentieth century, concerns over how best to understand and explain the mind's physical origins drive a significant portion of philosophical speculation regarding the mind. Additionally, concerns arising from philosophical interests in language and mathematics begin to pervade the philosophy of mind. It is, therefore, convenient to use this section to outline the standard positions in the philosophy of mind, including those that developed prior to the second half of the 20th century, before turning to the second half of the 20th century in chapter four.

As noted above, each view--materialism, dualism, and idealism constitute classes of ontological frameworks in which multiple theoretical permutations exist. For instance, in the case of dualism philosophers commonly note three distinct positions: Descartes holds the most common position--interactive dualism. Interactive dualism holds that mental substance and physical substance causally interact with one another. Interactive dualism might seem like the only possibility. However, two other possibilities emerge if one denies that mental and physical substances interact. Such a denial might seem ridiculous given the apparent connection between mental phenomena and physical phenomena. For instance, if someone steps on your foot (a physical phenomenon) you will likely experience a feeling of discomfort in your foot (a mental phenomenon). However, Descartes' clarity and rigor in differentiating mental and physical substance raises, ironically, a significant challenge to interactionism.

Recall that mental substance is essentially non-spatial, lacking all physical properties. Likewise, physical substance is essentially spatial, lacking all mental properties. If the mind and the body are fundamentally different sorts of stuff, one must ask, "How could these two substances possibly causally interact with one another?" For that matter, given that the mind is non-spatial, where could they possibly causally interact? Experience renders mind-body interaction *prima facie* indubitable, so interactive dualism must explain how

such causal interaction could possibly occur. Philosophers articulate many difficulties with interactive dualism, but most agree that the difficulties with causal interaction rank very high. In addition to difficulties with the very idea of inter-substance causation, another serious difficulty emerges almost immediately from dualistic interactionism. In a mechanistic, deterministic physical science, all changes in the physical world should be explicable (at least in principle) by universally applicable purely mechanistic, deterministic physical laws. But, if mental substances and causal substances causally interact, mental causation renders universal purely mechanistic, deterministic physical laws impossible. Mental to physical causation will always fall outside of these purely physical laws, thereby violating those laws.

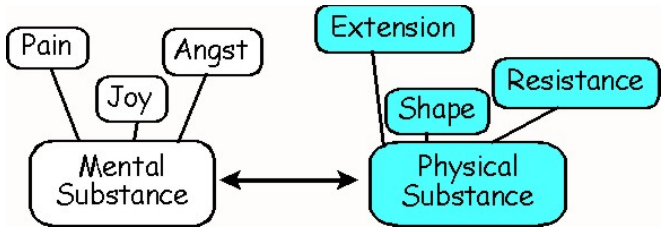
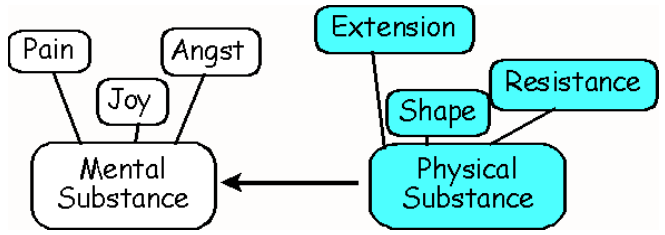
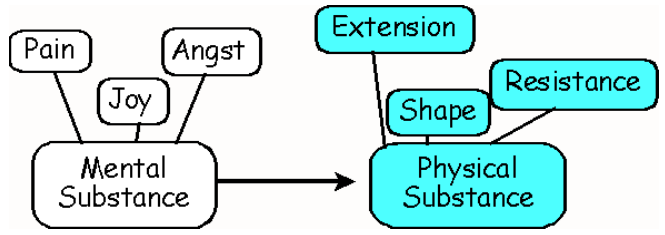
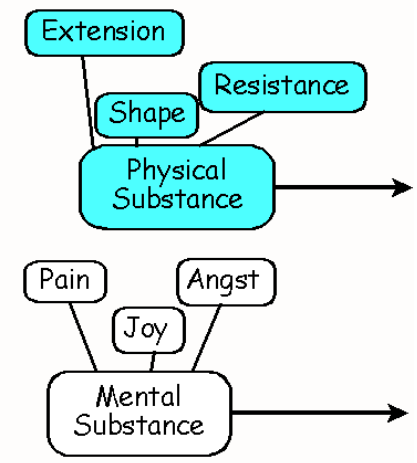
Possible Substance Dualisms			
Name of Position	Mental to Physical Causation	Physical to Mental Causation	Illustrative Diagram
Interactionism	Yes	Yes	
Epiphenomenalism (mental)	No	Yes	
Epiphenomenalism (physical)	Yes	No	
Parallelism	No	No	

Table of the possible substance dualisms with diagrams depicting each variety. Substance dualisms posit two fundamental types of substances, physical and mental. Each substance has distinct properties. Here conveniently yet inaccurately modeled by bubbles.

One possible solution to this last worry involves denying causal interactionism--at least in one direction. Epiphenomenalism asserts that changes in physical substances and properties can cause changes in mental substances and properties, but that changes in mental substances and properties cannot cause changes in physical substances or their properties. Thus, one still retains causal connections between the mental and the physical, without mental causation violating universally applicable purely mechanistic, deterministic physical laws. While epiphenomenalism might allow for deterministic physical laws, it implies that mental phenomena never cause physical phenomena--violating the seeming obvious nature of mind-body interactions. Worse still, it must explain why causation only runs from the physical to the mental, and not vice versa. Indeed, why theuniverse would exhibit such a causal asymmetry seems as daunting an explanatory target as explaining interaction itself—particularly given that experience does not lend support to an asymmetrical causation between the mental and the physical.

The third dualist position also seeks to solve to the problem of interaction by denying interactions. Parallelism asserts that mental and physical substances only appear to causally interact. Instead of causal interaction between the two substances, parallelism holds that mentally generated mental changes and physically generated physical changes merely mirror one another, creating the illusion of interaction. One might find one version of anti-interactionism less plausible than the next. However, considering the difference between causation and correlation might make parallelism seem somewhat more plausible. The time on Bill's watch may always correlate with the time on Tom's watch, but no one supposes that the two watches causally interact with each other. The above table summarizes the various substance dualistic positions.

Each of the modern substance dualist positions illustrates the tensions inherent in the oppositional substance dualist framework. Recall that early in the chapter I noted that the development of the Greek notion of the soul also illustrates a common dilemma that theorists have faced throughout the historical development of theories of mind: (D1) Physicalist theories face the difficulty of formulating physical mechanisms that plausibly explain various mental properties and processes. In contrast, (D2) Dualist oppositional theories face the difficulty of formulating accounts of how two fundamentally different types of objects could possibly interact in such a seemingly continuous and seamless fashion. Advocates of oppositional substance dualism generally face still more difficulties: Indeed, given the nature of mental substance, oppositional substance dualists often provide little insight into how one might explain mental functioning within their ontological framework. Mental substance, by its very nature, does not offer theorists the sort of properties with which one can explain mechanistic and causal changes in physical substance. For instance, mental substances do not exist in particular places, nor do mental substances have parts.

2.9 Arguments for Mind-Body Dualism

At various points throughout this text I suggest motivations and challenges for the various ontological frameworks. For oppositional substance dualists--dualists who assert a fundamental and irreconcilable difference between the kinds posited in their ontological frameworks (e.x., mental and physical substance) the most salient challenge lies in explaining (or explaining away) the seeming seamless and perpetual integration of mind and body. Thus, one might well ask, "Why would someone advocate dualism?" Descartes and other theorists present three mainlines of argumentation for their ontological framework; (1) Arguments based upon the apparent inimical differences between mental and physical phenomena, (2) Arguments based upon

knowledge claims linked to mentality, and (3) Arguments alleging the physicalist cannot explain various mental phenomena.

2.9.a The Argument From Leibniz's Law/Identity of Indiscernibles (Descartes)
Descartes gives readers a version of the first kind of argument in the *Mediations VI:*[106]

> … I here remark, in the first place, that there is a vast difference between mind and body, in respect that body, from its nature, is always divisible, and that mind is entirely indivisible. For in truth, when I consider the mind, that is, when I consider myself in so far only as I am a thinking thing, I can distinguish in myself no parts, but I very clearly discern that I am somewhat absolutely one and entire; and although the whole mind seems to be united to the whole body, yet, when a foot, an arm, or any other part is cut off, I am conscious that nothing has been taken from my mind; nor can the faculties of willing, perceiving, conceiving, etc., properly be called its parts, for it is the same mind that is exercised [all entire] in willing, in perceiving, and in conceiving, etc. But quite the opposite holds in corporeal or extended things; for I cannot imagine any one of them [how small soever it may be], which I cannot easily sunder in thought, and which, therefore, I do not know to be divisible. This would be sufficient to teach me that the mind or soul of man is entirely different from the body, if I had not already been apprised of it on other grounds. (M VI, ¶19)

Contemporary writers often update Descartes' argument as follows:

2.9.b Modern Argument From Leibniz's Law/Identity of Indiscernibles (Descartes)

> (L1) I can easily imagine my body being chopped-up, placed into garbage bags, and scattered about town. Hence, my body is divisible.
>
> (L2) I cannot imagine my mind being chopped-up. Hence, my mind is not divisible.
>
> (L3) If my mind was just my body, by Leibniz's Law, I should be able to imagine my mind being chopped-up. That is, identical things must have all and only the same properties. [i.e., if (x)(y)((x=y) then (P)(Px if and only if Py))]
>
> (L4) Hence, my mind is not my body.

Theorists criticize such Leibniz law arguments on the basis that the seeming differences between the properties associated with the mind or mental substance and the properties associated with the body or physical substance might well only appear to differ because of referential opacity. Theorists assert the referential opacity of two categories, concepts, or terms whenever the exact nature of the reference (or possibly co-reference) for those categories, concepts, or terms remains indeterminate. For instance, suppose that you have no experience of ice whatsoever, but you do know and have experience with water. In this context, ice and water will likely prove referentially opaque to you. That is, if someone holds up a piece of ice and announces that they are holding water you will likely deny the truth of their assertion. On the other hand, if they hold up a glass of water you will likely agree with their assertion. Thus, your context--your knowledge and your situation—prevents you from clearly determining the reference of the two categories, concepts, or terms. As a result, those terms, concepts, or categories are referentially opaque to you. In the case of the above Leibniz Law argument, the arguer asserts that mental and physical substance are distinct because one, physical substance, can be divided while the other, mental substance, cannot. But the premises do not

provide direct evidence that the two substances differ. Instead, the argument relies upon one's ability to imagine division of each substance. Logicians have long known that in contexts like imagining, knowing, and believing one cannot necessarily substitute co-referential but opaque terms *salva veritate* (i.e. without changing the truth value of the statement). Thus, it may be true that Bob believes that Richard Bachman wrote *Thinner*, and yet deny that Stephen King wrote *Thinner* (despite the fact that King did write *Thinner* under the pen name Richard Bachman). In short, in contexts like imagining, knowing, and believing *prima facie* differences in properties may result from non-identity or they may result from referential opacity.

2.9.c The Argument from Introspection

In the case of arguments from introspection, the arguer infers the differences between mental and physical substance on the basis of differences between one's sensory experiences of one's body and one's introspective perceptions of one's mental states and processes. Readers can find something like an argument from introspection in Descartes' *Mediation VI*: [106]

> …because I know with certitude that I exist, and because, in the meantime, I do not observe that aught necessarily belongs to my nature or essence beyond my being a thinking thing, I rightly conclude that my essence consists only in my being a thinking thing [or a substance whose whole essence or nature is merely thinking]. And although I may, or rather, as I will shortly say, although I certainly do possess a body with which I am very closely conjoined; nevertheless, because, on the one hand, I have a clear and distinct idea of myself, in as far as I am only a thinking and unextended thing, and as, on the other hand, I possess a distinct idea of body, in as far as it is only an extended and unthinking thing, it is certain that I, [that is, my mind, by which I am what I am], is entirely and truly distinct from my body, and may exist without it. (M VI, ¶9)

Putting this argument in a more generic and contemporary format gives one something like this:

2.9.d The Contemporary Argument from Introspection

> (I1) Introspection reveals mental states and properties to the introspector in much the same way that vision reveals objects in the visual world.
>
> (I2) Introspection reveals that mental states have none of the properties of brains or brain states.
>
> (I3) Thus, direct observation seems to belie the claim that mental states and processes are simply physical states and properties.

Writers like Paul Churchland [128-130] as well as psychological researchers [131-140] note the pitfalls of introspection as a means for accurately accessing mental states and processes.

2.9.e The Argument From Special Abilities/Inabilities (Descartes)

Logicians often refer to this current class of arguments as an appeal to ignorance. Arguments from special abilities or inabilities point to a lack of current ability and/or knowledge and attempt to infer an in-principle claim to the effect that the ability can never exist or that some fact or facts can never be known. Part of the appeal of these arguments stems from our tendency to see mental creatures as fundamentally different from other entities. Not everything acts in a manner people recognize as, for example, intelligent. Arguments

from special abilities infer from the fact that theorists do not fully understand some mental property or ability to the claim that such a property or ability can never be fully understood or realized in purely physical entities. Such arguments lose their efficacy insofar as viable physicalist explanations emerge for various aspects of mentality. For instance, in part five of his *Discourse on Method* Descartes suggests such and argument from disability:

> The second test is, that although such machines might execute many things with equal or perhaps greater perfection than any of us, they would, without doubt, fail in certain others from which it could be discovered that they did not act from knowledge, but solely from the disposition of their organs: for while reason is an universal instrument that is alike available on every occasion, these organs, on the contrary, need a particular arrangement for each particular action; whence it must be morally impossible that there should exist in any machine a diversity of organs sufficient to enable it to act in all the occurrences of life, in the way in which our reason enables us to act. Again, by means of these two tests we may likewise know the difference between men and brutes. For it is highly deserving of remark, that there are no men so dull and stupid, not even idiots, as to be incapable of joining together different words, and thereby constructing a declaration by which to make their thoughts understood; and that on the other hand, there is no other animal, however perfect or happily circumstanced, which can do the like. Nor does this inability arise from want of organs: for we observe that magpies and parrots can utter words like ourselves, and are yet unable to speak as we do, that is, so as to show that they understand what they say; in place of which men born deaf and dumb, and thus not less, but rather more than the brutes, destitute of the organs which others use in speaking, are in the habit of spontaneously inventing certain signs by which they discover their thoughts to those who, being usually in their company, have leisure to learn their language. (Part 5, ¶7)

2.9.f The Contemporary Schema of the Argument From Special Abilities/Inabilities

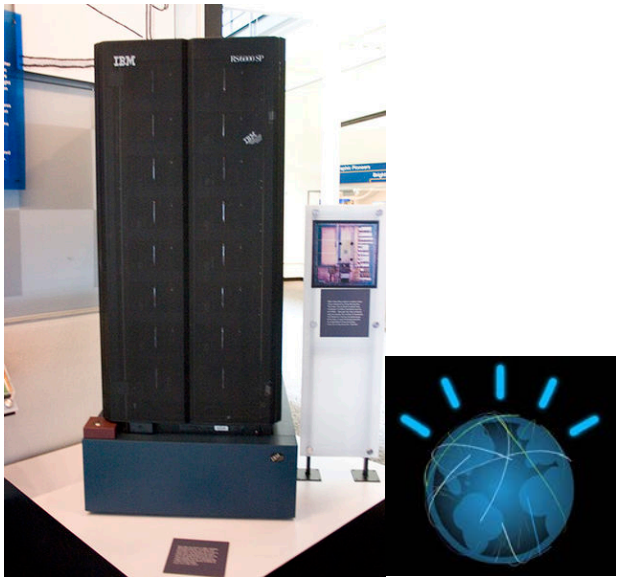
Put into a more contemporary template:

> (SA1) Only humans can _____.
>
> (SA2) If mental properties and abilities where just physical properties and abilities, then one would expect to find or to be able to create other physical systems with that can _____.
>
> (SA3) Since we do not, humans must be mental in virtue of some other, nonphysical substance having some other, nonphysical properties.

Over time the greatest difficulty with the argument from special abilities/inabilities lies in the slow march of human understanding and ingenuity. For instance, in the case of computers, many abilities once claimed as beyond the possible abilities of computers have been realized in computers. Computers have beaten the best chess players in the world.[141] In similarly spectacular fashion, computers have controlled vehicles in urban and off-road races without the intervention of human drivers.[142] Most recently a computer beat all of the best past contestants in the game Jeopardy.[143]

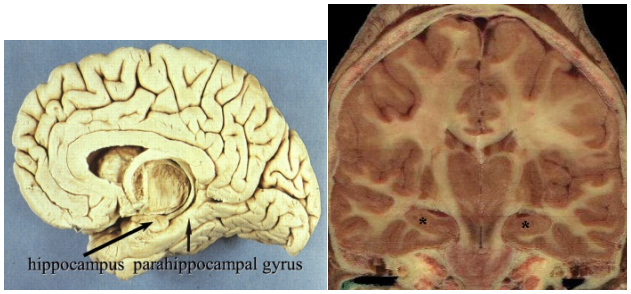
Similar problems emerge for the inability argument in light of the discoveries of scientists tying various mental abilities very strongly to specific neuronal structures. For instance, psychologists have long known that extensive bilateral (both sides) damage to a structure of the brain called the hippocampus results in the inability to form long-term declarative memories. Declarative memories are memories of facts and events.

Specifically, declarative memory systems share a common functional characterization and a significantly overlapping neural substrate. At the functional level, researchers consider declarative memory systems to be representational and to encode factual information (i.e., people, places, things, and times) as well as the significance of such information. Though not necessarily propositionally encoded, normal subjects can express information stored in declarative memory through linguistic and/or graphic mediums with sufficient precision to warrant its evaluation for veridicality--most often truth-functionality. Insight into the crucial role of the hippocampus in long-term declarative memory has been dramatically advanced by the selfless contributions made by Henry Gustav Molaison, (known as HM in the literature) and a musicologist and conductor, Clive Wearing. Each man suffered drastic bilateral (both sides) damage to their hippocampus. This damage

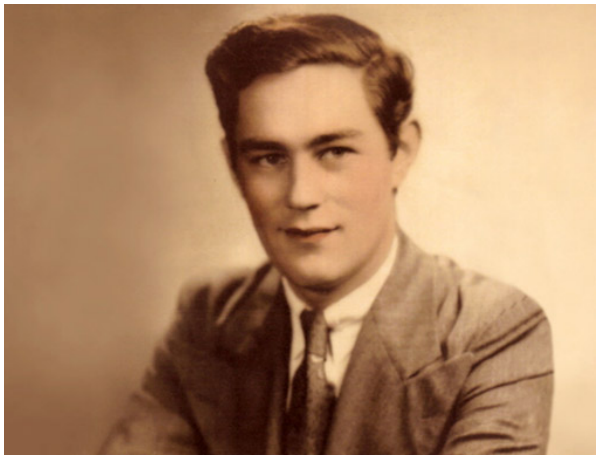


(Above left) Picture of deep blue. From Wikipedia (Above right) A Picture Watson's avatar—the Jeopardy Champion computer. From: Wikipedia

Two videos of memory patient Clive Wearing. After massive bilateral (both sides) damage to his hippocampus Mr. Wearing lost the ability to form long-term memories or to function for more than between 7-90 seconds without exhausting his working memory and "rebooting." Both videos are from Youtube. Click on the images to play the videos.



(Above left) A sagittal cut of the right hemisphere of the human brain revealing the hippocampus labeled in the picture. From: PNAS **(Above right)** A coronal bisection of a human brain revealing the hippocampal structures in each hemisphere. From: The Center for Neural Informatics, Neural Structures, and Neural Plasticity



Picture of the late Henry Gustav Molaison (1926-2008) who furthered research into long-term declarative memory after an epilepsy operation resulted in bilateral hippocampal damage. Mr. Molaison also donated his brain to science. Picture from Wikipedia

resulted Mr. Molaison and Mr. Wearing losing their ability to create long-term declarative memories. Each man had to function exclusively using their working-memories, their procedural memories, and their previously stored long-term memories. Worse still, each man's working memory limited his ability to consciously attend to activities and environments to continuous periods ranging between seven seconds and about one and one-half minutes. Nevertheless, both men volunteered for countless psychological studies and upon his death in 2008 Mr. Molaison donated his brain to science.

2.10 Arguments Against Dualism

Most theorists rely upon two kinds of arguments against an oppositional mind-body dualistic framework. On the one hand, theorists argue that oppositional substance dualism, by its very nature, cannot help us to understand the place of the mind in the physical world. On the other hand, theorists argue that oppositional substance dualism does not help us to understand the mind or its functioning. On this second line of argumentation oppositional substance dualism get portrayed as a failed research program.

2.10a The Problem of Interaction

Theorists often note that oppositional substance dualism by its very nature posits entities and properties that provide no obvious means of causal interaction. How does the pin-prick one gets (a physical event caused by physical entities and processes), cause the pain that one feels (a mental event supposedly caused by mental entities and processes)? How does something with no location in space provide one with a perspective from a location in space? Such problems regarding the interaction of mental and physical substances seem insurmountable to most theorists. This line of argumentation usually goes under the moniker of the problem of interaction.

The problem of interaction has many facets. Most obviously, oppositional substance dualism seems to lack a viable means for understanding the seeming continuous and fluid interactions between one's mental states and the physical world. However, it also renders attempts to study the mind equally problematic. To wit, how does one operationalize mental categories in oppositional substance dualism? By their very nature, mental states and properties seem to lack any causal connection to physical states and properties by which one might detect or measure their existence. Introspection might seem like a viable methodology, but given the lack of causal interaction between mind and body it remains utterly unclear how the mind could be causally responsible for introspective reports. Likewise, the privileged nature of introspective access deprives it of intersubjective validation and replication desirable in operationalizations. Furthermore, oppositional substance dualisms seem to have no obvious explanation for the neural dependence of mental functioning noted, for instance, in discussing HM above.

2.10.b Paucity of Explanatory Prowess and Progress

More recently Paul Churchland [128, 144] argues that oppositional mind-body dualistic frameworks do not actually provide plausible explanations for a much wider range of seemingly mental phenomena. For instance, why do humans sleep? Why do humans dream when they sleep? Why do humans develop mental disorders like schizophrenia? Substance dualism tends merely to posit a substance together with a set of properties corresponding to mental attributes such as fear, belief, desire, etc.. However, nothing about such entities or their proposed properties provides one with any dynamical mechanisms to explain how mental phenomena occur or lead from one property to the next. For this reason, substance dualisms seem to suffer from the

same difficulties faced by physicalistic theories. As noted in the beginning of this chapter, (D1) Physicalist theories face the difficulty of formulating physical mechanisms that plausibly explain various mental functions and properties. Churchland argues forcefully that oppositional substance dualisms face the same difficulties in explaining various mental functions and properties. Thus, in contemporary times many researchers allege that qualitative consciousness (viz., conscious experiences of red) represents a mental function that seems to resist explanation by known physical mechanisms. Churchland suggests that dualist theories likewise face the difficulty of formulating dualistic mechanisms that plausibly explain various mental functions like sleep, dreaming, etc.. Similarly, oppositional substance dualisms seem disconsonant with other, highly evinced theories like evolution.

The paucity of explanatory prowess to which Churchland refers becomes even more troubling in light of the fact that oppositional substance dualism does not seem to have made any significant inroads into these phenomena. Dualists have no well-defined research program. They have not created new theoretic models, nor elaborated upon existent theoretic models. In short, oppositional substance dualism seems to have little historical record to allay concerns regarding its current inability to explain wide swathes of mental phenomena.

2.11 Glossary of Key Terms

Dualism: According to Wallis, dualism refers to the supposition within an ontological framework of exactly two fundamental categories to fill a specific role. Substance dualism provides an example of a dualistic view regarding the number of categories of substance in that it hold that both mental and physical substance exist. Dualisms with regard to causation appear in many ontological frameworks. For instance, in Chinese philosophy the concept of yin and yang—complementary interacting forces represents a dualism of forces.[145]

Monism: According to Wallis, monism refers to the supposition within an ontological framework of a single fundamental category to fill a specific role. Thus, both monistic idealism and monistic physicalism provide examples of monistic views regarding the number of categories of substance. Unified field theory would constitute a monistic view regarding the number of categories of force in physics. Unified field theory seeks to replace the current four fundamental forces with a single force.[146]

Monistic Idealism (Idealism): Monistic idealism holds that mental substance constitutes the only entity in the universe. Berkeley stands out as one of the most influential monistic idealists. Berkeley holds that all mental and physical phenomena consist of nothing but ideas in minds.[125, 126]

Monistic Physicalism (Physicalism or Materialism): Monistic Physicalism holds that physical substance constitutes the only entity in the universe. Therefore, monistic physicalists hold that all phenomena—both physical and mental phenomena—result from modifications or permutations of physical substance. The Presocratic philosophers Leucippus[147] (and his pupil Democritus[148] (460-370 BCE) founded one school of monistic physicalism--atomism.[149] Greek atomists like Democritus hold that the universe consists of atoms and the void.

Oppositional Dualism: According to Wallis oppositional dualism refers to the supposition within an ontological framework of two fundamental categories to fill a specific role where the framework assigns opposite or fundamentally different properties to each category. Plato's dichotomy between the sensible and the

intelligible introduces a dualism of ontological kinds sharing no essential properties—an oppositional dualism. For Plato the sensible realm consists of entities that are changeable, divisible, and capable of manifesting contradictory properties. In contrast, the intelligible realm consists of immutable, indivisible entities that never manifest contradictory properties.

Oppositional Substance Dualism: According to Wallis oppositional substance dualism to refers to those substance dualisms that assign opposite or fundamentally different properties to each kind of substance. Thus, Descartes substance dualism counts as an instance oppositional substance dualism in that Descartes defines mental and physical substance in terms of opposing properties. For example, physical substance is divisible while mental substance is not divisible.

Pluralism: According to Wallis, pluralism refers to the supposition within an ontological framework of two or more fundamental categories to fill a specific role. For example, the current four fundamental forces in physics represents a pluralistic view regarding the number of categories of force in that physicists hold that the four fundamental forces, gravitation, electromagnetism, strong nuclear force, and weak nuclear force, constitute the set of forces necessary to explain physical phenomena. Similarly, Anaxagoras[32] (500-428 BCE) of Clazomenae (an area in Turkey in Asia Minor) appears as the ultimate substance pluralist, holding that all types of materials—from milk to gold—constitute distinct eternally existing substances with their respective characteristics.[33-35] Empedocles[36](490-430 BCE) of Agrigentum (now known as the city of Agrigento in Sicily) appears likewise to adopt a pluralism. Empedocles posits the existence of the basic four elements (earth, air, fire, and water) together with two forces, love for combining and strife for separating these elements to create other materials. [33, 37]

Substance Dualism: Substance dualism posits the existence of two fundamental kinds of substance-- mental substance and physical substance. In general, substance dualists assert the existence of two fundamental kinds of substances on the grounds that a single substance cannot explain both mental and physical phenomenon. Thus, substance dualists claim that all mental phenomena result from modifications or permutations of mental substance. All physical phenomenon, in contrast, result from modifications or permutations of physical substance. Importantly, substance dualism holds that mental substance and physical substance are irreducible to one another. Rene Descartes probably stands out as the most famous substance dualist.[106]

Substance Monism: Substance monism holds that only one type of substance exists; there is only one kind of entity in the universe. According to substance monism all of the universe's phenomena-- both mental and physical phenomena--result from some sort of modification or permutation of a single kind of entity. The two most common versions of substance monism are monistic physicalism (also called physicalism or materialism) and monistic idealism (also called idealism).

The Domain Hypothesis: According to Wallis the domain hypothesis refers to the often tacit theoretical supposition that some diverse set of phenomena, in fact, form a common set of interrelated phenomena (i.e., a domain). In this chapter Wallis suggests that the development of the Greek concept of the soul ultimately leads thinkers to formulate a domain hypothesis with regard to mental processes and properties. That is, theorists ultimately come to suppose that mental processes and properties form a common, interrelated set of phenomena—a domain.

The Common Locus Hypothesis: According to Wallis theorists forward the common locus hypothesis whenever they come to suppose that a set of interrelated processes and properties have a common locus—that there is a single thing that has the properties and where the processes occur. In this chapter Wallis suggests that the development of the Greek concept of the soul ultimately leads thinkers to formulate a common locus hypothesis with regard to mental properties and processes. That is, theorists ultimately come to suppose that there is a single entity—the mind—that has mental properties and in which mental processes occur.

The Mental Distillation Hypothesis: The process of property and process accretion through which theorists come to identify the contemporary mental processes and properties with the soul also infuses the notion of the soul with other, non-mental properties. Once Greek thinkers have come to accrete the set of contemporary mental properties and processes to the soul, they must also disentangle other properties and processes from that entity. Wallis calls this the mental distillation hypothesis.

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