

5 Defining the Problem

Introduction

This chapter is a milestone in our study of the mind-body problem. Previous chapters have prepared the way for the two critical tasks that are undertaken here, (1) defining what the mind-body problem is, and (2) describing what would count as a solution to this problem. There is nothing more important in our quest to solve this mystery. Understanding the nature of the problem takes us more than halfway toward its solution.

Simple Ignorance versus Paradox

In Chapter 2 we saw that the method of reduction breaks reality into two different categories, Elements-of-reality and Information. By definition, the Elements-of-reality are things that are irreducible, such as elementary particles, time and distance. In comparison, Information is what can be transmitted over a communications channel. This way of thinking is the basis of modern science, as well as our everyday common-sense. However, when we try to analyze the mind with this strategy we come to an obvious discrepancy. This situation arises because we can examine the mind from two different perspectives, the *first-person* and the *third-person* viewpoints. As presented in Chapter 3, when we look at the mind from the third-person view we see pure Information. In comparison, in Chapter 4 we found that the first-person perspective sees the mind as one or more Elements-of-reality.

Now, the problem in all of this could not be more obvious; how is it possible that one perceives their mind to be the exact

opposite of what science contends it to be? This apparent contradiction is the mind-body problem in its most basic form; it is the thing that we seek to understand. Figure 5-1 illustrates this deep discrepancy; observers that should agree, couldn't disagree more.

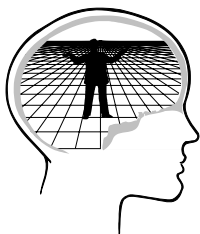
Of course, there are other mysteries about the brain's operation that are not included in the mind-body problem. For instance, science does not yet understand how learning and memories come about from synaptic changes. However, this is a completely different category of problem; it is a mystery totally contained in the third-person perspective. In other words, it is a matter of **simple ignorance**; we observe something and cannot immediately understand how to consolidate what we see with our previous knowledge. In comparison, in the mind-body problem we seem to understand what we are observing, but those observations are inherently contradictory. In other words, the mind-body problem is a **paradox**, something that is far more serious.

To illustrate this difference between simple ignorance and a paradox, let's look at two famous scientific problems that were solved in the last century. The first problem is how life continues from one generation to the next. For thousands of years, the common belief was that life involved some sort of mystical substance, often referred to as the *vital force*. Even though it could not be directly observed, it seemed clear that living things had it, and nonliving things did not. Life was seen as continuing from generation to generation by passing the vital force from parents to children. This was accepted as a reasonable explanation that accounted for the observations. Of course, this view was shattered in the 1950s with the discovery that the molecular structure of DNA held the instructions for creating new life, and that the vital force was nothing more than a myth.

The important point is that this is a case of simple ignorance; scientists look at something from the third-person

The First-Person View

When we look from the inside, the mind is one or more Elements-of-Reality



As evidenced by:

- Qualia
- Mental unity
- Semantic thought
- Present tense
- Free-will

The Third-Person View

When we look from the outside, the mind is nothing but Information

As evidenced by:

- Brain structure
- Brain function

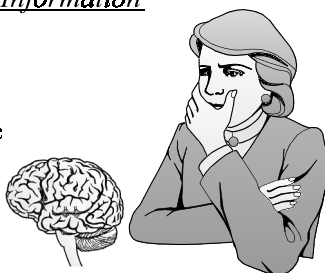


FIGURE 5-1

The mind-body problem. From the first-person viewpoint the mind appears as one or more Elements-of-reality, but to the third-person viewpoint it appears as pure Information.

perspective and don't understand it, or even worse, they misunderstand it. Science isn't perfect; it doesn't have a complete knowledge about the world and is bound to make mistakes. This is an inherent part of the scientific method.

This can be compared to the **twin paradox**, one of the most confusing aspects of *Special Relativity*¹ discovered by Albert Einstein in 1905. As typical in Einstein's work (see Fig. 5-2), this is based on a thought experiment. Suppose that we take a pair of identical twins, keep one on earth, and send the other to a distant star in a spaceship. Since stars are incredibly far apart, the spaceship will need to travel very fast, almost at the speed of light. One of the basic principles of special relativity is that *motion is relative*. That is, the twin on earth sees his brother moving away rapidly, while he remains stationary. On the other hand, the twin in the spaceship sees himself as stationary, while his brother and the earth are moving away.

Next, we bring in a second basic principle of special relativity, that is, *time moves slower at high speeds*. This means that the twin on earth sees his brother aging very slowly because of the spaceship's rapid motion. However, the twin in the spaceship thinks his time is passing normally, while he sees his brother, and everyone else on earth, aging more slowly. This comes to a head when the spaceship completes its mission and returns to the earth. When the brothers meet, each expects to see the other as much younger than himself. Of course, they can't *both* be younger than the other. This discrepancy is more severe than simply not being able to understanding our observations. A paradox has arisen; two sets of observations that should both be correct, are contradictory to each other.

The point is, the modern study of the mind involves two different types of problems. The first problem is understanding the structure and function of the brain, which is a matter of *simple ignorance*. The second problem is the mind-body problem, which is a *paradox*. The purpose of this book is to present a solution to the second problem, to resolve the discrepancy between the first and third person views. But even

1. Relativity: The Special and General Theory, Albert Einstein, Reprinted 1995, Crown Publishers, 188 pages. Read the master's own words! Mathematical, but written for a general audience.

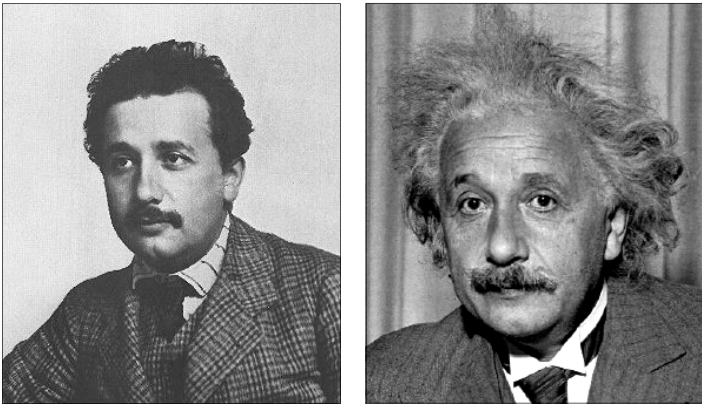


FIGURE 5-2

Albert Einstein (1879-1955). Einstein was a German-American physicist, best known for his discoveries of Special and General Relativity. Perhaps his greatest talent was being able to visualize problems in simple terms, and then analyze the consequences with rigorous mathematics. For instance, he wondered what it would be like to ride on a beam of light, or be trapped inside a moving elevator in space. These simple questions lead him to a mathematical description of curved space-time, the fundamental structure of the entire universe. Einstein struggled through his early school years, with his teachers believing he would never amount to much. Fifty years after his death, Einstein is widely regarded as one of the two greatest scientists of all time (the other being Isaac Newton)

if successful, the problems involving simple ignorance will still remain. Understanding the structure and function of the brain will likely require many decades of research.

By the way, which twin is right? In 1915, Einstein published a far more extensive theory called *General Relativity*, which shows that the passage of time is also slowed by gravitational fields and acceleration. Since the twin in the spaceship is the one who underwent the acceleration during takeoff and landing, he is the one who ages more slowly. We will hear more from Einstein in the next chapter.

The One and Only Problem

A variety of well-crafted examples have been presented over the years to illustrate the mind-body problem. These have proven very useful in shaping our understanding of the issues at hand. However, a key teaching of the Inner Light theory is that every one of these examples, every description of the mind-body problem ever written, can be reduced to a single issue. And this issue is what we have spent the last four chapters developing: *the third-person sees the mind as Information, while the first-person sees the mind one or more Elements-of-reality*. This is the root of the mind-body problem; everything else is just window dressing.

To illustrate this, Fig. 5-3 shows two lists. The “A” list contains words and phrases of how the mind is seen from the perspective of the third-person. As such, all of these items are *Information*. In other words, each of the entries on the “A” list could be reconstructed by a distant alien civilization, provided that we give them the assembly instructions and they have locally available Elements-of-reality. On the other hand, the “B” list contains words and phrases of how the mind is seen from the first-person viewpoint. These are all Elements-of-reality, things that are irreducible, entities that cannot be transmitted over a communications channel.

Now suppose that we want to develop a new argument illustrating the mind-body problem. We pick an entry from the “A” list and hold it up in our right hand, and pick an entry from the “B” list and hold it up in our left hand. We then proclaim: *“See, they are not the same; they have different characteristics; one cannot explain the other.”*

Let’s look at several examples from the philosophical literature to see how this strategy is used. To start, we will look at the catchy phrase from Patricia Churchland:

How do you get awareness out of meat?

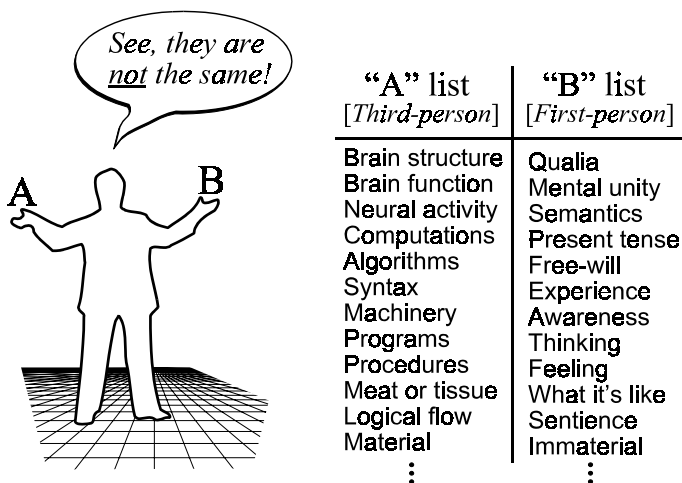


FIGURE 5-3

A recipe for creating examples. Examples of the mind-body problem can be created by picking an entry from the “A” list (Information as viewed from the third person), picking an entry from the “B” list (Elements-of-reality as seen by the first-person), and then discussing why the two items are not the same.

This gets right to the point; we have an item from the “A” list, an item from the “B” list, and an insinuation that they are not the same thing. In this same way, we can question the possibility of manmade machines becoming conscious:

$\begin{matrix} \text{A} \\ \downarrow \\ \text{Can computers think?} \\ \uparrow \\ \text{B} \end{matrix}$

Likewise, American philosopher and law professor Thomas Nagel invites us to imagine consciousness in lower animals:²

$\begin{matrix} \text{A} \\ \downarrow \\ \text{What is it like to be a bat?} \\ \uparrow \\ \text{B} \end{matrix}$

2. “What is it like to be a bat?,” Thomas Nagel, *The Philosophical Review* LXXXIII, 4, Oct. 1974, pp 435-450. Widely cited article stressing the first-person view of the mind. Look for it on the web.

Other interesting examples of the mind-body problem are in the form of short stories or scenarios. For instance, Australian philosopher Frank Jackson poses the story of **Mary**,³ a brilliant scientist who is forced to investigate the world from a black and white room via a black and white television monitor. In spite of her situation, Mary learns all that there is to know about the physical aspects of color, such as the wavelength of light, the different sensory cells in the eyes, and the neurophysiology of the brain. Then one day Mary is released into the world and has her first experience of actually seeing color. This is something new to her, something she has never known. Therefore her knowledge of the *physical aspects* of color (a member of List “A”) is not the same as her *experience* of color (a member of List “B”).

Perhaps the most well known example of the mind-body problem is called **The Chinese Box**,^{4,5} developed by the American philosopher John Searle. Imagine being locked in a small room with nothing but a rule book, a pencil, and paper. Through a slot in the door you are passed Chinese writing, which you find incomprehensible since you do not understand this language. Nevertheless, you blindly look up each symbol in the rule book, which tells you the appropriate symbols to write down on a sheet of paper. When the rule book indicates you are done, you obediently pass the paper back out of the slot.

On the outside of the room, a native Chinese speaker is having a delightful exchange. He writes down questions in Chinese, passes them into the slot, and receives an answer back in Chinese. In other words, your activity in the room, in

3. “What Mary didn’t know,” Frank Jackson, *The Journal of Philosophy* LXXXIII, 5, May 1986, pp 291-295. Search the web.

4. “Minds, brains, and programs,” John R. Searle, *Behavioral and Brain Sciences* 3: pp 417-424. See ref. 5 for updated version.

5. *The Mystery of Consciousness*, John R. Searle, 1997, New York Review of books, 224 pages. Excellent review of the present status of the mind-body problem, covering modern approaches from pure science to philosophy. At the top of the recommended reading list.

combination with the rule book, is sufficient to carry on a written conversation in this foreign language.

Now imagine that we replace you and the rule book with a computer that carries out exactly the same actions. That is, we give it Chinese writing, and it gives us back a reply in Chinese, all according to some predetermined computer program. The question Searle asks is this: Does the computer understand what it is doing? According to Searle, the answer is clearly no; if the man in the room doesn't understand Chinese, then it is not possible that the computer understands it either. In short, *syntax* (the logical operations carried out by the computer program) is not the same as *semantics* (i.e., the kind of understanding or meaning that occurs in actual minds). Again we see the same pattern; an entry from the "A" list (syntax) is compared with an entry from the "B" list (semantics), with a discussion of why they are not the same.

This brief overview certainly does not do these examples justice; they are thought provoking and full of twists and turns. The point is, all of these rest on the foundation of the same problem, and it is this foundation that we must identify and attack. It does little or no good to compare individual items from the "A" and "B" lists. What is needed is an explanation of why *everything* on the "A" list is different from *everything* on the "B" list. Anything less will be insufficient, and anything more will be superfluous.

To understand this better, imagine that we want to prove that a *magnetic field* and an *electronic document* (such as created by a word processor) are not the same thing. As our primary argument, we will use the method of reduction, and state:

Primary argument

A magnetic field is an Element-of-Reality;

An electronic document is Information;

Therefore, a magnetic field is not an electronic document.

We can also use a secondary argument, based on showing that the characteristics of the two things are not the same:

Secondary argument

A magnetic field has characteristics: P, Q, R, S, T.

An electronic document has characteristics: U, V, W, X, Y.

Therefore, a magnetic field is not an electronic document.

The point is, if the primary argument is valid, the secondary argument is unneeded and contributes nothing. If one thing is an Element-of-reality, and another thing is Information, we have proven that the two things are different to the full extent of our knowledge. In other words, the method of reduction has taken the issue to its ultimate conclusion, and we can learn nothing more by examining the details.

This leads us to the second of the major teachings of the Inner Light Theory:

Major Teaching #2:

Definition of the Mind-body Problem

There is one and only one issue in the mind-body problem: *How can the mind be seen as Information from the third-person perspective, but as one or more Elements-of-reality from the first-person viewpoint?* This is the question we are seeking to answer, the heart of what puzzles us about consciousness.

Furthermore, this also specifies what is required of a solution to this puzzle. Solving the mind-body problem is the same as explaining the discrepancy between the first and third-person observations. No more is required, and no less will suffice.

Previous Attempts at Solving the Problem

In this section we briefly look at previous approaches that have been tried to solve the mind-body problem. These methods fail for a variety of reasons. But in their failure we can learn a great deal about the nature of the problem, and how a potential solution must be evaluated. We will start by examining three traditional approaches, *materialism*, *idealism*, and *dualism*. These have been around for hundreds or thousands of years in the philosophical literature. Next, we examine three methods from modern day philosophy and science, *epiphenomenalism*, *emergence*, and *quantum mechanics*.

Since the mind-body problem is a conflict between two points of view, an obvious approach to solving the dilemma is to assert that one of the points of view is wrong. This is the approach taken by **materialism**,⁶ which maintains that the third-person view of the mind is correct, and what is seen from the first-person perspective is in error. This means that the world of science is the only thing that we can believe, and what we learn by introspection is flawed and not reliable. As evidence, materialists point out that much of what introspection tells us is obviously mistaken. For instance, when we look at optical illusions we see something that is different from how the world really is. As even stronger evidence of our introspective fallibility, each of us spends several hours a day living in a world that clearly does not exist, something that we call dreaming. If we are mistaken about these kinds of things from the first-person perspective, isn't it possible that we are mistaken about all of our introspective experiences?

The flip side of this is called **idealism**, claiming that the first-person view is correct, and the third-person view is mistaken. This means that scientific observation is an illusion;

6. Consciousness Explained, Daniel Dennett, 1992, Little, Brown & Company, 511 pages. Popular, written for general audiences. Uses scientific and philosophical arguments to convince us that our introspective world is an illusion. This idea has offended many.

there is no universe that exists independently of our thinking about it. The only thing that has a real existence is our mind, with its thoughts and ideas (hence the name, *idealism*). Interestingly, dreams can also be cited as evidence for the idealist position. If we can create our own private universe when we are dreaming, how do we know that we aren't creating our waking universe in the same manner? This book in front of you seems real, something that exists independently of your mind. The problem is, tonight when you dream about this book it will seem just as real, just as independent of your thoughts. Of course, it won't be. Idealists claim that the only thing we know for certain is that our minds exist; all else is just baseless supposition.

Materialism and idealism assert that one of the two perspectives is flawed. The problem is, most people thinking about the problem don't buy it; both of the views seem inherently correct. Nothing seems more obvious to us than the joint existence of the external world of science *and* the inner world of our own mind. There is a saying in science, popularized by the American astronomer Carl Sagan (1935-1996): "*Extraordinary claims require extraordinary evidence.*" The claims made by materialism and idealism are certainly extraordinary; they contradict our common sense understanding of reality at a fundamental level. Of course, this is not proof that they are false. However, the evidence in support of these positions is not compelling; in fact, it is almost nonexistent. While both realism and idealism are logically possible, little or nothing is given to make us believe that they are correct.

This leads us to **dualism**, which contends that both viewpoints can be taken at face value; the universe seen from the third-person perspective exists, as does the world of our inner thoughts. The first and third-person viewpoints disagree about the nature of the mind simply because they are looking at two different things. The third-person sees mindless neural activity in the brain, while the first-person is in direct contact with some sort of elusive mental reality, something that is

beyond our physical world. Dualism is a straightforward interpretation of what our senses tell us. We see an external world; we see an internal world; they both seem to be real; and they are not the same. In other words, the evidence for dualism is our personal observation that the mind and body are separate things. Given this, it is not surprising that dualism is the oldest and most widespread belief about the nature of the mind. Most religions are inherently based on the belief that humans have a soul or spirit that can exist independently of their bodies, such as after death.

Even though dualism is logically possible, it is deeply inconsistent with the scientific evidence. For instance, if the mind and brain are separate entities, why does damage to the brain result in damage to the mind? Even more troubling, if a person's actions are controlled by an independent mind, why does science observe the brain to be in control? While these and similar arguments are not absolute proof, the scientific evidence against dualism is more than compelling. As discussed in Chapter 3, science sees a mind that is embodied in the activity of the brain, and not a separate mental world.

In short, all three of the classical solutions are logically *possible*, but are starved for evidence that they are *true*. Add to this that realism and idealism conflict with our personal observations, and that dualism is at odds with the scientific evidence. Now let's turn our attention to the three modern day approaches to the mind-body problem and see if they are any more convincing.

Epiphenomenalism⁷ is an attempt to modify dualism such that it does not conflict with the scientific evidence. In this solution, the brain controls all body activity, just as described in

7. The Conscious Mind: In Search of a Fundamental Theory, David J. Chalmers, 1997, Oxford University Press, 414 pages. Uses philosophical arguments to emphasize just how difficult the mind-body problem really is. Very popular; good technical philosophy. Very questionable suggestion that epiphenomenalism is useful.

medical textbooks. However, it is claimed that brain activity alone cannot account for our first-person experiences; there must be a separate “mind” to do this. The distinguishing feature of epiphenomenalism is that the “mind” is an observer only, it cannot affect the brain or body in any way. As you go about your daily activities, your brain is in control of analyzing data from your senses, making decisions, moving your body, controlling your speech, and so on. In contrast, all your mind can do is watch these events unfold, without having power to change them in the slightest. Simply put, your mind is connected to your eyes and ears, but not your arms, legs, or tongue. In the jargon of the field, the mind is only an epi-phenomenon, meaning it exists upon or beside the main event.

Epiphenomenalism is important because of how it fails. While the three traditional methods are “possible but lacking in evidence,” epiphenomenalism does not provide a logically possible solution. The fundamental principle in this approach is that the “mind” cannot affect behavior in any way; all of our thoughts and actions are determined solely by the machine-like activity of the brain. In fact, even if our minds did not exist, our brains would carry out exactly the same day-to-day activities, and the entire history of mankind would be unchanged.

Herein lies the problem. If epiphenomenalism is true, then all of our words and writings about consciousness have nothing meaningful to say about the issue. After all, every book and article on consciousness would be exactly the same whether the mind did or did not exist, and any characteristics that the mind may or may not have. In short, accepting this as a solution to the mind-body problem leads us to the conclusion that we cannot think, speak or write about the problem in the first place. This is the logical quagmire of epiphenomenalism; it says of itself: “*I am meaningless.*” Of course, our introspective experience tells us that this entire line of reasoning is flawed. If we know anything at all, we know that we can think, speak, and write about the nature of our minds.

As previously discussed in Chapter 2, **emergence**⁸⁻¹¹ is one of the basic strategies we use to understanding the world around us. It works from the bottom-up, with complex entities being created from more simple structures. Just as a candle flame arises from the wick, wax and air, the human mind is viewed as arising from the neural activity of the brain. Emergent entities, such as candle flames and minds, are claimed to be more than just the sum of their components; they have an existence of their own. Emergence is very attractive to those studying neural networks and artificial intelligence. In short, it contends that if we look hard enough at brain activity, we will eventually find the recipe that accounts for the first-person experience.

Emergence is a powerful technique, and its importance in understanding the mind and brain should not be underestimated. In fact, it is the primary way that we will solve the mysteries regarding the structure and function of the brain, those problems that involve simple ignorance. But that is not the task at hand; our concern here is to resolve the paradox of the mind-body problem. And to do this we must find an explanation of why the third-person viewpoint sees the mind as Information, while the first-person perspective sees Elements-of-reality.

Can emergence provide such an explanation? The answer is no, it cannot. Emergence is a manipulation of Information, placing it in a form that humans can more readily understand and accept. But regardless of how Information is rearranged or packaged, it is still just Information; emergence does not have

8. Stairway to the Mind, Alywn Scott, 1995, Copernicus Books, 229 pages. Emergence from the viewpoint of a mathematician.

9. The Race for Consciousness, John G. Taylor, 1999, MIT press, 380 pages. From the view of a physicist and neural network expert.

10. The Astonishing Hypothesis, Francis Crick, 1994, Touchstone, 317 pages. Crick received the Nobel Prize in 1962 for discovering the structure of DNA. Seeks consciousness through brain research.

11. A Universe of Consciousness, Gerald M. Edelman, 2000, Basic books, 288 pages. Edelman received the Nobel Prize in 1972 for work on the chemistry of antibodies. A neuroscience viewpoint.

the power to create an Element-of-reality. This is inherent in how the methods of emergence and reduction operate, as discussed in Chapter 2. In short, emergence fails as an approach to the mind-body problem because it is powerless to explain what must be explained.

Our last approach is Quantum Mechanics, a topic so intriguing that we will give it its own section.

Quantum Mechanics

Quantum Mechanics deals with the world of the very small. Scientists began investigating this area during the first few decades of the 20th century (see Fig. 5-4). They found that atoms are composed of three smaller entities, the electron, proton, and neutron. Other residents of this subatomic world were also discovered, and given names such as the photon, muon, neutrinos, and quarks, to name just a few. But just what exactly are these things? Conventional science knows about two types of phenomena. First, there are **waves**, including sound waves, radio waves, waves on the surface of water, and so on. Second, there are **particles**, which are just chunks of matter, such as specks of dust, cannon balls, planets, and raindrops. Scientific commonsense tells us that the inhabitants of the subatomic world will also fall into these two categories; they must be either waves or particles.

Fortunately, waves and particles have very different characteristics and simple experiments can tell them apart. To start, we need a source of the subatomic entity that we want to test. For instance, this might be a radioactive material that emits neutrons, a light bulb that produces photons, or a glowing hot wire that gives off electrons. In this example we will arbitrarily assume that we are using electrons, just to give us a name to refer to. However, other subatomic particles would produce the same result.

Figure 5-5 shows the apparatus we will use. We will force the electrons being emitted from the source to pass through a

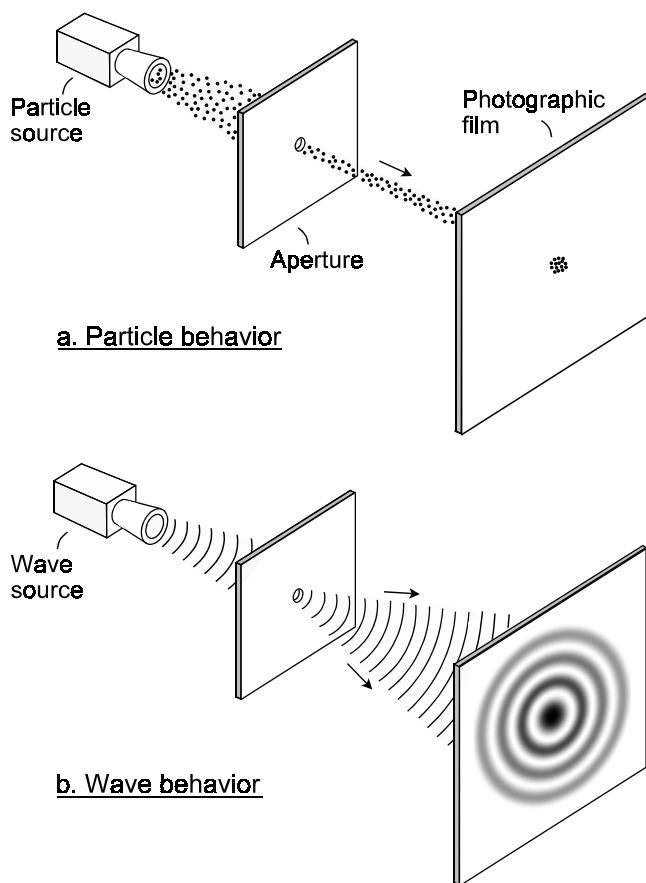


FIGURE 5-4
Werner Heisenberg (1901-1976) and Niels Bohr (1885-1962).
[Left and right, respectively]. Pioneers in Quantum Mechanics.

small aperture, such as a hole in a thin plate of metal. The electrons that exit the aperture are then detected by a sheet of photographic film, which is sensitive to electrons in the same way that it is sensitive to light.

If electrons are particles, as illustrated in Fig. 5-5a, they will travel in a straight line from the aperture to the photographic film. The developed negative will therefore show a group of dots in a circle about the same size as the aperture, with each dot corresponding to a single electron being detected.

In contrast, Fig. 5-5b shows what will happen if electrons are waves. After passing through the aperture, the waves will expand many times in size before striking the photographic film. Also, they will form into a series of smooth concentric circles, a pattern referred to as an “Airy disk” (named after George Biddell Airy, a British astronomer who first explained the pattern in 1835). By “smooth” we mean that there is a gradual change between the dark and light regions in the pattern, without sharp edges or discontinuities. This behavior of waves is well known in science and completely understood.

**FIGURE 5-5**

Particle and wave behavior. As shown in (a), particles move in a straight line and interact as individual events. In contrast, (b) shows that waves expand as they travel, and interact as a series of smooth concentric rings, a pattern called an *Airy disk*. These behaviors are well known in science and fully understood.

Now we come to the moment of truth; we turn on the electrons, run the experiment for a short time, develop the film, and look at the photograph. Do we see a large *Airy disk* with smooth rings, or a small circle of dots?

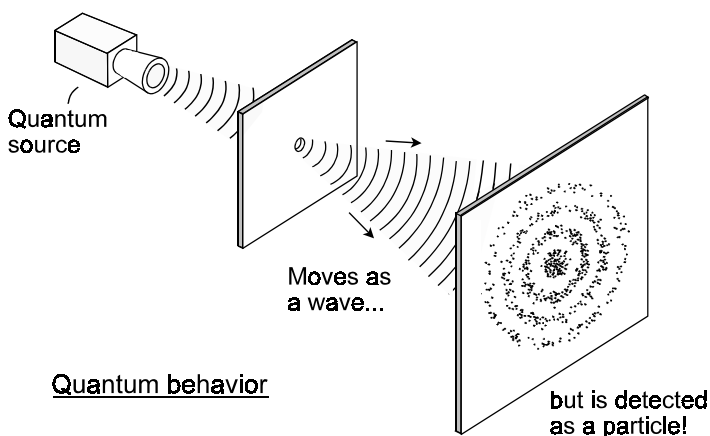


FIGURE 5-6

Quantum behavior. Quantum entities move as a wave, but then abruptly collapse into a particle when they are measured. The location that the particle comes into existence is random and totally unpredictable (except in a probabilistic sense). If you don't understand how this could happen, don't worry; nobody understands how this could happen.

Much to our surprise, we find a mixture of these two results. As shown in Fig. 5-6, the photographic film records an *Airy disk* that is formed from *individual dots*.

To understand just how strange this is, pick an individual dot in one of the rings and try to analyze how it could have been produced. In order for the photographic film to be exposed at this location, the electron must have moved as a wave between the aperture and the film. However, the individual dot means that the electron interacted with the film as a particle. In short, the electron behaves as a wave, but then suddenly turns into a particle when it is measured. This strange transformation is referred to as the “**collapse of the wave function.**” As previously mentioned, this wave-particle duality is seen in all entities of the subatomic world, not just electrons.

This aspect of Quantum Mechanics bewilders scientists to this day. Consider this passage from one of the founders of Quantum Mechanics, Werner Heisenberg (Fig. 5-4):

“I remember discussions with Bohr which went through many hours till very late at night and ended almost in despair, and when at the end of the discussion I went alone for a walk in the neighboring park I repeated to myself again and again the question: “Can nature possibly be as absurd as it seemed to us in these atomic experiments?”

Quantum Mechanics has now been around for nearly a century, has been experimentally verified beyond all doubt, and is mathematically expressed in fine detail. Even so, the nature of the wave collapse is still as mysterious and puzzling today as it was to Heisenberg and his colleagues. What is the nature of the wave before it is measured? What causes the wave to collapse? Where exactly does the transition from wave to particle occur? These questions strike at the very heart of our ability to understand the reality we exist in. And the more one looks at these questions, the stranger they become.¹²

Einstein was a great skeptic of Quantum Mechanics, in spite of making many contributions to its success. For decades he presented Niels Bohr with thought experiments designed to show that Quantum Mechanics was incorrect, or at the very least, incomplete. In his heart, Einstein continued to believe that the quantum world must consist of ordinary waves and particles. Bohr closed Einstein’s loopholes one by one, but in the minds of these two giants the issue was never settled. On the day that he died, Bohr had a drawing of one of Einstein’s thought experiments on his blackboard. This great intellectual exchange is now referred to as the *Bohr-Einstein debates*.

12. Quantum Reality, Nick Herbert, 1985, Doubleday, 255 pages. What Quantum Mechanics says about the nature of our reality. For a general technical audience. Well written; highly recommended.

What does this have to do with consciousness? At the most basic level, Quantum Mechanics and consciousness are both frustrating mysteries. The question is, are these two mysteries connected in some way? Many renowned scientists believe that such a connection does exist. Unfortunately, their reasons are highly speculative and poorly defined, to say the least.

For instance, John Von Neumann (Fig. 5-7) worked out the formal mathematics of Quantum Mechanics in 1932. As part of this, he tried to determine where the wave collapse occurs. Finding no special location, he concluded that it must be at the one place he did not understand, the interface between the mind and the body. The logic of the situation forced him to reluctantly accept the idealist view that reality is created by our minds. It must be remembered that Von Neumann is often regarded as the greatest mathematician of the 20th century. If he concluded that something was true, you had better think twice before disagreeing!

Von Neumann's reasoning is simple:

Since Quantum Mechanics cannot be understood by itself, something like consciousness must be involved.

FIGURE 5-7
John Von Neumann (1903-1957). Hungarian-American John Von Neumann is often considered to be the greatest mathematician of the 20th century. If it was new and exciting, Von Neumann was there to lend a hand! His concept of a stored program is the foundation of modern computers. He is also known for his work on the atomic bomb and his development of the formalized mathematics used in Quantum Mechanics.



Now we want to look at the flip side of this, a view that is expressed in the work of Roger Penrose.¹³ Penrose enters this debate with the claim that humans are capable of solving certain mathematical problems that cannot be solved by computers. For instance, consider the statement: “This sentence is unprovable.” After a considerable amount of thought, a human will judge this statement to be true. The reason is, judging that the statement is false results in a logical contradiction. However, Penrose claims that this conclusion cannot be reached by computational means; something more is required. In other words, the human mind has mathematical abilities above and beyond what can be explained by neural activity. To account for this extra ability, Penrose suggests that quantum effects may be at work. Simply put:

*Since consciousness cannot be understood by itself,
something like Quantum Mechanics must be involved.*

In conjunction with Stuart Hameroff,¹⁴ Penrose speculates that the underpinnings of consciousness arise in *microtubules*, tiny tube-like structures contained within nerve cells. Quantum effects in the microtubules influence synaptic activity, thereby linking the operation of the brain with the quantum world. A particularly interesting part of this view is that the wave function collapses because of a natural process, a new physical principle called *quantum-gravity*. In the Penrose-Hameroff model, quantum effects cause consciousness, not the other way around as seen by Von Neumann.

In summary, theories about quantum-consciousness come in two general varieties: (1) consciousness causes the wave

13. Shadows of the Mind, Roger Penrose, 1996, Oxford University Press, 457 pages. Very difficult reading. Penrose is a prominent mathematical physicist, well known for his work on black holes.

14. “Quantum coherence in microtubules: A neural basis for an emergent consciousness?” S.R. Hameroff, 1994, *Journal of Consciousness Studies* 1:91-118. Search the web for current work.

function to collapse, and (2) the wave function collapse causes consciousness. Taken separately or together, these possibilities lead to a variety of different scenarios about the nature of the mind and its relationship to reality.

While a connection between consciousness and Quantum Mechanics is intriguing, there is little evidence that it is true. Experts are very skeptical of the arguments presented by Von Neumann and Penrose. Even if they are true, there is an enormous gap between seeing a few dots on a photographic film and explaining introspective experiences such as qualia, free-will and semantic thought. If there is a connection between Quantum Mechanics and consciousness, it must be shown by hard evidence, not just the possibility that an answer is hiding in the unknown. To date, this evidence is not there, not in the slightest.

In addition, there is a colossal reason to believe that Quantum Mechanics and consciousness are *not* related. Quantum effects generally occur at very small distances, far smaller than nerve cells and synapses. This makes it very difficult to believe that neural activity is affected by the quantum world. It is much like trying to imagine how birds and insects could affect the path of a hurricane. The vast majority of scientists dismiss the possibility that Quantum Mechanics is related to brain activity. And if it doesn't affect brain activity, it is difficult to understand how it could be related to consciousness.

Whether consciousness is involved or not, the mysteries of Quantum Mechanics will continue to intrigue scientists and philosophers alike. This is one of the great puzzles of our time.

Moving Forward

These brief descriptions of the previous approaches only capture their flavor, not their full substance. There are many variations and subtle issues that we have ignored altogether. Nevertheless, this short presentation demonstrates the wide variety of approaches that have been used, and the equally wide

variety of ways that they have failed. But from these failures we can learn what is required of an acceptable solution to the mind-body problem:

- It must be logically possible and not self contradictory.
(*unlike epiphenomenalism*)
- It must be able to explain what must be explained.
(*unlike emergence*)
- It must not merely invoke a mystery to explain a mystery.
(*unlike Quantum Mechanics*)
- It must be consistent with our scientific knowledge.
(*unlike dualism*)
- It must be consistent with our introspective knowledge, or convincingly explain why.
(*unlike materialism and idealism*)
- It must be more than just possible; there needs to be compelling evidence that it is true.
(*unlike most of the previous approaches*)

In the last five chapters we have outlined the problem we are trying to solve. We have also defined what would count as an acceptable solution to this problem. Now it is time to move forward, to start the actual construction of the Inner Light Theory of Consciousness. In the next three chapters we discuss a strange situation that could arise in our universe, something we will call an *Information-Limited Subreality*. As we will see, this holds the solution to the mind-body problem, as we have so carefully defined it in the previous chapters.