IDEAS IN MIND

Ideas in Mind

A Conceptual History of Psychology

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PREFACE

The modern science of psychology is divided into many highly specialized disciplines, which can be integrated into what is known as the biopsychosocial approach. Psychologists investigate the biological basis of behavior in domains such as behavioral and cognitive neuroscience, motivation, and emotion. They also study the psychological domains such as learning, cognition, and perception, and the social domains of social and personality psychology. Some areas, like developmental psychology, encompass all of these domains. Further specialization occurs in the applied areas of clinical psychology, forensic psychology, human factors, and industrial/organizational psychology. Each of these areas is reflected in undergraduate psychology curricula; psychology majors at most universities take a selection of courses in the above topics.

Given the variety of specific research areas in psychology, it can be easy to forget that the material covered in all of those classes is connected at a fundamental level. They are all part of psychology, and knowledge from each topic is part of our ever-increasing understanding of the human mind and behavior.

One goal in a course on the history of psychology is to find the connections between these seemingly disparate fields of study. It is to be hoped that you will see they are not so different after all. In order to achieve this goal, we have to go back in time before psychology was so specialized and divided. However, that only takes us back a little more than 100 years into the latter part of the 19th century. While much could be learned about the origins of modern psychological research by studying the work done in this time, we really need to go back much further to connect all the dots. As we will see, questions about the nature of the human mind and behavior did not begin with the early psychologists of the 19th century. These questions have been around, perhaps, as long as humans have been around.

OVERVIEW OF THE BOOK

Chapter 1 will begin as a brief primer in philosophy of mind. Many ideas that may be new to psychology students will be presented here in brief form but will be revisited multiple times over the remaining chapters. You can use this chapter as a reference and come back to it when reading later chapters.

In Chapter 2 we will begin the retrospective into the history of psychology by starting with the ancient Greek philosophers. It may not seem obvious why we should discuss such old philosophy—but one of the main topics in philosophy over the millennia has been the human mind. It is called *philosophy of mind*, and one of the main goals in this book will be to trace the development of the philosophy of mind, beginning with the ancient Greeks, up through the ages until the rise of modern psychology. As you will see, psychology as a science arose when it became possible to address certain philosophical questions using the scientific method.

Chapter 3 continues this theme by discussing how Greek philosophy laid the foundation of much of

Western thought. In addition, in this chapter we will look into an important question in the philosophy of mind called the *Problem of Universals,* and also the founding statements of modern science.

In Chapter 4 we will address another classic philosophical problem relevant to psychology known as the *Mind-Body Problem* and introduce an important theme known as the veil of perception.

Next, Chapter 5 highlights the rise of a new force in philosophy called *British Empiricism*. This trend placed an emphasis on science as a way of knowing, and played an important role in early psychology, especially learning and perception.

Philosophical and scientific thinking have often differed between continental Europe and Great Britain, and after the development of British empiricism, a contrasting movement arose in German philosophical interests, as covered in Chapter 6. This *rationalist and constructivist philosophy* was also highly influential in early psychology.

Chapter 7 addresses the rise of two new sciences in the early 19th century: *neuroscience* and *psychophysics*. While the practitioners of these sciences considered themselves physiologists, not psychologists, we will see how much of their work shaped the beginning of scientific psychology.

Chapter 8 furthers this discussion in its coverage of the very first modern psychology research laboratory, at the University of Leipzig, and its founder, Wilhelm Wundt. As the first modern experimental psychologist, Wundt essentially trained the first generation of psychologists, many of whom are also noted in this chapter. Continuing in the realm of European psychology, Chapter 9 visits the *Gestalt Psychology* movement.

Chapter 10 jumps ahead a bit in time and space. The discussion of Gibson's theory of direct perception and his *ecological approach* provides an important contrast and conclusion to the perceptual theories discussed throughout the preceding chapters.

Not long after Wundt and his students set up their labs in Germany and the rest of Europe, William James and the first generation of American psychologists were establishing themselves in the United States. One of their main inspirations was Charles Darwin and his theory of natural selection, which is addressed in Chapter 11, alongside its applications to psychology. Chapter 12 surveys the development of early American psychology and its first official school of thought, *Functionalism*.

Another implication of Darwin's theory was that psychologists could study animal behavior and generalize their findings to human behavior, a field known as *comparative psychology*. Much of this work laid the foundation for one of the more significant early schools of thought in experimental psychology, *Behaviorism*. These issues are covered in Chapter 13. This is followed in Chapter 14 by a treatment of the *Cognitive Psychology* movement that overthrew the behaviorist school. Chapter 15 discusses the field of *Developmental Psychology* that emerged from the late 19th century and throughout the 20th century, which ties together influences from several of the preceding chapters.

In Chapters 16–19, the book shifts gears somewhat and looks at the applied field of *clinical and abnormal psychology*, its historical development (Chapter 16), philosophical antecedents (Chapter 17), and modern views (Chapters 18-19). Chapter 20 explores possible the present state of experimental psychology and the potential future directions.

CHAPTER 1: A PRIMER IN PHILOSOPHY

INTRODUCTION

Learning Objectives
Understand:

- The difference between metaphysics and epistemology
- The difference between monism and dualism
- The difference between materialism and idealism
- The mind-body problem
- The difference between rationalism and empiricism
- The difference between realism and nominalism

It seems there must be a thousand "-isms" in this book! I will not assume that you already know something about philosophy, and so everything will be explained at the basic level. Because there are so many philosophical topics, this section will be a gentle introduction and should be a useful reference for you as you progress through the text.

There are two main areas in philosophy that will be important to understand: metaphysics and epistemology. The latter is more obviously relevant to psychology, but as we will see, the former must be considered as well, so let's start with that.

METAPHYSICS

Metaphysics is the philosophy about reality. It is a philosophy about the nature of the universe. The prefix meta- is from the Greek for "beyond" or "after," so this is a study of physics beyond the science of physics. A central question in metaphysics, which we will endeavor to show has implications for psychology, is this: is the *true nature* of reality the same as the reality we can see, touch, hear, taste, and smell? While scientists use their powers of observation to study reality, many metaphysical philosophers (or metaphysicians) instead use logic and reason to deduce what must be true about the universe. One branch of metaphysics is *ontology*, which is the philosophy about what exists. We can ask many questions about what exists vs. what does not exist, and as we shall see, the answers to these questions must be considered prior to discussing the mind. For example, when considering the infamous *mind-body problem*, one relevant question is whether the mind even exists!

Another key ontological issue is called the *Problem of Universals*. In our minds we can think of universal (a.k.a. general, abstract) ideas such as truth, beauty, freedom, and justice, and the ontological question is whether these things are simply abstract ideas that exist only within our minds, or are they real things that actually exist somewhere "out there[1]" in the universe? The name for the former belief, that universals are just ideas that exist only within our minds, is ***nominalism***. The latter, contrasting idea that universals are real is called ***realism***.

Universals are not always such obviously abstract things. For example, consider the idea of a dog. When we think of a dog, what are we thinking about? For starters we might think of particular dogs we have seen, such as a German Shepherd, a Chihuahua, a Great Dane, or a Golden Retriever. Each of these particular dogs is very different from the other, in terms of size, body shape, hair color, length and texture (or even the absence of hair in the case of some very unattractive dogs!), and more. Putting these animals side by side, the differences are obvious, but they must have something in common, right? After all, they are all dogs. What is it about them that makes them dogs? We might first think, "Well, obviously it's their DNA." However, modern genetics research has shown that the exact genetic differences that delineate species are not so easily identified[2]. But DNA is not the relevant issue here, because when it comes to simply looking at any of these particular animals, we can recognize them as dogs without needing to conduct genetic testing. A typical 2-year-old child can do this. But on what basis do children learn how to categorize animals and recognize a dog when they see one?

Let's consider some possibilities. Is it four legs? Well, is a dog with three legs still a dog? Of course. Are all four-legged animals dogs? Definitely not. Okay, legs are out; what about the tails? I once had

1. Notice that I put quotes around the term "out there." The reader should be cautioned here that this term is philosophically loaded. If things exist "out there," it implies there is a complementary "in here." What or where is "here" and "there"? The implication behind these terms is that "in here" refers to the contents of one's mind, and "out there" refers to everything else, things that are outside of the mind and exist independently of it. However, this distinction between mental things and real (non-mental) things may not entirely be justified; other perspectives exist. We will get to these other perspectives in later chapters, but for the time being this distinction is used for convenience. But keep this in mind…

2. Does this mean that species are just ideas in our minds and are not genetically real? It's something to consider!

an Australian Shepherd with no tail; was he a dog? Yes, of course he was. My neighbors have some pets with tails; are they dogs? No, actually they are cats. So, tails are out. What about hair? Snout? Pointy ears? Cold noses? Barking? It seems that each of these options lead to the same conclusion: each trait is sufficient but not necessary for an animal to be a member of the general class of things we call dogs, or in other words, for them to possess the essential quality of dogness. We could keep trying, maybe by getting more complex and looking for the conjunctions of the characteristics listed above (i.e., possessing not just any one of those features, but most or all of them), but it is nevertheless a wild-goose chase. This exercise illustrates the distinction between the *particular* and the *general*. Each specific thing, such as the Chihuahua, is a *particular* entity with its own *particular* qualities. The *general* category, "dog", is an idea that incorporates all of the particulars. So, is the general concept of dogness a real thing (realism) or is it just a name (nominalism) we have invented to categorize particular things? Did language itself evolve as a way of making sense of our experiences by grouping things into categories, with accompanying names, that we could then use to communicate and share experiences with others? We will revisit this in more detail in Chapter 3.

When we started asking questions about what is real or not, we implied a division between the contents of the mind (the "in-here") vs. the contents of the physical universe (the "out-there"). This distinction is known as ***dualism***. With dualism, we are assuming the existence of two realms, a mental (a.k.a. psychological) and a physical. It may be apparent that the *problem of universals,* or the problem of realism vs. nominalism, is based on the dualist concern for whether psychological reality exactly matched the contents of physical reality.

Dualism comes in various types. One of the most widely understood versions is known as ***interactionism***, where the mental and physical can interact. For example, through the eyes, one registers the sensory impression of a dog. This sensory impression is a purely physical process that triggers a chain reaction of other physical processes inside the visual processing centers of the brain. At some point, though, this physical process must be converted into a psychological awareness, or conscious impression, of the dog. Further, one can decide to pet the dog, so the psychological idea, or *intention* (see Chapter 8), to move one's hand and pat the dog's head must transform from a mere idea into a physical process in the motor cortex of the brain that initiates the proper neural signals that will move the hand accordingly. In Chapter 4, we will consider Rene Descartes' attempt to explain how this process of mind-body interaction works, also known as the *Mind-Body Problem*.

Another take on dualism is called ***parallelism***. According to this notion, the mental and physical exist side by side, or in parallel with each other, without interacting. That is, there is no exchange of information between the two realms. The mind-body problem is particularly hard to explain with this theory. If the two realms cannot communicate, then how does my thought and intention to move my hand to pet the dog manage to make my actual physical hand move? The parallelist answer is that it does not! I may have the idea that I want to move my hand, and just as I have that idea, my hand moves. The idea here is that both the mental and physical worlds are running separately from each other, but in perfect synchrony. They are more of a reflection of one another instead of an interaction. We will find examples of this also in Chapter 4.

If instead we conclude that only one of these realms exists, then this position is called ***monism***. For example, instead of assuming that there is a reality outside of and independent of the mind, we could ask instead whether there is nothing outside of the mind. Perhaps the mind is all that there is in the whole of the universe. What appears to be an external reality outside of us is perhaps some sort of illusion. This position is called ***idealism*** (only ideas in the mind are real) or sometimes ***immaterial-***

ism (rejecting the existence of solid physical matter). On the other hand, we might suggest that everything is physical rather than mental, and what we consider psychological experience, the contents of the mind, are really just physical things (perhaps electrochemical impulses in the brain). This view is known as ***materialism***, or sometimes ***physicalism***, and is the foundation of much of modern neuroscience. We will encounter some monist philosophies in Chapter 5.

A final metaphysical problem should also be considered. In the problem of *Determinism vs. Free Will*, the metaphysical dilemma addresses the nature of the causal forces that govern the events that occur within the universe. Are events in the universe (and these include human cognition and action) determined by an unbroken chain of prior causes? Or, are there agents (such as humans, but possibly also nonhuman animals) that exercise control over their own thoughts, feelings, decisions, and actions? In the case of free will, any agent so endowed is free to think or act according to their will regardless of any prior events or experiences. This debate is intertwined with aspects of the mind-body problem. In the case of materialist monism, the mind is part of the physical universe, and as such would be governed by whatever laws govern physical bodies. In this view, the science of physics would be the primary science, and ultimately all other sciences, including biology, chemistry, and psychology, would reduce to physics; which is to say that ultimately the laws of physics would explain the phenomena in each of these other areas of study. If one is to assume that the laws of physics are deterministic, that for every physical event there is a prior physical cause, then one can see how materialist monism is connected to a rejection of free will. On the other hand, a dualist view exempts the mind from the constraints of the laws of physics, and thus potentially allows for free will. It is important to note here that while materialism can imply determinism and that dualism can imply free will, these philosophies are not one and the same; some dualists are deterministic while some materialists may not be deterministic.

EPISTEMOLOGY

It may not at first seem obvious why the discussion of metaphysics and ontology is related to the philosophy of mind, and ultimately psychology—although we touched on some psychological topics above such as the mind-body problem and free will. Further, as we shall see in more detail in Chapter 2, the metaphysical positions that certain philosophers adopt have direct implications for their epistemological positions. In the beginning of the section on metaphysics, we raised the question of whether the universe as it really exists is the same as the universe we experience with our senses – that is, does the "out there" match the "in here"? Is it the case that reality is really the way it looks? Or is it somehow different from that? If it is different from what our senses tell us, from what other source(s) might our ideas about reality come from? For that matter, where do we get any ideas? We humans appear to have a lot of ideas bouncing around inside us, and the question of whether this knowledge corresponds to reality or not is the question of realism vs. nominalism that we raised above. *Epistemology* is the philosophy of how we obtained these ideas in the first place. Where did they come from?

One possibility is that all knowledge is innate: We are born with all of the ideas we will ever have—or at least the foundation of ideas, and then as we mature, we use our abilities to introspect and logically derive certain conclusions from the innate knowledge. The point here is that, ultimately, any thought or notion that we have can be traced back to an innate idea, and so all knowledge is the product of human reason coupled with innate knowledge. This view is called ***rationalism***. It is also common among rationalists to disregard knowledge obtained via the senses. They discredit the senses as a way of obtaining any true knowledge of the universe and thus began a long history of sentiment pertaining to such themes as "don't trust your senses" or "the eyes can deceive." Even in modern psychology, we can see traces of this sort of thinking when we consider the research on visual illusions, and perceptual theories that emphasize how the mind must somehow construct a mental picture of reality given imperfect sensory data (a topic we will revisit numerous times in this book).

The alternative to rationalism is ***empiricism***, which is the view that rejects innate knowledge and states that any idea in the mind must have first been present in the senses. You may have heard of the concept of the *tabula rasa*, or blank slate—that we are born like a piece of blank slate, devoid of all content, until experience fills the mind with knowledge. Another metaphor used to describe this is that the mind at birth is like a sheet of blank paper, and the pen of experience writes upon it.

The debate between rationalism and empiricism is an important one that we will trace from the ancient Greeks all the way to modern psychology. Most psychology students should be familiar with this debate by another name, the *nature vs. nurture* debate. According to the former, our knowledge, abilities, and personality are in our nature, so this position is associated with rationalism and is also known as ***nativism***. The nurture side of the debate says that our psychological makeup arises from experience; it is nurtured within us by the events that shape us as we develop; this position is associated with empiricism. Psychology students should also know that this debate has been settled as *both* nature and nurture, but we still need to trace the development of this debate from its early beginnings when philosophers were willing to adopt the more extreme positions.

KEY TERMS

Key Terms

- nominalism, realism, dualism, interactionism, parallelism, monism, idealism, immaterialism, materialism, physicalism, rationalism, empiricism, nativism

STUDY QUESTIONS

Study Questions

1. Explain the difference between epistemology and metaphysics.
2. Define rationalism and empiricism.
3. Explain why studying the history of psychology is important.
4. Explain the mind/body problem and describe examples of different perspectives on it.
5. Define realism and nominalism.

CHAPTER 2: PHILOSOPHY OF MIND IN ANCIENT GREECE

INTRODUCTION

Learning Objectives
Understand:

- Pythagoras' theory of knowledge
- Parmenides' metaphysics and how it affected his epistemology
- Zeno's paradoxes and their implications for epistemology
- Heraclitus' metaphysics and how it affected his epistemology
- Democritus' metaphysics and how it affected his epistemology
- Democritus' theory of emanations
- The difference between deductive and inductive logic
- Plato's theory of forms and his reminiscence theory
- Plato's allegory of the cave and its implications for epistemology
- Aristotle's laws of association
- The connection between rationalism and deductive logic
- The connections between empiricism and inductive logic

Picking a starting point for the history of psychology is not an easy task. The obvious solution is to find the point at which people first started pondering the human mind and trace the development of this pondering up to the onset of modern scientific psychology. Clearly, the obvious solution is anything but obvious, because we do not have much information about when people first began this process of reflection – but it is worth recalling that the name of our species, *Homo Sapiens*, means wise-human in Latin, and that among the many traits that distinguish Homo Sapiens from earlier Hominids was a larger brain, including a pronounced prefrontal cortex that enabled more advanced cognitive skills, and perhaps also metacognitive skills. It is this latter ability, to not just think, but to think about thinking (metacognition), that may make humans special. And it is this form of self-awareness, or reflection, that is a likely cognitive prerequisite for psychology. Even then, that may not be enough. Modern research on animal behavior has investigated the question of whether some species of animals are self-aware, and there is growing consensus that many of them have a sense of self (DeGrazia, 2009). But there is more to psychology than self-awareness, because as psychologists we are also interested in others. We often say that all people are "amateur psychologists" because we all spend some time thinking about the minds of others. We all develop our own naïve theories about why other people do what they do, as soon as we are old enough, around ages 3-4 years, to develop what social psychologists call Theory of Mind – that is, an understanding that both we and others possess private mental lives. Is Theory of Mind thus the key prerequisite for psychology to exist? Do non-human animals possess Theory of Mind? While there is evidence that primates may have a limited Theory of Mind (Premack & Woodruff, 1978), the idea remains controversial, and we have little

reason to believe they can engage in the kind of "mentalizing about the minds of others" necessary for psychological inquiry.

The history of spirituality and religious thinking, on the other hand, may be more instructive. Why? Consider that spirituality involves the pondering of invisible forces guiding events in the world and our lives. Early religions developed cosmologies and creation myths to explain the existence of the world we live in, including elaborate supernatural explanations for why sometimes food was plentiful and other times it was scarce; why sometimes the weather was miserable and other times pleasing; why some people became sick, injured, or died while others lived longer and healthier lives. In so many words, they contemplated the existence of human suffering, and the reasons behind it. For some religions, living itself was seen as suffering, so the question of why suffering exists was equivalent to asking why life exists. This, of course, is the classic question of, "Why are we here? What is this all about?" So while early religious beliefs varied in their explanations, they shared this common motivation. And it must be the case that any people capable of spirituality were thus capable of reflection and introspection.

It is a bit beyond the scope of this book to provide a comparative history of religion and its implications for psychology. As mentioned above, we have to pick a starting point, and the historical emergence of naïve, or *folk psychology*, is not a good starting place for a history of psychology. Following other historians, that point will be the Golden Age of Greece. There is a sensible reason for this. Greek philosophy had a profound influence on Western thought, including the emergence of Western science and medicine. Given that modern science is largely derived from the Western mode, we should strive to understand these influences. Where relevant, we will also consider Eastern influences on psychology.

GREEK RELIGION AND PHILOSOPHY

The Golden Age of Greece, sometimes referred to as the Athenian Golden Age, is generally said to have begun around the time of Pericles, the statesman and general who ruled the city-state of Athens in the 5th century B.C. During Pericles' rule, Athenians enjoyed a wealthy and, for their era, comfortable existence surrounded by art, sculpture, architecture, theatre, and philosophy.

In this time there were two main religions that dominated Greek life. The first was the Olympian religion, in which devotees worshipped the Gods upon Mount Olympus who were seen as powerful yet vain. These Gods fought for power and glory amongst themselves, and thus were believed to dole out great rewards to any of their followers who achieved great and glorious deeds in their name. This religion was very popular among the rich and powerful of Athenian society, who attributed their wealth and status to the providence of the Olympians.

At the lower rungs of society, however, were people who worked hard for a living, who earned just enough to feed themselves and their families. They had little and suffered a lot. The appeal of the Olympian religion and its lofty rewards and beliefs about prosperity was lost on them. In its place was a different religion, spreading southward into Greece from the region of Thrace, known as Orphism. Like other religions, it offered a means to understand human suffering. In the Orphic view, humans possess a divine soul that originally lived in a perfect, divine realm of peace, tranquility and happiness, that is, in a place where suffering does not exist. However, in retribution for some sin committed in this divine realm, the soul was cast into its physical human form by a process known as transmigration, which means to move between the realms of existence (in this case from the spiritual realm of souls to the physical realm of the body). The soul must remain in the physical realm until it has been redeemed by its good deeds. Until that time, the soul stays in the physical realm and is continually reborn (reincarnated) into new bodies each time a previous one dies. If, in one life, one behaved badly, the soul would be reincarnated in a lower form, such as an animal or insect. Only through continued piety and appeasement of the Gods through rites and sacrifice could the soul escape the cycle of rebirths and return to the heavens. Thus, the adherents found meaning in their suffering and the promise that someday it would end. This is also similar to the Buddhist philosophy which emerged in India at around this same time.

A significant implication of this theology is the supposition of two realities, a spiritual one and a physical one. Quite obviously, the believers felt that the spiritual realm of existence is the one that really mattered. It represented the true and original nature of the universe. The physical realm existed only as an imperfect prison that was created because of sin. Another implication of this view is the equation of the human mind with the soul. The mind was seen as one's only remaining connection to the divine. Hence was the method of mysticism created as a way of reconnecting to the true spiritual aspect of the universe. Knowledge obtained via mystical revelation was seen as higher, purer knowledge, uncontaminated by the imperfect and base realm of physical sensations from the body (i.e., from the senses of the eyes and ears, etc.). Thus, physical sensations were to be ignored in favor of inner knowledge.

Orphism was not the first religion to envision such a theology, but it is significant in the effect it had on Greek thought. From this influence was born something entirely new. Knowledge obtained from personal reflection came to be valued more than what could be obtained via the senses. Love of the knowledge acquired by this means translates literally as philosophy, from the Greek words for love (*philo*) and knowing, or wisdom (*sophia*).

EARLY GREEK RATIONALISM

Pythagoras (born ca. 580 B.C.) was not just one of the earliest Greek philosophers, but he, in fact, coined the term "philosophy" (or rather, "philosophia"). You are probably familiar with his work, although probably not from any philosophy or psychology class, but rather, a geometry class. His famous theorem proving that the length of the hypotenuse of a right triangle is the square root of the sum of the squared lengths of the two sides, is one of the fundamentals of geometry and trigonometry. But Pythagoras was more than a mathematician, he was also a philosopher and mystic heavily influenced by Orphism, and he had a profound influence on Plato, who, as we shall see, represented the epitome of Greek thought.

Pythagoras and his followers set up a school in the Greek colony of Croton in what is now southern Italy, in the region known as Calabria. The Pythagoreans believed in something called the *Logos*, which describes a sort of divine rationality that lies at the heart of all existence. Accordingly, mathematics and geometry reflect this logical essence of the universe, and thus the study of these topics was a means of studying the universe itself. In their attempts to uncover the mathematical secrets of the universe, the Pythagoreans practiced meditation, and developed what was essentially a religion of numbers. Wisdom, in their view, comes only from looking within and using reason and logic to discover the truth of reality.

An example of this can be found in the contemplation of the idea of a perfect circle. Euclidean geometry tells us that the definition of a circle is a bounded round form in which all points along the circumference are equally distant from the center, that is, it has a constant radius, r. Following this definition are several other properties of circles. First, the ratio of circumference, c, to diameter, d, is a constant, which was labeled π, where $\pi = c/d$. From this follows other properties, such as the area equaling $\pi r2$. Any shape that meets these criteria is a circle, and any that does not is not a circle. So, I place this question to you, reader, "Have you ever *seen* a circle?" I am sure your immediate reaction is to say, "Yes, of course!" But, think again. For it to be a circle, it must meet those criteria listed above. The reality is that you have seen shapes that look a lot like circles, but you have never seen a true, perfect circle. So, then, if we have never seen a circle, from where did we ever get the idea of such a thing? Pythagoras' answer was that it comes from within; it comes from reasoning and revelation obtained through mystical experience. As you can see, the Pythagorean religion had much in common with the Orphic religion in that it devalued sensory experience in favor of a divinely inspired inner knowledge. If you recall the discussion of epistemology from Chapter 1, it should be obvious that Pythagoras was a rationalist.

We now turn to **Parmenides** (born ca. 515 B.C.), whose philosophy is notoriously difficult to understand, but, like Pythagoras, is easily connected to the Orphic view that mystical experience and human reason can provide the only true knowledge of reality. His philosophical insight revealed to him a fundamental truth: that *being is eternal*. That is, if something is, it is, and must have always been. That something cannot just come into being, because you cannot get something from nothing. Only nothing comes from nothing. So, if something is not, it never was and never will be. If you find this hopelessly confusing, you are in good company. There is general agreement, however, that Parmenides was

arguing against the possibility of change. If something is eternal, it has always existed and will always exist. It cannot come into being, nor can it be destroyed. Thus, it can never change. So, in his view, the universe was an unchanging, eternal place.

Using similar convoluted logic, Parmenides argued against the possibility of multiplicity, which is to say that the unchanging universe is not divisible into a mass of heterogeneously distributed matter but is instead The One. The universe, conceived in this way, is a singularity and cannot be broken down into smaller parts. It is an indivisible whole. Division of The One would be equivalent to change, which Parmenides already concluded cannot exist. Likewise, movement is also determined to be impossible because movement is defined as one part moving in space from one location to another. And, as The One, the universe cannot contain parts. As a form of change, motion is considered impossible and illogical. Further, if the universe is The One, then there is only one place, and no other place toward which to move, so space itself does not exist. His vision of the universe is that of a single, perfect sphere. Being singular, there is only just this sphere, and that is the whole of reality.

You may ask yourself, understandably, how this can make any sense at all! After all, we cannot see such a sphere. When we observe reality, we see *many* things. We see them changing. We see some things coming into existence (like a newborn child) and others go out of existence (like paper burning in a flame). We see plenty of moving things, and these many things are spread out unevenly through space, not existing as a homogenous single sphere. How does Parmenides explain this discrepancy between his philosophy and our perceptual experience of reality? The answer was suggested above. Mystical revelations and logical arguments of the sort Parmenides employed were considered more valid than other forms of knowing, including observation. Our senses must be wrong. It does not matter that we see multiple things changing and moving. That is only an illusion. We cannot trust our senses; we can only trust our logical, divine minds.

This latter idea was echoed by Parmenides' student, **Zeno of Elea** (born ca. 490 B.C.). Zeno is famous for posing a variety of paradoxes which highlight the opposition between the senses and reason. Perhaps the most famous is the story of Achilles and the Tortoise. As the story goes, the two are in a race, and Achilles allows the tortoise a head start. Let us assume that the tortoise, which travels a meager 1 meter per second, gets a 100-meter head start. The hero Achilles is endowed with great speed and can run 100 meters per second. Surely, as soon as Achilles starts running, he will overtake the tortoise in just a little over a second, right? According to Zeno, Achilles will, in fact, never catch up! To understand why, we have to realize that in the 1 second it takes Achilles to run 100 meters, the tortoise will have crawled 1 meter, leaving exactly that distance between himself and Achilles. To cover that 1-meter gap between himself and the tortoise, Achilles needs only 1/100th of a second. Thus, 1.01 seconds after he began, Achilles will have traveled 101 meters. But has he now overtaken the tortoise? Nope, because in those 1.01 seconds, the tortoise will have crawled 1.01 meters, so including his 100-meter head start, he will have traveled a total of 101.01 meters and will still have a .01-meter lead! So now Achilles must run another .01 meters (or 1/100th of a meter, i.e., a centimeter) to take the lead. It would take him 1/10,000th of a second to gain this centimeter, and so now, 1.0101 seconds after he started, he will have traveled 101.01 meters. But wait! The tortoise is making ground too! Given that extra 1/10,000th of a second, the tortoise gains ground by another .0001 meters. So now, a total of 1.0101 seconds into the race, the tortoise has traveled 101.0101 meters (including his 100-meter head start) and Achilles still lags behind at 101.01 meters. We could keep breaking the calculations down but there would be no point; poor Achilles keeps getting closer and closer, but he just cannot close that gap and win the race.

There is another, simpler example that illustrates this concept called the dichotomy paradox. A runner wants to run the 100-meter dash. Before she can run all 100 meters, she will at some point have to cross half of that distance, which is 50 meters. But before she can get to the 50m mark, she will have to first run half of that distance, which is 25 meters. And of course, before she can get to the 25m mark, she will have to cross half of that (12.5 meters). We could keep going with this, but the point is that the remaining distance between the runner and the finish line can always be subdivided further into smaller and smaller segments – it seems as if the runner can never even get off the starting line. It is almost as if there is an *infinity* of points between what should be a *finite* distance of 100 meters between the starting and finish lines. How can this be? Zeno's claim is that the mathematics is infallible; it is a perfect and logical system. So, if the mathematics is not wrong, it must be the concept of distance itself that is wrong. The point of these paradoxes is to show that distance is an inherently illogical concept and cannot be real, under the assumption that reality must be logical. Distance does not exist because, as Parmenides stated, the universe is The One, and there is only one place, and no other place. If there cannot be two places, or locations, there cannot be a distinction between the starting line and the finish line. They are the same, part of The One, indivisible, and there is no distance or space between them. Likewise, because the motion of the runner is defined as a change in location, if there is no distance, there can be no motion.

Stories like these were popular among the Greek philosophers and were used to show how imperfect and untrustworthy the senses really are. If one believes Zeno's conclusion that distance and motion cannot be real, and yet the senses tell us that distances exist and that things move, we must reject the senses! By rejecting the senses, they rejected empiricism as a way of knowing. The only ideas we can really trust are the logical and rational conclusions coinciding with the Pythagorean idea of the Logos.

We can now begin to understand some of the philosophical terms we introduced in Chapter 1. Parmenides' theory of the universe as The One is a *metaphysical theory*, that is, a theory about what is real and about the true nature of reality. However, adopting such a view contradicts our senses, so we must also realize that Parmenides was a *mind-body dualist* because of the supposition that what is really going on "out there" in the true universe is different than what is going on "in here" in our perceptual experience of reality. This disparity between appearance and reality is a hallmark of dualism. Also, these metaphysical ideas now have *epistemological* implications, because true knowledge is to be obtained, not from experience and the senses, but from inner reasoning and innate knowledge implanted by the Gods (as Parmenides believed was the source of our ability to reason and understand The One). Thus, like Pythagoras, Parmenides was a *rationalist*.

A DIFFERING VIEW

The rationalist views of the philosophers we have just considered were influenced by their metaphysical ideas about the nature of reality. You might suppose that if someone provided a different theory about the universe and reality, that they might have different epistemological views as a result. This was certainly true for Heraclitus and Democritus.

According to **Heraclitus** (born ca. 540 B.C.), the universe is defined by constant change. Every element in the universe is constantly moving, and the relative positions between them is never the same as it was in the past. As he claimed, *you can never step into the same river twice*. The idea is that the water, its currents and flows, even the molecules themselves, are always different and the river never takes the same form or configuration twice. The river, of course, is a metaphor for the entire universe. Heraclitus proposed that the *physis* (a term referring to the essential nature of things) of the universe is fire. It is perhaps best to view this as a metaphor, for fire is an example of a very vigorous transformation. Heraclitus' view of a constantly transforming universe is the exact opposite of the universe envisioned by Parmenides. Likewise, because our senses reveal to us a reality of things that are always moving and changing, then to some degree we may be able to trust our senses! But Heraclitus also understood that different persons perceive and understand the world differently. To explain this, he posited that in order to achieve a proper understanding of the things registered by the senses, perception must be accompanied by reason and wisdom. So, while he does not differ from the rationalists in stating that reason is important, he does claim that the origin of knowledge is ultimately the senses. Knowledge is only moderated by reason, not generated by it directly. Thus, Heraclitus can be considered an *empiricist*.

Democritus (born ca. 460 B.C.) offered an ontological theory of reality by contributing to one of the most important ideas in the history of science: the atom. According to his theory, the universe can be broken down into its fundamental units, and these are atoms. Everything is made of atoms. There are different kinds of atoms, corresponding to the different kinds of material objects that exist. The atoms composing these materials differed from each other in terms of their shape, size, number (or density), and arrangement. Keep in mind that Democritus was not working with what we know as the periodic table of elements, so he did not envision atoms like hydrogen, carbon, oxygen, etc., but instead a more naïve view of substance. He envisioned stone atoms, water atoms, wood atoms, flesh atoms, etc.

Democritus' atoms were not the same as how modern physicists understand them, with a nucleus of protons and neutrons surrounded by an electron shell. To Democritus, an atom was a very tiny, indivisible object—you can almost imagine microscopic marbles. Each atom/marble is unique to its kind, and these atom/marbles can move around in the æther (the empty space between atoms), and ultimately may collide with other atoms, sending them ricocheting off into the æther to collide with other atoms. Such motions trigger vast and complex chain reactions of motions of atoms, and thus, the movement and behavior of everything in the whole world can be explained in terms of the motions of atoms.

Democritus' atomic theory is a classic example of ***reductionism***. This is an approach, commonly used

throughout the history of science, to try and understand complex things by breaking them down into simpler parts that are easier to understand. The idea is that a complete understanding of the parts will ultimately tell us everything we need to know about the whole. In this case, the universe is complex and difficult to understand, but atoms promise simplicity. If one was able to understand the fundamental nature of atoms, one could potentially explain the universe, and reality itself.

This theory is also an example of ***determinism***, which is another common theme in the history of science and is often associated with reductionist theories. According to this view, a simple principle of *cause and effect* can be used to explain why things happen in the universe. Everything has a cause, and so if one can understand the laws of cause and effect, then one can understand reality. In Democritus' case, the motion of an atom through the aether is determined by the collisions it has with other atoms. Atoms do not have the free will to move on their own, and if we could know the simultaneous position and velocity of all atoms in the universe, we could know the future of the universe, as well as trace back prior causes to the very beginning of the universe.

A very significant component to Democritus' theory is that the human mind is not excluded from this analysis. The mind is also made of atoms! Hence, the mind is not immune to the laws that govern the behavior of atoms; as with the atoms that compose everything else in the world, mind atoms do not move of their own accord but are determined by their collisions with other atoms. Thus, this is also a reductionist and deterministic theory of the mind. Fanciful notions like thought, consciousness, emotion, feeling, judgment, reason, and so forth are not special mental events; they are merely the motions of the physical atoms of the mind. And further, humans do not feel and think of their own accord, because these things are determined by the motions of the mind atoms, which in turn are determined by the influence of other atoms. If you recall from Chapter 1, this view has implications for the mind-body problem, and Democritus is among the first to offer a nondualist view. He is, instead, a *monist*, because he states there is really only one kind of reality (i.e., atoms), and in particular he is a *materialist* because his reality is made of solid, physical matter.

How do other atoms trigger the motion of mind atoms? To explain this, Democritus has offered what may be the first psychological theory, and perhaps it is no coincidence that the first theory in psychology was a perceptual theory. We start with the idea that there exist objects in the world, composed of atoms, and that we can perceive these objects. How do we do so? As it happens, all objects emanate "images" of themselves in a form of something called the *eidolon*. According to this *emanation theory*, the eidola (plural for eidolon) are registered by the body, and at this point trigger the motion of mind atoms. Motions among the mind atoms thus correspond to perception, and because consciousness itself occurs because of the motions of mind atoms, perception and consciousness are a byproduct of these mind atoms. The implication is that the conscious mind would not exist if not for the external stimulation from the eidola. The mind is dependent on and determined by this stimulation. There is perhaps no more definitive example of *empiricism* than this, and such thinking lays the foundation for both British Empiricism and Behaviorism, as we shall see in later chapters.

THE CULMINATION OF GREEK PHILOSOPHY

We next look at Greek philosophy from a different point of view, and to do so, we shall first need to understand a little about logic and argumentation. In particular, we shall distinguish between deductive and inductive reasoning.

If you think back to your geometry classes, you may remember that a very common assignment was a proof, which is a step-by-step analysis proving that a certain geometric rule is true, given a set of premises. The arguments used to prove the rule represent general axioms, while the conclusion of the proof represents a particular conclusion that is necessarily true if the premises are true. Proofs are exercises in *deductive logic*, which is defined as *reasoning from the general to the particular*. Deductive arguments often take the form of a syllogism, which is a simple argument showing how a particular conclusion must be true given two general statements, or premises, that precede it. The example ubiquitous to all introductory logic texts is:

Socrates is a man;

All men are mortal;

Therefore, Socrates is mortal.

In this example, the first two lines represent general statements. We are given the facts that someone named Socrates belongs to the category of things called "man" and that all members of that category also belong to another category of things called "mortal." Therefore, if Socrates belongs to the first category, he must also belong to the second. If he is a man, he is mortal. This conclusion is a particular conclusion about one particular person given two general statements.

It should be evident that deductive logic is the form of logic preferred by the early rationalists. For one reason, deductive logic is the logic of math and geometry, and we have already seen how enamored these early philosophers were with these fields. But also, deductive logic is valued because it represents a method for discovering true and false ideas. Deduction follows rules, and if one follows those rules, then one's argument is valid; and if one's premises are true, then one's valid deductive conclusion is also true. Failure to follow the rules of deduction is called a fallacy, of which there are many examples. Here is a straightforward example of a fallacy:

Socrates is a man;

Some men are criminals;

Therefore, Socrates is a criminal.

As ought to be obvious, the conclusion does not follow, because the second premise states that only some men are criminals, so the fact that Socrates belongs to the class of things of which some are criminals does not mean he is one himself. The importance of this is that if one can seek out a set of true premises to begin an argument, and can follow the rules of deduction properly, one can derive all

sorts of truths—and the knowledge we gain from such exercises is knowledge about which we can be certain. This is exactly the motivation of the early Greek rationalists.

This feeling of certainty exhibited by figures such as Parmenides, Zeno, and Pythagoras drew some critical attention. One group of philosophers made a career out of poking holes in the possibility of being certain about anything. They were called the Sophists, and the central figure in this movement was **Protagoras** (born ca. 490 B.C.). He noted that while it was possible to use deductive logic to arrive at valid conclusions, there was really no way to ever prove that the premises were true to begin with. That is, any deductive argument about the true nature of reality must derive from some general premises – but these premises rest on a few assumptions. Parmenides and Heraclitus had two very different views about reality, and thus their premises were different. How can we determine which is correct? Protagoras contended that it was not possible to do so. Rather, it is more important to understand that there really is no absolute, objective truth about reality that we can know. Truth is merely how we perceive things, it is subjective. His famous claim is that *man is the measure of all things*. Thus, knowledge is relative and subjective, depending on the person and his or her own understanding. Much of this thinking lays the foundation for philosophies such as ***nihilism*** and will be a later influence on the philosophy of ***existentialism***, treated in Chapter 16. It is also an example of ***skepticism***, for it suggests that we be skeptical about what exactly we humans can know about reality. For now, we want to consider how the idea of questioning the absolute inspired one of the most famous Greek philosophers.

Socrates (born ca. 470 B.C.) raised the distinction between deductive logic, as described above, and *inductive logic.* If deduction is reasoning from the general to the particular, then induction is basically the opposite: *reasoning from the particular to the general*. Like Protagoras, Socrates asked how we come about knowing certain things, including abstract concepts like truth, beauty, piety, and justice. This was called the ***Problem of Universals***. The question is whether these kinds of abstractions are real things (***realism***), or are they just ideas that we give names to (***nominalism***)? Consider beauty. Protagoras argued that beauty is in the eye of the beholder. There is nothing that is absolute in beauty, no object is inherently beautiful. This is a nominalist view that suggests that people just create their own idea of beauty within their own mind, and thus beauty is nothing but a word we can use to describe our experiences.

Socrates disagreed, and in questioning how we come to know about beauty, he concluded that it must be part of our experience, but also derive from the beautiful things we behold. Thus, he was really asking: What is it that all instances of beauty have in common? The implication is that all of the things that we judge as being beautiful must share some common attribute that we can call the *essence of beauty*. If these things possess such an essence, it means that beauty cannot be arbitrary and subjective; such things are inherently beautiful because they possess this essential quality. The knowledge obtained in this way is consistent with the method of induction described above: observation of particular instances leads to the general concept. In the example, observing particular beautiful things leads to the idea of beauty. Thus, if one wants to understand the idea of beauty, then one must dedicate themselves to studying and observing beautiful things (art, nature, people, etc) and after sufficient study and contemplation, one will, via induction, come to understand the universal concept of beauty. Socrates can be considered a realist because he is suggesting that the Universals are real rather than just subjective opinions.

This kind of thinking is setting the stage for empiricism and science, for it suggests that we can use observation to understand the world around us. Socrates thus also promoted an academic mindset,

because anything you want to understand can be understood if you study it, question it, and observe it sufficiently. In an ironic twist of fate, the very thing that made Socrates famous, his questioning of things, led to his demise. The city officials in Athens charged him with corrupting the youth by causing them to question many of their traditions, laws, and authority. Socrates was found guilty and was sentenced to death by drinking a poisonous hemlock potion.

Socrates' most important student was **Plato** (born ca. 427 B.C.), who can be considered the most significant of all the Greek philosophers. Plato continued his mentor's search for essences, and how we come to know them, but he was also influenced by the Pythagorean idea that the true path to knowledge comes from within, not from observation. Echoing the idea that the senses are not trustworthy, Plato presented the *Allegory of the Cave.* Imagine a situation where three prisoners are chained up inside a cave so that their backs are turned toward the entrance of the cave and they can look only forward toward a wall. Light from outside the cave shines upon this wall, and as people and other things pass by outside the mouth of the cave, their shadows are cast upon the wall. These three prisoners have been in this cave their whole lives, so it is the only reality they know; they know nothing about the outside world and the people outside the cave. The only information they receive are the shadows on the wall. Soon they begin to recognize patterns and shapes that recur on this wall, and they make up names for them. Over time, they develop a language and concoct elaborate stories to explain the behavior of these shapes. This is the whole of the prisoners' reality, but it is clearly a false one. The shadows are at best a distorted version of the people outside of the cave, at worst amorphous figures that bear virtually no resemblance to the things that cast them, and the language the prisoners use reflects this imperfect knowledge.

The lesson here is that the cave/prison is a metaphor for the physical body (just as the Orphic religion viewed the physical realm as a sort of prison), and the prisoners represent the mind/soul trapped within. The shadows represent the distorted and impoverished version of reality that the senses are capable of registering. Thus, any knowledge about the true nature of reality, of what is really happening outside the cave, cannot come from these shadows. One must escape their bonds and leave the cave. This can only happen through meditation, introspection, and reflection, a sentiment that harkens back to the Pythagoreans. This was the context in which Plato coined the term ***psyche***, which means both mind and soul, and of course forms the root of the word psychology.

When Plato considered Socrates' question about how one can know about the essences of things like beauty, he agreed that these things must possess some essence, but disagreed that observation using the senses could provide us with the knowledge of this essence (per the Allegory of the Cave, observation only gives a distorted version of reality). Essences represent perfection, just like a perfect circle contains the essence of perfect circularity, so does an orchid contain the essence of perfect beauty. The senses, however, are imperfect and can never truly reflect or transmit the idea of perfection. Plato concluded that the only way we could possess such knowledge is if it was innate, and he developed two theories, one metaphysical, the other epistemological, to explain this. First, his *Theory of Forms* provides the metaphysical description of reality. Beyond the imperfect physical world there exists a perfect, spiritual, *ethereal realm*, and residing in this ethereal realm are the *perfect essences*. Plato described them as forms. Hence, the perfect form of a circle resides there, as does the perfect form of beauty. In addressing the Problem of Universals, Plato adopted the position known as ***exaggerated realism***. The universals are real, and they exist as entities unto themselves. Any of these forms can become manifest in the physical realm, but these manifestations are inherently imperfect. Thus, there are many beautiful things, and they appear different from each other, yet are still manifestations of the same form of beauty. Their differences are due to their imperfections, but at their core they are

the same. Thus, the physical realm is a lesser form of reality that is imperfect, while the ethereal realm is the higher perfect form of reality.

Next, Plato proposed his *Reminiscence Theory* as a *rationalist epistemology* designed to explain how we can come to know these forms. His idea is that prior to being born, the psyche inhabits the ethereal realm and there comes into direct contact with the forms, and thus comes to know these forms in their essence. However, during transmigration into the physical body, the psyche forgets this knowledge. It is not erased forever, but simply forgotten temporarily. As infants and young children, we are not aware of these memories, but gradually we encounter the imperfect manifestations of things that the psyche once knew in the ethereal realm. These encounters trigger *anamnesis*, or the reminiscence of the innate knowledge. Ultimately, then, knowledge is innate. The role of the senses is minimal, serving only to activate the memories. Once remembered, we only need reason and insight to develop our wisdom and understanding further.

A FINAL TWIST: EARLY SCIENCE

While Plato disagreed with his mentor Socrates about the importance of induction and observation, Plato's own student, **Aristotle** (born 384 B.C.), reintroduced this logical system in the form of the *scientific method*. He was not the first scientist (that honor might go to Thales, who lived almost 250 years prior), but he was the one who refined the idea that systematic observation of the natural world can lead to the discovery of the general principles by which that world operates. Aristotle wanted to understand the causes of things and believed that these causes could be understood through repeated observation. These observations provide the data, or the particulars, and the causes (general) represent the scientific theories. Hence, science relies primarily on the method of induction, in which general theories are reasoned on the basis of particular observations. Science is also an empirical enterprise, because the theories come from observing with the senses, not reasoning with innate ideas.

Given that knowledge accrues via experience in this way, the empiricist Aristotle also provides us with our second major psychological theory. Recall that the empiricist Democritus had previously provided a perceptual theory. Aristotle subsequently developed a theory of memory that will be strongly influential on the British empiricist movement some 2,000 years down the road. Aristotle's theory is based on the principle of ***associationism***. The theory is that memories are connected, or associated with each other, one the basis of four principles, or laws, of association. The first is the *law of contiguity*, in which when we think of certain events, we are also reminded of events that occurred at the same time. The *law of similarity* states that memories are also connected on the basis of similarity. For example, thinking of grapes may cause one to also think of wine. In a similar vein, the *law of contrast* states that we also will think of opposites. Pondering the concept of evil causes us to also factor in the concept of good. Finally, the *law of frequency* states that associations between memories can increase in their strength the more often the two memories are paired together. The more often I consume beer and cheese together, the stronger is my association between them. The notion is that ideas enter the mind via perception and are stored into memory according to these laws. These associations enable us to understand the essences of things because, as Socrates suggested, all of the things that belong to a common category, such as beautiful things, must share some essence. Hence, according to the law of similarity, all beautiful things become associated in our memories because of their similarity, or shared essence. Contemplation of these interconnected memories enables a deeper understanding of the meaning of beauty. Thus, Aristotle was not an exaggerated realist like Plato, believing that essences existed unto themselves in some separate reality, but rather, that essences existed within the particular things themselves. These particulars owe their identity to possessing such essences, and the essences exist within the particulars. This view is known as ***moderate realism***.

SUMMARY

Much of Western philosophy and science, and ultimately psychology, began with the issues raised by the Greek philosophers of the Golden Age. We have seen a variety of opinions on metaphysics, but more relevant to psychology is the effect these ideas had on epistemology, that is, the origins of knowledge. One of the main areas of contention among the Greeks was rationalism vs. empiricism. A lot of the debate has emphasized that the senses are not trustworthy. This point is significant, and we shall revisit it frequently as we move forward. The Problem of Universals has also been raised, and we shall tackle this particular issue in more detail in Chapter 3.

KEY TERMS

Key Terms

- rationalism empiricism, dualism, nihilism, existentialism, skepticism, monism, materialism, eidolon, reductionism, determinism, associationism, realism, exaggerated realism, moderate realism, nominalism, deduction, induction, psyche

STUDY QUESTIONS

Study Questions

1. What was the role of reason in Heraclitus' theory of knowledge?
2. Explain Zeno's dichotomy paradox and how it was used to justify rationalism.
3. Outline all the steps to knowledge in Plato's Reminiscence Theory.
4. Explain Democritus' perceptual theory.
5. Explain how the scientific method is an example of induction.

CHAPTER 3: THE PROBLEM OF UNIVERSALS

INTRODUCTION

Learning Objectives
Understand:

- How Neoplatonism came to influence western thought
- Why both Neoplatonism and early Christianity were rationalist philosophies
- The influence Aristotle had on the Islamic philosophers
- The differences between exaggerated realism, moderate realism, and nominalism
- How Ockham's razor was used to argue in favor of nominalism
- The difference between particular and essential qualities in Thomastic moderate realism
- The difference between primary and secondary qualities, and how they are related to the mind-body problem
- Bacon's approach to defining science

In the previous chapter, we saw how Greek philosophy laid the foundations for many central questions regarding the mind. But what happened to philosophy after the fall of the Greek civilization? First, we might want to consider what it takes for philosophy to even exist. As we saw with the Greeks, the centralized government and accumulated wealth of the Athenian state provided for the existence of those who could participate in the higher pursuits of philosophy, science, art, and literature. In the absence of such means, people had to subsist for themselves and had little time for these matters. Following the decline of the Greeks, the Roman Empire took over the mantle of being a center for the kind of wealth and luxury needed to support the arts and sciences. However, it might also be said that the political and military ventures of the Roman Empire discouraged many advances outside of engineering, for there are few Roman philosophers who contributed much to our story. However, one such Roman, Plotinus, is someone we shall want to consider.

NEOPLATONISM

Plotinus (born ca. A.D. 204) was born in Egypt of Roman descent, and later lived for a significant time in Rome. He lived at the end of a period in history known as the Hellenistic period, which lasted from approximately 300 B.C. to A.D. 300. Societies and nations throughout what is now Europe and the Middle East were undergoing massive cultural upheaval as Greek and Roman military campaigns and other travelers between nations spread word of the many different religions and philosophies practiced by these different cultures. During the Hellenistic period, many old religions were abandoned, many were morphed with others into new religions, and some others were born outright, including Christianity. Of course, the Christian religion did not arise within a void. There is general agreement that many core principles of Christian and Catholic philosophy is borrowed from the other religions that existed at the time. An example of this comes from Plotinus, who developed a mystical philosophy based on Plato, called ***Neoplatonism***, which later influenced significant Christian theologians like St. Augustine of Hippo. Even prior to Plotinus, some have argued that St. Paul of Tarsus, who contributed much to the Christian New Testament, was a Neoplatonist (Powell, 2004).

Plotinus envisioned a metaphysical view of reality based on a hierarchy. At the top of the hierarchy was *The One*, which harkens back to the Parmenidean metaphysics. However, this One is equated with a divine mind, or divine knowledge, and so is also comparable to the Platonic realm of forms, and which was later interpreted by Christian philosophers as God. In this theory, The One creates the universe by emanation: it radiates consciousness, and these emanations diminish in their quality the further they are from The One. The nearest emanation is the *nous*, which corresponds to the logical, and ultimately divine, human mind. Further from The One is the physical universe. The mind can reconnect with The One via the spirit. The reader ought to be reminded of various characteristics of the Orphic religion. Like Plato, Plotinus equates the human mind with the soul, and places it at a higher level of reality than the physical realm, which is imperfect. It is not too much of a stretch to see how this is compatible with Christian thought, which states that one can know God through prayer (inner experience), while sensual, bodily experiences are associated with sin, as argued by St. Paul, and only lead one farther away from God.

After the fall of the Roman Empire in the 5th century A.D., Europe entered the Dark Ages, where there was no longer any strong centralized government or accumulated wealth. European developments in science, arts, and literature correspondingly declined. However, as it turned out, philosophy was alive and well, sustained within the Catholic Church. The Roman Catholic Church dates to the time of the Apostle Peter (ca. A.D. 1–64), who was the first Bishop of Rome. Following the establishment of Catholicism in Rome, this religion began to spread throughout the Western Roman Empire, which occupied much of Western Europe. The spread of Catholicism occurred as monasteries began to be established through these lands. It was Saint Benedict, who in A.D. 530 formalized the principles of monastic life, giving rise to the Order of Benedictine Monks. These monks, who lived simply and sparsely, were able to devote much of their days to prayer, and beyond that, to philosophy and theology; and because of the influence of Neoplatonists like St. Paul and Plotinus, much of Western thought is rationalist and dualist, tracing back to the ideas of Plato and his theory that knowledge comes from the soul.

SCHOLASTICISM

Neoplatonism continued to influence Christian theology and philosophy throughout the Middle Ages, up until what is known as the Late Middle Ages, around the 13th century. At this time, a variety of Christian scholars like Peter Abelard, John Duns Scotus, William of Ockham, and St. Thomas Aquinas began a new attempt at understanding Greek philosophy in relation to Christianity, and began to emphasize the work of Aristotle, rather than Plato. This movement was known as ***Scholasticism***.

Aristotle's work had been lost to Western thinkers for several centuries. However, his ideas persisted in the Middle East thanks to Islamic philosophers. As Islamic cultures began to flourish in the Middle East, North Africa, and portions of southern Europe, they encountered Greek philosophy. They incorporated Greek mathematics from Euclid and Pythagoras, leading to the creation of algebra by Muhammad ibn Musa al-Khwarizmi. Notably, the Islamic philosophers Avicenna and Averroes drew heavily from Aristotle in their works.

In particular, **Avicenna** (born ca. 980) began with a dualist view of mind and body but envisioned that the brain was the point at which mind and body came together, and that it was the act of perception that enabled their intersection. He argued that the human mind is created only with the potential for knowledge and requires the mind to be tied to a physical body in order to acquire ideas via perception. Thus, like Aristotle before him, Avicenna was an empiricist and claimed that we are born a blank slate, or *tabula rasa*, with no innate knowledge.

Like the earlier Greek empiricist philosophers, Avicenna developed a psychological theory regarding the operation of the mind. This theory accounted for perception and attention, the organization of knowledge, and memory. His theory begins with the five senses: vision, hearing, touch, taste, and smell – information from which is then integrated into the five internal powers, or faculties, of the mind. The first of these is the common sense, which refers to the process of bringing information from the five distinct senses together into a common, unitary percept. The other faculties included imagery, imagination, estimation, and memory. Terms like these mirror what modern cognitive psychologists describe as the functioning of the components of the working memory system (e.g., Baddeley, 1992).

Following the onset of the crusades, when European armies attempted to capture portions of Islamic territory, Aristotle and Greek mathematics were rediscovered and translated into Latin by European scholars. In keeping with Aristotle and Avicenna, the Scholastics adopted something of an empiricist view and emphasized induction and the scientific method over deduction and knowledge from within via introspection and meditation. Scholasticism represented a movement away from the Neoplatonic ideas that the rational mind was all one needed in order to understand reality. The emergence of Western science followed sooner thereafter.

THE PROBLEM OF UNIVERSALS REVISITED

One of the themes of Scholastic philosophy was a renewed interest in the Problem of Universals. If you recall, the question was whether the so-called universals, or general categories, existed or not. We previously dealt with concepts like the perfect circularity, and abstractions like truth, beauty, justice, and piety. As an ***exaggerated realist***, Plato argued that not only do we possess the idea of a perfect circle within our minds, but that there also exists the form of perfect circularity in the ethereal realm. So, in his view, the circle is not just a concept; it is a real thing that exists independently of the idea, and also independently of the imperfect circles that exist in the physical realm, which are only imperfect manifestations of the perfect form.

One famous reaction to this view was raised by **William of Ockham** (born ca. 1288). He argued that we cannot doubt that the ideas themselves exist—for if they did not, we could not think of them. So, at least within our minds, the universals/abstractions do exist, but as ideas only. Consider again the example of dogs. From the exaggerated realist perspective, each *particular* dog, such as a Great Dane, a Chihuahua, a German Shepherd, or a Terrier, is a manifestation of the perfect form[1], or essence of "dogness" from the ethereal realm. So, the concept exists in our minds, and the form, or universal, exists separately in the ethereal realm.

William of Ockham's argument was that we cannot verify the existence of these forms; we can only verify the existence of the idea. Further, do we even need to posit the existence of the form to explain how the idea could exist? That is, is it possible for me to think about the idea of dogness without there also existing some actual essence of dogness somewhere out there in another reality? William of Ockham's answer was that it was not necessary to invoke the reality of the universals. His argument, as translated from his original Latin text, is that "entities must not be multiplied beyond necessity." That is, it is not necessary to have two entities (the idea and the form) when one is sufficient. From above, he argued that the idea is real and cannot be doubted or eliminated—so it is the form that must be removed from the theory. This is the famous **Ockham's Razor argument**, shaving off excess assumptions and entities from a theory, and in this case, it is used to shave off the ethereal realm, and the reality of the universals. Thus, the Razor is used as a method to support ***nominalism***: that the universals exist as ideas in name only. Returning to our example, the idea of a category of things we call "dog" is just that, a category, or name, that we apply to a bunch of particular creatures. It represents nothing but the human tendency to categorize, describe, and name our experiences[2].

There are some radical implications of nominalism. For example, it may imply that the way in which we use language to carve up nature into categories is subjective, artificial, even illusory. Plato had

1. Technically Plato did not say much about animals and forms, though many modern biologists have interpreted Plato to have implied that they must correspond to a form, and that this contributed to the age-old controversy about evolution (see Kitts, 1987).

2. In 20th century parlance, such categorizations might be called schemas, or in more modern cognitive theories, basic and super-ordinate level categories, or even semantic networks. We might also call them social constructs, highlighting the argument that these ideas exist only because of a social agreement that we will all use the same word to describe the same experience.

assumed that these categories were real, absolute things that exist independent of human thought, and so nominalism rejects this type of absolutism[3].

While William of Ockham preferred nominalism due to its simplicity and parsimony, not everyone agreed. In fact, this view deviated somewhat from Aristotelian thinking, which was usually considered consistent with a third view on the Problem of Universals called ***moderate realism***. This approach was emphasized by **St. Thomas Aquinas** (born ca. 1225), who provided such a famous argument for moderate realism that others later renamed the idea **Thomastic realism**.

Let's return to the example of the dogs. When I see a particular dog, it may be any of the breeds listed above, Great Dane, Chihuahua, and so on. On what basis do I recognize it as a dog? Extending Plato, it may be because it is an imperfect manifestation of the perfect dog-form, and it triggers my innate memories of that form buried deep within my soul. According to William of Ockham, it is simply because humans have invented a category of things called "dog," and as children we learn to recognize members of this and all other categories.

But the nominalist view fails to solve an important question – what is it exactly that we learn as children when we learn to recognize that an animal is a dog, and not a cat, or rabbit, squirrel, elephant, or chimpanzee? If you recall, we tackled this problem in Chapter 1, and we realized that there is no easily identifiable necessary characteristic that defines "dogness." It is not the fur coat, nor the four legs, nor the tail, the snout, none of it. Even the modern philosopher **Ludwig Wittgenstein** (born 1889) noted the apparent impossibility in defining the exact necessary and sufficient conditions for category membership.

Regardless of these difficulties, Thomas Aquinas affirmed that we nevertheless can and do recognize members of categories. Children have little difficulty learning the differences between dogs and cats. Thus, even if we cannot define the necessary and sufficient conditions for defining it, dogness must nevertheless be a *real* property that any particular dog must possess. Therefore, a dog is a dog because it has the *essential quality* of dogness, which enables its recognition as such. This may seem like a *tautology* (a circular argument in which a word is defined with itself, in this case "This animal is a dog because you can see it is a dog") but Aquinas' point is that if the particular animal did not possess the *essential quality* of being a dog, then it would simply not be a dog, and it would not be recognizable as such. Thus, for us to recognize a particular animal as a dog, it must possess some *real* physical property that defines what it is.

With this step, Aquinas designated two kinds of properties of things: ***essential qualities***, those which define the essence or category membership of things, and ***particular qualities***, those which make each thing unique and different from others. To list all the obvious phenotypic traits of the dogs, like the fur, legs, and tails, is only to list the particular qualities. The essential quality, while not being something easily defined, as Wittgenstein later pointed out, must still be some real property of the animal in question. Thus, the idea of the *universal* is now associated with the *essential* quality, which is a *real* quality. This is a form of **realism**, sometimes referred to as ***essentialism*** (because everything is said to possess some essence that defines what it is), but in contrast to Platonic exaggerated realism, the

3. Even the idea that any animal species exists as an actual thing becomes doubtful when adopting a nominalist view. Instead, the world contains a vast variety of creatures that vary only by degree, rather than in qualitative terms like the taxonomic ranks of kingdom, phylum, class, order, family, genus, and species. While this seems to violate common sense, modern genetics research has led some biologists to argue that the idea of a species is ill-defined from a genetic perspective (Mishler, 2010).

essence does not exist independently in some other realm, but within the particular thing itself. *The essential and particular qualities are interdependent*. You cannot have one without the other. A particular creature must at once possess the particular quality of being a unique, individual Great Dane, while also possessing the essential quality of being a dog. This is Thomastic ***moderate realism***.

THE UNIVERSALS AND QUALIA

We next fast forward about three centuries to the famed Italian astronomer **Galileo Galilei** (born 1564), who was a pioneer in extending the Scholastic ideas of empiricism into a more scientific approach to knowledge – and some have considered him the father of Western science. He was, of course, infamous in his time for having confirmed the controversial heliocentric theory of the solar system previously suggested by Copernicus in 1543, and who also refined the newly invented telescope and used it to discover new celestial objects. He also had a somewhat Pythagorean view of the universe, believing that the true nature of things could be described by a neatly ordered mathematical and geometric description. For example, in observing the motion of a projectile, such as a cannonball, Galileo noted its trajectory approximated a parabola. But why was it only an approximation of a parabola and not a true, perfect parabola? Our modern understanding tells us it is because of a dissipation of energy due to friction and air resistance, but for Galileo, this distinction between the idealized parabola as a geometric form and the imperfect flight of the projectile hearkened back to the Platonic and Pythagorean view that dissociated the true nature of reality (orderly, mathematical, and regular) from the nature of our immediate perceptual experience (disorderly, illogical, and irregular). Thus, one of his chief motivations in studying the celestial bodies was that they appeared to follow such orderly trajectories, whereas the ordinary objects of our everyday experience, here on Earth, seem more irregular and imperfect.

To address this, Galileo revived a dualist view of reality, and revised Aquinas' notion of essential and particular qualities to reconcile them with Platonic realism. Like the realists/essentialists, Galileo believed that the imperfect motions that we observe mask a true essence. Galileo referred to this essence as the object's ***primary qualities***, which are not perceptible in any immediate way. In this way, Galileo could explain why projectile motion was truly parabolic, even if it did not appear so. The parabola represents the ideal trajectory. However, since we cannot easily study these ideal states, or primary qualities, as they cannot be observed, we are limited to inferring them following observation of an object's ***secondary qualities***, which describes the way the object appears when we observe it. Thus, science is about recording and measuring our experiences of secondary qualities to discover a physical law. The secondary qualities only hint at the law, but once so hinted, we can use the rationalist tools of logic and mathematics to elaborate the theory. Galileo's view represents a reconciliation of the Pythagorean and Platonic emphasis on perfection with Aristotle's empiricist approach to science and observation as a way of knowing. Galileo was then able to reconcile his observations of movement on earth with the movement of the planets and stars and develop a unitary scheme of matter and motion that applied to the entirety of the universe.

Galileo's idea that perceptual experience is distinct from the physical reality of things is suggestive of dualism. The way things appear to us is not the same as the way they truly are. As with the projectile motion, the distinction between appearance and reality extends to all domains of observation. Consider the example of color. When I look at a blade of grass, I experience it as being green. But then we can ask, is the grass really green? That is, does it possess the property of being green? Isaac Newton made the discovery that when sunlight is refracted through a prism, it splits into all the colors of the rainbow. However, he concluded that the light itself was not colored, and neither was the object

from which the light was reflecting. Rather, color is nothing but a property of visual experience. It is a purely psychological thing.

Such secondary qualities, as psychological experiences, are now called ***qualia*** in modern philosophy of mind. An object may possess some physical primary quality that determines the way it interacts with light, reflecting certain wavelengths while absorbing others, but that is not color, it is just the reflectance of light rays. Thus, in the example of the grass, reflectance is a primary quality of the grass, wavelength is a primary quality of light waves, and the color green is qualia, the psychological rendering of the primary quality. Likewise, events in the world may cause vibrations which propagate through the medium of air molecules. Such vibrations can be described physically in terms of their amplitude and frequency of vibration. But in the mind, they are rendered as qualia, with properties of an event we call sound, such as loudness and pitch.

THE PHILOSOPHY OF SCIENCE

Galileo's epistemic achievement was to define science as a new way of knowing about reality that he considered a form of *natural philosophy* (philosophy enabled by observing and studying nature), by showing how we can combine the tools of empiricism, that is, careful observation, with the tools of rationalism, namely logic and mathematics, to develop a theory of reality.

This was a formalization of the scientific method based on the principle of *induction* – that is, reasoning to general principles based on empirical observation of particulars. This was formalized as a definition of science by Galileo's British contemporary, **Francis Bacon** (born 1561). Any theory that attempts to define science and distinguish it from other forms of knowing is called *philosophy of science* and is a recurring theme in the history of psychology's evolution as a science. Bacon famously rejected the mixing of religious doctrine with science, or natural philosophy, a controversy that certainly affected Galileo, leading to his sentencing of house arrest for the final nine years of his life for the charge of heresy deriving from his heliocentric theory of the solar system. Bacon argued that many religious beliefs contradicted scientific observation, and that rather than trying to twist our interpretations of empirical fact to reconcile them with religious tradition, that we should accept observations as facts to be understood on their own merit.

Bacon was also one of the first to express concern over the role of theory in science. He described two ways of theorizing about the world. The first is called *anticipation of nature*, which relies on appeals to authority, traditional beliefs, and assumptions that lead one to expect certain outcomes in the course of scientific observations. Bacon believed that this was problematic because it could lead to a form of confirmation bias, in which only the anticipated observations, that is, the ones that were expected based on pre-existing assumptions, would be regarded as valid, and contradictory findings could be discounted after the fact. In its place, Bacon proposed an approach called *interpretation of nature*, which begins with systematic observation and piecing together inductive statements to build a scientific theory of the world that could then ultimately make predictions and be tested. Ultimately, the empirical data that support such a theory would accumulate to such a degree as to make the theory undeniably true.

This new science provides a way forward from the skepticism raised by Protagoras when he criticized the metaphysical theories of his fellow Greeks. Whereas Protagoras claimed that the deductive arguments of Parmenides, Pythagoras, and Heraclitus rested on unproven and unprovable general premises, Bacon's scientific method allowed for the inductive process to establish such premises, and only once scientifically verified beyond all doubt would deductive claims be warranted.

Isaac Newton (born 1642) approached science in much the same way. Like Galileo, he felt that the universe followed a set of mathematical rules, and following some controlled observations, developed theories about physical reality centered on his three famous laws of motion, which were mathematical equations. The second of these laws is going to be important for later discussions—it is the law that describes the acceleration of a moving object as the result of two properties: its mass and the force act-

ing upon this mass. It is often stated in a different way, defining force, F, as the product of an object's mass, m, and acceleration, a:

$$F = ma \qquad \text{(Eq. 3.1)}$$

With this equation, we can see how observations can be used to describe the true properties of the universe, even if we cannot directly observe those properties. When we observe an event, such as a falling object, we see only its motion, represented in Equation 3.1 by its acceleration. Going beyond this observation though, we arrive at the conclusion that there exists something that causes the acceleration to happen:

$$a = F/m \qquad \text{(Eq. 3.2)}$$

The left-hand side of Equation 3.2 represents visible properties, the secondary qualities of the event, whereas the right-hand side corresponds to the primary qualities of the event. In Newton's view, this was a *natural law*, an inviolable law that specifies the relation between primary and secondary qualities. So even if we cannot see force directly, we can infer, or theorize, its existence by observing the regularity of acceleration. The most famous of all such regularities is the observation that freely falling bodies accelerate at exactly 9.81 m/s2. And so even if the story of Newton observing apples falling from trees is apocryphal, the importance of observation becomes a central idea in science, and in this case led to the famous theory of gravity.

We will encounter these ideas again in Chapter 5 following advances in empiricist philosophy. In the meantime, we shall need to continue to Chapter 4 and delve further into the dualistic implications of Galileo's work.

KEY TERMS

Key Terms

- Neoplatonism, Scholasticism, exaggerated realism, moderate realism, nominalism, Ockham's razor, essential quality, particular quality, essentialism, primary quality, secondary quality, qualia

STUDY QUESTIONS

Study Questions

1. Explain how Ockham's razor is used to justify nominalism.
2. Define primary and secondary qualities and explain how these terms imply a mind-body dualism.
3. Explain the difference between essential qualities and particular qualities.
4. Explain the difference between exaggerated realism and moderate realism.
5. Explain Bacon's distinction between anticipation of nature and interpretation of nature.

CHAPTER 4: THE MIND-BODY PROBLEM

Learning Objectives
Understand:

- The veil of perception and its implications for knowledge
- Descartes' brain-in-a-vat exercise and why it can lead to solipsism if taken seriously
- How the brain-in-a-vat exercise is used to support rationalism
- Descartes mechanistic theory of mind-body interaction and the problems with it
- The similarities and differences between interactionism, occasionalism, double-aspectism, and parallelism
- Why both Spinoza and Leibniz were determinists
- How Spinoza accounted for the appearance of free will
- Leibniz's hierarchy of monads

INTRODUCTION

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- The veil of perception and its implications for knowledge
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- Why both Spinoza and Leibniz were determinists
- How Spinoza accounted for the appearance of free will
- Leibniz's hierarchy of monads

In Chapter 3, we tackled the Problem of Universals, and saw Galileo move this discussion into the domain of mind-body dualism by framing physical primary qualities vs. perceptual/psychological secondary qualities. We can now ask the famous dualist question—maybe the most famous philosophical question! Are you ready? Here it is: "If a tree falls in the forest and there is no one there to hear it, does it make a sound?"

Remember that, for Galileo, sound is qualia, a perceptual experience, so the sound of the creaking and crashing of the falling tree must be a property of auditory experience. What is the primary quality? It would be the vibrations of the tree, for that is what leads to the perception of any sound—a physical vibration in the world, which is transmitted via vibrations of air molecules, ultimately entering the ear where the organs therein begin to vibrate as well. In the dualist view, at some point this physical vibration becomes a perceived sound, jumping the gap from the physical realm to the psychological. So, what is the answer to the question? Does the sound exist without a witness? For the dualist, the answer is clearly "no," for until that physical vibration jumps the mysterious gap into the mind, it is just a vibration, not a sound. If there is no mind, there is no sound.

But what exactly is this gap between the physical and psychological? How can something jump across it? How might the physical become psychological? And how might psychological ideas manifest as physical reality? The latter question deals with the problem of how the mind controls the body. After all, the body is a physical thing, and so if I have the notion that I want to scratch my nose, how does this purely psychological notion jump into the physical realm to cause my physical arm to move? Recalling the lessons of Newton, for the mass of my arm to accelerate, a physical force must be applied to it? How might ideas in the mind exert such a force?

THE VEIL OF PERCEPTION

Prior even to Plato's Allegory of the Cave, the Chinese philosopher **Chuang Tzu** (born ca. 369 B.C.) questioned whether people could tell the difference between a dream and reality. He famously dreamt that he was a butterfly, and the dream was so vivid and compelling that he remembered nothing of himself, and only upon waking did he realize it was just a dream. However, he was compelled to ask, "Was I Chuang Tzu dreaming I was a butterfly or am I now really a butterfly dreaming that I am Chuang Tzu?"

This is not quite the same as the situation Plato's prisoners find themselves in, but nevertheless, a common theme emerges that it may not be possible to distinguish reality from, if not a dream, then the falsity of the shadows on the cave wall. What happens when one of the prisoners escapes? Upon first leaving the cave, he will be confused and disoriented. But after a while, he will adapt and come to understand this reality. Even later, he may decide he should return to the cave and explain to the other prisoners what he has learned. Will they believe him? Or will they tell him to shut up and leave them alone as they go back to watching their shadows?

This scenario has become a popular trope in modern movies, with the 1999 film *The Matrix* being a classic example. In that movie, the protagonist Neo discovers a similar truth about humanity: that we are all prisoners, but not in a cave. Rather, humans are kept in pods, providing energy for evil robots, and to keep humans docile, they are fed a simulated reality through wires implanted into their brains. Like Plato's prisoners, these humans are unaware that their perception is false and hides a very different reality "behind the scenes." As stated by the Wizard of Oz, "Pay no attention to that man behind the curtain!"

Between the time of Plato and our modern tendency to turn such nihilism into cynical entertainment, the French rationalist philosopher **René Descartes** (born 1596) proposed his own take on this dualist dilemma with his evil demon hypothesis. Descartes asked whether it could be possible that we are just a brain in a vat, not entirely unlike humans in the matrix. This brain in a vat is at the mercy of an all-powerful evil demon, who is bent on controlling and deceiving us into thinking that we are not a brain in a vat, but a brain in a body, which in turn is in a physical world that we can see, hear, touch, taste, and smell. The demon does this by simulating the types of signals our nerves would normally receive from such a world, and feeding this information to our brain, where our conscious mind would register the ideas that normally correspond to a real world. Of course, there would be no such world in actuality; it is just a deception, an illusion, just as in the Matrix. Descartes used this "thought experiment" as a justification for doubting the senses, by concluding that if such a situation were to be true, we would never be able to know it. We could never tell the difference between an actual reality and a simulated one.

What these three tales, the butterfly dream, Plato's cave, and Descartes' brain in the vat, all share is a barrier between the realm of immediate perceptual experience and external reality. We may call this the veil of perception: a barrier that separates what we experience from what is actually there. If such a veil exists, then our senses cannot be trusted to tell us what the world is really like, we can only see

what it is like from behind the veil. These are the same doubts of the senses we first encountered in Chapter 2, and are at the core of the problem of skepticism: the unsettling possibility that we may have no reliable access to reality at all. There are many ways philosophers respond to this problem, but the theme running from Pythagoras and Plato up to Descartes is rationalism. Through logic, reason, and mathematics, we may pierce the veil.

DESCARTES' SOLUTION

Part of Descartes' goal was to find a philosophical premise that could not be doubted, and in which he could be certain. Recall the Sophist movement in ancient Greece, and how they had argued that one could never be certain of any absolute truth, so no philosophical argument could lay claim to ultimate truth. Descartes felt that if it were possible to establish at least one absolute and undoubtable premise, then it could be used as the groundwork for an infallible philosophy. So, he began by doubting, and asking what sort of things could be doubted. As we saw with the veil of perception, the senses may be doubted. However, he concluded there was at least one thing that could not be doubted, which was his own ability to doubt his very own existence. The fact that he was performing this doubting, or thinking process, in the first place, confirmed his own existence as a thinking being. Thus, the rational mind exists, but everything else can be doubted. The famous phrase is one you have surely heard before, "I think, therefore I am," or in Latin, "Cogito ergo sum." As should be obvious by now, this rationalist conclusion relied on the assumption of a dualist disconnect between the mental and physical worlds—a dissociation between appearance and reality.

What makes this compelling, aside from being a catchy turn of phrase, is that the Cogito is both an epistemological claim what one can know (I think) and an ontological claim about what exists (I am). With this, Descartes has effectively merged epistemology and metaphysics. The very act of thinking proves that something exists. This is the Cartesian answer to the skeptical threat of the veil, and thus it is reason that delivers certainty over reality.

But "wait!" you may be thinking. So far Descartes has only proven the existence of the singular thinking self, not any external reality. This is a real concern and if Descartes had stopped at this point, we could be left with the same skepticism already noted. In fact, this form of skepticism is a special type called ***solipsism***, and it means that while we do not doubt our own existence, we may still doubt the existence of any external reality and even of other people, or other thinking minds of any sort. In sum, we would be all alone in the universe. This may seem an unsatisfactory conclusion to Descartes' philosophy, especially given that he wanted to eliminate skepticism. Here, Descartes simply rejects the possibility of the evil demon, and instead invokes a non-deceptive God, and claims that it is God's will that we experience a clear and distinct perception of a true reality.

INTERACTIONISM: THE MIND-BODY PROBLEM

Now that Descartes has established the existence of a thinking self and an external reality, he next turns to the question of what exists in that reality. In his answer, he arrives at one of the most influential and also controversial ideas in the history of philosophy, which is his claim that reality is composed of two fundamentally different kinds of substance. On the one hand is the thinking substance, the stuff of mind, which doubts, reasons, and wills. On the other is material substance, the stuff of body (and all of physical non-thinking reality), which has spatial extent and operates by mechanical principles. In this move, Descartes transforms the more implicit dualism described earlier into an explicit distinction we now call ***mind-body dualism***.

The Cartesian material world (*res extensa*, or extended thing) is defined as being the realm of solid, physical matter. Matter is solid and spatial, which is to say it extends in three dimensions—objects have a width, a height, and a depth. (As an aside, Descartes spent a bit of time describing the spatial properties of this world, and in so doing invented what you learned in high school math classes as the Cartesian coordinate system and analytic geometry, and you may further note that this places Descartes into the lineage tracing from Pythagoras that reality is intelligible through reason and math.) It is also the realm of motion, for if objects can occupy coordinates in this spatial world, then they can change coordinates, and so movement is defined in the Cartesian system as a change in coordinates. On the other hand, the psychological world (*res cogitans*, or thinking thing) is the opposite in all respects. It is immaterial, which means it does not possess the properties of physical objects; it has no size, shape, weight, location, or extension in space. Further, without extension, it cannot move.

But perhaps we now face a new problem, for if the mind is *res cogitans* and the body is *res extensa*, can two substances so fundamentally different interact with each other? And if so, how? How can an immaterial mind cause a body to move, or bodily events produce ideas in the mind? Descartes approached this problem in part by developing a mechanistic account of the body and nervous system. Though animal dissections, he examined the structure of the brain, spinal cord, and peripheral nerves, viewing them as components of a physical system capable of transmitting motion throughout the body. He reportedly took inspiration from a display of mechanical statues he observed in the royal gardens just outside Paris. These statues moved around and engaged in a variety of pantomimed actions. The mechanisms that controlled them were pipes, flowing with water, which moved the articulated bodies of the statues using hydraulic pressure. Descartes then had the insight that perhaps the nerves worked in a similar fashion, and so he envisioned the nerves as *hollow tubes* that connected to the ventricles in the brain (keep in mind that this was prior to the invention of the microscope and the discovery of the neuron). The ventricles were full of a fluid he called *animal spirits.* To move a limb, then, the animal spirits must flow from the brain, down the spine, into the relevant peripheral nerve, and out to the muscles controlling that limb. There, the spirits enter the muscle and inflate it, causing it to expand, and thus moving the desired joints. These animal spirits are not meant to invoke any sort of ghostly or immaterial forces. Rather they were defined as a highly refined, fast-moving bodily fluid produced in the brain, and transmit motion (and thus information) between brain and body.

The second part of Descartes' solution was to explain how movement of the animal spirits was trig-

gered within the ventricles of the brain. Again, Descartes drew from his knowledge of neural anatomy, and in comparing human and animal brains, concluded that the human brain possessed a structure the animal brain did not: the *pineal gland*. As it turns out, he was wrong about that observation, owing to the fact that the animal specimens he had observed had small pineal glands that he did not notice. Further, Descartes also believed that the pineal gland was special because of its central location at the base of the brain and its lack of bilateral structure. He then reasoned that this gland was the *seat of the soul.* It was here that the mind resided, and inside the gland, tiny movements of the mind triggered the flow of animal spirits in the ventricles, which amplified the tiny movements and transferred them on to the rest of the body.

Do we find this a satisfactory explanation to mind-body interaction? Recall the opposing definitions of the physical and psychological above. The mind, as defined, was nonspatial and does not have the property of movement. So, how could the mind be localized to an extensive space such as the pineal gland? Further, how can it move so as to trigger the flow of the animal spirits? And even further, if the animal spirits are considered to be a physical fluid inside the brain and nerves, how can the immaterial mind contact them and force their motion? This critique was first raised by Princess Elisabeth of Bohemia, who exchanged numerous letters with Descartes near the end of his life, and he may have ultimately given in to her arguments that it simply not possible, depending on how you interpret his replies.

In fact, a modern critique effectively characterizes the Cartesian mind as a mere *ghost in the machine* (Ryle, 1949), and such a mind with ghost-like properties cannot exert physical force on matter. One way of pressing this problem is to move toward a single substance approach, aka monism, and say, let the mind *materialize* inside the brain, and as such it could then easily interact with the physical body. In so doing, we have abandoned dualism entirely, and the mind has become some form of *res extensa*. But Descartes still clung to the notion of a mind-body distinction, which is perhaps not surprising, because as we have traced so far in this book, this way of thinking is very old and was just a fundamental part of the way philosophers thought. Rejecting the separation of mind and body would have to be a gradual process that was only just beginning to gather steam. In the meantime, other philosophers tackled the problem in various other ways designed to preserve some distinction of mind and body.

THE MIND-BODY PROBLEM AFTER DESCARTES

One example of an alternative mind-body dualism without interaction was championed by **Nicolas de Malebranche** (born 1638). According to his ***occasionalism***, the mind-body interaction occurs because of the intervention of God. Now, when I want to scratch my nose, God is aware of my itch and moves my arm for me! Likewise, the relief afforded by the scratching is communicated back to my mind through God. Thus, there is no direct interaction between the mind and body, only an indirect, God-mediated communication. God must be pretty busy!

Baruch Spinoza (born 1632) saw that Descartes' problem arose out of the contradictory definitions of mind and body. Spinoza's solution was thus not about proposing an alternative to interactionism per se but to find a different way of defining substance by rejecting the two-substance part of the theory while preserving the distinction between the mind and body. To do this, he wrote that instead of two substances (mind and body), there is just one. For Spinoza, this primal substance was God. Spinoza's view is sometimes treated as a form of ***pantheism***, in which God *is* everything. Per this view, God is equated with the lawful structure of an infinite universe and has infinite attributes. However, humans can only apprehend two of these attributes, namely thought (mind) and extension (physicality and spatiality). Spinoza has thus preserved these elements of Cartesian thought as just two of the many attributes of an all-encompassing *Deus sive Natura* (paraphrased as *God is Nature*). Extending this logic, if thought is one of the attributes of *God is Nature*, then all of reality has this attribute. Is thought really an attribute of all reality? This is called ***panpsychism*** and is another implication of Spinoza's work.

Because these two attributes, mind and body, are two aspects of the same underlying substance (God), they are like two sides of a coin: different, yet inherently connected, and the position has been called ***double-aspectism***. The relation between mind and body is explained by the claim that anything that happens to one happens to the other. A bodily event and a mental event are the same, just expressed differently. For example, you may touch a hot stove: your body responds and you feel pain – these are just two aspects of the same thing.

Spinoza also presented an early psychological theory as a natural consequence of his metaphysics. If God is everything and is infinite, and all finite things are expressions of *God is Nature*, then what exactly does it mean to be a thing? Spinoza says that to exist, to be a thing, is to strive to exist. A thing can exist only because it has this *essence* of striving to exist which Spinoza called *conatus*. When conatus is considered within the mind, Spinoza called it *will*, but in relation to mind and body together, he called it *appetite*, and one's awareness of this is *desire*. Thus, all our actions (will) and desires originate from conatus, a striving to persevere in being. (Without getting ahead of ourselves, it should be noted here that these ideas anticipate and set the stage for the later work of Schopenhauer with his Will to Live and Freud's Eros instinct, which we will cover in later chapters.)

A final significant consequence of the theory is that *God is Nature* is lawful, and mental and bodily events unfold according to necessity, which is to say they are determined. All thoughts and events must have prior causes, and Spinoza claims that free will is an illusion. The only reason people believe in it is because they attend more to conatus, their desires, needs, and feelings than to the prior events

that caused these mental states to arise in the first place. Spinoza claimed that human action, emotion, and need followed laws analogous to those found in Euclidean and Cartesian geometry. In a way, Spinoza continues the tradition from Pythagoras, Plato, and Galileo that the universe is constituted of an underlying lawful mathematical and geometric structure. This theme is worth keeping in mind throughout the history of psychology, because a recurring aspiration of Western science is to explain reality through lawful regularities discoverable through formal analysis. We will see this aspiration reappear whenever psychologists treat cognition and behavior as lawful, predictable, and scientifically intelligible, from psychophysics and behaviorism to computational models of cognition.

A contemporary of Spinoza, **Gottfried Wilhelm von Leibniz** (born 1646) was a polymath (a person with expertise in many fields) from Leipzig, Germany. Like Spinoza, he challenged the Cartesian dual-substance approach but instead of monism, he invented a sort of ***pluralism***, in which there are many kinds of things. Leibniz wrote that the fundamental building blocks of reality were indivisible elements called *monads*. While these may sound similar to atoms, there are important differences. Monads are not inert matter, but are active and alive, and even have consciousness, giving us another example of panpsychism. But monads have varying degrees of consciousness according to a hierarchy.

At the base of the hierarchy are found *simple monads*. All inanimate material is made of these, i.e., a rock is an aggregate of simple monads. Do such things have consciousness? Technically yes, but importantly they do not have self-awareness, meaning that a rock does not know it is a rock, nor is there anything to be said about "what is it like to be a rock?" Rather, such consciousness is an extremely primitive form of perception, without self-awareness, but dim, confused internal representations of reality. Next are *sentient monads*, which constitute the minds of animals, which are capable of self-awareness, but lack rational thought. The latter is an attribute of *rational monads*, which constitute the human mind. At the top of the hierarchy is God as the *supreme monad*, capable of knowing all, or omniscience.

The consciousness of each monad serves to reflect the events going on around it, with varying degrees of clarity corresponding to the nature of the monad. In terms of the mind-body problem, if my nose itches, my mind is aware of the itch, and my arm moves to scratch it, but how? The answer, for Leibniz, is ***psychophysical parallelism***. The experience of the itch occurs in the rational monad constituting my mind, and corresponding changes occur in the simple monads of the body. This is achieved because, at the beginning of the universe, God set up all monads to follow a preestablished plan, and their states are always synchronized and exist in a state of *preestablished harmony* without any causal interaction. Here, Leibniz converges with Spinoza in rejecting free will as they both reject Cartesian substance dualism.

SUMMARY

We have seen several approaches to the mind-body problem in this chapter. Each of them, in different ways, preserves a basic distinction between the mind and body, even when attempting to coordinate them through appeal to divine causation in one way or another. Taken together, these theories reflect the difficulty in explaining how two apparently different domains of reality can manage to coexist and correspond. It may perhaps seem obvious that another solution is to just collapse the distinction between mind and body, and adopt a fully monist framework in which mental and physical phenomena are treated as a unified ontological order. These early modern rationalists may have struggled to shed themselves of this very old and established mind-body distinction, but in the next chapter, we shall see that the British empiricists were more willing to do exactly that.

KEY TERMS

Key Terms

- mind-body dualism, interactionism, solipsism, occasionalism, double-aspectism, pantheism, panpsychism, pluralism, monad, psychophysical parallelism

STUDY QUESTIONS

Study Questions

1. Explain how Descartes' "brain in a vat" exercise could lead to solipsism.
2. Explain why Descartes is considered a rationalist.
3. What is the main difference between parallelism and interactionism?
4. According to Spinoza, why do people believe they have free will?
5. Explain Descartes' solution to the problem of interactionism and the problems with it.

CHAPTER 5: BRITISH EMPIRICISM AND THE RISE OF SCIENCE

INTRODUCTION

Learning Objectives
Understand

- The concept of epiphenomenalism
- Locke's Theory of Ideas and the difference between simple and complex ideas
- The concept of associationism and the role it plays in Locke's Theory of Ideas
- The associationist principles of contiguity, frequency, vividness and compound association
- The difference between mental physics and mental chemistry
- Why British empiricism and associationism are passive theories of mind
- Berkeley's argument for "to be is to be perceived" and immaterialism
- Hume's theory of human knowledge, especially his views on knowing causality
- Hume's idea of mental habit and how he used to explain knowledge of cause and effect
- Reid's common sense rebuttal of Hume's theory
- The difference between direct and indirect perception
- The concept of positivism and how Comte and Mach differed in their definition of science

While rationalist and dualist thinking persevered on the continental mainland of Europe perhaps well into the 19th century, philosophers on the British Isles were buffered from this dogmatism, many influenced by Francis Bacon's rejections of traditional assumptions – and thus found it easier to think toward monism as a solution to the long-standing mind-body problem. Like the few monists before them, such as Democritus, they were also led to empiricist-leaning epistemologies. Further, the success of Isaac Newton's mathematically-based physics seemed to confirm that the empirical methods of science could unlock the secrets of the natural world. But perhaps ironically, some empiricists came to question this conclusion.

MATERIALISM

We will first address the emergence of materialism, and for that we start with **Thomas Hobbes** (born 1588), who came from England but lived for some time in Paris and was a contemporary of Descartes. Hobbes was influenced by Galileo and classical geometry, and like Descartes shared a commitment to the emerging mechanistic and mathematical analysis of reality. Hobbes saw reality as *bodies in motion*, and that a body in motion may be a cause, and the effect is another body in motion. This thinking recalls the simplistic determinism of Democritus' atomism. He further argued that any immaterial mind of the Cartesian type could not be involved in such linear chains of cause and effect and thus are not needed to explain any physical event. In a way, Hobbes echoed Occam's razor here, and shaved off immateriality as an unneeded component of reality. Having shed the ghost in the machine, Hobbes presented a ***materialist monist*** account of mind and body, and interaction was explained via simple physical cause and effect.

However, collapsing mind and body into a single substance carries some explanatory challenges. As noted in the preceding chapters, there are many aspects of ideas in the mind that do not seem to be explainable in physical terms, such as the distinction between primary and secondary qualities as framed by Galileo. How might a materialist account for qualia? Hobbes simply rejects the need to talk about such things as if they are a separate ontological category. By dissolving the distinction between mental and physical, then mental descriptions of events, i.e., "the grass looks green," are ultimately grounded in motions of external bodies, transmitted through sensory organs and continuing as motion in the brain. We should note here that this depiction also provides a materialist account of perception and shows Hobbes to be an empiricist as well. That this again parallels Democritus' earlier work should be no surprise.

Returning to the proverb of the tree falling in the forest, we have already seen that a dualist may claim that the sound and the vibratory event that created it remain ontologically separate. But a materialist like Hobbes would instead claim that sounds and vibrations are just two words for the same thing. Much later, another materialist, the evolutionary biologist **Thomas Huxley** (born 1825) approached the problem of qualia by treating mental events as epiphenomena; that is, they are nothing but by-products of physical events in the brain. Thoughts are created by neural activity, so there is a sort of causal relationship between body and mind here, but it exists in strictly one direction: body (brain) causes mind. **Epiphenomenalism** sits in a vague relation to both monism and dualism, as it is not Cartesian substance dualism, nor is it a fully materialist view, but it nevertheless assigns all explanatory power to material reality. It treats conscious experience as a passive accompaniment to neural activity; it is produced by the brain but does not participate in explaining or producing behavior.

THE FOUNDING OF BRITISH EMPIRICISM

While Hobbes is an important early British empiricist, we generally look to **John Locke** (born 1632) for the official doctrine of this school of thought. Locke echoed Aristotle's and Avicenna's blank slate philosophies with his white paper metaphor, as he wrote, "Let us then suppose the mind to be, as we say, white paper, void of all characters, without any ideas; how comes it to be furnished? . . . To this I answer, in one word, from *experience*" (Locke, 1690/1964, pp. 89–90, as cited by Thorne & Henley, 2001; italics in the original). Locke then labored to explain the process by which sensory impressions accrue in the mind, and to thus account for learning and the organization of knowledge.

Locke's **Theory of Ideas** starts with a physical sensation registered by one of the sense organs and then transmitted to the mind, where it is registered as a *simple idea*, the direct psychological correlate to the physical sensation[1]. Simple ideas are labeled as such because they cannot be broken down to any simpler or smaller element (Chappell, 1994). This is as opposed to *complex ideas,* which are seen as constructed out of many simple ideas, and so can be broken down. A good example of a simple idea is sour, which is a very basic sensed quality of an object. A complex idea might be a lemon, which is composed of many simple ideas, including sour, but also sweet, yellow, ovate, and so on. So, a complex idea is any idea that can be analyzed into smaller, simpler qualities, and simple ideas are any ideas that cannot be broken down any further than they already are.

After the mind registers many such simple ideas simultaneously, they are compounded through a process of association to create complex ideas. To return to our dog example from previous chapters, our senses will initially register the physical sensations of the dog's shape, size, color, and so on, and each of these sensations is converted into a simple idea. The many simple ideas, perhaps of black and brown fur, long tail, pointy ears, brown and black eyes; so on, associate together to create the complex idea of, say, a German Shepherd. Perhaps it would be more accurate to say that patches of black and brown are associated to create the complex idea of a fur coat. A particular arrangement of the black and brown patches into a long, or pointy shape is associated to create the complex idea of a tail or of ears. A concentric arrangement of black and brown circles creates the complex ideas of eyes. Subsequent to the creation of all of these complex ideas, these ideas are in turn associated with each other to create the even more complex idea of the German Shepherd. In turn, the complex idea of German Shepherd can be associated with other complex ideas such as Chihuahua or Great Dane. As we have already labored to point out: the simple ideas used to construct each of these are not identical – there is no subset of simple ideas (that we have so far identified) common to all dogs and unique to dogs that constitutes each of these complex ideas.

1. The reader may note here that Locke's terminology is somewhat dualist in tone, and he did accept and formalize the Galilean distinction of primary and secondary qualities.

ASSOCIATIONISM

The principle that simple ideas come together to create complex ideas via the process of association represents a significant contribution to psychology, for now we have a *theory of learning*, and yet again an important major psychological theory comes from an empiricist. Much of this recalls Aristotle's laws of association. For example, **David Hartley** (born 1705) restated the *law of contiguity*, arguing that events, or simple ideas, that occur at the same time must be associated with each other. Hartley further approached this process from a materialist perspective, attempting perhaps to reconcile Locke's theory of ideas with Hobbes' materialism. But rather than motions in the brain, Hartley conceived of nerves as a vibratory system, described by Newtonian mechanics in terms of oscillation frequency and resonance. Hartley coined the term *vibratiuncle* to describe small and subtle nerve vibrations that correspond to simple ideas. Per the law of contiguity, repeated vibrations become linked with each other, so that one specific vibratiuncle may activate others and produce compound vibrations that correspond to complex ideas. Poetically, we might treat this as akin to the difference between individual musical notes and whole chords, though Hartley did not express it quite this way.

James Mill (born 1773) revived Aristotle's *law of frequency* and added also the *law of vividness*, both of which are used to explain the *strength of association* between two ideas. The more often two simple ideas co-occur, the stronger is their association. Also, the more vivid, or salient, are these ideas, the stronger their association. To clarify the notion of a complex idea, James Mill used the term *mental physics.* The idea here is that the creation of a complex idea is a simple linear process of adding multiple simple ideas together. The complex idea can be defined as the list of all the simple ideas that went into it.

James Mill's son, **John Stuart Mill** (born 1806) provided a different view. He envisioned the creation of complex ideas as a *mental chemistry*, not unlike a chemical reaction, where the chemical compounds combine and reform into something entirely new. Just as the new compound that results from such a reaction has properties that cannot be explained simply as the sum of the properties of the chemicals that went into it, the creation of a complex idea is not simply the sum of the simple ideas.

Alexander Bain (born 1818) represented the culmination of associationist theory. He took the various laws of association mentioned so far and added to them the *law of compound association*, in which any one idea, whether simple or complex, can be associated with any number of other ideas. Hence, once we have the complex idea of a German Shepherd, a Great Dane, a Chihuahua, and a Poodle, we can form associations between all of these ideas to create another complex idea that we call "dog". Further, we can take the complex idea of "dog" along with the complex ideas of "cats," "deer," "elephants," and "giraffes" to create an ever more complex idea, this time "animals." The entire way in which human knowledge is constructed and organized occurs based on these associations. And, of course, it all begins with simple ideas, and their physical counterpart, sensations. So not only is this ***empiricism***, but it is also definitely ***nominalism***, for the general categories, or universals, exist only as patterns of associations between many, many simple ideas. Bain's formulation and integration of the laws of association into a single and coherent theory laid the foundation for much of the psychological research on learning and behaviorism that followed soon after his death in 1903.

One important aspect of associationism cannot be ignored. Associations are created via the *laws* of association, and thus it *must* be that the mind creates associations between ideas when the right conditions are met (e.g., contiguity). There is no room for free choice in this matter. The mind *passively* registers the sense data and creates simple ideas, and the simple ideas are passively and reflexively associated into complex ideas. Hence, the whole of the human mind is a passive accumulation of sensations and the associations between them. Thus, this theory is an example of what might be called *empirical determinism*, where one's thoughts are determined by one's past sensory experiences and the associations that follow. This is distinct from *materialist determinism*, where the mind, being part of the physical world, must obey the laws of physics. So far, we have seen many materialists were also empiricists, though the positions remain distinct, but both views may lead to determinism for these different reasons. As you may note, Spinoza and Leibniz attempted to address problems with Cartesian dualism, and they also found their way to determinism, and in the current case, the materialists of the current chapter have done so as well.

We should note here the general character of British empiricist philosophy of mind. What we think of as the mind is really just a passive accumulation of simple and complex ideas. The thoughts within this mind are determined by these associations, which in turn are determined by the external sensory stimulation to which we are exposed. The complex ideas of which we are conscious are merely the set of associations between simple ideas and thus have no clear connection to reality. This is a form of *reductionism*, where all knowledge can be reduced to elementary sensations. It is also a form of *nominalism*, given that any complex idea such as of a dog, is just the set of associations formed between other simpler ideas. This could mean that our concept of the thing we call dog is nothing but our inherent tendency to form associations. We might see how this could lead to some degree of skepticism as we may have returned to being excluded from reality by the veil of perception. Can we be sure our complex ideas correspond to anything real at all? Does the real world even exist or are we just aware of simple and complex ideas in the mind? How do we know? The rationalists at least saved human knowledge from this skepticism by endowing us with innate knowledge, but Locke has already done away with that, so without innate ideas, we are left with nothing but doubtable and subjective sensations and the associations between them.

IDEALISM

George Berkeley (born 1685), appointed Bishop of Cloyne within the Anglican Church, was well aware of the potential for skepticism from the passive nominalism of Locke's theory. He was also aware that such thinking could lead to skepticism about the existence of God (agnosticism) along with the rest of the universe. Berkeley sought to counter this thinking,

not by rejecting empiricism or nominalism, but by again rejecting the dualism that manages to still linger about. However, rather than supporting the materialist version of many of his counterparts, Berkeley argued for ***idealism***, aka ***immaterialism***, that it is only the mental world (or the world of ideas), and not the physical world, that exists. Or, if we use the distinction between primary and secondary qualities, then only secondary qualities exist.

Berkeley started by rejecting the existence of a physical world that is independent of experience and claiming that *to be is to be perceived*; that is, nothing exists until it is first perceived. To revisit the old saw, "If a tree falls in the forest and there's no one there to hear it, does it make a sound?" the answer for an idealist is that that tree did not exist at all! Without a perceiver, not only did the sound not exist, but neither did anything else. The original framing of the question presumes a physical reality that exists independent of our perception of it. The implication of Berkeley's idealism is that there is no such thing and that the question is incoherent as asked. All that is real is that which is perceived.

You might wonder if there aren't some strange implications to this theory. For instance, does that mean that my house does not exist when I leave it in the morning and go to work? After all, no one is there to perceive it. Except, maybe, when the mail carrier comes at 3:00 p.m., perhaps it pops back into existence while they are there? Then does it dissolve back into the void until I come home again? What about the room you are sitting in now, reading this book. Close your eyes. You are no longer seeing the room, although you might still hear or touch parts of it, but for many of the objects, you are no longer in any perceptual contact with them. Are they still there? Open your eyes, there they are. But wait—how do you know they continued to exist during the time your eyes were closed? This was exactly Berkeley's point: when something is not perceived, we do not know it is there, so it is simpler, and better, to just say that it is not there. His claim, ultimately, is that the only things we can be aware of are sense-ideas, and thus, whether it is my house or your room, these too are but sense-ideas. He claimed it is a contradiction to state something is an idea, but also not an idea. Thus, my house is an idea in my mind, and it cannot be anything else but that.

But, doesn't this sound a lot like the skepticism that Berkeley was trying to eliminate? Does he really think nothing exists except when we perceive it? Existence depends on perception, yes, but importantly, human perception is finite. In contrast, Berkeley contended that God, being omniscient, simultaneously sees all and knows all. Thus, God is the Ultimate Perceiver that keeps the universe in existence even when any single person is not around to perceive it and that further, God is the cause of all human sensory impressions, and thus all knowledge. In conclusion, we can also see that Berkeley was not just an idealist and empiricist, but also clearly a nominalist, because the general categories,

like everything else, exist only as ideas. But his invocation of God establishes an objectivity to perceptual reality and avoids skepticism.

SKEPTICISM

From Scotland came **David Hume** (born 1711), who accepted Berkeley's emphasis on perception in establishing what we can know. There was, however, one significant difference between Hume and Berkeley. Where Berkeley used the primacy of perception as a springboard to a positive metaphysical conclusion, that reality consists of minds and ideas sustained by God, Hume refused to make that leap. All knowledge comes from the senses, as Locke had said, and Hume was unwilling to claim more than the senses could deliver. While never publicly admitting to it, Hume was widely viewed as an atheist, and he might note that the senses cannot deliver God to us. So, without Berkeley's Ultimate Perceiver, how might Hume explain the continuity of reality? He simply did not. Rather, he claimed that knowledge originates with sensations, and from there, people form beliefs and assumptions about what they think caused sensations, but that there could be no logical justification for proving the veracity of these beliefs.

We should pause here to note a curious parallel between Berkeley and Descartes. Both of them sought to defeat skepticism, and used very different arguments to do so, and yet they both converged on God to patch up their theories. Descartes began with a thinking self and needed God to build a bridge to external reality. Berkeley burned this bridge and then needed God to replace it with a different way to account for the coherence and continuity of experience. It seems that both remain trapped behind the veil of perception and relied on a theological escape hatch because pure argumentation failed to get them completely out of it. Hume recognized as much, and by rejecting appeals to God, he argued against the possibility of escaping skepticism.

As an empiricist, Hume used associationism to explain how beliefs and assumptions come to form in the human mind. As an example, when I look out upon my office right now, I see my books, computer, telephone, and pictures arranged messily on my desk. I close my eyes, so now I cannot know if they are still there. I open my eyes, and there they are, just as they were before. Because, in my experience, objects seem to be always just where I left them the last time I perceived them; then through another law of association that Hume called *resemblance,* I form an association between the objects as they existed before and after the time my eyes were closed. This association causes me to link them together and conclude that they are the same objects, from which I also infer that they existed in the interval when my eyes were closed. Thus, my tendency to assume they existed is the byproduct of the passive laws of association that govern the operation of our minds. This is a pessimistic view of human knowledge, because not only is much of knowledge considered as assumption, but we are also not in control of these assumptions, because the laws of association make us assume them!

One of Hume's most well-known positions dealt with his treatment of *causality.* He used billiard balls as an example. When watching them collide, we see one ball moving, contacting a second, which in turn moves. To our eyes, we can only know the motion of the first was followed by the motion of the second. Do we know that the first caused the second to move? No, because the causal force at work was not visible. At no point was the cause present in the sensations, only the motions were sensed. Again, Hume invoked associationism and claimed that ideas of *cause and effect* are just associations created based on the *law of sequence*. When one observes events that occur in particular sequences

like the collision of the billiard balls, this law causes us to assign a causal interpretation to it. But, as the adage goes, correlation does not prove causation – and in this case, Hume argues that all that we know, all that was given to the senses, was nothing but the correlation of the motions of the balls. The idea of causation is merely another assumption.

Hume called this tendency to infer and assume *mental habit.* Through experience, we have repeatedly observed that when one ball moves and contacts a second, the second ball moved in particular ways. The regularity of these occurrences leads to the habit of assigning a cause-and-effect relationship to the event, even though it is merely an assumption. Hume thus drew a sharp line between what people assume to be true vs. what can be logically proven to be true. This, as it turns out, is a direct challenge to Newton and his second law of motion, $F = m \times a$, which describes the accelerating motion of an object in terms of the forces applied to it. Hume noted the senses could deliver ideas of acceleration to the mind, but not force. Newton, of course, believed he had described force (and gravity) as a real physical property of the world. But Hume, as the skeptical nominalist, said that force and gravity are nothing but ideas invented by the scientist to explain certain motions that are observed in specific situations. This is Hume's famous C*ritique of Induction*, and which was also then a critique of Baconian science. He claimed that we cannot logically justify that future observations will resemble the past, and so for Hume, Newton's laws were just more examples of mental habit. This, of course, raises deep concerns for the epistemic status of science. When we do science, or indeed whenever we reason from experience, are we using the tools of empiricism to discover the real properties of the external world, or are we merely describing our observations and inferring explanations for them?

INDIRECT PERCEPTION

To further unpack Hume's skepticism and its connection to the veil of perception, consider this analogy. Imagine speaking to someone who only speaks Italian. Let us assume that, for this example, you do not know any Italian and that the other person does not know any English and that these are the only languages either of you can speak. We might be at an impasse, unable to figure out how you and the other person can interact at all. Let's say we find a translator who speaks both languages. So now the Italian speaker says "Ciao!" and the translator says, "Hello." And so the conversation goes. But wait. How can we know for sure that what the translator is telling us is true or not? Our translator could be deceiving us (hey, remember Descartes and the Matrix?). Or, maybe the translator is not very good, so maybe the translated message is a poor representation of what the Italian speaker actually said. You surely know the phrase, "Lost in translation." Well, there could be a lot that was lost in translation.

The problem is that the only thing we have direct knowledge of is what the translator has told us, and our knowledge of what the Italian speaker has said remains necessarily indirect. This is just another way of framing the veil of perception as previously illustrated by the butterfly dream, Plato's cave, and the Cartesian brain-in-vat. We only have *direct* knowledge of our perception (the result of the translation process), and *indirect* knowledge of the outside world (that which is being translated). Perhaps you can see why Hume was so skeptical, and why he believed that any claims to knowledge beyond what is given directly by the senses was not justified. When the translator says "Hello," the only thing I really know is what the translator is saying. I cannot claim any certainty about what the Italian speaker really said.

The core dilemma so far derives from the assumption that we are not in direct perceptual contact with external reality, and that all perceptual interaction with the world entails some sort of mediation, as in the case of the translator. Working under this assumption, how can we ever verify what our senses, working as the translator between our minds and the external world, tell us? Even Berkeley acknowledged this problem when he claimed that all that we know, and all that can be said to be real, are just these ideas created within our minds.

Consider the below schematic diagram of the kind of *indirect perceptual theory* implied by this framing (Figure 5.1). On the left is a photograph of a tree that we may assume exists in the real world, but keep in mind it is included for illustration purposes only – as we have discussed, Berkeley challenged the notion that such things exist, and as depicted, it has qualities such as color and form that are considered secondary qualities and thus would not be properties of the tree-in-the-world[1]. Following the conventions of modern perceptual psychologists, we will call this tree the *distal stimulus*, because it stimulates our senses from a distance. How does it do so? In the case of vision, light reflecting from the tree manages to enter our eyes and make contact with the photoreceptors of the visual nervous system, the activity of which we will call the *physical sensations* (sometimes called the *proximal stimuli*). But so far these steps in the process are purely physical events involving objects, light and the nervous sys-

1. Note that it is impossible, by definition, to depict primary qualities. All depictions, representations, and visualizations contain only secondary qualities.

tem, but if we continue working from Locke's claim that visual sensations must at some point become simple ideas in the mind, then we must change the level of description and use terms appropriate for *qualia*, thus we get visual sensations of color, brightness, form, texture, and so on, corresponding to simple ideas. But each of these simple ideas are individually meaningless, in the sense that seeing *green* in a visual image does not tell you that you are seeing a tree, or a leaf on a tree, or a blade of grass, or a person in a green shirt, etc. So it seems as if the mind, on the right-hand side of the diagram, does not speak the same language as the world on the left (to continue with our translator analogy above) and the sensations must be translated into perception. Something has to happen in the mind to *add* psychological meaning to what is treated here as meaningless sensory input, ultimately giving us the perceptual representation that we are seeing a tree with a brown trunk and green leaves forming a rounded canopy. The claim here is that meaning can only be created inside the mind by some internal cognitive process, akin to our translation. In the views of the British empiricists, it is a bottom-up process based on associations, represented as the arrow connecting sensations to perception. Perhaps now we can understand Hume's skepticism. If, as he claimed, all that we can know is what is given to the senses (i.e., the meaningless sensations, or simple ideas), then how can we know that the complex ideas that form in our minds correspond truthfully to things outside the mind?

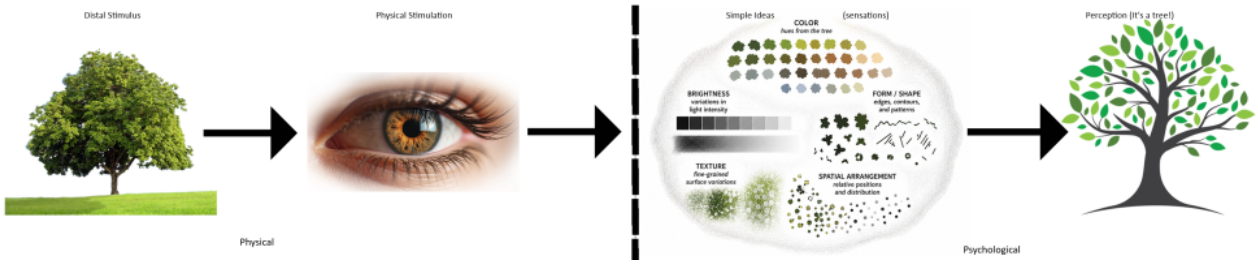


Figure 5.1. A diagram depicting the indirect perception theory. On the left, an object in the world (the distal stimulus) stimulates an observer's eyes, creating physical stimulation of the receptors. This stimulation is then converted into psychological sensations (i.e., sensations of color, brightness, texture, form/shape, spatial arrangement) which then must be organized into a full and meaningful perception of the object, at which point one becomes aware of seeing a tree. (Note the mismatch between the distal tree and the mental representation of one.) The dividing line in the middle represents the veil of perception, separating the outer physical world from the inner psychological world.

COMMON SENSE

A fellow Scotsman and contemporary of Hume, **Thomas Reid** (born 1710) disagreed with Hume's skepticism. He realized that the skepticism arose from two main sources. The first was the assumption that the mind was passive and subject to the laws of association, giving us no control over the way in which ideas formed in the mind. He rejected this by simply arguing that the mind is active and uses its faculties of reason to understand the world around us. In fact, Reid argued that one must employ reason to analyze the mind at all, so there must be something more going on in the mind than simple association between ideas. One example of this rebuttal came in Reid's treatment of mental habit and the law of sequence. Hume claimed that the law of sequence causes us to assign cause-and effect relationships to any sequence of events that occur with frequency and regularity, such as billiard balls colliding. Reid asked, then, why it was *not* the case that all people believe that day caused night and night caused day, for this sequence of events occurs with the greatest possible frequency and regularity. But of course, no one believes this. Reid hence concluded that it was because the mind has the rational ability to discriminate real causal relationships from spurious ones. For this reason, some consider Reid to be a rationalist (e.g., Hergenhahn, 2009). But while he argued that the rational mind could appropriately judge the meaning of sensations, he still supported the blank slate, and in the end, Reid proposed a perceptual theory in which we can trust the senses and so ought to be considered an empiricist.

The second sticking point in Hume's philosophy for Reid was the assumption that the sensations work as a translator, only giving us indirect knowledge of the world. Hence, the root of the problem is the implicit dualism behind the veil of perception, as represented by the dividing line of Figure 5.1. Simply by rejecting dualism and removing the dividing line, Reid claims that we can perceive the world directly, and that our ideas correspond to reality, and to justify this, Reid appealed to ***common sense***. This is the core of Reid's contribution and it, too, rebuts Hume's treatment of causality. When judging the causal relationship of one billiard ball to another, Hume said that the senses only contained the motions, but not the force, or cause. Hence, the motions can be known but their cause cannot. Reid claimed that this conclusion arose from what is called a ***representationalist*** account of knowledge. In this view, all that we can be immediately aware of are ideas in the mind, and these ideas are nothing but representations of things outside the mind[1]. Reid further claimed that when philosophers adopt a representationalist view of knowledge, it causes them to change the meanings of common words. For example, when a common person uses the word tree, such as saying, "It's a tree!" then to that person, the word means an actual object in the world, and that is common sense. But to a representationalist philosopher, the word means an idea in the mind, not a real tree, and thus Reid is rejecting representationalism as a violation of common sense. His conclusion is that seeing a tree means *seeing an actual tree*, not becoming aware of the idea of a tree in the mind. Extended to the case of Hume's billiard balls, it means that seeing one ball cause the motion of the other means *seeing an actual causal event*, not having the idea of causation.

1. Note the dualism implicit in representationalist theory.

Reid's perceptual theory is thus direct, because it entails immediate awareness of the outside world, rather than through the intermediary of mental representations (ideas), and it is realist because he claims that we know reality, not just ideas and their names. This philosophy can be called ***direct realism***, but has also been called ***naïve realism***, because he unquestionably accepts the faithfulness of the senses. To Reid, *common sense* proves the universality of perception- that we all perceive the same reality, and thus we share, in *common*, the same *sense* of what is real.

In the end, Reid claimed that Hume violated common sense to such a degree that even Hume must not believe his own theory! After all, if one does not believe in one's own perception of the world, then what is to stop one from behaving in any odd or eccentric way that one chooses? As Reid wrote, "I resolve not to believe my senses. I break my nose against a post that comes in my way" (Beanblossom & Lehrer, 1983, p. 86, as cited in Hergenhahn, 2009). Hume certainly acted in no such way but rather behaved as if his perceptual experience was valid and trustworthy.

POSITIVISM AND THE PROGRESS OF SCIENCE

Science generally works under the assumption that controlled observations, coupled with reason, can help us understand the world around us – and that was certainly Francis Bacon's conclusion as discussed in Chapter 3. The success of Newton and those who followed him seemed undeniable, however, and so the march of science proceeded on. But Hume's Critique of Induction lingers: can empirical observation provide humanity with knowledge of reality? Can we advance human understanding, both of ourselves and the world around us, using scientific methods? This appears to be the million-dollar question.

Despite such concerns, there were some who saw science as the key to human advancement. **Henri de Saint-Simon** (born 1760) developed a historical view of human society based on the way knowledge was acquired, and he championed the Enlightenment ideals of progress out of the older theological and autocratic systems. But Saint-Simon was also somewhat critical of the Enlightenment thinkers such as Voltaire or Diderot, suggesting they had served a *negative* function, having dismantled the legitimacy of autocracy, aristocracy, and theocracy, but had not provided a sufficiently *positive* map for the future.

Saint-Simon saw science as the answer. His account of human progress focused on historical patterns of intellect and knowledge acquisition, and he argued that science had emerged as the most reliable form of knowing. He leaned on Baconian science, emphasizing empirical observation with a goal of discovering laws and regularities in nature. He also argued that the authority of any claim rested essentially on one's ability to demonstrate its truth, rather than any appeal to status. Quite importantly, Saint-Simon argued that the application of the scientific method could solve what he thought was the most important emerging question for all of humanity. If the Enlightenment's liberation of the individual from the older, oppressive structures was as a net gain for humanity, then in the absence of these structures, what holds society together? The later sociologist **Émile Durkheim** (born 1858) coined the term *anomie* to describe the psychological outcome of excessive individualism: social fragmentation, weakened norms, and feelings of isolation. Saint-Simon's pioneering application of historical and sociological methods led him to champion the idea of new social order, *technocracy*, where society would be led by scientists and engineers, not by nobility or the Church. He is thus seen as one of the forefathers of modern *social science*, in particular those that work at the larger scales of humanity, including sociology, history, political science, and economics. His methods set the stage for other sociological analyses of human history, such as by **Karl Marx** (born 1818), the aforementioned Émile Durkheim, and **Auguste Comte** (born 1798).

Comte, in particular, had worked closely with Saint-Simon, and agreed with the need to use science to replace the old order. Like Saint-Simon, he used a historical analysis. Comte envisioned the history of the world in three phases. The first stage was *theological*. In this stage, humanity adopted primarily supernatural explanations to explain causes in the natural world. Humanity, at this stage of development, saw the world in magical terms. The next stage was *metaphysical*, as humanity began to adopt more formal methods of reasoning about the world, engaging in less magical thinking. This corresponded to the emergence of metaphysical philosophy. The third and final stage was the *positive* stage,

in which scientific thinking emerged, and humanity discovered the natural laws of the world through empirical science.

Comte's idea for the future of humanity was that a new religion, based on science, would replace superstitious religions, which he felt had impeded humanity's development and progress. He envisioned a new Religion of Humanity, employing science in the service of humanity. Thus, a scientific revolution was needed that would eliminate all the major religious institutions, and society could be reshaped based on a natural, rather than a supernatural, law. Comte believed, with the emergence of modern science, that humanity was entering the positive stage of history, and that to succeed, science must be clearly defined so that it could be distinguished from superstition and metaphysics. Like Saint-Simon, Comte drew from Baconian science, emphasizing objective, empirical observation. Objective, in this sense, means that science should only concerned with publicly observable events. It is not acceptable that one person subjectively observes an event – and with this claim, Comte eliminated introspection, insight, meditation, and mystical revelations as valid means of knowing. Rather, multiple observers must observe the event, agree on their observations, and even better, it would be desirable to measure and quantify the event, so that the observers could record their observations objectively and systematically. This definition of science was called ***positivism***.

As Bacon did before him, Comte began to classify the sciences. In his view, physics was truly positive, and that chemistry and biology were on the cusp of positivism by rejecting their metaphysical antecedents of alchemy and vitalism, respectively. By rejecting ***vitalism***, which is a metaphysical philosophy that states that living things possess a special life force that separates them from inanimate matter, Comte envisioned that biology was ultimately reducible to chemistry, which reduced to physics. Comte argued that psychology was yet to become truly positive and remained metaphysical because of the many lingering speculations about the nature of mind/soul. Eventually, though, a truly positivist psychology would be materialist and thus reducible to biology and the other positive sciences. Thus, positivism was ultimately a materialist view of reality, with physics, and its goals of uncovering the laws of the natural, material world, serving as the fundamental science. All scientific questions would eventually be answerable in physical terms.

In contrast, others who agreed with Berkeley and Hume adopted a different view of science and human knowledge. Emphasizing the representationalist perspective, **Ernst Mach** (born 1838) argued that all scientific knowledge was really just the knowledge of ideas in the mind. Thus, in order to truly understand reality, we must first understand the nature of ideas, and how they come to be. In the end, all sciences reduce to perception, and because psychology entails the scientific study of perception, then psychology, rather than physics, becomes the fundamental science. According to Mach, the scientific understanding of anything would amount to understanding the nature of sensation and the organization of sensations into human knowledge. Mach's version of positivism then was perhaps even more emphatic, compared to Comte, about the significance of observation. Echoing Berkeley, he argued that anything not observed could not be said to exist, and in his later years he became especially skeptical of the emerging field of quantum physics, with its atoms that could not be observed.

KEY TERMS

Key Terms
materialism, epiphenomenalism, simple idea, complex idea, associationism, mental physics, mental chemistry, law of contiguity, law of frequency, law of vividness, law of compound association, law of sequence, empirical determinism, materialist determinism, idealism, immaterialism, skepticism, representationalism, direct realism, naive realism, common sense, vitalism, positivism

STUDY QUESTIONS

Study Questions

1. . Explain the importance of association to the empiricists.
2. Describe the difference between mental physics and mental chemistry.
3. "If a tree falls in the forest and there's no one there to hear it, does it make a sound?" How would John Locke, as an empiricist and a dualist, answer that question? Explain your answer. How would an idealist like Berkeley answer the question? Explain why. What about the skeptic Hume? Finally, how would the common-sense empiricist Thomas Reid answer the question? Again, explain your answer.
4. Explain positivism as it was defined by Comte.
5. Explain why many empiricists tended to be determinists.

CHAPTER 6: CONSTRUCTIVISM AND PERCEPTION

INTRODUCTION

Learning Objectives
Understand:

- The difference between bottom-up and top-down processing
- How Kant differed from Hume in his explanation of perception and knowledge
- Why Kant and Helmholtz considered it necessary for perception to involve interpretation
- The difference between the noumenal world and phenomenal world
- How Kant accounts for the structure of phenomenal experience
- The goals of Biological Kantianism
- The concept of a local sign
- The stages of Helmholtz's perceptual theory and the role of prior experience
- The evidence in favor of Helmholtz's theory and the problems with it

Modern cognitive psychologists use the terms bottom-up and top-down to describe different theories of perception. Both views are based on the representationalist view of knowledge, in which sensations are a starting point for perception, but in themselves contain no psychological meaning, as we learned in the previous chapter. To go from sensation to perception, meaning must somehow be created within the mind, and the result will be a meaningful mental representation of the world. The difference between these theories rests on the nature of this perceptual process. ***Bottom-up processing*** is synonymous with the idea of *data-driven processing*, which means no information beyond the sense data is used to create psychological meaning. ***Top-down processing*** allows for some other form of knowledge, that exists already within the mind prior to the sensations, to be used in the perceptual process.

The British empiricist view was that we are born a blank slate, and thus no knowledge exists within the mind before the first sensations are experienced. Thus, knowledge can only be *built-up* out of sensations, as Locke described with his association-based Theory of Ideas. While we can trace this kind of thinking about perception and knowledge back to Aristotle, we can consider Locke's theory to be the modern genesis of bottom-up processing and which culminates in the modern behaviorist emphasis on stimulus-response associations. Modern cognitive psychology, by contrast, emphasizes top-down approaches and thus owes an intellectual debt to the constructivist views next considered.

We have seen the problem of perception lead Hume to a skeptical position regarding human knowledge. On the European continent, however, many philosophers were still working within the traditions of dualism and rationalism and were still looking for a rational escape hatch from the veil of perception. It was in this context that **Immanuel Kant** (born 1724) came to prominence with his refu-

tation of Hume's epistemology. While aspects of Kant's ideas can be traced to Plato, we can consider Kant's work to be the modern genesis of top-down processing.

KANT'S METAPHYSICS

In previous chapters, we have started by discussing a particular philosopher's metaphysical philosophy to understand how it ended up shaping their epistemological views. But Kant's approach did not work in this way, as he is not generally known for a clear metaphysical position. Kant is sometimes labeled a dualist, but his ideas in this area are notoriously confusing and still the subject of debate within philosophical circles. We will not try here to address these debates or settle whether Kant is a dualist, but it may help to briefly discuss some key terms introduced in his *Critique of Pure Reason* (1781/1787). In this book, Kant described two kinds of objects. There are things known to the mind, what we have so far been calling ideas, or mental representations, and there are "things-in-themselves". These "things-in-themselves" exist in the ***noumenal world***, which is distinct from the ***phenomenal world*** of the mind. This distinction may remind us of Galileo's theory of primary and secondary qualities, or even Descartes' two substances, but the philosophies are not quite equivalent.

So, what are these things in the noumenal world? This is where Kant's philosophy gets tricky, because he states that we simply cannot know anything about them. In fact, he says that all that we can do is intuit the possibility of something existing outside of the mind, but that we cannot otherwise describe it, because any attempt at description entails applying mental concepts to these things-in-themselves. However, mental concepts can only apply to phenomenal objects, not to noumenal objects. That is, if I want to describe the tree as seen in Figure 5.1, I might say that it is tall, with green leaves. But all of these terms describe my idea of it, not the thing-in-itself, and the descriptors themselves (tall, green) are also ideas. In short, it seems there is very little we can know or say about noumenal objects other than the possibility of their existence. Thus, Kant did not divide the world into a well-defined duality of substances as did Descartes, but rather he separated what we can know (phenomenal reality) with what we cannot (noumenal reality).

As a result, the understanding of the phenomenal world, and why it has the structure and character that it does, becomes a far more important endeavor to Kant, and he makes no attempt to appeal to noumenal reality to do so. His approach is called ***transcendental idealism***, which at its core is an epistemological statement about what can be known and the nature of what it means to know, and thus should be distinguished from Berkeley's metaphysical idealism, which is a statement about what exists. Subtleties regarding the definition of transcendental idealism remain a debate in modern philosophy, which we will again not attempt to settle here. Rather, we will focus on a core component of this idea, which is Kant's attempt to explain why we experience the world the way that we do. Kant's goal here was to provide a groundwork for justifying some universality, and thus objectivity, to human perception, and thus to counter the subjectivity inherent in Hume's skeptical empiricism.

KANT'S EPISTEMOLOGY

One of Kant's major goals was to respond to Hume's skepticism about causality. Hume had argued that we have no justification for believing in necessary cause-and-effect relations, since all we observe is one event following another. Kant proposed that the mind contributes essential structure to experience, including the concept of causality. In this sense, cause and effect are not known via perceiving the world but rather are an inherent part of how we perceive the world.

While this is a rejection of Hume's skepticism, it is not the sort of realism we saw with Thomas Reid, since Kant denied that we can know reality as it is in itself and so is not interested in any justifying any correspondence between ideas in the mind and any mind-independent reality. In effect, the challenge in evaluating such a correspondence is at the heart of skepticism, and Kant's move is to abandon the question entirely by focusing instead on the universal and objective character of phenomenal experience.

For Kant and his transcendental idealism, we experience the world the way that we do because of certain innate structures called intuitions and categories, which are the psychological conditions that make experience possible in the first place. The two core intuitions are space and time. These are the primary conditions of experience and are inherent features of mind, not mental habits or associations derived from experience. Thus, we can only have experiences that span space and time. These need not be features of any external world, but are structures of cognition that shape all experience, and they are necessary for any experience to occur in the first place. This is a universal framework, and Kant's claim is that all human minds work this way, and in so doing he establishes a universal and objective character to human experience.

The *a priori* nature of space and time is what makes them transcendental, and for Kant, this means that mental structure is innate. In addition to the intuitions of space and time, Kant added an additional 12 innate categories of thought. One of these is importantly the category of causality, and so Kant here establishes the objectivity of causal understanding as a rejection of Hume's skeptical treatment of it.

A helpful way to understand this is to imagine the categories act as something of a filter on experience. Consider wearing specialized lenses attached to goggles, perhaps a fisheye lens that bends and distorts vision. If you had worn such lenses for your entire life, this would simply be the only way you understand the visual world. Thus, even though there may be an external world that serves as the cause of your visual sensations, the structure and meaning of those sensations is very much a function of the lenses. Unlike Plato's prisoner in the cave, who escapes to find the true nature of reality, we cannot remove our lenses – but because everyone wears the same lenses, we experience an objective reality in the sense that we all share the same phenomenal experience of it. Space and time, plus the 12 categories, equip us with these perceptual filters. Kant's perceptual theory is called ***empirical realism***, in that he claimed an objectivity to the phenomenal world of appearances. However, the exact relation between phenomenal objects and noumenal objects remains unspecified, so we might also be tempted to think of Kant an ***indirect realist***. Returning to the translator analogy from Chapter 5, it is the innate

categorical perception that plays the role of the translator, but we may escape the veil of perception and skepticism because we all use the same translator.

THE PERCEPTION OF A 3-DIMENSIONAL WORLD

Because Kant had included the idea of space as one of the fundamental properties of the mind, it provides the basis for how we experience objects as have a spatial extent extending in three dimensions (i.e., length, width, depth). This was helpful for solving another long-standing challenge for those interested in perception, especially visual perception. This was the problem of depth and distance.

Berkeley had previously described the problem of the visual perception of distance. Consider the image in Figure 6.1. We see a photograph of a simple scene, depicting blades of grass in the foreground, and rolling hills in the distance. Images such as this are a projection of a 3D world into a 2D image; the depth, or distance, between the foreground and background is not literally present in the image, but rather it is perceived. This is equivalent to what happens in vision, with the chambered eye that uses a lens to project light rays from the world onto the 2D surface of the retina. Thus, objects depicted on the retina, as in photographs, can be described in terms of their height and width, but the depth dimension is missing. Berkeley described the depth dimension as a *line presented endwise to the eye*, and this line, when projected to the retina, collapses to a point so that depth is lost in the optical projection. So how then do we manage to perceive a 3D visual world given only 2D visual sensations? Berkeley adopted a typically nominalist and empiricist approach by suggesting that the mind uses various depth *cues*, which are simply patterns in the image that the brain *associates* with distance. One example is the cue called relative size. In Figure 6.1, the nearest blades of grass are shown to be larger than the farther ones, and the very far ones appear as mere specks. Yet we perceive not that the grass is shrinking, but rather that all the blades are approximately the same size in the world, and the change in their relative size really means a change in distance.



Figure 6.1. A bucolic scene depicting depth. (Image copyright 2007 by nuagedenuit flickr account, https://www.flickr.com/photos/nuagedenuit/478207866/ used by Creative Commons license BY-NC-ND 2.0)

Recalling Figure 5.1, it may help to think about perceptual theory in four steps, or stages:

1. Things-in-themselves; objects in the world that cause sensation.
2. Sense data (or sensations).
3. Translating or processing the sensations.
4. Perception and recognition of an objective reality.

Thinking in terms of the British empiricists, Step 3 is bottom-up processing relying on association and only what the senses provide. Kant's contribution is to reframe this step as a form of top-down processing based on the sense-data combined with the innate categories and intuitions of the mind. In Figure 6.1, the only difference between the near and far segments of the field, as shown in the image, is a vertical distance between them, that is, far elements are higher than the near in the image. But the vertical separation between points in the image is not the same as their separation in depth. How do we manage to see it in three-dimensions (3D)? The answer lies in Kant's Step 3: using the innate intuition of space as the relevant filter on perception.

What we have thus far described is a constructivist theory of perception. The British empiricists had already recognized that raw sensation is insufficient for the structured, meaningful experience of a stable world, but their solution was to build upward from sensation through association, compounding simple impressions into complex ideas through the laws we examined in the previous chapter. Kant accepted the insufficiency of raw sensation but rejected the empiricist solution as inadequate. For Kant, the transcendental structure of the mind does not add to sensation from below but organizes it from above, imposing on sensory experience a necessary and universal framework that no amount of associative learning could either produce or undermine – and here we can see how Kant gives us an early version of top-down perceptual processing.

PHYSIOLOGICAL PSYCHOLOGY

Kant's emphasis on the transcendental structure of the mind tended to omit the noumenal world and even the role of our biological structure in shaping mental structure. But emerging discoveries in the early 19th century began to suggest that much could be learned about the mind by studying the brain and nervous system. Would it be possible to recast the mind's role in actively interpreting sensations not as transcendental structure, but neural structure? Such attempts later came to be known as ***Biological Kantianism***.

One of the leading figures in this movement was **Johannes Müller** (born 1801), who proposed the ***Doctrine of Specific Nerve Energies***. Per Müller, each sensory nerve produces only a certain kind of sensation. For example, visual sensations can be described in two ways: brightness and color, and so all visual experiences have such qualities, which are properties of the optic nerve. Thus, no matter how the optic nerve is stimulated, one still experiences brightness and color. Typically, the optic nerve is stimulated by light entering the eye, but physical pressure applied to the outside of the eyeball mechanically stimulates the optic nerve (don't try this at home!) – each of which generate sensations of brightness and color known as phosphenes. Likewise, the auditory nerve imposes the qualities of loudness and pitch on auditory sensations. The tactile nerves of the somatosensory system impose the qualities of pressure, location, movement/vibration, and texture. The chemosensory nerves of taste and smell of course impose their own specific qualities, such as sweet, sour, salty, bitter and savory. Müller thus speculated that, could it be possible to detach the optic nerve from the eye and attach it to the organs of the inner ear, that we would then *see* the sound waves. Likewise, an auditory nerve attached to the eyeball would *hear* the light.

It is worth pausing to note a significant implication of Müller's doctrine. If we are aware only of the activity of our nerves, and not of whatever caused those nerves to become active in the first place, then the veil of perception has reappeared, this time not as a philosophical thought experiment like the Cartesian brain in a vat, but as an empirical fact about the nervous system. We are aware of the activity of our nerves, but not directly of their external causes. This raises an immediate problem for the objectivity of perception: if each person's nervous system is the intermediary between world and experience, what guarantees that different people's nervous systems impose the same structure on their experience? Without such a guarantee, perception risks collapsing into a physiological solipsism, with each organism locked inside the particular energies of its own nerves. The only available escape is to argue that the structure imposed by the nervous system is universal which would guarantee a shared perceptual world even if that world is known only indirectly through neural intermediaries. This is precisely the move that connects Müller's physiology to Kant's transcendental philosophy, and thus giving Biological Kantianism its name and its program.

Another key figure was **Rudolf Hermann Lotze** (born 1817), who could be considered the first physiological psychologist, in the sense that it was in his 1852 book *Medical Psychology or Physiology of the Soul* in which the term *physiological psychology* was first used (Thorne & Henley, 2001). Lotze's work addresses an important missing element in the Doctrine of Specific Nerve Energies. That idea can explain why visual experience has the properties it does, in terms of brightness and color, but it does

not explain how we come to visually perceive a spatially organized world, as described above in reference to Figure 6.1.

For Lotze, the answer is to invoke a new sort of sensation that derives from the spatial properties of the sensory organs. For vision, the array of photoreceptors across the retina represents a spatial distribution of points, and so the brain can track not just that sensations of brightness and color have occurred but also the spatial distribution of these sensations across the visual field. Each individual receptor is thus assigned a location in this overall distribution, and that is called the **local sign**. But as we already know, this map of visual local signs is flat, missing the third dimension. But let's not forget the other senses! Local signs can also be present across the body, arising from tactile and kinesthetic experiences. These local signs are correlated with the actual 3D shape of the body and with the 3D displacements of the body as we move through space. Thus, haptic perception occupies a privileged position as a spatial sense.

The critical move is that visual spatial perception can be learned by integrating visual local signs with haptic spatial knowledge. Looking at an object while touching it allows the tactile and visual local signs to be integrated and aligned. The mind and brain then organize the local signs spatially, creating a 3D representation of the body, and from that, a 3D representation of the world around the body, and so the brain constructs the idea of spatial awareness from non-spatial sensations. The visual system, in effect, learns to see depth by being taught by the haptic system about how depth looks and feels. Again, we can visualize the theory in four steps:

1. Objects in the world.
2. Senses register local signs of stimuli.
3. Local signs are mapped into the world based on past experiences.
4. We perceive in 3D.

Lotze's approach to the problem of depth perception represented an important bridge between rationalism and empiricism. His theory did not require innate knowledge, so it was consistent with the empiricist idea of a blank slate, but it also employed active, top-down processing, revealing a strong Kantian influence. Like Kant, Lotze's theory is also a constructivist theory, and it employs top-down processing because spatial knowledge is not part of the sensations but is imposed onto them (in Step 3) as a form of pre-existing knowledge.

A NEW PERCEPTUAL THEORY

Müller's most significant student was **Hermann von Helmholtz** (born 1821). Helmholtz is possibly the most important name in 19th century physiological psychology and perceptual theory. Much of his work reflected the influence of his mentor, including the *Young-Helmholtz Theory of Color Vision*, which stated that the perception of color was due to a pattern of activity amongst three different kinds of photoreceptors within the eye. Each receptor had a specific energy associated with a particular wavelength of light. For example, the experience of the color red was simply the activation of receptors that responded to long wavelength light. Also, his *Place Theory of Auditory Perception* explained the perception of pitch by assigning different pitches to different fibers within the auditory nerve. When a sound wave enters the ear, it excites a vibration of the basilar membrane in the inner ear. Hair cells embedded within this membrane are stimulated by this vibration and in turn activate fibers in the auditory nerve. Helmholtz's study of the basilar membrane led him to conclude that sounds of different frequencies activated the membrane at different locations along its length. This differential excitation of the membrane resulted in the activation of a specific set of hair cells, and correspondingly, a specific set of nerve fibers. The activity of a specific fiber corresponds to the perception of a specific pitch.

Helmholtz's most significant contribution was a theory of perception that synthesized the threads we have been tracing throughout this and preceding chapters. Where Müller had shown that the nervous system imposes its own qualitative structure on experience, and Lotze had shown how spatial structure is constructed from local signs through cross-modal learning, Helmholtz proposed a general account of how the mind constructs a meaningful perceptual world from the impoverished data that the senses deliver. He called this account **unconscious inference**.

The theory is Kantian in its insistence that the mind contributes structure to sensation from above — perception is not a passive registration of sensory data but an active interpretive process. But where Kant had located that contribution in innate transcendental categories, Helmholtz located it in learned experience. The inferences that give structure to perception are not innate but acquired, built up from a lifetime of sensory experience that teaches the perceiver what kinds of stimuli typically produce what kinds of sensory signals. In this way Helmholtz achieved what neither rationalism nor empiricism alone had managed: a constructivist account of perception that required no innate knowledge and yet did not collapse into Humean skepticism, because the inferential machinery built from experience was sufficient to construct a stable and coherent perceptual world.

Returning to the problem of depth perception, again refer to Figure 6.1. How do we know which objects are near and which are far? Well, perhaps we have encountered scenes like this before. So, when viewing this image, we quickly and unconsciously access memories of these prior experiences. This prior knowledge can be used as a reliable and trustworthy translator of the current sensations. Perception is now considered a form of active construction and inference, drawing on past experiences in conjunction with current sensory input. We can again visualize it in four steps, although the third step, involving the top-down translation process, is divided into two substeps:

1. Objects in the world.

2. 2D sensations about the objects are registered. Depth is lost.

3a. Relevant prior experiences are accessed.

3b. These experiences are used to infer the meaning of the sensations.

4. We perceive 3D objects and successfully interact with the world.

Importantly, Helmholtz tested his ideas scientifically. He conducted experiments on perceptual learning and adaptation with human subjects. In this way he ought to be considered one of the first experimental psychologists, but for the fact that he considered himself a physiologist rather than a psychologist (not to mention he was also a physicist who pioneered work in chemical thermodynamics). In his time, a lot of what was being called psychology amounted to metaphysical philosophy, which Helmholtz felt was unscientific. One of the most important studies Helmholtz conducted in support of his theory was the use of optical prisms to investigate perceptual adaptation. When glasses fitted with wedge-shaped prisms are worn over the eyes, the visual field is shifted laterally, so that an object that is straight ahead will be perceived as being somewhat to the left or right, depending on the orientation of the prism. Hence, when the subject reaches for the object, they will aim to the right, for example, and of course will miss. Over time, one adapts to the effect of the prisms and begins to reach accurately. This is called prism adaptation, and it shows that perception is not a rigid response to sensation but rather can adapt through experiences. There are two other results from this work that really make this point, though these findings are a bit more modern (Held & Freedman, 1963; Held & Hein, 1958). First, once a subject has fully adapted to the prism, if the glasses are removed and the person is then asked to point to an object, now they will make errors in the opposite direction. This is called *negative aftereffect*. For example, if the prism caused the object to be seen 10 degrees to the right of its actual location, then subjects will initially miss it by 10 degrees. In the process of adapting to the prism, they are learning to reach to the left of where the object looks to be. Now, without the prism, they see the object and reach 10 degrees to the left of it, missing it, and now must re-adapt back to the normal viewing condition. The idea is that there is no absolute mapping between the visually perceived location of an object and where we place our hand to touch it, but rather this alignment is determined purely by prior experience. One last finding bears noting. Imagine a subject who has fully adapted to the prism, so that they are aiming 10 degrees to the left of the visual position of the object. Now, the glasses are removed, and the subject is blindfolded and instructed to just point straight ahead of their nose, that is, just hold an arm out straight as if it were pointing to something straight in front of their face. What do you think happens? They actually point a few degrees to the left of their nose! But to the subject, this arrangement, or posture, of the arm and shoulder *feels* like straight ahead. Again, this perceptual experience of the position of our own bodies is not absolute but is affected by prior experiences.

Helmholtz also cited rare cases of individuals born blind who were later able to acquire sight. In such cases, without prior visual experience, they were not able to see but rather had to learn to see by acquiring experience. Helmholtz also studied visual illusions, which he argued provided evidence that perception is not strictly a function of the sensations but is also structured by internal inferences that may result in systematic errors. Inference is akin to an educated guess (in this case, educated by past experience), which may occasionally be wrong. Later studies have found that visual illusions such as the famous Müller-Lyer illusion (Figure 6.2) may be driven by cultural differences, such as those

caused by living in a built environment that contains right angles, which are not frequently found in nature (Segall et al., 1966).

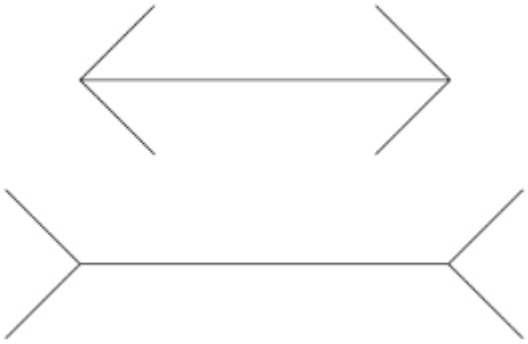


Figure 6.2. The Müller-Lyer illusion in which participants tend to judge the horizontal line segment of the bottom stimulus as longer than the upper stimulus, despite their equivalence.

The account, as presented, holds that perception involves the unconscious application of inference rules to sensory data, where the inference is guided by prior knowledge and past experience. The perceiver infers the most likely cause of the current sensory input given prior beliefs about what kinds of objects and scenes typically produce such inputs, and a not insignificant body of research seems to agree. This seems like a genuine explanatory account of how we get from sensory data to object perception. But notice what is required for the inference to work. The prior knowledge that guides the inference must already be structured in terms of objects, surfaces, causes, and other environmental regularities — it must already represent the world in the very terms that the theory is supposed to explain how we come to perceive. The inference from sensory data to object percept works only because the inferential machinery already contains a representation of what objects are like, what their typical sensory signatures are, and how sensory data maps onto object properties. In other words, the theory explains object perception by assuming a prior representation of objects. The question of how we come to have structured representations of objects in the first place, which is the hard question of perceptual theory, is not answered but assumed. This is known as the *begging the question fallacy*, or *petitio principii*, which is a form of circular reasoning attempting to support a conclusion with a premise that presupposes said conclusion. For perception, this looks like: we can perceive a stable reality, now in the current moment, because we have previously acquired knowledge of what a stable perceptual reality should look like.

While it might seem obvious to appeal to some form of perceptual learning, shaped by feedback, to establish the prior knowledge (just as with the prism studies), this runs into multiple additional problems. The first is the *problem of infinite regress*. If a current perceptual inference is dependent on past experience, we might ask of our past experiences, "How were we able to perform that previous inference?" The answer might be that we had some experience even before then – but note that this does not solve the problem of learning perceptual inference, it only pushes the answer further back in time.

But we cannot go back forever, at some point we face being born a blank slate with no experience to draw upon. It is worth noting that the infinite regress problem is a specific instance of a more general difficulty known as the *homunculus fallacy*. Unconscious inference explains perception by positing an inner process that reads sensory data, applies inference rules drawn from prior knowledge, and delivers a perceptual conclusion. But this description implicitly requires an agent capable of performing each of these operations — akin to an inner scientist who already knows how to read sensory data, how to apply inference rules, and how to recognize when a valid conclusion has been reached. The theory has not explained how perception works; it has explained how perception works given that there is already a perceiver inside doing the work. The homunculus, the little man in the head, is the unavoidable consequence of any theory that explains a cognitive achievement by invoking an inner agent with that same achievement already in place. And like the infinite regress, the homunculus cannot be eliminated by adding more detail to the account of the inner process, because each new detail will itself require an agent to execute it. And when we ask the deeper question of how the homunculus performs any of these perceptual or cognitive operations, are we faced with the conclusion that it too has its own internal homunculus that perceives and infers? Where could we stop once we start invoking homunculi to do the work of perception and cognition?

While we may be jumping ahead a bit here, it is important to note that the work of developmental psychologist **Jean Piaget** (born 1896) was done with the challenge of perceptual learning in mind. In Piaget's theory, early perception involves the construction of specialized knowledge structures called ***schemas*** and are rooted in a child's successful interactions with the world. Piaget compared the developing child to a naïve scientist, who develops naïve theories of the world and tests them by interacting with the world and observing what happens. When these observations make sense to the child, the schema can *assimilate* this information, and hence behavior and cognition remain stable. But because the theories are naïve, in the sense of being structured by limited experience, then novel experiences cannot be assimilated, and the schema must be updated to *accommodate* the new data. But this sets up the second concern: how can we know, during the learning process, whether one can properly interpret sensory data using the knowledge already in place (assimilation) or whether one should update that knowledge based on this new information (accommodation).

To unpack this, let's next extend Piaget's analogy of the child as naïve scientist, who implicitly makes inferences to either assimilate or accommodate, to Helmholtz's homuncular inner scientist, who is making unconscious inferences of a similar sort on our behalf. Further, let's also keep in mind the guidelines of scientific inference laid out by Bacon and positivism. In Bacon's terms, we would consider an exemplary scientist to be one who does not anticipate nature, but rather interprets nature. Consider the perceiving mind now as a sort of scientist in your head attempting to find the best explanations of your current sensory input. The interpreting scientist ought to collect the sensory data and provide an unbiased reading of its structure with respect to reality. Unfortunately, this breaks down under the assumptions we have been working with — that the sensations are not delivering to our inner scientist a sufficiently coherent structure that can inform about external reality. In turn, then, the mind must behave like the anticipating scientist, inferring the meaning of sensory information based on prior knowledge and beliefs. These beliefs create expectations that guide the interpretation of the data, perhaps by selectively weighting the importance of different data points, or constraining what counts as evidence for or against a specific belief. In modern science, we are frequently concerned with such bias – not necessarily those who are outright deceptive (though still a concern) but rather those who let their biases and expectations for what theories they think ought to be true guide their interpretation of data. In many cases, this results in Questionable Research Practices (see Nagy

et al., 2025) that are not necessarily done with deliberate malicious intent but still work to implicitly shape how they analyze their data until it matches whatever hypothesis they had hoped to affirm. This is one of many issues thought to contribute to the infamous *replication crisis* and led even to the provocative article by John Ioannidis (2005) titled "*Why most published research findings are false.*" The parallel is instructive. If anticipation of nature in science raises concerns about the reliability of published findings, then the analogous anticipation of nature in perceptual inference raises the same concern about the reliability of perceptual knowledge. Should we begin to fear the possibility of an *epistemic crisis* for all human knowledge?

It should be noted that these problems, in their totality, derive from the veil of perception problem. The prior knowledge that guides inference is itself a product of past experience filtered through the same inferential process, which means the inner scientist is always interpreting sensory data through a veil of their own accumulated expectations, with no unmediated access to the reality those expectations are supposed to represent. So, what would it look like for the scientist, whether Helmholtz's inner scientist or Piaget's developing child, to genuinely interpret rather than anticipate sensation? This would require truly escaping the veil of perception and allowing the sensory input itself to deliver sufficient structure so that prior knowledge is not needed. Whether such richly structured input can be formalized and a different perceptual theory built on a non-constructivist platform is a question we will take up in Chapter 10.

SUMMARY

We have encountered in this chapter several new approaches to the problem of perceiving the world outside of us. They all seem to have in common the idea that perception does not speak the same language as the outside world and requires translation and interpretation. So, they also, then, have in common some kind of stage of perceptual processing (step 3 in the four-step illustrations above) that serves as the interpreter and translator. Knowledge of the world is then indirect, but rather than going the route of skepticism as Hume did, they found various ways of justifying realism. Kant argued that the innate categories were universal and created objectivity. Müller and Lotze argued for a universal sensory architecture that provided for objectivity. Finally, Helmholtz claimed that because prior experiences were successful at enabling us to interact with the world, they will work as reliable translators. While research supports the Helmholtzian view that perception is active and adaptive, it remains an open question as to whether unconscious inference is the best accounting of these findings. We should ourselves attempt to remain interpreting scientists when evaluating the data of perceptual research.

KEY TERMS

Key Terms
bottom-up processing, top-down processing, noumenal world, phenomenal world, transcendental idealism, empirical realism, indirect realism, Biological Kantianism, local sign, unconscious inference, schema, assimilate, accommodate, homunculus

STUDY QUESTIONS

Study Questions

1. What is the difference between noumenon and phenomenon for Kant?
2. What is a local sign and how does it enable depth perception?
3. Explain how Helmholtz's theory of unconscious inference is similar to, and different from, Kant's perceptual theory.
4. Outline the evidence in favor of unconscious inference.
5. Explain the difference between top-down and bottom-up processing.

CHAPTER 7: THE BEGINNINGS OF A PHYSIOLOGICAL PSYCHOLOGY

INTRODUCTION

Learning Objectives
Understand:

- The empiricist and materialist bases of sensationalism
- The role that sensationalist philosophy played in influencing early neuroscience
- The doctrine of localization of function
- The concept of phrenology and why it is a pseudoscience
- The technique of ablation and the discoveries that came from it
- The autopsy technique and the discoveries that came from it
- The technique of electrical stimulation and the discoveries that came from it
- The goals of psychophysics and how it sets the stage for a science of psychology
- The difference between the absolute and difference threshold
- The relationships between Weber's law, Fechner's law and Steven's Power law

The book so far may have felt a bit removed from what you might recognize as psychology, at least until the work of Lotze and Helmholtz in the preceding chapter. But these philosophical explorations not only revealed the core of the problems of perception and knowledge, they also set the stage for the forthcoming topics that lay the foundation of what is starting to looking like the beginning of experimental psychology, and thus topics that look more familiar to the psychology student. In this chapter, we will find that early physiological psychology, studying the function of nerves and parts of the brain, and the measurement of sensation, emerge directly from the philosophical problems we have so far addressed.

The first root is the one most recently covered. The Biological Kantians of Chapter 6 were looking for a physiological structure that could scientifically explain Kant's transcendental structure. This was a pretty clear early example of physiological psychology, as Lotze himself called it in his work. If the mind imposes structure on sensation through the specific architecture of the nervous system, then understanding the nervous system becomes a philosophical as well as a scientific imperative. The question of how we perceive the world had become, by the mid-nineteenth century, a question that could be investigated in a laboratory. The second root runs in a quite different direction, which is from the materialist and empiricist tradition that emerged in Chapter 5. If the mind is nothing but the activity of the brain and nervous system, if thought is what the brain does, in the same way that digestion is what the stomach does, then the study of the nervous system is not merely one approach to understanding the mind, it is the only approach that ultimately matters.

These two traditions, the Biological Kantian and the materialist, thus converged on the nervous system from opposite philosophical directions. The Kantian tradition arrived there through episte-

mology: because the nervous system mediates between the world and experience, understanding its structure illuminates the conditions of knowledge. The materialist tradition arrived there through ontology: because the nervous system is all there is, understanding its structure is understanding the mind. The physiological psychology that emerges in this chapter is the product of both influences, and it will be useful to keep both in view as we trace its development, because the two traditions did not simply merge but remained in tension, generating different research questions, different methods, and different interpretations of what the science of the nervous system could ultimately tell us about the mind.

We begin with the materialist thread, which in many ways arrived first. Recall that Hobbes, while living in Paris, was part of a movement in the early 17th century that rejected Cartesian dualism. While there, he had a key ally in **Pierre Gassendi** (born 1592). Gassendi's materialism was grounded in a tradition far older than Descartes. He was the most important 17th century advocate for the revival of the work of the Greek philosopher **Epicurus** (born 341 BC), who in turn had extended Democritus' theories about atoms and the nature of sensory experience. Gassendi thus shared the materialist views of these predecessors alongside his contemporary Hobbes, and he famously criticized the Cartesian Cogito as proving only that thinking is occurring, but not that the thinking thing was necessarily immaterial. And so if one treats thinking instead as a material, physical event, then any such act can be substituted and the Cogito can be reframed as *I move* (or I walk, or I breathe, etc.), *therefore I am*. In the long run, we may find such ideas influential in modern approaches to cognitive science, especially embodied and enactive cognition (Varela et al., 1991) but first, Gassendi's work lays the foundation for the French Sensationalist movement.

FRENCH SENSATIONALISM

In the 18th century, **Julien Offray de La Mettrie** (born 1709) inherited this materialist perspective and, borrowing from Descartes' mechanistic view of animal behavior, applied it also to humans, since now in his materialist view there was no mind in the pineal gland (or ghost in the machine) to control things. In his famous work *L'homme machine* (1747; conventionally the title is translated as *Man a Machine*, though *Man is a Machine* captures the main idea more directly) he wrote that it should be possible to compare directly human and animal behavior, because similar mechanistic principles would apply to the behavior of both. Further, he adopted the empiricist view that all knowledge occurs via the senses, so then to whatever degree animals share sensibilities with humans, their intellect ought to be of a somewhat comparable nature. Of course, these comparisons extend beyond the sense organs and into the brain, so even if animals have a similar sensory experience, they may not have the same level of intellect as humans because their brains are not as large or complex. But the key theme for La Mettrie was that the difference between humans and animals was one of degree, not kind, and this was a major departure from the Cartesian view that humans possessed an immaterial soul (in the pineal gland), and thus rationality, that animals lacked. La Mettrie was also one of the first to theorize that apes could be taught some form of language, which was a question addressed by several 20th century researchers who attempted, with limited success, to teach American Sign Language to chimpanzees (e.g., Gardner & Gardner, 1969).

Next, **Étienne Bonnot de Condillac** (born 1714) illustrated the principle of blank slate empiricism almost literally with his *Sentient Statue* thought experiment. Imagine a marble statue. Further, imagine this marble statue has a living brain inside of it, but no sense organs at all. What would the mental life of this statue be like? A rationalist (especially in the vein of Plato) would argue that this may be ideal, because the statue would be free to introspect and reason on its innate knowledge without the contamination of untrustworthy and lowly sensations. Condillac reasoned instead that it would be equivalent to blank stone, with no thoughts or ideas, no consciousness at all. But now imagine endowing the statue with functioning ears. The ears can register sounds from the outside world and deliver those sounds to the brain. Now, the statue has its first ideas, which would be very simple and would only be auditory in nature. But now imagine we give eyes too. Now the statue can possess visual ideas, and it can begin to connect its visual and auditory ideas to enrich the complexity of its knowledge, and correspondingly of its consciousness. If we keep going and endow the statue with the senses of touch, taste, and smell, its consciousness becomes more complex than ever before. Presaging Lotze and local signs, Condillac also suggested that the first ideas of spatial extent emerge only when the sense of touch is activated. And so, his analogy to the human mind is that without sensation, consciousness would not exist at all. This idea that the mind *depends* on sensation for its very existence is at the heart of empiricism.

Finally, we consider **Pierre Jean Georges Cabanis** (born 1757). Cabanis lived through the French revolution (unlike many of his countrymen), and after witnessing how victims of the guillotine blinked and moved their eyes, while the headless bodies often exhibited a variety of motor acts, sought to dispel a growing belief that maybe the brain was not in fact necessary for consciousness and controlling the body. In his analysis and presentation to the Société de Médecine in 1795 (see also Staum, 1980),

the movements were uncontrolled reflexes and the guillotine victims died instantly. Cabanis' work was important for psychology though, because his methods foreshadowed the later development of neuroscience research, including the method of ablation discussed below.

THE PERSONAL EQUATION

A curious anecdote, related in many sources (see Bolles, 1993; Boring, 1950; Schaffer, 1988), tells the story about how the inspiration for much of 19th century physiological and experimental psychology came not from philosophy, but from an incident at the Greenwich Observatory, where the Royal Astronomer Maskelyne fired his assistant Kinnebrook when it was discovered that Kinnebrook had appeared to make errors in his observations.

Kinnebrook's job had been to record the transit time of certain stars. With the telescope pointing at a specific star, a fine strand was laid over the lens, and as the star moved through the night sky, it would at some point blink out of view behind this strand on the lens. Kinnebrook's job was to record the exact amount of time this star was out of view. Such measurements for different stars was used to estimate the distances to the stars, and had to be as precise as possible. However, there were no precise timing instruments in 1795, the year Kinnebrook was sacked. Kinnebrook relied on a clock that was ticking away the seconds, and so while listening to the ticks, he had to note the relation between when the star passed out of view relative to the time of a tick, then start counting the ticks until the star came back into view. It was not sufficient that the times be recorded in whole seconds, but rather in hundredths of a second, so if the star reappeared part-way between two ticks of the clock, Kinnebrook would have to estimate how much time had passed between the ticks. Was it .25 seconds? Or was it .50 seconds? Of course, it was good to have multiple workers perform these measures, just to assure reliability in the measurements. Then one day Maskelyne discovered that Kinnebrook's measurements of transit time were, on average, about 0.75 seconds longer than Maskelyne's own observations. This was a pretty large error according to their standards, and so Kinnebrook was fired to preserve the integrity of the Greenwich Observatory's reputation.

The implication of this story for psychology arose 25 years later, when the German mathematician and astronomer Friedrich Bessel, who was also interested in measuring the distances to the stars, studied the data from Greenwich and other observatories. He found that it was not just poor Kinnebrook, but all of the observers varied in their measurements of transit times. Bessel's goal was to somehow remove all of this variability from the data so he could arrive at a more accurate measure of transit time. To do this, he had to figure out each observer's own unique error and remove this from his measurements. Each observer would have his own *personal equation,* which would be used to normalize his recordings. Hence, the study of *individual differences* was born. It is also significant that Bessel drew from the work of one of his contemporaries, Carl Gauss, who is well-known for discovering the normal distribution. Bessel realized that the pattern of individual errors was described by the normal distribution and so the statistical properties of this distribution enabled Bessel to determine the personal equations of the observers; hence began the use of statistics in the study of human behavior.

The procedure Bessel developed is worth pausing over, because it reflects a commitment to a much older tradition in the history of science. Recall that Galileo, in his mathematical approach to natural philosophy, sought to extract the underlying lawful structure of nature from beneath the variability and imperfection of sensory appearance, treating the mathematical ideal as the truth and the messy

observations as approximations that needed to be corrected for disturbing influences. Bessel, like Galileo, was a ***scientific realist***, believing that the mathematical abstractions that captured the essence of empirical observations represented true knowledge of reality. And so his method was structurally similar to Galileo's, but where the latter's corrections were for external physical factors like friction and air resistance, Bessel's corrections were for something internal: the systematic perceptual biases of the individual human observer. The personal equation is not a correction for what the world does to the measurement but for what the observer does to it.

Following up on this problem, Bessel began to speculate about this exact concern: what exactly is happening in the observer that contaminates their measurements? Recall that the task at hand was to detect the exact moment the star blinked out of sight behind the strand and simultaneously listen for the timing of the ticking clock and then detect the moment the star came back into sight and again correlate that observation to the ticks of the clock. It could be that some time was lost in transmitting the signal from the eye to the brain, or from the ear to the brain. However, this assumption was ruled out initially because Müller had already argued, and it was thus generally accepted, that nerve impulses were instantaneous. Per this view, at the exact moment a sensation is registered in the eye or ear, it is simultaneously registered in the brain (and mind). Maybe the eye and ear cannot operate simultaneously and so there would be a delay in shifting between them. At least that is what Bessel hypothesized, but for some time there was no agreement on the cause of the delay.

Little progress could be made on this front until more was known about exactly how nerves worked. Recall that Descartes had viewed them as hollow tubes conducting the animal spirits. Müller believed in ***vitalism*,** which was a theory that stated that living beings possess a special vital force that separates them from inanimate matter. This vital force was much like Descartes' animal spirits and was the justification for his conclusions about the instantaneousness of neural transmission. However, in the late 18th century, **Luigi Galvani**, a physician at the University of Bologna in Italy, discovered that nerves conduct electricity after observing that a frog muscle twitched when an electrical current was passed through the nerve innervating that muscle. Galvani's discovery was influential outside of physiology, too, as it inspired Count Alessandro Volta's invention of the battery, a device capable of storing an electrical potential, much like a nerve does. The idea that nerves store electrical potential inspired **Émil du Bois-Reymond** to discover, in the mid-19th century, the role of positive and negative ions in nervous transmission, and the concept of the *action potential*, and he further likened the activity of the nerves to the newly invented telegraph system, "the soul in its office, the brain, incessantly receives dispatches from all parts of its empire, the body, through the telegraph wires, the nerves, and dispenses commands in all directions to its officials, the muscles" (du Bois-Reymond, 1851, as cited in Zahnoun, 2025).

Almost ironically, it was Müller's own student, Helmholtz, who determined that nerve transmission was not instantaneous, and who devised a technique for recording the speed of the impulse. Using Galvani's technique of applying electrical current to nerves, Helmholtz had isolated a nerve fiber from the leg muscle of a frog, and then, stimulating it at different distances from the muscle, recorded how long it took for the leg muscle to twitch. The closer to the muscle the stimulation was applied, the sooner the muscle twitched. After making several observations along the length of the nerve, Helmholtz was able to calculate neural transmission speed at about 90 feet per second. Helmholtz also attempted to measure neural transmission speed in humans by stimulating a subject on either the toe or thigh, with the instruction to press a button as quickly as possible once the stimulation was detected. Because the toe is farther from the brain than the thigh, the response latency to toe stimulation was longer than for thigh stimulation, and Helmholtz estimated neural transmission speed as

between 165 and 330 feet per second in humans. These estimates have since been refined by more precise methods, but the experiments clearly demonstrated that Müller was wrong; nerve transmission was not instantaneous. Did Helmholtz succeed in explaining the personal equation problem? Unfortunately, not quite, for these speeds were too fast to explain some of the long delays noted by Bessel. We will need to revisit this question in Chapter 8 in discussion one of Helmholtz's most significant students and the official founder of experimental psychology, Wilhelm Wundt.

Meanwhile, in 1873, **Camillo Golgi** developed a staining technique that aided in the microscopic study of nerves, which led directly to **Santiago Ramón y Cajal's** discovery that nerves were not continuous tubes or webs as Descartes and others believed, but were instead sequences of discrete cells, called *neurons,* that must somehow transmit signals between themselves (Figure 7.1). Golgi later used his staining technique to discover a sensory receptor that bears his name, the Golgi tendon organ. From these discoveries, du Bois-Reymond and others began to theorize about how neurons communicate, such as the aforementioned telegraph analogy. It was not until the Nobel Prize–winning work of 20th century physiologists such as **Charles Sherrington** (born 1857) and **Otto Loewi** (born 1873) that the exact properties of the *synapse* were revealed, and of the role of neurotransmitters in synaptic transmission (Loewi discovered acetylcholine).

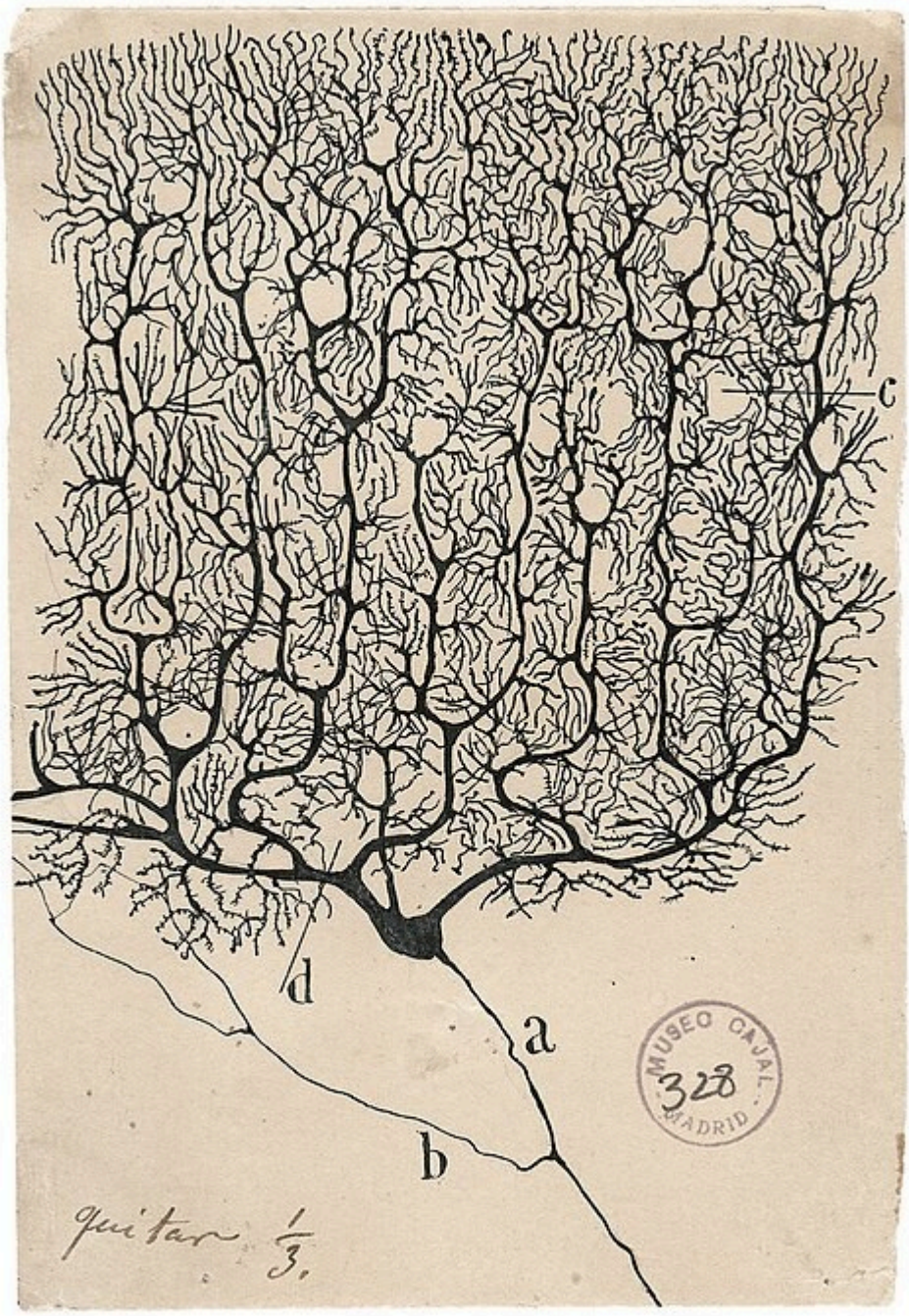


Figure 7.1. One Santiago Ramón y Cajal's famous detailed drawings of neurons, in this case a Purkinje cell of the human cerebellum (Santiago Ramón y Cajal, Public domain, via Wikimedia Commons).

LOCALIZATION OF FUNCTION

By the early 19th century, physiologists were taking an interest in nerve function, but little was yet known of the brain. It may be obvious via anatomical observation that the nervous system is organized into different components, such as the peripheral and central nervous systems, and that each of these were further subdivided into identifiable structures. The obvious question may then be whether each identifiable structure has a specific function, perhaps accounting for some aspect of cognition or behavior. As we have seen, this approach began with Descartes' attempt to localize the mind in the pineal gland and continued with Müller's attempt at localizing Kant's innate categories in the sensory nerves. However, there was little to no scientific research backing these claims. Could it be possible to determine experimentally the function of neural structures?

In the early days in the development of the science of the nervous system, **Franz Joseph Gall** (born 1758) proposed a theory on the localization of function in the brain. His theory was based on a very old idea, dating back to the ancient Greeks, called ***physiognomy***, from the Greek words *physis*, meaning nature, and *gnomon*, which meant to know or to judge. The idea is that one could judge the nature of another person by their appearance. As the saying goes, they believed in judging a book by its cover. His idea, that came to be known as ***phrenology***, has long been associated with pseudoscience, but Gall was a serious scientist who believed, rather sensibly, that individual differences in personality and ability could be explained by differences in the brain.

Gall was the first to propose that specific cognitive functions were associated with specific cortical regions, and that also differences in the structure and size of these regions could explain individual differences in ability. While it is true that Gall suggested that the shape of the cranium could reveal such differences, based on the faulty assumption that the cranium reflected the underlying shape of the brain, he also emphasized the need for detailed neurological analysis of brain areas, developmental changes in the brain, cross-species brain differences, and the effects of brain damage on cognitive function.

While Gall's logic that mental ability is related to cortical development has some validity, the ideas behind phrenology came under criticism somewhat early on. Many critics reported that they could not verify his observations of relationships between cranial features and cognitive ability. To make matters worse, the idea caught on in the popular imagination despite the concerns within the scientific community. Many practitioners began to promote phrenology as a way of being able to learn about yourself – not too different than the many personality quizzes one can take online these days. But of course, they charged for their craniometric services, exploiting the ignorance of their audiences, which only furthered the scientific skepticism of the idea.

While aspects of phrenology lacked scientific credibility as a method of understanding the brain, the idea that functions were highly localized in the nervous system was still a guiding theme in early neuroscience. All that was needed was a more scientific approach. The first, and probably most primitive, method was *ablation*. If it were possible to destroy, or ablate, a portion of neural anatomy, and then observe the effect of this damage on cognition or behavior, then one could deduce the function of

the damaged structure. One of the first studies using this technique was published in 1811 by Charles Bell. An idea that had been around for centuries was that the body contained two different kinds of peripheral nerves: sensory nerves that carried *afference* from the sensory receptors to the brain, and motor nerves that transmitted *efference* from the brain to the muscles. Bell observed that where the peripheral nerves attached to the spinal cord, there was a distinct division between those that connected to the rear, or back side, of the spine, the *dorsal roots*, and those that connected to the front, or belly side, of the spine, the *ventral roots*. Bell found that stimulating the ventral roots in rabbits caused muscle contractions and that severing the dorsal roots did not prevent these contractions. Bell did not share his findings with a wide audience, but a few years later, François Magendie (1822) completed the picture with a more systematic approach. Using dogs, he severed the ventral roots, leaving the dorsal roots intact. The affected limb was unable to move, but retained sensation, as the animal would respond to any painful stimulus applied to the limb with signs of distress. In a separate preparation, Magendie severed the dorsal root and left the ventral root intact. In this case, the affected limb retained motor function but lost sensation, with the animal showing no response to a painful stimulus. A controversy later arose, because Magendie had not known of Bell's earlier work and thus did not cite it. Bell was famously offended and campaigned for recognition of his priority in this discovery, and even in some cases may have distorted his original findings to make them seem more decisive, more similar to Magendie's methods. In time, the scientific community acknowledged both scientists, and the discovery is now known as the *Bell-Magendie Law.*

Ablation of nerves and nursing an animal back to health in order to observe the consequences on behavior was apparently not very difficult from a technical perspective in the early 1800s. But what about the rest of the nervous system, and in particular, the brain? Ablation of the brain was a less exact procedure, and obviously riskier, and of course, could not be performed on human subjects. In the early 19th century, **Pierre Flourens** found that ablation of the cerebral cortex in the pigeon resulted in a complete loss of perception and voluntary movement. Ablation of the cerebellum in the dog resulted in a lack of coordinated movement while cognitive and perceptual abilities were still intact. However, it was a curious accident on September 13, 1848, that provided a better insight into the organization of the brain. A railroad worked named **Phineas Gage** was setting a hole for blasting powder during construction of a

railway when the explosion occurred prematurely, sending a metal spike into his left cheek, passing through his prefrontal cortex, and exiting near the top of his head. Miraculously, Gage survived the accident, and although he recovered physically, he showed changes in personality and executive function. Where he had previously been considered a reliable and efficient employee of the railroad, when he returned to his job he had become indecisive, unable to plan and commit to tasks, and even behaved in ways unlike his previous self, such as engaging in profanity and obscene jokes. As his friends said, he was "no longer Gage" (Harlow, 1868, p. 340). His physician, John Harlow, was an advocate of phrenology and had emphasized the personality changes in his report, and many rumors swirled and much has since been written about the role of the prefrontal cortex and personality. However, recent work (Macmillan, 2000) has uncovered a different story about Gage. Apparently, only four years after the accident, he moved to Chile and secured the demanding job of driving a coach with a team of six horses through winding mountainous passes used by gold miners, suggesting his level of functioning was not as bad as reported. Ultimately his health deteriorated as he began experiencing seizures, which led to his death 12 years after the accident.

Another method for determining the function of neural structures was the *autopsy* method. Presented with a patient suffering a neurological disorder, but lacking modern imaging technologies, only a

postmortem study of the patient's brain could be used to discover any abnormalities that underlay the behavioral problem. Such was the situation faced by **Paul Broca**, who in 1861 had been charged with the care of a patient at the Asylum de Bicêtre, a hospital for the insane in the suburbs of Paris. For 30 years, this patient had been at the Bicêtre with the sole symptom of being unable to talk. He could communicate in other ways, and could understand the speech of others, but simply could not himself speak in comprehensible language. A mere five days after Broca took charge of this patient, he died, and Broca's autopsy revealed a lesion in the left frontal lobe of the patient's brain. This area, dubbed *Broca's area,* was concluded to be the site of speech production in the brain. Correspondingly, a person suffering from damage to this region of the brain, and who is unable to speak, is said to have *Broca's aphasia.* Just a little more than a decade later in 1874, a German physician named **Carl Wernicke** discovered an area that appeared to complement Broca's area. Wernicke's patient could speak without effort, but their speech tended to lack meaning, and they also could not comprehend the speech of others. Postmortem examination revealed lesions to the left temporal lobe. Thus, *Wernicke's area* was discovered as the site of speech comprehension, and patients with damage to the area suffer from *Wernicke's aphasia.* Taken together, these two portions of the left hemisphere in the brain correspond to the speech and language center of the brain.

A third approach to studying localization in the nervous system involves *electrical stimulation*. Recall that Galvani had demonstrated that nerves conduct electricity, and later Helmholtz had measured the speed of neural transmission. However, it was not exactly clear that the brain worked according to these same electrical principles. Mechanical stimulation of the brain during surgery on conscious patients failed to produce sensory or motor phenomena in the patients, leading many major physiologists to believe that the brain was not sensitive to direct stimulation (Thorne & Henley, 2001).

However, Fritsch and Hitzig found in 1870 that electrical stimulation of a part of the frontal lobe of a dog produced movements. Prior to their work, the existence of a dedicated motor area in the brain had only been theorized, so this was the first official discovery of the motor cortex. Later work confirmed their findings and extended it to the discovery that the occipital lobe of the brain was relevant to vision, and a portion of the parietal lobe devoted to processing touch information from the skin. An infamous case, related by Thorne and Henley (2001), occurred in 1874 when physician Roberts Bartholow electrically stimulated the exposed brain of his patient, eliciting motor and sensory responses. However, his attempts to investigate further by increasing the voltage resulted in a seizure and loss of consciousness of the patient, who died three days later. Bartholow attributed the death to the patient's cancer, which had eaten the hole in her cranium in the first place, but the incident resulted in a scandal and Bartholow was forced to leave his practice in Cincinnati. The use of electrical stimulation to further map out the cortex had to wait until more advanced methods in the 20th century. One early pioneer of this was **Wilder Graves Penfield**, who, in the 1930s and 1940s, used the technique to identify the locus of seizures in epileptic patients. He further studied the motor and somatosensory cortices, discovering that their organization reflected a map of the body, with the amount of area of cortex devoted to each body part directly proportional to the motor coordination or tactile sensitivity of that part, respectively. This cortical map is also called the *cortical homunculus*.

PSYCHOPHYSICS

As noted at the outset, there were two historical roots for physiological psychology, and the materialist tradition surely influenced a significant portion of what we have so far covered. But the Biological Kantian perspective influenced a very different approach. If, as the Doctrine of Specific Nerve Energies claims, the sensory nerves impose a characteristic structure onto the nature of sensation, and if that structure is lawful and systematic rather than arbitrary, then it should in principle be describable in mathematical terms. This raised an empirical question that no one had yet answered: what are those mathematical terms, and how might they be established?

One figure who had already sensed the possibility of a mathematical psychology, though without the empirical tools to realize it, was **Johann Friedrich Herbart** (born 1776), who had famously succeeded Kant as the chair in philosophy at the University of Göttingen. Herbart theorized that ideas were the basic units of the mind, and they had varying degrees of strength, and interacted lawfully, competing for access to conscious awareness. At the center of his system was the concept of the limen (Latin for threshold), the boundary between unconscious and conscious mental content. An idea that fell below the limen did not disappear but continued to exert pressure on conscious experience from below, influencing thought and behavior without being directly accessible to introspection. Ideas above the limen were conscious; ideas below it were unconscious but active. The idea may even seem reminiscent of Locke's Theory of Ideas, but the key difference is that Locke's theory was rooted in passive associations, and Herbart's mind was an active and structured Kantian system.

Herbart's system was sophisticated for its time, but it remained theoretical. He had no way of measuring it empirically, no method for determining where exactly the boundary between unconscious and conscious actually fell, or how it shifted under different conditions. This was the gap that the emerging science of psychophysics would fill. If the nervous system imposes lawful structure on sensation, and if Herbart was right that consciousness has a measurable threshold, then perhaps the relationship between physical stimulation and conscious experience could be established experimentally, giving the Biological Kantian program its first genuinely quantitative and empirical form.

Beginning in 1818, the physiologist **Ernst Weber** (born 1795) began studies at the University of Leipzig on the anatomy associated with the sense of touch. Weber thought he could map out the organization of the touch-related sensory nerves through some careful measurements of subjects' touch sensations. In one study, he applied two fine points to the skin simultaneously, varying the distance between the points. He found that in certain parts of the body, such as the fingertips, the subjects reported that the stimuli were detected as two distinct points on the skin, even when they were as little as 1/16th of an inch apart (Bolles, 1993). On other parts of the body, such as the back, that 1/16th of an inch separation felt just like one pressure point. Rather, the two points had to be separated by a few inches before they would be felt as separate. This method was called the two-point limen test, and it revealed that the acuity of the touch system varied across the body. Weber followed this study with a measure of tactile sensitivity, regarding the faintest degree of pressure that could be detected. Weber invented a set of fine bristles, which, when applied delicately to the skin, resulted in very small and controlled amounts of pressure. Subjects were asked to report if they felt any pressure at all. Some

very faint stimuli were not felt, others were felt clearly. Weber discovered there was a fair correlation between the body parts that were highly sensitive and that were also acute, and this observation revealed that those body parts must be subserved by a rich supply of nerves. But Weber's studies did more than uncover the organization of the somatosensory nerves; they also revealed that human sensory responses could be investigated systematically with experimentation.

In subsequent studies, Weber had subjects hold weights in their hands. Then, they would lift a second small weight which would be just a fraction of an ounce heavier. Was the slight difference in weight noticeable to the subject? If so, a noticeable difference was achieved. What was the smallest difference in weight that could be detected? Weber studied this through repeated trials and measured the so-called *just noticeable difference* (*jnd*). In his calculation of the *jnd*, Weber noticed a curious pattern. When comparing the ratio of the initial weight of the stimulus to the amount of change in the weight needed to produce a *jnd*, a constant ratio was observed. For example, if a 30-ounce weight was held, the weight would have to be increased by 1 ounce for it to be perceived as heavier. Anything less than 1 ounce was not detected. But further, if the starting weight was instead 60 ounces, did that same 1-ounce increase result in a *jnd*? No, because it was the constant ratio of 1/30 that made the difference. Hence, a 60-ounce weight would have to be increased by 2 ounces before it seemed heavier.

Subsequently, **Gustav Fechner** (born 1801) studied under Weber at Leipzig. He went on to study mathematics and physics, had a nervous breakdown and left academia, became a poet and a mystic writing under the pseudonym Dr. Mises, and in general spent a lot of time lying in bed contemplating the many problems of life and the human mind (Bolles, 1993). Besides Kant, another philosophy that appealed to him was Spinoza's double-aspectism, in which mind and matter are two aspects of a single underlying reality. He also understood, from Weber's research, that the relationship between physical and perceived stimulation was not direct, but it was nevertheless measurable. It might not be possible to pierce the veil of perception, but it might be possible to measure and formally model it. And so it was that, on October 22, 1850, while lying in bed, Fechner had the insight as to how to map out the relation between the physical and the psychological, and thus the field of ***psychophysics***, and hence, experimental psychology, was born!

Fechner (1860/1948) realized that each *jnd* could be thought of as a unit of sensation. Starting at a level of zero stimulation, *jnds* could be stacked to represent the entire range of sensory receptivity. The first jnd would correspond to the weakest detectable stimulus, and drawing from Herbart, Fechner called this the ***absolute threshold***. Fechner saw that, starting with stimulus intensity at zero, and increasing it until it could be detected, is like measuring a *jnd* relative to zero. He considered this particular *jnd* the absolute threshold, and every *jnd* above that point marked a ***difference threshold***. Each subsequent difference threshold would map out a series of *jnds* up to the maximum amount of stimulus energy detectable (i.e., the point at which injury to the sensory organ would occur).

Fechner was able to characterize Weber's discovery that *jnds* represented a constant ratio of intensities using a mathematical expression. Weber's constant ratio, specifying the change in stimulus intensity (ΔI) relative to the initial stimulus intensity (I) needed to produce a *jnd,* came to be called the *Weber fraction*:

$$\frac{\Delta I}{I} = k \qquad \text{(Eq. 7.1)}$$

Equation 7.1 specifies a linear relationship between physical stimulus intensity (I) and the amount of intensity required to produce a change in the perceived, or psychological, intensity (ΔI). A little algebra makes this clear. Multiply both sides by I to get,

$$\Delta I = kI \qquad \text{(Eq. 7.2)}$$

Recall the equation for the straight line and note the similarity of these functions,

$$Y = bX + a \qquad \text{(Eq. 7.3)}$$

where Y is predicted as a linear function of X, with the slope (rise over run) specified by the coefficient *b* and the y-intercept specified by *a*. If we want to use a physical measure of stimulus intensity (I) to predict a psychological response (ΔI), then just like for the equation for the straight line (Equation 7.3), we just need to multiply by the slope and add the y-intercept. In Equation 7.2, the value of *k* specifies the slope, and the y-intercept is simply zero, so it is not written. The linear relation between the physical and perceived values of intensity is called ***Weber's law*** and represents one of the first psychological laws arrived at through human experimentation. However, Fechner realized that Weber's law was not the whole story. To start with, the linearity breaks down at the extremes of stimulus intensities. Fechner's second main insight was that, while the *jnds* represented a linear scale of sensory units, the entire range of stimulus energy that the sensory anatomy can respond to is an exponential scale. In order to map an exponential scale to a linear scale, a logarithmic term must be included. Hence, Fechner developed his famous equation, now called ***Fechner's law***,

$$S = k \log I \qquad \text{(Eq. 7.4)}$$

in which S is the unit of sensation, I is the physical unit of stimulation, and k is Weber's constant.

Extending on Weber's methods of measuring thresholds, Fechner developed the methods of psychophysics, including his *Method of Limits*. Using this method to measure an absolute threshold for hearing, for example, the psychophysicist would present the subject with a tone too faint to be heard and ask if any sound was detected. The subject should be expected to report, "No." Next, the psychophysicist increases the sound intensity by a small amount and repeats the trial. This procedure is repeated until the subject reports, "Yes," and the absolute threshold discovered. This is called an *ascending series*, because the stimulus intensity increases until it is detected. *Descending series* are also used, in which the initial stimulus is well above threshold and is gradually decreased until the subject reports that it is no longer detected. Frequently, the results of ascending and descending trials are different, and the usual procedure is to average the measurements. However, the differences in the trials can be possibly attributed to a variety of judgment biases. Other methods were developed to address this, including the *Method of Adjustment*, in which the subject is allowed to control the stimulus intensity and quickly dials in their threshold setting. More refined is the *Method of Constant Stimuli* (Hegelmaier, 1852, translated by Laming & Laming, 1992), in which stimuli of varying intensities are presented in a random order, so that the subject does not have a chance to habituate to any particular response or pattern in the trials.

Fechner's law stood as the primary explanation of psychophysical data until the 1950s, when the work of **S. S. Stevens** (born 1906) at Harvard University developed new psychophysical methods, and a new psychophysical law. While Fechner's methods involved having subjects compare stimuli in succession, Stevens attempted to measure sensations directly. Instead of asking subjects to rate whether a stimulus was more or less intense than a previous one, he asked subjects to provide a numerical estimate of stimulus intensity, a procedure known as *magnitude estimation*. For example, given a standard tone at some loudness, the psychophysicist labels it with some arbitrary number, such as 100. The subject then has the task of assigning numbers to subsequent tones in relation to this standard. Stevens also developed the procedure of *magnitude production*, in which the subject produces a response of some magnitude in proportion to the stimulus. For example, one could adjust the brightness of a light to a level of intensity intended to match the loudness of a sound. This is called *cross-modality matching*.

Stevens discovered that the results of psychophysical studies using these new methods followed a power law, rather than Fechner's logarithmic law,

$$S = kI^n \qquad \text{(Eq. 7.5)}$$

where the relationship is based on the exponent, n, as well as Weber's constant. The value of n specifies the shape of the curve mapping the physical to the psychological, a detail for which Fechner's law was unable to account. ***Stevens' Power law*** (Stevens, 1957) became the standard for modeling psychophysical data in the 20th century.

Even later, researchers became concerned with the variation in threshold measurements obtained when using these various methods, and the aforementioned judgment biases. While psychophysicists had generally considered such variation to be measurement error, and could be safely averaged out, advocates of ***Signal Detection Theory*** (SDT) argued that there were two independent factors involved in a subject's detection of a stimulus (Green & Swets, 1966; Tanner & Swets, 1954). The first is the actual *sensitivity* of the sensory system, and the second is *response bias*. Thus, psychophysical experiments should be concerned not just with measuring thresholds (presumed to measure sensory sensitivity) but also various extraneous variables that might bias the subject to saying "yes" or "no" to the presence or absence of a stimulus. According to SDT, on a given trial, four possible outcomes can occur. If the stimulus is present, the subject may say "yes", which would be called a *hit*, or the subject may so "no", which is a *miss*. Alternatively, if the stimulus was not present, the subject may correctly say "no", dubbed a *correct rejection*, or they might say "yes", which would be a *false alarm*. The two kinds of errors, misses and false alarms, trade off with each other. A subject could be biased, for example to say "yes" more often during a series of trials. Such behavior would increase the number of hits (and correspondingly decreasing misses) but would also increase the number of false alarms. Conversely, if the subject was biased to say "no" more often, the number of false alarms would decrease, but misses would subsequently increase. Consider the example of a TSA agent in an airport, screening baggage using an x-ray scanner. The agent is searching for banned items, such as weapons, and is told to be extra careful in not allowing any possible contraband through the security checkpoint. The agent will adjust their response bias to say "yes" more often, resulting in finding more contraband (hits), but also mistakenly singling out harmless items as possible weapons (false alarms). If this should unnecessarily delay the security screening process, the agent might gradually shift their response bias toward saying "yes" less often, resulting in fewer false alarms, but unfortunately increasing the likelihood of a miss. These biases in judgment occur independent of the agent's actual sensitivity to detecting contraband

and are largely a function of the perceived cost of the different types of errors. As you might guess, SDT has broad relevance to many applied questions in psychology, making it a key tool for modern applications in Human Factors Psychology.

The development of SDT revealed a further complication that classic psychophysics had not fully anticipated, and one that connects back to a story we encountered earlier in this chapter. Recall that Bessel's insight about the personal equation represented a conceptual shift from Galileo's approach to measurement error: where Galileo had sought to correct for what the world does to the measurement, Bessel recognized that the observer also does something to the measurement, introducing systematic distortions that originate not in the physical world but in the perceptual characteristics of the individual nervous system. Classic psychophysics was working essentially in the Besselian tradition, it sought to characterize what the nervous system does to the stimulus, establishing the mathematical relationship between physical input and conscious sensation. The observer was treated as a measuring instrument whose characteristic distortions could be identified and corrected for, much as Bessel had corrected for the personal equation of the astronomers.

Signal detection theory introduced a further layer of complexity that neither Bessel nor Fechner had fully reckoned with. The observer is not merely a measuring instrument with characteristic sensory properties but is also a decision maker whose willingness to report a detection depends on factors that have nothing to do with sensory sensitivity. The same physical stimulus, producing the same neural response, may result in a reported detection on one occasion and a missed detection on another, depending on the observer's motivational state, the costs and benefits associated with different response outcomes, and the criterion the observer has adopted for saying yes. What gets through the veil of perception, it turns out, is not determined solely by the nervous system's properties, it is also determined by the observer's decision strategy.

In Biological Kantian terms, this is a significant development. Müller's doctrine had located the veil in the sensory architecture. Classic psychophysics had accepted this framework and sought to characterize it quantitatively. SDT showed that the veil has a second layer that is not sensory but decisional. It was not a property of the nervous system's architecture but of the observer's active, motivated engagement with the detection task. Poor Kinnebrook, it seems, was not merely the victim of a slower personal equation than Maskelyne, he may also have been operating with a different decision criterion, a different threshold of willingness to commit to a judgment, shaped by the asymmetric power relationship between a junior assistant and his demanding superior. The lesson that Bessel drew from the Kinnebrook incident was that observers differ in their sensory characteristics. The lesson that signal detection theory adds is that observers also differ in their decision strategies, and that these two sources of variability, sensory and decisional, must be disentangled before we can say anything precise about what the nervous system is actually doing.

KEY TERMS

Key Terms

- sensationalism, scientific realism, vitalism, physiognomy, phrenology, Bell-Magendie law, ablation, autopsy, Broca's area, Wernicke's area, psychophysics, absolute threshold, difference threshold, just noticeable difference, Weber's law, Fechner's law, Method of Limits, Method of Adjustment, Method of Constant Stimuli, Steven's Power law, magnitude estimation, magnitude production, cross-modality matching, Signal Detection Theory, sensitivity, response bias

STUDY QUESTIONS

Study Questions

1. What is the difference between the absolute threshold and the difference threshold?
2. What was the purpose in the development of the psychophysical functions?
3. Outline three methods of 19th century neuroscience research.
4. Why should the study of the physiology and function of the nervous system be of interest to those who adopt an empiricist and materialist position?
5. Describe any 2 psychophysical methods, including details of the procedures.

CHAPTER 8: THE BEGINNINGS OF EXPERIMENTAL PSYCHOLOGY

INTRODUCTION

Learning Objectives
Understand:

- The concept of mental chronometry
- Donders' subtractive method for measuring response times
- Wundt's concept of the will
- The difference between mediate and immediate experience
- The difference in research methods used to study mediate and immediate experience
- The concepts of perception, apperception and creative synthesis
- The role of introspection in Titchener's structuralist research
- Why structuralism is a reductionist theory of mind
- Why phenomenology is a rejection of structuralism and reductionism
- The concept of intentionality
- The 3 methods of studying the mind as classified by Brentano
- The problem of other minds and intentional eliminativism vs. intentional realism
- Husserl's idea of the Wesensschau
- The concept of imageless thought and why it is at odds with voluntarism

In the previous chapter, we learned of the story of Kinnebrook's firing at the Greenwich Observatory, and how it eventually led to studies of the personal equation and attempts to attribute individual differences in *reaction time* (RT) to neural transmission. While physiological explanations of this phenomenon failed to explain it adequately, **Wilhelm Wundt** (born 1832) had the insight that not only settled the matter but set up the foundations of modern psychological research and in so doing, created the very first psychological laboratory at the University of Leipzig (the same place where Weber and Fechner established psychophysics) in 1879. Wundt was well educated in the history of the personal equation and referred many times to the story of Kinnebrook in his writing (Bolles, 1993). Of course, this exposure came from his professor, Helmholtz, at the University of Heidelberg. It is difficult to sort out who the very first experimental psychologist was—it appears Fechner was first. However, both he and Helmholtz considered themselves physiologists first and foremost, and though Wundt was trained as a physiologist, he named his lab at Leipzig the Institute for Experimental Psychology and was the first to openly commit to psychology research (Bolles, 1993).

MENTAL CHRONOMETRY

Around the time Wundt was studying with Helmholtz, a Dutch physiologist named **Franciscus Cornelis Donders** (born 1818) used the reaction time methods created by Helmholtz to measure the speed of the nerve impulse, but further adapted them, using the *subtractive method*, to measure the timing of other cognitive processes. First, he set up an apparatus that provided a mild electric shock to the foot of a subject, who was instructed to press a key to close a switch, which would shut off the electric current. A timer could then record the exact amount of time between the onset of the shock and the time it took for the subject to press the key. Donders called this the *simple reaction time*, because all that it required was for the subject to detect the presence of the stimulus and then quickly respond. Next, Donders set up a variation in which a shock could be applied either to the left or right foot. If the shock occurred on the right foot, the subject was to respond by pressing the key as quickly as possible. A shock on the left foot was to be ignored. The interesting result was that the reaction time to press the key on trials with a right-foot shock was longer than in the previous condition. What could account for this difference? Donders reasoned that it was due to perceptual processing, requiring discrimination between the two possible stimuli. In the simple task, no discrimination is required; if a stimulus is present, press the key. Now, the subject must determine which stimulus is present before pressing the key. The extra time associated with this perceptual discrimination is the reason why the response latencies were longer. The difference in reaction times between these trials and the simple reaction times was called *discrimination time*, and so was called the subtractive method because it measured the duration of the cognitive processes by subtracting one reaction time from another. In a final twist, Donders added a second response key. If the shock was on the left foot, the subject was instructed to press the left key. If the shock was on the right foot, the subject was supposed to press the right key. In these trials, the average response time was even longer than in the discrimination trials. What accounted for the extra processing time? Donders argued it was the *response selection time*. The idea is that once the perceptual discrimination process is completed and the subject has determined whether the shock was on the left or right foot, they now have to make yet another decision, corresponding to which key to press, introducing additional latency to the response. Again using subtraction, the duration of this response selection could be measured by comparing average reaction times in this condition to the average reaction time of the discrimination trials. Donders called his line of research ***mental chronometry***, and his study revealed the existence of definite stages of cognitive processing. For the first time, the existence of such processes was more than just a theoretical supposition—the data themselves suggested their reality and even measured their properties!

Wundt was impressed with Donders' findings and applied them to gain insight into the personal equation problem. He found that it was not possible to attend to the visual stimulus of the star and the auditory stimulus of the ticking clock at the same time. Some degree of attentional switching must occur, and this switching would take time. Wundt realized it ought to be possible to measure the duration of this process and invented his "thought meter" to do just that. The apparatus consisted of a pendulum clock hanging on the wall, with the bob of the pendulum swinging over a graduated scale. An observer would sit facing the pendulum and the scale, observing the pendulum pass over the gradations labeled on the scale. At a predetermined time, unbeknownst to the observer, a bell would sound

while the pendulum was directly over a certain mark on the scale. The observer's job was to note over which mark was the pendulum when the bell sounded. The task ought to be easy enough: the observer never has to look away from the pendulum and scale, only to keep their eyes fixated upon it, wait for the bell to sound, and then note where the pendulum was. This task was functionally similar to the astronomer's task. Wundt found that observers' responses were always delayed and they gave responses that were incorrect. By comparing the true location of the pendulum at the sounding of the bell, to the reported location of the pendulum, Wundt was able to estimate the amount of time between the sounding of the bell and the time it took to respond. The idea is that even though the observer is looking at the pendulum the entire time, they must first detect and process the sound of the bell, then shift attention to the eyes, and notice where the pendulum was relative to the scale. This shift accounted for the latency in the observers' responses and provided a compelling account of the personal equation.

VOLUNTARISM

Wundt continued performing mental chronometry studies in his lab at Leipzig, along with various psychophysical studies. In fact, Wundt's first two students, **Max Friedrich** and **Granville Stanley Hall**, were subjects in a Donders-type study conducted by Wundt (Bolles, 1993). Importantly, Friedrich and Hall may be considered the first to receive doctorates in psychology, although the issue is complicated. At the time, all doctoral degrees were formally degrees in philosophy, and psychology departments did not exist. Friedrich's dissertation, completed in 1881 in Wundt's laboratory, used experimental methods and has perhaps the strongest claim to being the first doctoral dissertation in experimental psychology (Domański, 2004). Hall had already received a PhD from Harvard in 1878 for a dissertation on the muscular perception of space that was empirical in character but had taken place in a department without a formal laboratory like Wundt's. Hall's two-year visit to the Leipzig lab was specifically so he could learn the experimental methods that he would bring back to the United States.

Wundt was working in the Kantian tradition and adopted the themes of an active, structured mind in his work. One aspect of this was his notion of the will, as a central cognitive process that controlled attention, including the switching of attention in his thought-meter experiments. The existence of the will reflected an active mind and because of his emphasis on volition, choice, and purpose in cognition, Wundt named his approach ***voluntarism***, which became the first school of thought in psychology.

Wundt further subdivided the nature of conscious experiences into two major types. The first was called ***immediate experience***, which was the level of experience that could be directly studied using the experimental techniques derived from physiology, and significantly, Wundt added to these techniques the method of ***introspection***. Introspection had a long history in philosophy of mind, as it was only natural that philosophers would look within themselves to develop their insights into the nature of mind. Wundt modified this personal introspection into an experimental introspection, or *internal perception under experimental conditions*. Wundt would present observers with various stimuli and trained them to report the intensity or duration of their sensations. For example, when presented with an image of a rose, observers might note the sensation of redness and were tasked with reporting the intensity or other qualities of this redness.

The contents of immediate experience are acted upon by the mind, and the nature of these operations were a major focus of Wundt's work. First is *perception*, which for Wundt was the immediate registration of sensory content in the mind, and the sort of thing that trained observers were meant to report in the internal perception method. This was a somewhat passive process for Wundt, as the sensory content emerges into consciousness on its own, but the other operations were more active processes of the will. Most central then was *apperception*, which means the active, attentive focusing of the mind onto the perceptual content. This then brings the selected elements into the focal center of awareness. The term itself derives from Herbart's *apperceptive mas*s, or the current contents of one's consciousness, and from which Herbart defined the threshold as the minimum energy needed to enter into apperceptive mass. For Wundt, apperception is the activity of the will that selects and brings sensory elements into conscious awareness. In this act, the individual sensory elements cohere into a unitary

percept, and through the third operation of *creative synthesis*, the full understanding and recognition is achieved, and rather than being aware of a combination of sensations, one is instead aware of some perceived and recognized object (the reader ought note that this is an active re-interpretation of J.S. Mill's mental chemistry).

At this stage, Wundt proposed a second type of experience. When seeing the rose, immediate perceptual experience refers to the raw sensations such as color (red), shape, size, fragrance, and so on. But following creative synthesis of these sensations, one may then call it a rose, or a flower, or assign romantic connotation. These are higher ordered mental processes that entail assigning meaning to the sensations. This is ***mediate experience***. In his introspection studies, Wundt wanted observers to focus exclusively on their immediate experience, rather than naming the object they saw. To aid in this, Wundt used the newly invented *tachistoscope*, designed for very brief stimulus presentations. Such rapid stimulus presentation was thought to prevent too much post-exposure reflection, allowing the observer to focus on their sensations only.

It is worth pausing to note how this distinction maps onto the philosophical threads we have been tracing, especially in terms of the veil of perception. Wundt's immediate experience represents the closest approach to that veil from the inside, sensation stripped as far as possible of interpretation, as near to the raw sensory surface as conscious report can reach while still remaining within experience. Mediate experience, by contrast, represents movement away from the veil deeper into the experiential interior, sensation elaborated by meaning, language, culture, and inference into the rich cognitive content of ordinary conscious life, a characterization that owes a clear debt to Helmholtzian unconscious inference. The physiological approaches of the preceding chapter probed the veil from the physical side, measuring what the nervous system does to stimulation through physical instrumentation. Wundt's introspective program attempted to approach the same boundary from the experiential side, peeling back the layers of mediate experience to expose the immediate sensory surface beneath.

Wundt felt that the study of mediate experience required different methods, such as studying the way it is manifest in linguistic patterns, cultural universals, and literature. Hence the methods included comparative linguistics, cultural anthropology, and analysis of literature and myths. Wundt (1900) published his work on these topics in a massive volume called *Völkerpsychologie*, or *Cultural Psychology*. This work seems to have obvious parallels to other domains of social science also emerging in the late 19th century. However, there is little evidence of a direct influence between Wundt and Auguste Comte, whose ideas on positivism and the evolution of human knowledge (Chapter 5) spurred him to coin the term sociology, which was later developed into a formal field by Émile Durkheim in the 1890s. Likewise, Franz Boas pioneered the field of cultural anthropology in that same decade, and while his work often referenced the physiological findings of Fechner, Helmholtz and Wundt, he does not seem to have been influenced by the Völkerpsychologie.

STRUCTURALISM

The idea that introspective analysis could be used to understand sensations was the major theme of the work of one of Wundt's more famous students, **Edward Bradford Titchener** (born 1867). As noted, the sensations as elements of immediate experience somehow come together to create a structured and meaningful whole that Wundt called mediate experience. However, before studying under Wundt, Titchener attended Oxford University in England, and his allegiance was to the bottom-up, associationist empiricism of Locke and Bain. Hence, he was unwilling to appeal to any sort of a priori knowledge to explain how structure and meaning are added to the sensations. Rather than propose yet another philosophy or theory to explain it, he sought to discover this structuring process empirically, and thus his approach was called ***structuralism***.

Titchener believed that the mind had a discoverable elementary structure, a set of basic mental building blocks whose properties and combining rules, once identified, would constitute a complete scientific account of conscious experience. His ambition was explicitly modeled on the natural sciences. Just as chemistry had identified the elements of matter and the laws by which they combine into compounds, psychology should identify the elements of mind and the laws by which they combine into complex conscious states. The periodic table of mental elements, once complete, would do for psychology what Mendeleev's table had done for chemistry.

In 1892, Titchener completed his dissertation under Wundt, and then joined Cornell University in Ithaca, New York. There he established his laboratory using his own version of introspective analysis. Titchener identified three basic types of mental element: sensations, which are the basic elements of perceptual experience; images, which are the elements of thought and memory; and affections, which are the elements of emotional experience. Each of these elements had specific attributes: quality, which distinguished one sensation from another; intensity, which described its strength; duration, which described how long it lasted; and clearness, which described how prominently it stood out in the focus of attention. The task of introspective analysis was to identify these attributes precisely and systematically for every type of sensation, building up a comprehensive catalog of the mind's elementary contents.

Titchener considered sensations to be the atoms of conscious experience, and their coming together into complex wholes was paralleled by J.S. Mill's earlier idea of mental chemistry. As in Wundt's studies, Titchener's participants were instructed to introspect and report about their immediate experiences without naming the stimulus, a mistake he called the stimulus error. If an observer reported seeing a red apple rather than reporting the specific qualities of color, shape, and brightness that constituted their actual sensory experience, they had committed the stimulus error; they had described the interpreted object rather than the raw experience, substituting mediate for immediate experience. Titchener's trained introspectors were supposed to avoid this by attending exclusively to the sensation itself, stripped of all meaning and interpretation.

It is worth connecting this back to the veil of perception thread. Titchener's entire program rested on the assumption that immediate experience, or raw sensation, was accessible through sufficiently dis-

ciplined introspection. The trained observer, by attending carefully to the sensory surface rather than to the interpreted object, could approach the inner face of the veil of perception and report on what was found there. This was a bold epistemological claim, and it was one that several of Titchener's contemporaries disputed vigorously. Could introspection actually reach the level of raw sensation, or was the act of introspection itself already a form of mediate experience that inevitably transformed what it sought to observe? This methodological challenge would prove to be one of the most serious difficulties facing Titchener's program.

Thus, for Titchener, sensations were the building blocks of the mind. Any and all aspects of the human mind and behavior, including emotion, could in principle be reduced to the level of sensation. Once the nature of the mental elements and their combining rules were fully catalogued, the job of scientific psychology would essentially be complete. This is a strikingly reductionist and completionist vision — the claim that all the higher processes of mind, including the functions that Wundt had argued required cultural and linguistic methods such as those of the Völkerpsychologie, could ultimately be understood at the level of elementary sensation. This was an idea as ambitious as it was controversial, and it generated a correspondingly energetic set of reactions. Risking getting ahead of ourselves, the functionalists (Chapter 12) would argue that Titchener had asked the wrong question entirely — not what the mind is made of, but what it does. The Gestalt psychologists (Chapter 9) would argue that the elements he sought to catalog did not exist as separable units but that the whole of perceptual experience was prior to and irreducible to any set of parts. And the behaviorists (Chapter 13) would argue that introspection itself was not a legitimate scientific method. Structuralism did not survive these challenges, but understanding precisely what it claimed is essential for understanding the shape of twentieth century psychology.

PHENOMENOLOGY

One of the very first critiques of Titchener's enterprise originated back in Germany in the late 19th century, and it challenged two core assumptions of structuralism. The first assumption was that the appropriate unit of psychological analysis was the sensation and that experience could be decomposed into separable atomic units without loss, that the whole of conscious life was in principle reconstructible from its elements in the way that a chemical compound is reconstructible from its constituent atoms. The second assumption was that the method of trained introspection could actually reach the level of immediate experience, that the observer who successfully avoided the stimulus error was genuinely reporting on raw sensation rather than on an already-interpreted experience that merely felt immediate. The act of attending to a sensation and preparing to report on it is itself a mental act, and it is far from obvious that such an act leaves the sensation unaltered. If introspection inevitably transforms what it observes then Titchener's program was merely producing a new and particular kind of interpreted experience that it mistook for immediacy.

It was precisely these two concerns that motivated the approach of **Franz Brentano** (born 1838). For Brentano, the fundamental question is not about the building blocks of experience, but what exactly distinguishes mental phenomena from physical ones in the first place, and what the essential structure of a mental act looks like regardless of its specific content. Rather than instructing subjects to analyze their experiences into the simplest possible elements, Brentano emphasized intact, meaningful experiences to better understand their essence.

In Brentano's program, the defining characteristic of the mind was ***intentionality***. Mental phenomena are intentional in the sense that they are always directed toward something; every mental act refers to or is about some content. When I perceive, I perceive something. When I judge, I judge something. When I desire, I desire something. There is no such thing as a contentless mental act, and there is no such thing as mental content that exists independently of the act that is directed upon it. This is what Brentano meant by saying that mental content has *immanent objectivity*, the object of a mental act exists within the act itself as its intentional object, rather than as an independently existing physical thing. Importantly, this means that intentionality does not require the external existence of its object: I can think of a unicorn, fear an imaginary threat, or desire something I have never encountered, because the intentional object exists immanently within the mental act regardless of whether it exists in the physical world. Perhaps the work immanent needs unpacking – consider your own experience for a moment. Just now, having read it, you were thinking of a unicorn. But where was the idea of a unicorn in your mind prior to reading that sentence? It one sense it was available to you, as you have the concept, you know what a unicorn is, but it was not an intentional object until the very moment you directed a mental act toward it. This is what it means to say it became an intentional object and its existence was immanent.

Physical phenomena, by contrast, have no such intentional character. Objects exist as things-in-themselves and do not require any sort of act, mental or otherwise, to be directed toward them in order for them to have objectivity. A stone does not mean anything. A neural firing does not refer to anything. A color patch on the retina is not about anything. Physical events simply are what they are, without

the essential directedness toward content that defines mental life. It is this difference that Brentano proposed as the fundamental distinction between psychology and the physical sciences. The goal of Act Psychology is to study the phenomenal world of the mind, which is fundamentally different in character from objects in the physical world.

This view directly addresses the problems we identified in Titchener's program. Unlike Titchener's structuralism, there is no such thing as the stimulus error in Brentano's Act Psychology, because it is never possible to separate acts from their content in the first place. Such a separation would render the acts meaningless; a mental act stripped of its intentional content is not a purer or more elementary mental state, it is simply not a mental state at all. And this means that the entire reductionist project of structuralism is misconceived from the ground up. Consciousness cannot be decomposed into simpler sensory atoms without stripping away the very intentionality that makes mental phenomena mental in the first place. The appropriate task for psychology, on Brentano's view, is not to catalog the elementary contents of experience but to describe and classify the essential structures of mental acts in their full intentional complexity.

Brentano further classified the means of studying the mind into three methodologies. The first is a form of introspection called *direct inner observation*, which entails observing one's mental acts as they occur. This is the type of introspection employed by Wundt and Titchener. Brentano rejected this as a valid method, arguing that observing one's mental acts necessarily changes them. For example, when feeling an emotion such as anger, the mental act is "feeling", and its content is "anger". The act of introspecting and observing the anger transforms it. Now the mental act is presentation, or ideation, and its content is "the feeling of anger". The content of this new mental act is the emotion one had previously experienced. By observing the anger, you are no longer angry, and the mental act associated with the emotion has become a mental object that one is now analyzing but no longer feeling. You become an observer of the emotion rather than an experiencer of the emotion.

Instead, he supported *indirect inner observation*, which entails introspecting mental acts that occurred in the past. Participants are asked to recall past experiences, to describe them and express their thoughts and feelings about them. Recalling these experiences does not change them, because they had previously occurred intact and meaningfully, and the act of recall does not change that fact, that is, it cannot change the past. While Brentano advocated for this method, it may be worth emphasizing that modern work on false memories by **Elizabeth Loftus** (born 1944) suggests otherwise – the context of recalling a memory may alter the memory! Plus memory may be subject to various biases, and of course, such subjective introspection is never verifiable.

Finally, a third technique involved *objective observation*, defined as observing the externalized mental acts of other people. The outward behavior of another person, on this account, reflects their inner intentional acts. If I see you reach for a glass of water, I infer that you have a desire (the desire to drink, i.e., that you are thirsty), and a belief (that the glass contains water and will quench your thirst) that together caused the behavior. In this way, the behavior of others becomes a window onto their mental lives, and the study of behavior becomes a legitimate method for the psychological study of mind.

This though raises one of the most fundamental problems in the philosophy of mind, known as the ***Problem of Other Minds***. My access to my own mental states, however limited, is at least direct in some sense; I am the one having them. But my access to your mental states is entirely indirect. I observe your behavior and infer the mental states that produced it. What justifies that inference? How can I be certain that your behavior is produced by genuine intentional mental states rather than by purely

physical processes that merely resemble intentional behavior from the outside? The philosophical problem is that no amount of behavioral evidence can conclusively establish the presence of inner mental life in another person, because the same behavior could in principle be produced by a system with no inner life at all.

Despite this philosophical difficulty, the inference from behavior to mental states is something that human beings do automatically and constantly, and it appears to be a fundamental feature of social cognition. The philosopher **Daniel Dennett** (born 1942) described this as taking an intentional stance — treating other agents as if they had beliefs, desires, and intentions, and using this assumption to predict and explain their behavior. Dennett's point was not that the intentional stance was philosophically guaranteed to be correct but that it was practically indispensable; we could not navigate social life without it. The intuitive psychological framework through which we routinely attribute mental states to others on the basis of their behavior is called ***folk psychology***, and it is the implicit theory of mind that underlies all ordinary social interaction.

The strongest challenge to this method comes from ***intentional eliminativism***, which is the position claiming that folk psychological categories like beliefs, desires, and intentions do not refer to any real entities. On this view, folk psychology is a theory, and like any theory it can be wrong. A mature neuroscience, the eliminativist argues, will eventually replace folk psychological explanation with a more accurate account of the physical processes that actually produce behavior, much as modern chemistry replaced the folk theory of phlogiston with a more accurate account of oxidation. The suggestion that intentions do not exist and that what we call intentional behavior is really just physical process described in folk psychological vocabulary, is a form of eliminative materialism, and it represents perhaps the most thoroughgoing rejection of Brentano's starting point that psychology has produced.

In a modern twist, the debate between eliminativism vs. intentional realism underlies the debate about whether artificial intelligence is possible. Can machines think and possess intentions? This was the exact question posed by **Alan Turing** (born 1912) in his 1950 paper on the subject. Because intentions and similar psychological constructs like thoughts, ideas, feelings, intelligence, and even consciousness itself are difficult to define and cannot be directly observed, Turing decided to settle the debate by changing the question. It does not matter whether machines think, in his analysis, but rather, can they make us think they think? In other words, do they make people adopt an intentional stance when interacting with them? If so, then the machine passes the so-called *Turing test*, and is considered artificially intelligent. The way this is tested is a setup called the "Imitation Game." Subject A is a person recruited for the experiment, instructed to engage in an online chat with two other entities. One of these entities, Subject B, is a real person. The other, Subject C, is a computer that possesses the ability to process the text inputs from Subject A and generate text responses (an early form of what we would now call a large language model). The task given to Subject A is to determine which of the other two entities is the real person and which is the computer. If Subject A is correct, then something about the computer's responses must have seemed artificial, canned, and thus not governed by intentions, and the computer fails the Turing test. But if the computer is convincing enough that Subject A cannot decide, or even makes the wrong choice, then it passes the test. Subject A reacts to the computer in the same way as they do a real person and cannot tell the difference between the behavior of the computer and a real person. For all practical purposes, then, the computer is intelligent. **John Searle** (born 1932) criticized the Turing test with his *Chinese Room thought experiment* (Searle, 1980). He devised a scenario in which Subject C is not a computer, but a real person. This person is brought into the lab and given a code sheet full of Chinese characters. Each line on the sheet matches one character to another. The person is then placed inside a room with two slots in the door that accesses the room.

They are given the instruction that if they receive a slip of paper in the "input" slot containing Chinese characters, that they should then consult the code sheet, and write the specified Chinese characters on a blank piece of paper and insert it into the "output" slot of the door. Meanwhile, Subject A, who happens to be able to read and write in Chinese, enters the lab and is told of this special invention, a machine that can communicate in written Chinese! To test it, Subject A writes messages in Chinese on a piece of paper and places them into the slot labeled "input." After a while, a response emerges from the slot labeled "output." If Subject A is convinced that the entity in the Chinese Room truly understood the message and generated an appropriate and meaningful response, then the entity passes the Turing test. However, we already know the entity in the room is not an intelligent machine. It is just a person with a code sheet. The person, Subject C, is generating canned responses based on this sheet, and knows nothing about the meaning of the "conversation" in which they are engaged. This is not an intelligent process, even if it appears so to Subject A.

Searle's argument remains highly contested. The *Systems Reply*, for instance, argues that while the person in the room lacks understanding, the system as a whole (person, rulebook, room, and all) might constitute a understanding entity in the relevant sense. The debate has become considerably more urgent with the development of large language models (LLMs) that can produce remarkably human-like text, raising the question of whether Searle's argument applies to systems that learn statistical patterns, as LLMs do, rather than following explicit symbolic rules. We will return to these questions in Chapter 14, when we examine the cognitive revolution and the emergence of artificial intelligence as a research program. For now, it is enough to note that the debate about machine intelligence is, at its philosophical core, a debate about intentionality — about whether the kind of meaningful directedness toward content that Brentano identified as the mark of the mental can be realized in a physical computational system, or whether it is irreducibly a feature of biological minds. While we appear to be today no closer to proving that either machines or humans have intentions or think intelligently, the question remains an open and important one.

Returning to the historical thread we left with Brentano, we turn now to one of his most important students, **Carl Stumpf** (born 1848), who echoed his teacher's sentiments that the true subject of psychological inquiry was whole, meaningful mental phenomena, rather than meaningless elements. Stumpf did not add much to the theory of phenomenology, but he did have two major contributions to the history of psychology. The first is the story of Clever Hans, the horse that reportedly could perform arithmetic. When asked "What is 2 plus 3?" Hans would stamp his hoof five times, apparently giving the correct answer. Stumpf organized a commission to investigate the claims, and his student Oskar Pfungst conducted the decisive experiments. Using carefully controlled observation, Pfungst discovered that Hans was not calculating but detecting subtle involuntary cues from his questioners, a slight forward lean, a barely perceptible change in breathing, that signaled when to stop stamping. When the questioner did not know the answer, Hans's accuracy collapsed entirely. When Hans could not see the questioner, the same result followed. In what may be one of the earliest examples of double-blind experimental control in psychological research, Pfungst designed conditions in which the questioner was unaware of the correct answer, effectively eliminating the cue that Hans was responding to.

The story is more than a charming historical curiosity. It illustrates the way in which the presence and behavior of the observer can shape the phenomenon being observed. Questioners who watched Clever Hans were adopting the intentional stance toward him, attributing arithmetic understanding and genuine intelligence to his behavior, and being systematically misled. The behavioral evidence seemed compelling; the mental attribution it supported was entirely wrong. The parallel to the

methodological problems we have been tracing throughout this chapter, from Titchener's stimulus error to the problems of introspection to the epistemological challenges of the problem of other minds is instructive. Behavior, whether of a horse or a human, is an unreliable guide to inner mental life. Stumpf's other major contribution to psychology was his most famous student, **Edmund Husserl** (born 1859).

Husserl studied under both Brentano and Stumpf, and his work transformed the insights of both teachers into a systematic philosophical and psychological program that he called ***phenomenology***. Where Brentano had identified intentionality as the defining characteristic of mental life and had raised serious doubts about the reliability of deliberate introspection, Husserl took up the challenge of developing a rigorous method for describing the essential structures of conscious experience. His starting point was what he called the natural attitude, the ordinary, unreflective stance we take toward the world in everyday life. In the natural attitude, we simply assume that the world exists, that our perceptions are of real objects, and that our experiences are about a mind-independent reality. This assumption is so automatic and pervasive that we are normally not even aware of making it. It is, in effect, the default setting of human consciousness, and for Husserl, it was precisely this default setting that needed to be suspended if we were to examine the structure of experience itself with philosophical rigor.

His method for achieving this suspension he called the *epoché*, a term borrowed from ancient Greek skepticism meaning the withholding of judgment. The phenomenological epoché does not deny that the world exists or adopt a skeptical position toward it. Rather, it brackets the question (sets it aside, neither affirming nor denying) in order to redirect attention from the objects of experience to the structure of experiencing itself. This distinguishes Husserl's method sharply from Descartes' method of doubt, which suspended belief in the external world in order to find something epistemologically certain. Husserl was not looking for certainty but for descriptive accuracy; he wanted to describe what conscious experience is actually like, rather than to establish what can be known with confidence. The epoché is a methodological tool for redirecting attention, not a skeptical conclusion about the limits of knowledge.

It is also worth connecting the epoché to the veil of perception thread that has run through this book since Chapter 4. The veil generates the question of how we can access a mind-independent reality through experience, and has driven philosophy of mind from Plato's cave through Descartes' brain in a vat to Helmholtz's unconscious inference. Husserl's response is unlike any we have encountered: he brackets the question entirely. Rather than trying to pierce the veil through reason, work within its constraints through empiricism, or deny its existence through direct realism, phenomenology suspends the question of what lies behind experience and focuses instead on describing the structure of experience itself. Whether this suspension constitutes a genuine solution to the veil problem or merely a methodological evasion of it is a question philosophers continue to debate.

Once the epoché has bracketed the natural attitude, what remains for the phenomenologist to describe is the intentional structure of experience, the relationship between the act of consciousness and its intentional object that Brentano had identified as the mark of the mental. Husserl developed an elaborate vocabulary for describing this structure. He distinguished between the noesis (the act of consciousness, the how of experiencing) and the noema (the intentional content or meaning through which an object is given to consciousness). The noema is not the object itself but the way the object appears or is meant in the act of consciousness directed toward it. The same physical object can be given through different noematic contents depending on the mode of consciousness; perceiving a

chair, remembering a chair, imagining a chair, and judging that a chair is comfortable are all different noeses with different noemata, even though they may all be directed toward the same object.

The goal of phenomenological description, for Husserl, was ultimately to identify the essential features of conscious experience, which are necessarily present in any instance of a given type of experience regardless of the particular circumstances. His method for doing this was what he called *eidetic variation*, systematically imagining a given experience with various features changed in order to identify which features are essential and which are contingent. If one can vary a feature without the experience ceasing to be the type it is, that feature is contingent. If varying a feature would transform the experience into a different type entirely, that feature is essential. The intuition of the essence that results from this process of systematic variation Husserl called the *Wesensschau* translated literally as *the seeing of the essence*.

We can connect this to the Problem of Universals introduced in Chapter 3. When we ask how we recognize something as beautiful — the question Socrates posed and that the rationalists and empiricists answered so differently — Husserl's phenomenological answer is neither the rationalist's appeal to innate ideas nor the empiricist's appeal to accumulated experience. It is an appeal to the essential structure of the experience of beauty as it presents itself to consciousness after the natural attitude has been bracketed. What makes something beautiful is not a Platonic Form existing independently of mind, nor an abstraction built up from repeated sensory encounters, but an essential feature of the type of experience we call aesthetic appreciation, a feature that eidetic variation can reveal by showing us what we cannot remove from the experience without it ceasing to be an experience of beauty at all. Phenomenology, in this sense, is a third path between rationalism and empiricism rather than a combination of the two.

Husserl's influence on psychology and philosophy was enormous and is still felt today. His phenomenological method provided the philosophical foundation for the existentialist tradition of Heidegger and Sartre, which we will examine in Chapter 17. The questions Husserl raised about the structure of conscious experience: how objects are given to consciousness, what the relationship is between the act of experiencing and its intentional content, and how essential structures can be identified through systematic description, remain central to philosophy of mind, cognitive science, and the phenomenological tradition in clinical psychology.

THE PERIPHERY IN GERMANY

While Wundt was at the center of attention for most of German psychology, there were others who were conducting important psychological research with less fanfare. But, in the long run, we have seen that their contributions were no less significant. Perhaps the most famous of them was **Hermann Ebbinghaus** (born 1850), working first at the University of Berlin and then at Breslau. Ebbinghaus is famous for his pioneering work on memory. He developed objective measures of studying human memory capacity, such as using the CVC trigram, a nonsense syllable consisting of a consonant, vowel, and consonant. Ebbinghaus preferred this stimulus because attempting to memorize familiar words would allow connections to be made based on their familiarity. Thus, the recall accuracy would be contaminated by the words' familiarity. By creating completely unfamiliar stimuli to be memorized, and by equating each in terms of their complexity, he could be sure of a purer measure of memory ability. Using primarily himself as a subject, he memorized very long lists of CVC trigrams and discovered a lot of memory phenomena. For example, he discovered that the amount of forgetting increases as a function of time since the initial learning session. He developed *savings time* as a means of measuring forgetting. Rather than simply memorizing a list of words, waiting a period of time, and then attempting to reproduce the list noting the percent accurately recalled, the savings time technique involved studying a list until it is 100% learned. Then, after a period of time, say one day, Ebbinghaus would not remember the whole list, and so would relearn it. If it took 1 hour to learn the list in the first session, but only 15 minutes on the second session a day later, then the savings time was 45 minutes. Ebbinghaus discovered that the amount of savings time decreased as a function of time since learning. He also discovered the importance of overlearning, which means that even after a list was completely memorized, it was beneficial to study it further. Such overlearning resulted in greater savings time. A contemporary of Ebbinghaus, **Georg Elias Müller** (born 1850) conducted work on psychophysics, and later memory, following up on Ebbinghaus' studies. What was the reason that forgetting occurred over time? Was it simply that the memory trace decayed in the mind? For Müller, the answer was no. He was the first to propose an *interference theory of forgetting*, suggesting that new information brought into the mind since the time of learning conflicts with the older information, making it harder to access those memories.

We shall conclude with a brief mention of **Oswald Külpe** (born 1862), one of Wundt's most loyal students. Why should he be mentioned among the periphery in German psychology if he was such a strong Wundtian? The problem arose when Külpe attempted to apply the introspection techniques to the domains of reasoning and problem solving. What he found, unexpectedly, was that in the act of solving a problem, the subjects could not introspect about their process. More precisely, they claimed that the processes involved in solving problems were not accompanied by sensory imagery of any sort, no colors, sounds, or other qualities that Wundt or Titchener might have argued were the necessary elements of conscious thought. And so much of the Wundtian enterprise is directly contradicted by this apparent *imageless thought* reported by Külpe. Wundt and Titchener thus considered Külpe a traitor (Bolles, 1993). The idea behind imageless thought was that there was more to the process than just the structuring of sensations. One way to put it is that the whole of conscious experience is more than the sum of its elements, or parts.

SUMMARY

This chapter has traced the emergence of psychology as an experimental discipline from two converging traditions. The first, represented by Wundt and Titchener, sought to make psychology scientific by applying the methods of physiology to conscious experience, using psychophysics, mental chronometry, and trained introspection to decompose the mind into elementary constituents. The second, represented by Brentano and Husserl, argued that this reductionist program fundamentally misunderstood what consciousness is, that the attempt to decompose experience into sensory atoms stripped away the intentionality and meaning that were the defining features of mental life, and that what psychology needed was to describe the essential structures of conscious experience rather than reducing them to their most elementary components. Külpe's imageless thought seemed to support the latter. The mind, it appeared, was doing things that trained introspection could not catch.

This was the intellectual situation that sets the stage for the next major school in German psychology. The phenomenological tradition had provided a powerful critique of reductionism but had not yet produced a research program that could compete with the Leipzig laboratory model on scientific grounds. Into this situation came a group of psychologists who proposed a genuinely different answer to the question of what the mind's basic units were — and their answer was that the question itself was wrong. The whole of perceptual experience is not constructed from elementary parts but is prior to and irreducible to any set of parts. The elementary unit of psychological analysis is not the sensation but the organized whole, the Gestalt. And this organized whole is not built up from elements through association or mental chemistry but is given directly in experience as a structured unity that precedes any analysis into components. In effect, they were responding to the same fundamental question raised by Kant: how does the mind contribute structure to experience? Their answer, as we shall see in the next chapter, drew on a new set of experimental demonstrations that made the organized character of perception dramatically visible, and in doing so, transformed the landscape of experimental psychology.

KEY TERMS

Key Terms

- mental chronometry, voluntarism, mediate experience, immediate experience, apperception, introspection, structuralism, reductionism, phenomenology, intentionality, direct inner observation, indirect inner observaton, objective observation, Problem of Other Minds, folk psychology, intentional stance, intentional eliminativism, intentional realism, Turing Test, phenomenology, Wesensschau, imageless thought

STUDY QUESTIONS

Study Questions

1. According to Wundt, what is the difference between immediate and mediate experience?
2. Define intentionality from the perspective of the phenomenologist tradition.
3. Define Brentano's three methods for studying consciousness.
4. Explain how Kulpe's findings were at odds with Wundt's voluntarism.
5. Define and contrast intentional realism and intentional eliminativism.

CHAPTER 9: GESTALT PSYCHOLOGY

INTRODUCTION

Learning Objectives
Understand:

- the phi phenomenon and why it demonstrates that perception is more than the sum of sensations
- the Law of Pragnanz and how the organizing principles are used to achieve a perceptual whole aka good form
- the principle of isomorphism
- the difference between analog and digital processes and how these relate to the brain
- Lewin's characterization of behavior within a psychological field

We left off in the previous chapter hinting at the development of ***Gestalt psychology***. The first person to consider is **Max Wertheimer** (born 1880) who studied with both Stumpf and Külpe, and while their influence was important, the story usually told about the beginnings of Gestalt psychology begins with a train ride. Wertheimer had been thinking about the perception of movement, and was aware of the phenomenon of motion pictures, which was a relatively new invention at the time. Motion pictures worked by flashing static images on a projection screen, very rapidly in sequence. The rapid projection results in the perception of moving images on the screen. But of course, nothing in the film was actually moving; it was just a sequence of still images. Wertheimer considered the structuralist view of perception, which states that it is built up from the sensations, and how Titchener's goal was to understand the process by internal analysis of the sensations. However, in the case of movies, there is no sensation of movement! The movement exists only in perception but not in the sensation. Wertheimer's insight, echoing Külpe's findings regarding imageless thought, was that there is more going on than, quite literally, "meets the eye."

The story goes that in 1910, Wertheimer had this realization while riding on the train, and so got off at the next stop, which was the Frankfurt station, to buy a toy stroboscope, a device which made spinning objects look stationary by means of a rapidly flashing light. According to the story, Wertheimer never got back on the train but proceeded to the university to see if he could start researching the idea (Bolles, 1993). The professor of psychology at the University of Frankfurt was Friedrich Schumann, who had also been a student of Stumpf. Already at Frankfurt were two other former students of Stumpf, **Wolfgang Köhler** (born 1887) and **Kurt Koffka** (born 1886). Wertheimer, Köhler and Koffka, were the founders of Gestalt psychology.

Wertheimer recruited Koffka and Köhler to be subjects in his study of the *phi phenomenon*, which was the controlled demonstration of illusory motion using a tachistoscope. Wertheimer used the tachistoscope to create the illusory perception of a moving object by presenting a vertical line on the left-hand side of the display. The line would be visible for a brief moment, and would then disappear, to

be replaced by another line on the right-hand side of the display. When the timing of the alternation of the lines was slow, the observers reported seeing two separate lines presented in succession, one on the left, and one on the right. When the timing of the alternation was very rapid, the observers again reported seeing two separate lines, but instead of succession, they were seen simultaneously, as if they were both present at the same time. More importantly to Wertheimer's hypothesis, though, was what happened at a moderate rate of alternation. In this condition, the observers reported seeing only one line, moving back and forth from the left to the right and back again to the left! They saw a moving line, when in fact there was no movement taking place. Further, as this line moved from left to right, the observers had the distinct impression that it did cross the space in the middle of the display, even though no line ever appeared there. It was clear to Wertheimer that this observation contradicted any view of perception based on sensation and was a convincing refutation of structuralism.

After their collaborations at Frankfurt, each moved on to different appointments. Eventually they all left Germany to escape the Nazis. Wertheimer ended up at the New School for Social Research in New York City. The New School has an interesting history itself. It was founded in 1919 by a group of academics, many recently resigned or fired from Columbia University, for expressing unpopular political views. The New School was to be a free, progressive institution. By 1933, with the arrival of several academics fleeing the Nazi and other fascist regimes of Europe, the University in Exile was founded as a division of the New School. Wertheimer was among this latter group.

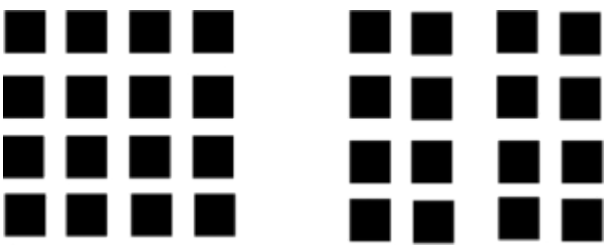
Koffka was the first to arrive in the United States. He accepted a visiting professor position at Cornell University in 1924. But after a short stay at the University of Wisconsin-Madison, he ended up at Smith College in Northampton, Massachusetts, where he stayed for the remainder of his career. Köhler took a more roundabout path to the United States. First, he accepted a position at the Primate Research Station on the island of Tenerife, part of the Canary Islands off the western coast of Africa. There, in studies reminiscent of Külpe's work, he studied problem solving in chimpanzees. This work was yet another blow to structuralism, for Köhler found that the chimpanzees, when faced with a problem, appeared to experience a moment of insight, akin to an "aha" moment, in which the solution seemed to just appear without any obvious steps or reasoning, being involved. Specifically, Köhler would present the chimpanzees with problems such as a bunch of bananas hanging high and out of reach within their enclosure. Scattered about the enclosure were a variety of empty crates, sticks, and poles. A few of the chimps attempted to reach the bananas with sticks but quickly realized they were not long enough. For a time, nothing happened. But then suddenly, one of the chimps started stacking the crates on top of each other, until he had built a tower tall enough to climb and reach the bananas. Köhler observed a variety of different problem-solving behaviors apparently involving insight in the chimpanzees, a finding that challenged not just structuralism, but also the behaviorist views that were emerging in the United States at the time. Köhler then returned to Germany, succeeding Stumpf at the University of Berlin where he and Wertheimer worked together through the 1920s until Wertheimer left for the New School (Bolles 1993). A year later, Köhler arrived at Swarthmore College in the suburbs of Philadelphia.

TENETS OF GESTALT PSYCHOLOGY

Wertheimer's discovery demonstrated that perception is not merely the sum of the sensations, or in the classic phrasing of this sentiment, the whole is more than the sum of the parts. In a reductionist theory like Titchener's, the idea is that understanding the parts allows for an understanding of the whole, but for the Gestaltists, this cannot be true. In fact, the German word "gestalt" means configuration, pattern, or form, and Wertheimer, Köhler, and Koffka adopted this word to describe their new approach, which emphasized that the mind is always actively finding and creating patterns, even where there are none. The phi phenomenon is a classic example of the mind inventing a coherent pattern even though there are no sensations corresponding to this pattern.

The tendency of the mind to organize experience reflected a principle the Gestaltists called the ***Law of Prägnanz***, from the German for good form, clarity, or conciseness. The law states that perceptual organization tends toward the simplest, most regular, most stable pattern that the available stimulus information will support. When the sensory input underdetermines the perceptual organization, such as when several different organizations are consistent with the available information, the perceptual system resolves the ambiguity in favor of the simpler and more regular interpretation. The Law of Prägnanz is not a claim that we always see the simplest possible form regardless of the stimulus, but that we see the simplest form the stimulus will support. The specific organizing principles, proximity, similarity, continuity, closure, figure-ground, and others, are the specific mechanisms through which Prägnanz is achieved in different stimulus configurations. They are, in a sense, the particular ways in which the general tendency toward good form expresses itself.

The principle of *proximity*, illustrated in Figure 9.1, is perhaps the simplest of these. In Figure 9.1a, we find merely an arrangement of 16 squares in a 4×4 grid. There may be various patterns one may find here, such as seeing the whole of the 4×4 grid, but one may also notice four rows, or four columns, or maybe four adjacent 2×2 grids, or even a central 2×2 grid within the larger 4×4 grid. None of those organizations are especially stable however, because the stimulus is underdetermined, and no single simple form is supported. But now notice in Figure 9.1b, with one small change of the spatial arrangement, a simpler form because stable, and the tendency to see two vertical columns is established. This occurs because the rule of proximity perceptually binds nearby elements into a whole, and perceptually separates elements that are distal to each other.



(a) (b)

Figure 9.1. Two figures illustrating the effect of the proximity principle on visual perception.

The principle of *similarity* extends this logic to other visual properties. Elements that share a common feature (e.g., color, shape, size, or orientation) tend to be grouped together even when they are not spatially adjacent. In a grid of dots where some are filled and some are open, you will spontaneously perceive the filled dots as one group and the open dots as another, regardless of their spatial arrangement. The principle of *continuity* governs the perceptual organization of lines and contours. Elements that follow a smooth, continuous path tend to be grouped together, and the perceptual system tends to follow the smoothest possible continuation of a line rather than making sharp unexpected turns. If two curved lines cross each other, you tend to perceive two continuous curves passing through the crossing point rather than two angles meeting at a corner, because the continuous interpretation is the simpler and more regular one. Continuity is particularly important for understanding how we perceive objects that are partially hidden behind other objects, as the visible portions of a partly occluded object are grouped into a single continuous form because the perceptual system follows the principle of good continuation across the gap. The principle of *closure* reveals perhaps most dramatically how the perceptual system actively contributes to experience rather than merely registering what is present in the stimulus. When presented with an incomplete figure, such as the famous Kanizsa (1976) triangle, a circle with a gap, a triangle made of three disconnected line segments, the perceptual system tends to complete it, filling in the missing contours to create a closed regular form. You do not perceive the line segments as separate lines; you perceive a triangle, even though no triangle is actually present in the stimulus. Closure shows clearly that perception is not a passive registration of what is there but an active organizational process that goes beyond the available information to produce a complete and coherent percept.

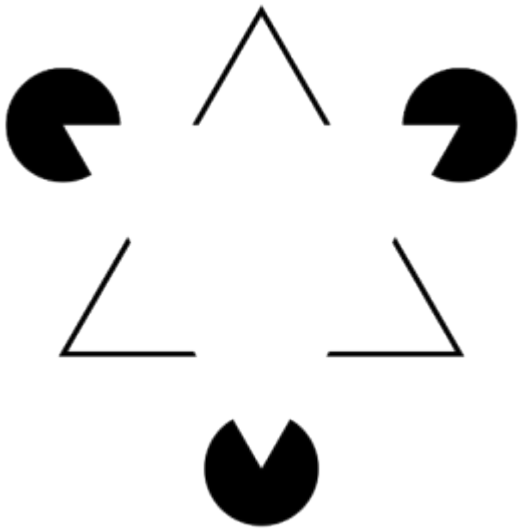


Figure 9.2. The Kanizsa triangle illustrating the principle of closure. (Original: Fibonacci, CC BY-SA 3.0 http://creativecommons.org/licenses/by-sa/3.0/, via Wikimedia Commons)

Before any of these principles can operate, the perceptual system must first accomplish a more fundamental organizational task, which is to separate the visual scene into a figure and a ground. Fig-

ure-ground organization refers to the perceptual tendency to divide a visual scene into a primary element, the figure, that stands out as a distinct form against a secondary element, the ground, that recedes into the background. The classic demonstration is the Rubin vase: the same image can be perceived either as a white vase against a black background or as two black faces in profile against a white background, depending on which region the perceptual system treats as figure and which as ground. Crucially, both interpretations are consistent with the available stimulus information, which is underdetermined in the absence of additional organizing information. As a result, the observer's perceptual system must impose a separation, and neither remains stable for the long-term.

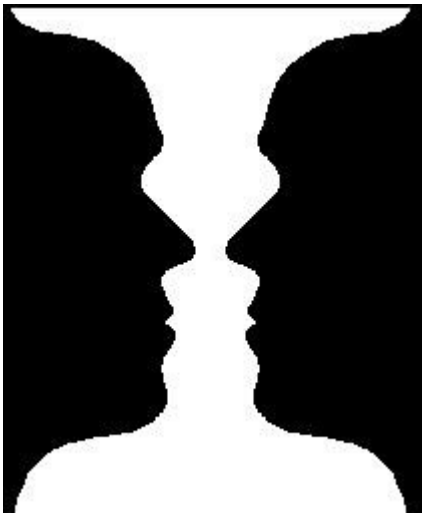


Figure 9.3. The Rubin vase. (Wikimedia Commons. Public domain. https://commons.wikimedia.org/wiki/File:Facevase.JPG)

Taken together, these principles paint a picture of perception that is strikingly different from the reductionist account of Wundt and Titchener. Instead of a structured perceptual experience built up through a process of combining and associating sensory elements, the Gestaltists proposed that the perceptual system perceives wholes as the primary units of experience. The parts, the individual dots, lines, and contours, are not the starting points from which wholes are built but are abstractions derived by analyzing wholes that are already given. Again, the whole is something other than the sum of its parts, not because it has some mysterious additional quality, but because it is the primary perceptual reality from which parts can only be derived by deliberate analysis.

The Gestalt psychologists were not content to describe the organizing principles of perception without proposing an explanation of how the perceptual system organizes experience in these ways. Their explanatory framework drew on Maxwell's field theory in physics and electromagnetism, and extended in Einstein's relativity, of regions of space with distributed organizational properties that determine the behavior of elements within them. Köhler had studied physics before turning to psychology and proposed that the brain should be understood as a physical field whose organizational properties constrain and shape perceptual experience in the same way that a magnetic field constrains and shapes the behavior of iron filings within it.

Echoing Biological Kantianism, the brain's field-like organization was the neural basis of the organizing principles we have just described. The *brain field* is organized in such a way that perceptual input is naturally channeled toward configurations of maximum regularity and simplicity, i.e., toward good

form. Thus, the Law of Prägnanz reflects the physical dynamics of the brain field that underlies perception.

Köhler called the relationship between the brain field and perceptual experience *isomorphism*, meaning same form. The principle of isomorphism holds that the organizational structure of perceptual experience corresponds to the organizational structure of the brain field that underlies it. This is not a claim that the brain contains literal pictures or replicas of what we see but rather is a claim about relational correspondence. The same pattern of spatial and temporal relationships that characterizes our experience characterizes the underlying brain field. When you perceive squares as closer to each other than to other squares, as in Figure 9.1, the neural events corresponding to the closer squares are relationally closer in the brain field than the neural events corresponding to the more distant dots. The form of the experience and the form of the neural process share the same relational organization, even though they are physically quite different kinds of things.

The concept of isomorphism can perhaps be understood by considering the difference between two kinds of measurement devices: *analog* and *digital*. A digital device measures whatever it is intended to measure and then converts those measurements into an arbitrary code. Computers are classic examples of digital devices, because they convert all information into binary digits, or bits. Their processors then perform computations on the bits. Other examples of digital devices are as simple as a clock that displays time using numerals, such as 11:14 p.m. These numerals are just a code that has no structural relationship to the time it indicates, it is arbitrary symbol with a meaning established by convention. Analog devices are different, however. They do not convert information into a code but rather respond directly to whatever it is they are measuring. Their state is structurally analogous to the quantity measured. An analog clock displays the time based on the orientation of its hands, and the passage of time is marked by the movement of the inner machinery of the clock. That is, the movement of the clock's machinery is analogous to the passage of time, and the configuration, or form, which the machinery has taken directly reflects a certain time of day.

This distinction between digital and analog can be applied to the brain. In the Gestalt view, the brain is an analog device that "measures" the world via perception. The pattern of information in the inner machinery of the brain, that is, the brain field, represents the way the brain structures incoming sensory data, and correspondingly, conscious perception reflects the relational form of the brain field. This contrasts with the idea that the brain could work as a digital computer, in which sensory information is converted into some arbitrary code that only the brain understands, just like a computer processor only understands binary code. Around this same time, however, the emergence of cognitive psychology (Chapter 14) would challenge this notion and present a digital approach to understanding brain and cognition.

An important extension of the brain field idea comes from **Kurt Lewin** (born 1890). He worked at the University of Berlin during the time that Wertheimer and Köhler were there, and after coming to the US, he held posts at universities such as Cornell and Iowa before establishing the Research Center for Group Dynamics at MIT. Lewin is often considered one of the key founders of *social psychology*, and he extended the Gestalt ideas, including field theory, into the domains of personality, motivation, and social behavior. At the heart of this approach is the idea that behavior (*B*) is a function of both the person (*P*) and the environment (*E*), captured in the formula $B = f(P, E)$. But for Lewin, the "environment" is not merely the physical setting, it is the person's *psychological field*, or *life space*, which includes their perceptions, goals, needs, and social context at a given moment. Just as Gestalt psychologists emphasized the organization of perceptual experience, Lewin emphasized the dynamic organization of a

person's psychological experience. He proposed that behavior could be understood as the movement of the individual through this psychological field, shaped by forces like tension, conflict, and valence (attractiveness or repulsiveness of goals). Lewin's approach provided a framework for understanding not only individual motivation but also group dynamics and social influence.

Lewin's work brings the story of Gestalt psychology to a natural stopping point. What began as a set of observations about perceptual organization had by Lewin's time expanded into a general framework for understanding how organized dynamic systems, whether perceptual, motivational, or social, shape behavior through the field-like properties of their organization. The influence of this view extended beyond academic psychology into clinical practice as well. **Fritz Perls** (born 1893) drew on the Gestalt emphasis on holistic experience and the figure-ground distinction to develop Gestalt therapy in the 1940s and 1950s, which was a therapeutic approach that used present-moment awareness and the completion of unfinished emotional experiences as its primary tools. The connection between Gestalt therapy and Gestalt psychology is looser than the shared name implies, as Perls had combined Gestalt concepts with psychoanalytic and existentialist influences in ways that the original Gestalt psychologists did not always recognize as continuous with their program, but it illustrates the influence of the Gestalt school.

SUMMARY

It is worth stepping back to appreciate the larger arc of the tradition we have traced in this chapter. Gestalt psychology was, in an important sense, the culmination of a distinctly German intellectual lineage. The conviction that the mind contributes active organizing structure to experience, rather than passively accumulating sensory atoms from the outside, runs from Kant's transcendental categories through the Biological Kantianism of Müller and Helmholtz, through Brentano's intentionality and Husserl's phenomenology, to the Gestalt psychologists' demonstration that perceptual organization is holistic, immediate, and irreducible to its elements. This was a tradition that asked, above all, what the mind brings to experience, and answered that question with increasing empirical and theoretical sophistication across more than a century of German philosophy and science.

That tradition came to an abrupt and tragic end not through intellectual defeat but through political catastrophe. The rise of National Socialism in the 1930s forced the leading figures of the Gestalt movement, Wertheimer, Köhler, Koffka, Lewin, and many others, to flee Germany for the United States, where they spent the remainder of their careers in exile. They found a psychological culture that was in many respects inhospitable to their ideas. American psychology in the 1930s and 1940s was dominated by behaviorism, which had no patience for the phenomenological and holistic commitments that defined the Gestalt program. The Gestalt psychologists made significant contributions in their American years but they did not establish a second generation of Gestalt psychologists in the way they might have done had they remained in Germany. When the cognitive revolution of the 1950s and 1960s finally displaced behaviorism and restored mental processes to the center of psychological inquiry, it did so not by embracing and reviving the Gestalt tradition but by adopting the digital computer as its governing metaphor — a move that, as we noted in the discussion of isomorphism, took psychology in a direction that was in many respects the opposite of what the Gestalt psychologists had proposed. The conversation had changed, and the generation of American psychologists who took up the new cognitive science had largely moved on from the questions that had animated the German tradition.

KEY TERMS

Key Terms

- phi phenomenon, Law of Pragnanz, isomorphism, analog, digital, psychological field

STUDY QUESTIONS

Study Questions

1. With regard to sensation and perception, what did the Gestaltists mean by the phrase "the whole is more than the sum of its parts"?
2. Define the Law of Prägnanz.
3. Contrast analog and digital devices and explain how the former relates to the Gestalt view of the brain.
4. Explain the principle of isomorphism.
5. What is the significance of illusory motion to the Gestaltists?

CHAPTER 10: ECOLOGICAL PSYCHOLOGY

INTRODUCTION

Learning Objectives
Understand:

- the difference between indirect and direct realism
- the problem of constancy in perception
- the difference between radiant and ambient light
- Gibson's idea of the optic array as the stimulus for vision
- the concept of the perception-action cycle
- the idea of the affordance
- the stages of Gibson's perceptual theory and how they differ from those of Kant and Helmholtz
- the implications of Gibson's theory for both bottom-up and top-down perceptual processing

If there is a single thread that has run through this book from its opening pages, it is the problem of the veil of perception. From Plato's cave to Descartes' brain in a vat, from Locke's secondary qualities to Hume's radical skepticism, from Kant's transcendental categories to Helmholtz's unconscious inference, the history of philosophy and psychology has been haunted by a single troubling possibility: that we are enclosed within our own experience, separated from external reality by a veil we cannot see past. The question of how, or even whether, that veil can be pierced, worked around, or dissolved has generated more philosophical and psychological argument than perhaps any other question in the history of ideas. It has driven the rationalist tradition to invoke innate knowledge, the empiricist tradition to develop associationist accounts of how the mind builds up its picture of the world from sensory fragments, the Kantian tradition to argue that the mind contributes organizing structure to experience through its transcendental architecture, and the Biological Kantian tradition of Müller and Helmholtz to seek the neural mechanisms of that contribution in the physiology of the nervous system.

The Gestalt psychologists, whose work we examined in the preceding chapter, offered a partial but important challenge to this tradition when they proposed that organized form was given directly in experience, prior to any process of construction or analysis. This was a significant departure from previous accounts, but it was not yet a rejection of the veil of perception itself. The Gestalt psychologists still assumed that perception was an achievement of the nervous system, and that the brain's field-like organizational properties were responsible for imposing structure on experience. The veil was still there; what had changed was the account of what the nervous system did on its side of the veil. We have now arrived at a moment that warrants explicit reflection on where we have been and where we are going.

REALISM REVISITED

At the conclusion of Chapter 6, we compared the homunculus of Helmholtzian theory to an inner scientist engaged in anticipation of sensation, making and confirming assumptions, and we considered whether this allowed us to ever be certain about our knowledge of reality, or whether it may lead to an epistemic crisis. Helmholtz's answer, which remains the most influential in modern perceptual psychology, was to argue that the veil is real but not catastrophic. His theory of unconscious inference accepted that sensations are impoverished and ambiguous, i.e., that the retinal image, for instance, underdetermines the layout of the three-dimensional world that produced it. But it argued that the mind, equipped with prior experience and unconscious inferential processes, could reliably translate impoverished sensations into accurate perceptions of the external world. Perception is indirect, as it goes via the translator of unconscious inference, but it is veridical, meaning sufficiently faithful to reality to support successful interaction with the world. This is the position called ***indirect realism***: the world exists independently of mind, perception is real in the sense of being about that world, but the path from world to perception runs through an intermediary that contributes its own structure to the final result.

But recall the problem we identified with the translator analogy. If everything we know about the world comes through the translator, we have no independent means of checking whether the translator is doing its job faithfully. The translator might be systematically mistaken in ways we could never detect, because any attempt to check the translation would itself require using the translator. We are, as it were, entirely at the translator's mercy. This is not merely a philosophical puzzle, as it connects to the question of scientific realism that we introduced in Chapter 6. If perception is indirect, then science, which is ultimately grounded in perceptual observation, is also indirect. The question of whether science describes an external reality or merely systematizes our experience of appearances becomes acute. The positivist tradition of Mach responded by suggesting that science describes regularities in experience, and whether those regularities correspond to a mind-independent reality is not a scientific question. But this response purchases philosophical safety at the cost of scientific realism, and most working scientists are uncomfortable with the implication that their theories are not about anything beyond experience. As a result, both perceptual and scientific realism are thought to be guaranteed by the success of the process itself. If perception is not rooted in reality, then over time, perceptual inferences might be expected to fail catastrophically. Given that this does not ordinarily occur, then it seems that the inferences are veridical.

There is a further problem with indirect realism that an evolutionary argument makes vivid. Inferences require high level top-down cognitive processing, memory, and prior experience. Consider the example of *size constancy* in perception. How is it that we are able to perceive the size of an object that we can see? One solution might be that the perception of size is based on the size of the image of the seen object that is projected onto the retina. However, we know that the retinal image size is completely insufficient to explain size perception, because it is ambiguous with respect to the object's size. That is, an apple seen close up projects a large image onto the retina. Held close enough to the eye, the image of the apple is so large it occupies nearly the entire retina, and correspondingly the entire field of view. The same apple apprehended at a distance projects a much smaller image onto

the retina, however. At a long enough distance, it is but a mere speck in the visual field. But do we perceive a giant apple in the former case, and a tiny one in the latter? No, of course not. We perceive the same sized apple at near and far distances. This is the phenomenon of size constancy: we perceive objects as having a constant size despite their changing image sizes as a function of distance. This has long puzzled students of visual perception. The apple in the world has a constant size, and the apple in our perception is also constant, but the retinal image, the sensation, that exists as the intermediary between them, is anything but constant! It is continuously varying in size. *The problem of constancy* in perception is the problem of understanding how perception remains tied to real, constant properties of objects in the world despite the continuously varying qualities of the sensations. Theories like Helmholtz's explain it by invoking inferential processing; the ambiguous retinal image is supplemented with past experience and the perceived size of the object is a mental construction, a best guess based on the particular combination of sensations and inferences that are used. Perceptual constancy is not just an issue related to size perception; there are many constancies in vision, such as shape constancy, color constancy, and brightness constancy.

This raises a challenging question: do all perceiving organisms possess these cognitive capacities? Köhler (1947) raised this very question and claimed that an advocate of perceptual inference would not expect "young or very primitive subjects" (p. 61) to exhibit perceptual constancy. But Köhler himself tested chickens, young chimpanzees, and human toddlers in terms of brightness constancy and found that they all exhibited it to the same degree as an experienced adult human with a good visual system. Thus, either all of these subjects possess advanced visual cognition systems, or perhaps more likely, such information processing is not required. This was, of course, Köhler's conclusion. Not surprisingly, Köhler used the observation to argue in favor of the Gestalt view of innate organizing principles that do not require learning, memory, or cognition. This was an improvement over Helmholtz and it removes the dependence on prior experience and makes constancy available to organisms without extensive cognitive histories. But as noted at the close of the preceding chapter, the Gestalt account remains within the indirect realism framework. The brain field is still a translator that imposes an organizational process between the sensory input and the perceptual result. The veil of perception has been updated, not removed.

Against this background of indirect realism in its various forms there stands one significant dissenting voice from within the history of psychology. Thomas Reid, whom we encountered in Chapter 5 as the common sense philosopher who rejected Hume's skepticism, was a direct realist about perception. Reid argued that the entire tradition from Descartes through Locke through Hume had made a fundamental mistake at the outset — the mistake of treating ideas or sensations as the objects of perception rather than treating external objects themselves as what we directly perceive. For Reid, we do not perceive ideas of apples; we perceive apples. In Reid's view, the representationalist framework that generated the translator problem was but a philosophical error that had been built into the tradition's starting assumptions. Reid's position was dismissed by most of his contemporaries as naïve, hence the label naïve realism sometimes applied to it, but it anticipated a line of thinking that would eventually find its most sophisticated scientific expression in the work of **James J. Gibson** (born 1904).

Most crucially, Gibson challenged the assumption that sensory input was impoverished in the first place, which is the assumption that had driven the entire tradition of the veil of perception. Gibson argued that the visual environment, properly understood, contains rich and structured information that specifies the layout of the environment, the properties of surfaces and objects, and the possibilities for action that the environment affords, without any need for inferential supplementation, neural field organization, or any other form of mental or neural enrichment. The veil of perception,

on Gibson's account, is not a feature of the perceptual situation that psychology must somehow overcome. It is a philosophical fiction generated by a mistaken starting point: the assumption that the relevant input to the perceptual system is the impoverished retinal image rather than the rich structured ambient optic array within which the active, moving organism is embedded. For the majority of the preceding theories, the organization and structure of perceptual experience is an achievement of the inner workings of the mind in the face of a chaotic and meaningless flux of sensory data. For Gibson, this structure is an inherent feature of an animal's ecological niche.

This reconceptualization dissolves the translator problem rather than solving it. Helmholtz had to invoke a translator because the sensory input was impoverished and required supplementation. Gibson's move was to show that the impoverishment was an artifact of the wrong starting point. If you start with meaningless sensations, you have indeed lost depth information and constancy-specifying information and much else besides, and you will need a translator to recover it. But if you start with different input, it changes the situation entirely. Gibson's ecological approach to perception is in many ways the most radical position we have encountered in this history. Gibson rejected nearly all of the preceding views (excepting Thomas Reid's anti-representationalism and common sense) by rejecting the shared premise that the organism is enclosed within its sensory experience and must somehow get from that experience to the world beyond it. For Gibson, the organism is always already in the world, coupled to it through active perception and action, and the question of how to get from inner experience to outer reality is simply the wrong question. Understanding how Gibson arrived at this position, what it means in detail, and what evidence supports it requires understanding a set of concepts that are genuinely new in the history of perception are the subject of this chapter.

ECOLOGICAL REALISM

With regard to vision, the notion of impoverished sensations begins with the retinal image, which has long been assumed to be the starting point of vision. Light, reflecting from surfaces in the world, is projected onto a retinal pattern, and thence triggers a process of neural response. Descartes famously dissected the eye of a cow and was able to study the nature of lens function and how an image was projected onto the retina. He discovered that the image was inverted, that shapes and sizes were distorted, and distance and depth were not represented at all. Clearly, the retinal image is a seriously impoverished version of the world represented within it. And further, if such an impoverished image is to serve as the basis of the visual perception of the world, then this input is going to need to be supplemented with a lot of processing, and the recovery of meaning in the final percept seems a daunting task. In fact, Michaels and Carello (1981) characterized the indirect realist approach to perception as involving "an essentially miraculous process by which sense data must be wheedled and cajoled by higher-order processes into accurate knowledge of the external world" (p. 3).

Gibson would have agreed that the retinal image is indeed impoverished and ambiguous, but his move was to shift the starting point of vision away from the retinal image to what he called the *ambient optic array*, defined as the structured light that projects from objects in the environment to a *potential point of observation* in space. The idea of a potential point of observation is significant, because it is used to define the patterns and structure in the array of light projected to that point, without reference to any particular observer, nor in particular, to that observer's retinal image. In this case, these optical patterns would exist regardless of an active observer. To an extent, one could say these patterns exist "in and of themselves", but more accurately they are relationships between light, surfaces, and a point of reference in the environment.

Understanding the optic array starts with radiant light. *Radiant light* is light emitted from a light source. It is *unstructured* and *homogenous* and, in Gibson's analysis, is therefore incapable of being a stimulus for vision. However, when radiant light strikes the surfaces of objects in the world and reflects off them, it becomes altered by this interaction. The nature of the alteration is *specific* to the *primary qualities* of the objects, and hence the radiant light has at this point become *structured* and *heterogeneous*, with a structure specific to the objects themselves. According to Gibson, the light is now called *ambient light*, and the structure within it counts as *information* about the surfaces from which it is reflected. The array of ambient light available at a potential point of observation is the information available about the environment to any observer who occupies that location. The observer only needs a sense organ capable of detecting patterns in ambient light, and by virtue of these patterns, the observer will perceive, *directly*, the properties of the world s/he is seeing. As we have seen, there have been numerous debates about how experience comes to have structure. Gibson's theory is unique in that he proposed that the structure of experience is a function of information in the environment, not of various internal cognitive processes.

From this theory, seeing animals need not have complex cognitive processes, but only organs capable of detecting the patterns in the ambient optic array. The chambered eye, and its retinal image, is just one of nature's ways of solving the problem of information detection in the environment. Insects, for

example, have a different solution involving the compound eye, which importantly has no lens, no retina, and thus no retinal image. Nevertheless, they can see many of the same spatial properties of the world that we can. Ultimately, physiological psychologists should explain the processes by which such visual systems function, but this is a separate problem from illustrating the information available to them.

Because the structure in the optic array is information, in the sense that there is a 1:1 relation between the patterns in the array and properties of surfaces in the world, then by definition it is not ambiguous or meaningless. This is Gibson's definition of perceptual information. As such, it requires no cognitive processing, no interpretation, no inference, and no memory. Meaning in perception is removed from the mind of the perceiver and instead placed into the environment itself. William Mace (1977) captured the essence of this concept perfectly with the title of his article, "James J. Gibson's Strategy for Perceiving: Ask Not What's Inside Your Head, but What Your Head's Inside Of." Because of the emphasis placed on information in the environment, and of a perceiving organism within that environment, Gibson (1979) titled his theory the *Ecological Approach to Perception*. Relevant to this naming is an influence from Darwin and evolutionary theory. Sensory organs and associated neural systems evolved within an ecological niche that included patterned energy (e.g., ambient light, acoustic waves, etc), and their function is shaped by the environment via natural selection.

PERCEPTION AND ACTION

Another aspect of Gibson's theory that derives in part from evolutionary adaption is the inherent coupling of perception and action systems. Gibson (1968) emphasized that perceiving animals are never stationary, and so the optic array is experienced during active exploration of the environment. Crucially, this movement causes a changing pattern within the optic array that is specific to the changing relationships between the ambient light and the moving point of observation. These changes themselves carry additional information about this particular state of affairs, that is, the animal's movement through the environment. While it is intuitive to think that perception is necessary for movement and action in the world, this latter point also signifies that movement itself generates meaningful perceptual information. This gives Gibson's (1979) *perception-action cycle*: "we must perceive in order to move, but we must also move in order to perceive" (p. 223).

The movement-induced changing patterns in the optic array are, it should be noted, *spatio-temporal* patterns. This means they contain a structure that is both spatial and temporal, and thus can serve as a source of information both about spatial relationships between the animal and its environment, and also how these change over time. The result is called *optic flow*. Because these patterns can be generated by one's own movement, these patterns provide information about that movement. Gibson called this "visual kinesthesis", referring to the ability to perceive visually our own movement through an environment by observing the optical flow of objects as we move around them.

A simple example of this is to imagine that someone, holding a video camera, walks around inside a building. The person is never visible in the scene, only the rooms through which the person is walking. Later, you watch this video and not only are you aware of the rooms and the items within them, but you are also aware that this is from the point of view of a person walking. You *see* the slight bobbing up and down from the person's gait, you *see* the speed of their movement. You might even see how tall the person is, but you never see the person at all. All of this information is specified simply by the pattern of movement of the stationary objects the person holding the camera was walking past! The idea that such visual information specifies observer motion is demonstrated convincingly in immersive virtual reality or IMAX movies. As the camera, perhaps fixed to an airplane, moves through the environment, the audience members experience this as optical flow projected on the very large screen in the theater. This is like the example above of watching the video of someone walking around inside a building—except now the screen is very large and occupies nearly your entire visual field. This pattern of stimulation is more like the natural case of walking around on your own, and seeing things flow past as you walk by them. The effect on the audience is a strong sense of self-motion, called *vection*.

Vection was experimentally demonstrated in a set of clever "moving-room" experiments by David Lee (1976). Lee set up a false room in which the walls and ceiling were suspended within a much larger room. A subject would be placed inside this room, not knowing anything about the setup. Lee would then gradually and slowly begin to move the false room, causing the wall in front of the subject to get slightly closer, and then he would sway it back the other way, with the front wall now receding away from the subject. Visually the subject would experience a pattern of optic flow that would normally

correspond to postural sway; that is, if you were in a normal, nonmoving room and the wall in front of you just got slightly closer, it would mean that you were leaning forward. You might take this to mean that you were swaying a little and ought to counteract this forward sway by leaning back a little. Lee found that observers inside this slightly swaying room eventually ended up swaying back and forth, in phase with the oscillations of the walls.

The structure of optic flow is useful not just for informing us about self-motion, but it generates useful information for future actions. The spatio-temporal nature of optic flow is inherently action-relevant, as any action we take, whether walking on level ground, climbing stairs, or reaching to grasp a cup, are inherently spatio-temporal events. Gibson coined the term ***affordance*** to account for this tight coupling of perception and action. Affordances are the opportunities for action for a particular perceiving organism in a particular environment. They are not properties of the organism, nor of the environment, but are relationships between the two. As such, they are specified when the moving organism perceives this environment. The environment is perceived in terms of the affordances for action. These include properties such as the graspability of a tool, the passability of an aperture (i.e., a doorway), the climbability of a set of stairs, or a tree, the walkability of a ground surface, and so on. The function of perception is to enable the perception of affordances so that we may act within our environment. Action generates new perceptual information that is used to enable continuing actions.

One of the most philosophically significant features of Gibson's ecological approach, and one that is easy to miss if affordances are read simply as properties of objects, is that the concept of affordance was specifically designed to dissolve another critical philosophical debate. The *subject-object distinction* is the idea of there being a division between the experiencing mind on one side and the physical world on the other. This is another way of framing both the veil of perception problem and the mind-body problem. Most theories, whatever their other differences, have accepted this distinction as their starting point and have then struggled with the problem of how to connect the two sides, that is, how the subject comes to know the object, how the mind comes to represent the world, how inner experience relates to outer reality.

An affordance, as Gibson defined it, is neither a property of the object alone nor a property of the subject alone but a property of the relationship between an organism and its environment. The affordance of walkability, for example, is not a feature of the surface considered independently of any organism, because the same surface that affords walking to a human being does not afford walking to a fish. But it is equally not a feature of the organism considered independently of the surface, because the same human being cannot walk on water. The affordance exists in the relationship — in the fit between the organism's action capacities and the environment's physical properties — and it cannot be located on either side of the subject-object boundary because it spans that boundary. This is total rejection of the subject-object distinction, and correspondingly, of mind-body dualism.

DIRECT REALISM

Gibson's ecological theory is a form of ***direct realism***, in that perception via information in light is direct, and is veridical by virtue of the *natural laws* that constrain the interaction of light with objects. Now that we are given a mind that is in direct perceptual contact with the external world, several long-standing philosophical problems disappear. The mind-body problem is no more, as there is no disconnect between appearance and reality, no distinction between primary and secondary qualities. We perceive primary qualities without interpretation or translation. In fact, there is no longer any need to refer to the properties of objects as primary, as if to imply there are other kinds of properties. We simply see the visible, action-relevant properties of objects. The theory is empiricist, but without the skepticism implied by meaningless input. There is now meaningful input, and thus for internal processing of sensory information, whether it be bottom-up or top-down. Rather, the entire debate between bottom-up vs. top-down is rendered moot. We previously conceptualized perceptual theory in terms of four stages, with a crucial stage 3 that entailed interpretation of the sensory data:

1. Objects in the world to be perceived.
2. Meaningless and ambiguous sensations are received.
3. Some form of bottom-up (e.g., associationist) or top-down (e.g., unconscious inference) processing occurs here.
4. We perceive the properties of the objects.

We can create an outline for Gibson's theory, but it looks very different, most significantly, it contains no stage involving information processing or inference:

1. Objects in the world to be perceived.
2. Ambient optic array as a medium that carries information about objects to a point of observation.
3. An observer perceives the real properties of objects by virtue of the patterns in the optic array.

SUMMARY

Gibson's ecological approach was not just a new theory of perception but was a fundamentally different way of thinking about perception and the mind. Rather than asking how the mind constructs reality, it asks how reality is already structured in a way that minds can detect. This reverses centuries of assumptions and calls for a psychology that is grounded in embodied action, relation, and reality itself, not in internal processing. The implications are profound and connect to every thread we have traced in this book. The veil of perception — the barrier between experience and reality that has haunted the history of philosophy and psychology since Plato's cave — disappears not because it has been pierced or because a better translator has been found, but because it was never there in the first place. It was generated by a mistaken starting point, the assumption that the relevant sensory input was the impoverished retinal image rather than the rich structured ambient array. The dualism implicit in indirect realism, the division between the sensory experience on one side of the veil and the external reality on the other, also dissolves, because there is no longer any need to posit two separate realms connected by a translator. The organism and its environment are coupled directly through the invariant information that perception detects and action produces. The translator is neither improved nor trusted but is eliminated.

At the conclusion of Chapter 6, we saw Helmholtzian perception as entailing a homunculus, an inner scientist engaged in perceptual inference, and that this was biased by engaging in what Bacon had called anticipating science. Does Gibson's ecological view give us an inner scientist that interprets rather than anticipates? It may be tempting to think in these terms, but critically his dissolution of dualism and the veil of perception takes the inner scientist along with it. Equally important then is to emphasize a Baconian approach to perception science. Gibson's critique suggests that the earlier perceptionists designed their studies specifically around their assumptions. They built into their methods the assumption that stimuli were impoverished, designed their experiments to confirm that assumption, and found exactly what they were looking for. The visual illusion, the tachistoscopic flash, the static two-dimensional image were their experimental tools and were not neutral instruments for studying perception, but theoretical commitments embedded in apparatus. They guaranteed the discovery of the inner scientist's activity because they created the conditions under which that activity was necessary.

Gibson by contrast championed the need for ***ecological validity*** in perception science. The norm of being an interpreting rather than anticipating scientist therefore applies not just to how we evaluate the data of perceptual research but to how we design the situations in which that data is collected. An interpreting scientist does not build the conclusion into the experimental setup. They do not study perception exclusively with stimuli so impoverished that inference is the only available explanatory resource and then conclude that inference is the universal mechanism of perception. Instead, they should ask what information is available to the organism in its natural environment and then design methods to study perception as it occurs in that environment rather than in the artificial conditions of the laboratory. This is the ecological validity criterion that Gibson proposed, and it is as much a norm of good scientific practice as it is a claim about the nature of perception.

Gibson's legacy, then, is double. He gave us a new theory of perception, direct, ecological, grounded in the richly structured information of the ambient optic array. And he gave us a methodological critique of how perception had been studied, a demonstration that the anticipating scientist's experimental tools had shaped and distorted the findings of a century of perceptual research. Both contributions point in the direction of a psychology that is grounded in the study of organisms in their environments, detecting the information that is available to them, performing the actions that are meaningful to them. Whether this vision of psychology can be fully realized, whether the ecological approach can provide a complete account of perception, cognition, emotion, and social life, is well beyond the scope of Gibson's stated goals, but remains a viable aspiration.

KEY TERMS

Key Terms

- indirect realism, direct realism, radiant light, ambient light, optic array, perception-action cycle, optic flow, affordance, ecological valdity

STUDY QUESTIONS

Study Questions

1. Explain the difference between direct and indirect realism.
2. Can indirect realism be justified? Explain why or why not.
3. What is an affordance and what role does it play in perception?
4. For Gibson, what is the importance of action for perception?
5. Explain how Gibson's theory is situated with regard to the distinction of bottom-up and top-down theories of perception.

CHAPTER 11: HEREDITY, MIND, AND MEASUREMENT: THE ORIGINS OF MENTAL TESTING

INTRODUCTION

Learning Objectives
Understand:

- Lamarck's theory of evolution based on the inheritance of acquired characteristics
- Why Lamarck's theory is a teleology
- The general principle of evolution by natural selection
- the Spencer-Bain principle and how it connects psychology to evolution
- why Social Darwinism is a pseudoscience and is not based on Darwin's theory of natural selection
- the motivation behind Galton's research in psychometry
- the nature-nurture debate as it applies to intelligence
- the concept of g and its variants
- the difference between trait and type approaches to personality
- the difference between idiographic and nomothetic approaches to psychology

It is now time that we change gears considerably and examine a very different thread in the history of psychology. Rather than philosophy of mind and perception, we now turn to the realm of biology and evolutionary theory. We have already seen the emergence of biological and physiological psychology, and we should also discuss how other developments in 19th century biology further influenced new ideas in psychology.

The theory of evolution by natural selection associated with Charles Darwin is one of the most consequential ideas in the history of science, and its impact on psychology, which we shall trace throughout this chapter and beyond, was profound and lasting. But Darwin did not invent the idea of evolution. He developed rather the mechanism of natural selection that made evolution scientifically credible. The broader idea that species change over time has a longer history and understanding that development is essential for appreciating both Darwin's work but also how these other ideas impacted psychology in their own ways.

PRE-DARWINIAN IDEAS ON EVOLUTION

The dominant view of life through most of Western history was what naturalists called the *fixity of species*. This was the conviction that the species of plants and animals that exist today are the same species that have always existed, created by God in their present forms and unchanging since creation. This view was supported by theological authority and was consistent with both Platonic forms and common observation: dogs have always produced dogs, never cats. And then it was given scientific credence by the systematic natural history of **Carl Linnaeus** (born 1707), whose taxonomic classification of living organisms into a nested hierarchy of genera, families, orders, and classes seemed to reflect a fixed ordering of species.

But several developments in the late 18th century began to strain this view and pointed toward the need for an alternative framing. The first was the fossil record. As geological investigation advanced, it became increasingly clear that the rock layers of the Earth contained the preserved remains of organisms that no longer existed. Extinction was difficult to reconcile with the idea of a fixed creation. And if extinct species had been replaced by new species, how did this happen? The fossil record demanded either a theory of extinction and replacement or a theory of transformation, implying that old species had changed into new ones.

The second was the sheer diversity and geographic distribution of living organisms. As European naturalists explored the world's continents and islands, they found living things that were simultaneously bewildering in their variety and yet suggestive in their patterns and consistency. The same anatomical structures, such as the bones of the vertebrate forelimb, appeared in the wing of a bat, the flipper of a whale, the foreleg of a horse, and the arm of a human, all modified in different ways for different functions but clearly built on the same basic plan. What could account for this apparent continuity across the animal kingdom?

The third was the increasing recognition of the Earth's antiquity. The Scottish geologists **James Hutton** (born 1726) and later **Charles Lyell** (born 1797) developed the principle of *uniformitarianism*, which was the idea that the geological features of the Earth had been produced by the same slow processes observable today, operating over vast stretches of time. This meant the Earth was enormously older than the roughly 6,000 years that biblical chronology implied, and old enough, in principle, for species to have changed gradually over many generations. These developments created the intellectual space within which evolutionary thinking could emerge. What was needed was a plausible mechanism.

Erasmus Darwin (born 1731), the grandfather of Charles Darwin, expressed proto-evolutionary ideas. He proposed that all living things had descended from a common ancestral filament, that species had changed over time in response to their needs and desires, and that these changes could be inherited by offspring. Though he proposed no clear mechanism beyond a vague appeal to the responsive powers of living matter, the ideas are significant as an early statement for the mutability of species, and as evidence that evolutionary thinking was in the air before more serious scientific treatments emerged.

Jean-Baptiste Lamarck (born 1744) was a French naturalist, who, in his early work in botany and zoology, coined the term biology, and then later invertebrate and made fundamental contributions to the classification of the latter into worms, insects, arachnids, crustaceans and mollusks, etc. As he later developed his ideas on evolution, Lamarck proposed that species transformation was driven by two distinct mechanisms.

The first was what he called the tendency toward increasing complexity, which was a kind of inherent drive toward greater organization and perfection. In Lamarck's view, life did not merely respond passively to its environment but was animated by an inner tendency that pushed organisms toward more complex and more perfect forms over successive generations. This sort of thinking reflected ideas popular among some French philosophers that nature was organized by a vital force that expressed itself progressively through the hierarchy of living forms. The simplest organisms had arisen spontaneously from non-living matter and were continuously being driven upward toward greater complexity by this inherent vital tendency. On a long enough time scale, this process would produce the full diversity and complexity of the living world from the simplest beginnings. This part of the theory is also an example of a ***teleology***, a philosophy that proposes that natural processes are directed toward goals or purposes. Events do not just happen because of prior causes, but also because of desired outcomes pulling from the future.

The second mechanism was the *inheritance of acquired characteristics* and which is the principle now most associated with Lamarck's name and commonly called Lamarckian inheritance. This mechanism addressed a specific puzzle: if there is a general tendency toward increasing complexity, why are there so many different species rather than a single progressive sequence from simple to complex? Lamarck's answer was that organisms also responded specifically to the demands of their particular environments, developing the organs and characteristics that their way of life required. The specific mechanism he proposed operated through use and disuse. Organs that were regularly used became stronger and more developed, while organs that were not used atrophied and eventually disappeared. Crucially, Lamarck proposed that these use-induced changes were heritable such that characteristics acquired by an individual organism during its lifetime could be passed on to its offspring.

The giraffe example has become the canonical illustration of the theory. On the Lamarckian account, the ancestors of modern giraffes lived in environments where ground-level vegetation was depleted, requiring them to stretch their necks to reach leaves on higher branches. This habitual stretching caused the neck muscles and vertebrae to develop more than they would otherwise have, producing a slightly longer neck in each individual. This longer neck was then inherited by offspring, who in turn stretched further, developing still longer necks, and so on over many generations until the modern giraffe's neck was produced. The key feature of this account is that the driving force is the organism's own activity and need, its striving to reach the food it requires, and the results of this activity are directly heritable.

Lamarck's theory also had consequences for the understanding of mind and behavior. If acquired behavioral habits and learned responses could be inherited, then the evolutionary history of a species would directly encode the accumulated behavioral experience of its ancestors. The instincts and behavioral tendencies of an organism would be, in effect, inherited memories, forms of behavior that had been acquired through experience by ancestral generations and then fixed in the hereditary material through repeated use over many generations.

Lamarck's theory ultimately failed on both of its central mechanisms, and understanding why is

important for appreciating what Darwin's contribution actually was. The inheritance of acquired characteristics has been conclusively refuted by modern genetics. The mechanisms of heredity operate through the transmission of genetic information in the germ cells and changes that occur in the somatic cells of the body during the organism's lifetime do not affect the genetic information in the germ cells and therefore cannot be transmitted to offspring. A weightlifter's larger muscles do not produce children with larger muscles. A giraffe that stretches its neck does not produce offspring with longer necks. The germ line is, in the language of the biologist August Weismann, isolated from the soma. The body's developmental changes do not feed back into the hereditary material.

The inner tendency toward increasing complexity fared no better scientifically. There is no known physical or biological mechanism that drives organisms toward greater complexity as such. The observations of the naturalists suggested that evolution produces adaptation to particular environments, but this does not necessarily mean greater complexity, and many evolutionary lineages show simplification rather than complexification over time. Parasites, for instance, typically lose complex organ systems that their lifestyle renders unnecessary. The progressive developmental drive that Lamarck envisioned reflected an assumption more than an empirical finding.

Despite these failures, Lamarck's theory was the first to provide a systematic account of how species change over time, replacing the vague speculation of Erasmus Darwin and others with a theoretical framework that could be tested and debated. He established that the question of how species change was a scientific question amenable to explanation rather than a theological question to be answered by appeal to authority. And he identified the right kinds of factors: environment, function, and heredity, even if the details were wrong.

By the time **Charles Darwin** (born 1809) began his work, the intellectual climate in natural history had been thoroughly transformed from the fixity of species consensus. The fossil record had established that species had appeared and disappeared over geological time. The uniformitarian geology had established that the Earth was ancient enough for gradual change to produce significant results. The comparative anatomy tradition had revealed the deep structural similarities among apparently different organisms. And Lamarck had demonstrated that a mechanistic account of species transformation was at least possible in principle, even if his specific mechanisms were disputed. What was missing was a mechanism that could explain adaptation without appealing to either inherent vital drives or divine design.

DARWIN'S THEORY OF NATURAL SELECTION

It is beyond the scope of this book to provide a thorough and detailed account of the ***theory of natural selection***, but a brief primer on the topic will be necessary in order to appreciate how it came to have some influence on psychology. It begins with Darwin's famous voyage on the *HMS Beagle* in 1831. The purpose of the voyage was to survey the coast of South America, but through his connections with Cambridge botany professor John Henslow, Darwin secured a place on the ship so that he could tag along as a naturalist, to observe and collect the flora and fauna that they encountered during the trip.

Darwin made many detailed observations about the organisms he saw on the trip, although there were perhaps none more famous than the finches on the Galápagos Islands off of the western coast of South America. He observed several different kinds of finches across the archipelago, and they were all about the same size but with one important difference: their beaks were highly variable in size and shape. And of course, the birds with their different beaks ate different things across the archipelago. Darwin suspected an evolutionary and adaptive explanation for this, the idea that the beaks had become "modified for different ends" (Darwin, 1859).

Despite his insight into the evolution of the beaks, and their adaptation to the food sources on the islands, Darwin still lacked a mechanism to explain it, and so he could only claim that evolution was the source of morphological diversity across and within the many species of the world, but it had no scientific basis, *yet*. For years after his return home from the voyage, Darwin pondered the idea. He read Lyell's work on uniformitarianism, which for Darwin meant that if the natural environment was to exert an influence on the flora and fauna that lived within it, such an influence would be comparable around the Earth. Darwin also read Thomas Malthus' (1798) *Essay on the Principle of Population*, in which Malthus wrote that while animal populations grow at an accelerating, exponential rate, resources in the environment grow at a linear rate. This means that, while there may be times of plenty in which there are more resources than there are animals that use those resources, eventually the population will outgrow the food supply, resulting in competition for limited resources. This latter work appears to have been the key for Darwin, for then he realized the significance of the finches' beaks.

The theory of natural selection begins with envisioning an environment in which there are sufficient resources for a particular population of animals. Within a population of finches, for example, there is some naturally occurring, random variation of features, including beak size and shape. As the population grows, there comes a time when the critical point is reached in which the resources become insufficient, as Malthus predicted. Now, with competition over the food supply, Darwin realized that some individual finches would have an edge in the competition, because their beaks would be better suited for getting food. For example, if the food was small insects that lived in the bark of trees, then small, narrow beaks would be better suited for digging in the bark than large blunt beaks. If the food was nuts in shells, perhaps the heavier blunt beaks would be advantageous. Over time, the individual finches that possessed just the right beaks would obtain more food, and thus be more likely to survive, and thus have more offspring. The offspring would be likely to resemble their parents (the science of genetics was not yet understood but it was already accepted that physical traits were inherited) and

thus possess the same beak. Over sufficient generations, this particular beak would become pervasive throughout the population. This, Darwin concluded, was the mechanism in which the natural environment *selects* traits in populations of animals.

EVOLUTION AND PSYCHOLOGY

Working prior to Darwin's theory, **Herbert Spencer** (born 1820) published *The Principles of Psychology* (1855). Spencer had been influenced heavily by Lamarck and had applied these ideas to psychology in the form of ***evolutionary associationism***. Recall that Alexander Bain, one of the British empiricists, refined the concept of association as the foundation of all learning. We learn by forming associations between ideas. Actions are learned as responses associated with stimuli, forming the basis of what will later become stimulus-response psychology, or behaviorism. Spencer, following Lamarck, added to this the idea that acquired associations are passed on to one's offspring. Thus, evolution has endowed us with the ability to learn via association and the ability to pass on this learning to our offspring. This came to be known as the ***Spencer-Bain principle*** and was used to explain the differences in mental complexity across the species. Spencer then applied his theory to explain the differences in mental complexity, or more precisely intelligence, within a species, and in particular, in humans. In this way, he accounts for the evolution of human intelligence, but in accordance with Lamarckist teleology, the concept also suggests that it should be expected to improve, however gradually, from one generation to the next.

Spencer also used human intelligence to explain the structure of human society. It was he who first used the phrase *survival of the fittest* to explain that some people seem to be more mentally fit to succeed in society than others. This idea became very popular in late 19th century industrialized nations, where the emerging industrial-capitalist culture rewarded those with the acumen to succeed in their business affairs, especially the likes of J. P. Morgan, Andrew Carnegie, and John D. Rockefeller. Rockefeller himself stated that the forces of the free market and the success of some at the expense of others were not evil but merely the expression of natural law (Hofstadter, 1955). At the same time as Spencer's evolution-inspired thinking was influencing both business and social science, Darwin's ideas were also becoming well known, and many began to confuse the works, so that Spencer's idea came to be known, by the mid-20th century, and somewhat inaccurately, as **Social Darwinism**, even though the phrase was originally Spencer's. Perhaps a more accurate term for Spencer's work would be Social Lamarckism, although that term is now used to describe a slightly different theory.

A major component of Social Darwinism is that societies are like organisms and evolve toward complexity and perfection, and this is closely tied to the evolution of intelligence. Over time, as humans became more intelligent, human society became more complex and organized. Spencer believed this process reflected an inherent progress toward perfection and harmony and was directed toward a utopian ideal. He argued that primitive societies were simple and undifferentiated (e.g., no division of labor), while modern societies are complex and interdependent (e.g., with specialized institutions and roles). He believed this trend was both natural and inevitable, reflecting an overall improvement in social organization. Spencer thus saw the evolution of human intelligence, reasoning, and moral judgment as central to societal progress. He argued that mental development was shaped by experience, and that useful mental habits acquired over generations could become inherited, following the Lamarckian logic. As human intelligence improved, societies became more rational and moral. He believed education, science, and the reduction of warfare were all signs of mental, moral and thus societal advancement. So, in Spencer's system, the evolution of society was deeply tied to the improve-

ment of individual minds, with mental evolution enabling better social structures, and in turn, more advanced minds emerging within those structures.

MENTAL TESTING

Spencer's belief in the progressive evolution of mind and society also carried a subtle danger, for if society was on a path toward utopia, why wait for nature to take its course? For some the logical next step was to intervene in the evolutionary process, specifically to guide it rationally and accelerate it by selecting who should reproduce, and how. If mental abilities and moral character could be inherited, as Spencer believed, then improving society would mean improving its genetic stock in those terms. This line of reasoning gave rise to the movement known as ***eugenics***, the idea that society should actively breed for intelligence and eliminate "undesirable" traits. What began as a philosophy of natural progress was thus transformed into a program of artificial selection, with serious ethical consequences – not the least of which is the challenge of defining what exactly counts as a desirable or undesirable trait.

For such a program to succeed, however, it would become necessary to define and measure intelligence, and so it was this thinking that eventually spawned the fields of intelligence testing and the measurement of the mind, called ***psychometry***. Curiously, it was Darwin's cousin, **Francis Galton** (born 1822) who championed the Spencerian view and promoted eugenics. To prove his point, he set about finding ways to measure intelligence and establish that it was heritable.

In some of Galton's early work, he studied the lineage of eminent persons, such as scientists, authors, statesmen, and so on, and determined that such eminence tended to run in families. That is, eminent and successful people tend to be related to other eminent and successful people. Galton, himself a member of such a family, presupposed that intelligence was necessary to achieve such eminence, and concluded that this was evidence for its heritability, and published his findings in his 1869 book *Hereditary Genius: An Inquiry into Its Laws and Consequences*. This conclusion ought to remind the psychology student of the famous ***nature vs. nurture controversy***. The debate is over whether our psychological makeup, such as intelligence and personality, is in our nature (e.g., genetically determined at birth) or whether it is nurtured within us after we are born. The debate also mirrors the classic dichotomy of rationalism and empiricism. One might immediately notice some flaws in Galton's logic. Just because there is a *correlation* in the intelligence of parents and their children does not mean that there is a direct causal relationship. Again, as any psychology student knows, *correlation does not prove causation*. One problem is that there could be a third variable outside of inheritance, such as money (or access or opportunity). The eminent families in Galton's work tended to have more money, and thus better access to education, health care, and nutritious food, which was especially true in the 19th century when concepts like free and mandatory public education, and other social support systems, were yet to be devised. Thus, with more money and the benefits that come with it, the children of eminent parents were more likely to achieve success and become eminent themselves.

Galton was aware of these limitations, however, and so set about finding more convincing ways to demonstrate the heritability of intelligence. For one, he pioneered the use of twin studies as a "natural experiment" for separating the effects of heredity and environment. While Galton found evidence to support his ideas, it should be noted that he did not carefully distinguish monozygotic from dizygotic

twins (as is done in modern behavioral genetics), and that he relied mainly on anecdotes and other informal measures of intelligence and other psychological traits.

Galton also pioneered ways of measuring mental abilities, including some of the earliest questionnaire research, and attempted to measure the correlation of these abilities between siblings and other relatives. It is worth noting that the statistical analysis of correlations was invented for this purpose. One of Galton's followers and collaborators was **Karl Pearson** (born 1857), for whom the *Pearson correlation coefficient* is named. Also, because he was arguing for a biological basis for intelligence, Galton felt that mental abilities must also correlate to a variety of other physical traits. Thus, he set up the first *anthropometric laboratory,* where he measured the size of a subject's various physical features. The idea that mental ability correlates with one's physical appearance may sound familiar, as it is very much the same type of sentiment as Gall's phrenology and its physiognomic influences. Galton further speculated that intelligence was the result of an efficient brain and nervous system, and he included in his work measures of reaction time, sensory acuity, grip strength, and psychophysical threshold testing. While he did report confirmatory evidence, Galton still lacked a formal measure of intelligence and relied instead on eminence and other proxies. Further, the correlations he reported occurred largely within families, and so appearance-based correlations could be explained without appeal to inherited intelligence. Despite the weak evidence, Galton did not abandon his belief in inherited intelligence. Instead, he attributed the unexplained variance to measurement limitations and remained focused on family lineages to support his core argument. Though his specific tests proved inadequate, his commitment to the idea of heritable intelligence helped launch the fields of psychometrics and behavioral genetics.

In Galton's later work, he worried openly that mentally unfit people, equated with the poor working class, were having large families and in essence were reversing the "natural" process of social evolution. His approach was to oppose social programs that prop up the poor and enable them to survive and reproduce when the "natural law" of Social Darwinism would mandate that they should not, and further to encourage selective breeding so that the gene pool of the more fit members of society would not become contaminated. In this way, Galton's work furthered the sentiments of eugenics, which sought to improve human populations through selective breeding. These ideas came to be intertwined with *scientific racism*, the attempt to classify and rank human groups based on flawed biological assumptions about race and intelligence. Tragically, these combined beliefs were distorted and weaponized by the Nazi regime in Germany to justify horrific policies of racial persecution and genocide. Though Galton did not advocate such extremes, the misuse of eugenic and racist theories stands as a stark warning about the ethical responsibilities of scientists and the dangers when scientific ideas intersect with political ideology. Eugenics and scientific racism also fueled forced sterilizations, discriminatory immigration laws, and systemic inequalities in many countries during the 20th century, reminding us of the vital need for ethics in psychological research and practice.

One final example of this is the work of educational psychologist **Henry Herbert Goddard** (born 1866). He noticed that many of the children that he studied at the Vineland Training School for Feebleminded Children had siblings who also had intellectual problems, which to Goddard was further evidence supporting Galton's views. Goddard chose one of the students at the school, Deborah Kallikak, for further study. Kallikak was a pseudonym created by Goddard to protect the family's identity. The 22-year-old Deborah was calculated as having an IQ of just over 50 (it was Goddard who coined the term *moron* to apply to individuals with such a low IQ (Hergenhahn, 2009)). The Kallikak family had quite a history, as Goddard discovered. The family tree was traced back to Martin Kallikak Sr., who was a respected officer in the Continental Army during the Revolutionary War. Apparently,

Martin had a fling with a "feeble-minded" barmaid and fathered a child with her, Martin Jr. He later married a "worthy girl" and had 10 apparently normal children, whereas Martin Jr. later sired five feeble-minded children. The resultant lineage produced several mentally deficient children. Goddard studied and photographed the Kallikak family and reported his findings in *The Kallikak Family: A Study in the Heredity of Feeble-Mindedness* (1912). As with Galton, Goddard voiced a belief in eugenics and advocated the extreme position of forced sterilization of such individuals. In essence, he believed that family lines such as the Kallikaks' were inferior and needed to be cut off.

A controversy arose several decades later concerning Goddard's case study of the Kallikaks. The evolutionary biologist Stephen Jay Gould was skeptical of Goddard's Social Darwinist and eugenics views and argued that the photographs of the more mentally deficient members of the Kallikak family had been doctored so as to make them appear sinister or menacing, and thus playing into the physiognomic tradition. While Gould's accusations have been the subject of debate and have largely been rejected (Zenderland, 1998), Goddard's analysis of the Kallikak family is problematic for other reasons. Primarily, the data on the family history of mental deficiency was gathered through local reputation, hearsay, and informal observation without any standardized assessments. It is quite likely that the biases of Goddard and his assistants heavily influenced their judgment of the different family lines.

In fact, after the publication of his book on the Kallikaks, Goddard turned his attention to immigrant testing at Ellis Island in New York. Medical screenings of immigrants had been performed there since 1892 and had long involved screening for mental deficiency. Goddard contended that the use of standardized intelligence tests would improve the rigor of this process. But crucially, these tests are time-consuming and must be administered by trained assessors, and so not all immigrants could be tested. Instead, Goddard and his assistants pre-selected immigrants for examination based on visual inspection, which again raises concern over biases deriving from physiognomic beliefs. In fact, the people most likely to be examined were from eastern and southern Europe and belonged to a variety of ethnic groups common to those regions. As Goddard reported, people from these groups scored poorly on his tests. In Gould's critique, he labeled this as nothing but a self-fulfilling prophecy, given the nature of the circumstances under which the test was administered:

> For the evident reason, consider a group of frightened men and women who speak no English and who have just endured an oceanic voyage in steerage. Most are poor and have never gone to school; many have never held a pencil or pen in their hand. They march off the boat: one of Goddard's [assistants] takes them aside shortly thereafter, sits them down, hands them a pencil, and asks them to reproduce on paper a figure shown to them a moment ago, but now withdrawn from their sight. Could their failure be a result of testing conditions, of weakness, fear, or confusion, rather than of innate stupidity? Goddard considered the possibility, but rejected it. (Gould, 1981, p. 166, as cited in Hergenhahn, 2009, p. 317)

THE SCIENCE OF INTELLIGENCE

We have previously distinguished the anticipating scientist, who imposes expectations and beliefs onto their observations, from the interpreting scientist that engages a more neutral reading of scientific data. The distinction remains relevant to the question of intelligence, and we may be justified in seeing much of the preceding work as anticipation of nature, and so it may also be obvious that a more objective science of intelligence needs to be formulated.

The first question is how to define intelligence. We should not rely on assumptions or the casual everyday use of that term in this context. The problem of intelligence represents the classic problem of *constructs* and *variables* in psychology. A construct is an abstract idea that cannot be directly observed. Intelligence and personality are both psychological constructs. We presume that these are real things that all people possess, but we cannot directly see what they are. Rather, we must invent some kind of test as a way of operationalizing the construct, with the results of the test being the variables we use to measure the construct. So, to study intelligence we need an intelligence test.

One of the first to tackle the issue was **James McKeen Cattell** (born 1860), who had studied under Lotze and later Wundt, where he became the second American to earn a PhD with Wundt. After founding the psychological laboratory at Penn, and later at the University of Columbia, Cattell began evaluating Galton's claims. He and his student Clark Wissler conducted studies involving reaction time, psychophysical thresholds, grip strength and memory. Critically, these tests were done not on families but on a pseudo-random sample of college students, and not only did these measures fail to correlate with each other, they also did not correlate with the students' academic performance. Such findings effectively spelled the end of Galton's measures, at least in scientific circles, but academic standing was not a validated variable for the intelligence construct. Thus, the search for a valid intelligence test was just beginning.

In France, **Alfred Binet** (born 1857) and his student **Theodore Simon** (born 1873) were working for the French government to establish a way of measuring the aptitudes of children. France had recently enacted a law that all children go to school, but they were worried that some children exhibited learning and behavioral problems that made it impossible for them to learn in the normal classroom. The government wanted to establish a means to determine which children required a special education. Binet and Simon discovered fairly quickly that Galton's measures were insufficient to identify intellectual problems and soon developed their own. In 1905, they presented the *Binet-Simon Scale of Intelligence.* Over the years it went through several revisions, but common to all versions of the test was the idea of testing a range of cognitive abilities. Further, in terms of the nature vs. nurture debate, Binet fell definitively on the nurture side. As an educational psychologist, he worried that if a teacher felt that a child's intelligence was innately determined, that the teacher could be biased toward the child in terms of the quality of the education that they provided. He believed in *mental orthopedics,* mental exercises that, like physical ones, could strengthen the mind and increase intelligence, and which further reflected his view that experience rather than genetics determines one's mental abilities.

The results of these tests were originally interpreted in terms of the child's so-called *mental age*. For

example, a 5-year-old child performing like other 5-year-olds would be considered normal. A 5-year-old performing more like a 6-year-old would be considered of above average intelligence, and of course a 5-year-old that performs like a younger child would be considered of below average intelligence. **William Stern** (born 1871) modified the results slightly. He argued that the mental age should be divided by the child's *chronological age* to produce an *intelligence quotient (IQ).* For example, a 5-year-old child performing like a typical 5-year-old would have both a mental age and a chronological age of 5. The resultant IQ would be $5/5 \times 100 = 100$. Thus, an IQ of 100 was, by definition, normal. A gifted 5-year-old might be performing at the level of a typical 8-year-old, so that their IQ would be $8/5 \times 100 = 160$. It was through this thinking that the concept of mental retardation was introduced as a way to understand intellectual problems in children. The claim was that the mind was developing slower than the body. You might notice an implicit dualism in such thinking – it was for this and many other reasons that the term retardation was later abandoned.

Charles Spearman (born 1863) extended our understanding with his ***Two-Factor Theory of Intelligence***, which came about due to his work on the statistical technique of *factor analysis*, used to break down the intercorrelations between items on an intelligence test. For example, consider a test with 100 different items, or questions. Even though the 100 items are different, they do not actually measure 100 different abilities. Some of them are measuring the same thing. How many different things are really being measured by the test? Factor analysis allows the statistician to break down the intercorrelations among the items and determine exactly how many underlying factors are being measured for a given test. Spearman determined that there were two factors: the *general factor* (**g**) and the *specific ability factor* (**s**). The g factor, Spearman argued, was the most psychologically important of these, as it was what people meant when they talked about intelligence in general, and it was what explained why cognitive abilities tended to cluster together. Theoretically, it suggested that intelligence was not merely a heterogeneous collection of independent abilities as Binet's scale implied but had a real underlying unity. Practically, it suggested that a test designed to measure g would be a more theoretically grounded and potentially more predictively useful instrument. The testing movement that followed drew heavily on this thinking.

Next, **Lewis Terman** (born 1877), working at Stanford University, took the Binet-Simon scale, which had been translated into English by Goddard, and expanded it, creating the Stanford-Binet Intelligence Scale. He also began an ambitious longitudinal study in the 1920s, following a group of over 1,500 children with exceptionally high IQs (typically above 135) through much of their lives. These participants were affectionately nicknamed the "Termites." The study was one of the first and most comprehensive investigations of gifted children and their development over time. Terman found that his Termites generally performed well in school, and many went on to complete higher education degrees. Their high intelligence correlated with academic achievement and professional success. Many of the Termites achieved professional distinction in a variety of fields, though not all became prominent leaders or innovators. The study showed that intelligence alone was not a perfect predictor of extraordinary achievement. Importantly, factors such as socioeconomic background, family support, and traits such as motivation and persistence predicted these things better than did IQ alone.

The next major development in intelligence testing came from a very different context. **David Wechsler** (born 1896) was a clinical psychologist at Bellevue Hospital in New York City, where he worked with a diverse adult population that included psychiatric patients, criminal defendants, and individuals with neurological disorders. He noted that the Stanford-Binet test, designed for schoolchildren and expressed in terms of mental age, was poorly suited to the assessment of adult intelligence. For example, what would it mean to say a 30-year-old is operating at the level of a 40-year-old and

thus has a high IQ? These age-based comparisons simply do not work above a certain age. Wechsler replaced the ratio formula with a statistical approach. He calculated an individual's IQ from their position in the distribution of a normative sample of the same age, expressed as a standard score with a mean of 100 and a standard deviation of 15. An IQ of 115 means performance one standard deviation above the mean for one's age group, regardless of whether the person is 10 or 60. This statistical reframing allowed IQ scores to be directly comparable across age groups in a way that ratio IQ scores were not. Further, this enabled the field to move away from the implied dualism of mental age.

The second contribution was the organization of the Wechsler scales into separate *verbal* and *performance* subscales, with each composed of several specific subtests. The verbal scale assessed abilities including vocabulary, general information, arithmetic reasoning, and verbal comprehension. The performance scale assessed abilities including block design, picture completion, object assembly, and digit-symbol coding which were tasks that required spatial reasoning, perceptual organization, and processing speed. This multidimensional profile approach was more clinically informative than the single composite score of the Stanford-Binet. A profile showing high verbal and low performance scores, or the reverse, carried diagnostic implications that a single overall IQ score concealed. The verbal-performance distinction also challenged the pure g-factor model that Spearman had proposed. If all cognitive abilities were simply expressions of a single general factor, the distinction between verbal and performance abilities would carry no additional information beyond what g alone provided. The clinical utility of profile interpretation suggested that cognitive ability had a structure more complex than g alone.

Next, **Louis Leon Thurstone** (born 1887) challenged Spearman's g using a different method of factor extraction and rotation than Spearman had employed. This yielded not a single general factor but seven correlated primary mental abilities: verbal comprehension, word fluency, number facility, spatial visualization, associative memory, perceptual speed, and inductive reasoning. Thurstone argued that these seven factors were the basic building blocks of intelligence and that Spearman's g was an artifact of the particular statistical method he had used rather than a genuine psychological reality. The debate was eventually resolved in favor of a hierarchical model in which specific abilities were organized under broader group factors, which were in turn organized under a general factor at the apex of the hierarchy, giving a structure that accommodated both Spearman's g and Thurstone's primary abilities without requiring either to be abandoned.

Raymond Cattell (born 1905) contributed to this hierarchical picture with the distinction between ***fluid intelligence*** and ***crystallized intelligence***. Fluid intelligence referred to the capacity for novel reasoning and problem solving that was relatively independent of specific learned knowledge. It was the ability to identify abstract patterns, solve novel puzzles, and adapt flexible reasoning strategies to problems. It was measured by tasks that minimized the role of prior knowledge including matrices reasoning, spatial reasoning, and analogies using unfamiliar content. Crystallized intelligence referred to the accumulated knowledge and cognitive skills that had been built up through education and experience such as vocabulary, factual knowledge, and the application of learned strategies to familiar problems. It was measured by tasks that explicitly drew on prior learning like vocabulary tests, general knowledge questions, and reading comprehension.

Cattell proposed that fluid intelligence was primarily biological in origin and showed a characteristic developmental trajectory, rising through childhood and early adulthood, peaking in the mid-twenties, and declining gradually thereafter with the biological aging of the nervous system. Crystallized intelligence, by contrast, was primarily a product of educational experience and continued to accumu-

late throughout the lifespan, so that older adults typically showed higher crystallized intelligence than younger adults even as their fluid intelligence declined. This developmental divergence had important practical implications for understanding cognitive aging and for the design of intelligence tests for different age groups.

The psychometric tradition described thus far is one of the core domains of modern psychology, and the g factor is one of the most replicable findings in the field. IQ scores predict academic achievement, occupational attainment and a range of other important outcomes. Yet there has been persistent criticism as well. These approaches focused heavily on academic and analytic skills measured under standardized conditions. Challengers noted that human intelligence, broadly writ, also entails the capacity to navigate the complexities of real social and physical environments, creating novel ideas, and solving the practical problems of everyday life.

Howard Gardner (born 1943) was a developmental psychologist at Harvard who had noted that if intelligence were truly a single general capacity, damage to the brain should produce proportional deficits across all cognitive domains, and exceptional ability in one domain should tend to be accompanied by exceptional ability in others. Neither of these predictions was borne out by clinical and developmental evidence. He also argued that the concept of traditional IQ was too narrow and reflected a cultural bias toward the kinds of abilities that Western academic institutions happened to value. He proposed instead that humans possess a set of relatively independent intelligences, each with its own developmental trajectory, its own neurological substrate, its own characteristic pathology when the relevant brain regions were damaged, and its own cultural expressions across different human societies.

His original proposal identified seven intelligences. *Linguistic intelligence* was the capacity for effective use of language, corresponding to the ability most centrally measured by traditional intelligence tests and most highly valued in academic settings. *Logical-mathematical intelligence* was the capacity for abstract reasoning, quantitative thinking, and the recognition of logical and numerical patterns, which was the other ability most prominently measured by traditional tests. *Spatial intelligence* was the capacity for accurate perception and mental manipulation of spatial relationships such as the ability to navigate, to read maps, to visualize three-dimensional objects, and to create visual art. *Musical intelligence* was the capacity for perception, discrimination, transformation, and expression of musical forms. *Bodily-kinesthetic intelligence* was the capacity for skilled use of the body in athletic performance, dance, craft, and surgery such as for the manipulation of objects with fine motor precision. *Interpersonal intelligence* was the capacity for accurate perception of and effective response to the moods, motivations, intentions, and desires of other people, corresponding to what later came to be called emotional intelligence. *Intrapersonal intelligence* was the capacity for accurate self-knowledge. In later work he added *naturalistic intelligence* as the capacity for recognizing and categorizing the natural world, the ability that characterized great naturalists, farmers, and hunters, and tentatively proposed *existential intelligence* representing the capacity for reflection on the deepest questions of human existence, including mortality, meaning, and the nature of consciousness.

Gardner's theory resonated powerfully with educators and with the general public but the reception among psychometric researchers was considerably more skeptical, and the criticisms they raised were substantive. The most fundamental objection was that Gardner's criteria for distinguishing intelligences were interesting but did not constitute evidence that the proposed intelligences were statistically independent in the way the theory required. If linguistic and musical intelligence were truly distinct and unrelated abilities, then measures of the two should be uncorrelated. This means that

knowing someone's linguistic ability should tell you nothing about their musical ability. But when researchers administered tests designed to measure Gardner's different intelligences and examined the correlations among them, they found substantial positive correlations. People who scored high on one type of intelligence tended to score higher on others, and people who scored low on one tended to score lower on others. Such findings that distinct intelligences may share a common underlying factor look suspiciously like Spearman's g. Critics argued that Gardner may have identified genuine cognitive distinctions that were worth studying but that these were perhaps better understood as factors within the hierarchical psychometric model than as distinct intelligences.

A related criticism was that the term intelligence was being used in a way that diluted its scientific meaning. Several of Gardner's intelligences were defined by a diverse set of criteria that had nothing to do with the psychometric tradition, and examples such as bodily-kinesthetic intelligence, musical intelligence, interpersonal intelligence in particular, were more commonly described in everyday language as talents, skills, or social abilities rather than intelligences. Calling all of these constructs a form of intelligence suggested that the concept covered everything from solving differential equations to dribbling a basketball, a breadth that made it scientifically less useful precisely because it was theoretically too inclusive.

Robert Sternberg (born 1949) approached the limitations of the psychometric tradition from a different angle. Sternberg accepted that the psychometric tradition had identified something real but argued that it had identified only one component of a broader and more complex picture of human intelligence. His ***triarchic theory*** proposed three distinct components of intelligence that together provided a more complete account of intelligent behavior than g alone could offer.

The first component was *analytic intelligence*, the ability to analyze, compare, evaluate, and judge. This was the ability most directly measured by conventional intelligence tests, including the capacity for abstract reasoning, critical evaluation, and the systematic solution of well-defined problems. Sternberg did not dispute that such intelligence was real, but he was instead concerned with whether it was sufficient to complete the picture of human intelligence.

The second component was *creative intelligence*, defined as the ability to generate novel and effective ideas, to go beyond existing knowledge in formulating new approaches, and to combine existing elements in unexpected and productive ways. Creative intelligence was poorly captured by conventional tests, which typically had single correct answers that could be derived by systematic application of known procedures. Sternberg argued that creative intelligence was at least as important as analytic intelligence for real-world achievement in most domains.

The third component was *practical intelligence*, which was the ability to adapt to real-world environments, to shape those environments to better fit one's abilities and goals, and to select new environments when existing ones proved intractable. Practical intelligence was the capacity that distinguished people who were successful in the real world from people who performed well on tests but struggled to translate that performance into effective functioning outside the testing room. It included the ability to read social situations accurately, to navigate organizational hierarchies, to identify the implicit rules and expectations that governed different social contexts, and to deploy one's abilities strategically rather than mechanically.

Sternberg's research on practical intelligence drew directly on the ecological validity concern that we encountered in Gibson's critique of laboratory perceptual psychology. Sternberg argued that psy-

chometric intelligence research had built its theories on artificially simplified tasks that were unrepresentative of the real problems that intelligence was actually used to solve. The decontextualized, well-defined, single-answer problems of intelligence tests were unlike almost every important problem that people faced in real life, which were typically ill-defined, context-dependent, multiply determined, and admissible of many possible responses. A theory of intelligence built on performance in this artificial situation might tell us something real about one component of intelligence, in particular the analytic component, but it could not claim to capture the full picture.

PERSONALITY AND THE MEASUREMENT OF CHARACTER

The psychometric tradition that grew from Galton's program of measuring individual differences was never confined to cognitive ability alone. Galton himself had been interested in the full range of human individual variation in temperament and character as much as in sensory acuity and mental quickness. The statistical methods he and Pearson developed were as applicable to personality characteristics as to cognitive ones. It was perhaps inevitable, then, that the factor-analytic approach that Spearman had applied to the structure of intelligence would eventually be turned toward the structure of personality. The result was a tradition of personality research that ran parallel to the intelligence testing movement, shared its methodologies, and generated debates about the nature of human character that are in many respects still unresolved.

But before the quantitative personality tradition could emerge, a prior conceptual question had to be addressed just as we asked with intelligence: what is personality? This question had been asked informally for millennia, such as the ancient tradition of physiognomy, the Hippocratic theory of the four humors, and the elaborate attempts of Renaissance-era scholars to define human character, which all represented attempts to identify stable, recurring types of persons. What the modern period added was the demand that the answer be empirically grounded and scientific. And here, as in the intelligence tradition, the path from common observation to scientific measurement ran through the question of how many dimensions were needed to describe the relevant variation.

Gordon Allport (born 1897) was one of the most influential figures in the early development of personality psychology, and his starting point was a simple observation about language. Every human language contains a large number of words for describing the characteristic ways in which people differ from one another with words like anxious, cheerful, impulsive, conscientious, suspicious, and generous. Allport and his collaborators identified approximately 18,000 such personality-descriptive terms in an unabridged English dictionary. This lexical hypothesis, the proposal that the most important and universal personality characteristics would be encoded in the vocabulary of any natural language, became one of the foundational assumptions of the trait approach to personality. The sheer number of personality-descriptive terms might make the need for dimensional reduction obvious, but for Allport, the variation was important. He saw people as unique individuals, and so rather than develop a general principle of personality that applied to all, his goal was to capture the variation itself. This is a classic example of the ***idiographic approach*** in psychology. The tension between this and the ***nomothetic approach*** (to develop a general theory that applies to all) is one of the defining debates in personality psychology and it may be fair to claim that the latter has dominated the field in the time since Allport.

No nomothetic theory of personality could work with 18,000 independent variables, and so the task of identifying the underlying factor structure became the central project of the quantitative personality tradition. Lexical analysis was one possible solution, which amounted to simply identifying which terms were synonymous with others, and thus reducing the list based on overlapping meaning. This is limited however, and subject to disagreement over the meanings of words. Factor analysis, the same

statistical technique that Spearman had used to reveal the g factor in cognitive ability, was however the natural tool for this project.

Raymond Cattell, who as noted gave us the ideas of crystallized and fluid intelligence, was also one of the main advocates of factor analysis in personality research. He applied factor analysis to Allport's terms and successfully reduced the large pool of personality descriptors to what he claimed were 16 primary personality factors, forming the basis of his Sixteen Personality Factor Questionnaire, or 16PF. Each factor represented a bipolar dimension along which individuals varied, e.g., warmth versus reserve, dominance versus submissiveness, emotional stability versus neuroticism, and so on.

Hans Eysenck (born 1916) proposed a more parsimonious solution, arguing that the essential structure of personality could be captured in just the two fundamental dimensions of extraversion versus introversion, and neuroticism versus emotional stability. These two dimensions, he argued, were biologically grounded, and he claimed that extraversion reflected differences in cortical arousal thresholds, and neuroticism reflected differences in the reactivity of the autonomic nervous system. Eysenck's biological grounding of personality dimensions connected the trait tradition back to the physiological psychology of Chapter 7 and anticipated the later neuroscience of personality that would develop in the late 20th century. His two-factor model was later extended by the addition of a third dimension called psychoticism, reflecting tendencies toward unconventional, impulsive, and antisocial behavior.

By the 1980s and 1990s, a convergence had emerged across multiple independent factor-analytic studies of personality conducted in different languages and using different measurement instruments. Regardless of the specific items used, the specific language of the personality descriptors, or the specific sample of individuals studied, factor analyses of personality consistently yielded five broad dimensions. These came to be called the Big Five, or the ***Five Factor Model —*** Openness to Experience, Conscientiousness, Extraversion, Agreeableness, and Neuroticism, sometimes remembered by the acronym OCEAN.

The convergence across studies and languages provided the strongest available evidence that the five-factor structure reflected something real about the organization of human personality. Cross-cultural research subsequently confirmed that the five factors appeared in personality ratings across many different human societies, including non-Western ones, which suggested that they might reflect universal features of human social life rather than culturally specific categories. The Big Five should not be confused with a finished theory of personality, however. They describe the major dimensions along which people vary but do not explain why those dimensions exist, how they develop, how they interact to produce behavior in specific situations, or why some people are high and others low on each dimension. The Big Five is better understood as a descriptive taxonomy than as an explanatory theory. Explaining the dimensions requires additional theoretical work drawing on genetics, developmental psychology, and neuroscience, and this work is still very much in progress (DeYoung, 2015).

TYPES VERSUS TRAITS

Before the trait tradition achieved its current dominance, a competing approach emphasizing personality type had a significant period of influence and deserves attention both for its historical significance and for the contrast it provides with the trait approach. The distinction between types and traits is fundamental. A trait approach treats personality characteristics in ways that describe people as both similar and unique. The idea is that all people have the same set of traits (whether 16PF, Eysenck's 3, or the Big Five) but differ in terms of whether they score high or low on any one of them. Thus, traits are continuous dimensions rather than discrete categories. A type approach treats personality categories as discrete. Type theories treat people as fundamentally different from each other, you are either one type or another, with no intermediate cases or overlap. Proposed types tend to be more memorable and more intuitive than trait theories, which may explain their persistent popular appeal, especially in cases like the MBTI or Enneagram, but they are generally less empirically supported and theoretically less flexible. The type approach has ancient roots in the Hippocratic theory of the four humors as well as the physiognomic tradition that psychological character was connected to physical constitution, and traces a lineage through the craniometric, phrenological, and anthropometric traditions of the 19th century, culminating with Galton.

William Sheldon (born 1898) proposed one of the more infamous examples in modern psychology. He claimed that human body types, which he called ***somatotypes***, could be classified along three dimensions corresponding to the relative development of the three embryonic tissue layers. The endomorph, derived from the endoderm, was characterized by roundness and softness, that is, a tendency toward fat deposition and a large digestive system. The mesomorph, derived from the mesoderm, was characterized by muscularity and athletic build with a tendency toward bone and muscle development. The ectomorph, derived from the ectoderm, was characterized by linearity and fragility, revealed by a tendency toward a slender build with a large nervous system relative to body mass. Sheldon then claimed that each somatotype was associated with a characteristic temperament. Endomorphs were sociable, comfort-loving, and relaxed. Mesomorphs were assertive, energetic, and risk-taking. Ectomorphs were introverted, anxious, and intellectually inclined. The correlations between somatotype and temperament that Sheldon reported were remarkably high — implausibly high, as later critics noted.

The problem with Sheldon's data was a methodological one that connects directly to Bacon's anticipating scientist. Sheldon himself had rated both the somatotypes and the temperaments of his subjects, without any attempt to blind himself to the subjects' characteristics when making each rating. A rater who believes that mesomorphs are assertive will tend, even unconsciously, to rate muscular individuals as such, and to rate individuals he has already judged as assertive and risk-taking as more muscular. When later researchers conducted properly controlled studies in which physique and personality were measured independently by different raters who did not know each other's assessments, the impressive correlations that Sheldon had reported largely evaporated. Sheldon's constitutional psychology was, in effect, a large-scale demonstration of the confirmation bias. The researcher had anticipated nature rather than interpreted it and had found exactly what he had expected to find.

SUMMARY

This chapter has traced one of the most consequential and yet most troubling threads in the history of psychology — the attempt to measure the human mind and to use those measurements to understand, classify, and ultimately to manage human populations. The story emerged from the broader intellectual upheaval produced by evolutionary thinking, but early disputes about what evolution is and how it works sparked the eugenics movement and the subsequent scientific racism which represents a dark side to this work. But the later ideas on human intelligence and personality reflect more positive themes about what it is like to be a human.

Psychometry is one of the domains in the history of psychology that most clearly illustrates the challenges of conducting psychological science. The risk of allowing biases and beliefs to shape how one collects and interprets scientific evidence was on full display in this chapter. The lesson is that measurement is never theoretically innocent, and that the gap between what a test measures and what we claim it measures is always a site of potential distortion. Perhaps the risk is stronger because Bacon's anticipating scientist can operate with particular authority when the quantification makes the results seem more objective than they are.

Though much of the mental testing movement drifted from Darwin's original insights, his emphasis on variation influenced the science of intelligence, and later theories of personality traits. His emphasis on adaptation and environmental pressures continues to inform fields such as evolutionary psychology. Darwin's emphasis on continuity between species inspired researchers to study animal behavior and cognition as a way of understanding human psychology. By arguing that differences between humans and other animals were of degree, not kind, Darwin legitimized the scientific investigation of animal minds. His work also deeply influenced the development of early American psychology, especially through the work of William James. We will explore these ideas in more detail over the next two chapters.

KEY TERMS

Key Terms

- uniformitarianism, Lamarckism, teleology, inheritance of acquired characteristics, natural selection, evolutionary associationism, Spencer-Bain principle, Social Darwinism, eugenics, psychometry, nature vs. nurture controversy, construct, variable, intelligence quotient, factor analysis, g, fluid intelligence, crystallized intelligence, triarchic theory of intelligence, idiographic approach, nomothetic approach, Five Factor model, personality trait, personality type, somatotype

STUDY QUESTIONS

Study Questions

1. Explain how Lamarck's theory of evolution is an example of teleology.
2. Outline the rationale of Social Darwinism.
3. Explain the nature-nurture debate as it relates to intelligence.
4. Summarize how the science of intelligence developed over the 20th century.
5. Summarize how the science of personality developed over the 20th century.

CHAPTER 12: ADAPTATION AND FUNCTION IN AMERICAN PSYCHOLOGY

INTRODUCTION

Learning Objectives
Understand:

- Peirce's pragmatic maxim
- William James' pragmatism and how it differs from Peirce's
- Dewey's instrumentalist version of pragmatism
- the contributions of Granville Stanley Hall in early psychology in the United States
- the adaptive theme of the functionalist school
- the motivation behind Galton's research in psychometry
- the nature-nurture debate as it applies to intelligence
- the S-O-R chain and the role of the mind in functionalist psychology
- the difference between functionalism and its more mentalistic predecessors (e.g. voluntarism, structuralism, phenomenology)

The preceding chapter traced what happens when evolutionary thinking is applied to the measurement of human minds and how Darwin's insight that organisms vary, compete, and are selected evolved into Galton's program of measuring, ranking, and ultimately managing human populations. That application of evolutionary ideas was consequential and troubling in equal measure. But there was another way to take Darwin's legacy into psychology, one less interested in measuring the distribution of mental abilities than in understanding what mental abilities were for.

This second appropriation of Darwin asked a different question entirely. Rather than asking how much intelligence does a person have, they asked instead what does intelligence do? How does the mind help organisms, human or otherwise, navigate the challenges of living in a complex and changing world? The shift from the first question to the second is the shift from psychometrics to functionalism, and it produced a psychology that was in many respects distinctively American, pragmatic in its philosophical commitments, applied in its orientation, and concerned with the adaptive function of mental life rather than its elementary structure.

But adaptation, as we shall see, is not only a theoretical theme in this chapter. The institutions that American psychology built in its founding decades were themselves under pressure to adapt and accommodate minds and voices that their founders had not designed them to include, and that they did not always welcome. The story of American psychology's founding is therefore a story of adaptation in more than one sense, and both senses deserve our attention.

EARLY AMERICAN PHILOSOPHY AND PRAGMATISM

When the first universities were founded in the United States, psychology was not yet an established discipline, but there was nevertheless the philosophy of mind that we have already discussed in depth. Because of America's close ties to England, and its colonial history, the first universities in the United States had a British flavor, and their philosophers were proponents of John Locke and British empiricism (Hergenhahn, 2009). In the mid-18th century, these included Samuel Johnson of Columbia University and the Yale-educated Calvinist minister Jonathan Edwards. However, Thomas Reid's common sense views became appealing to American philosophers, and it became a dominant trend in the United States during the end of the 18th century and into the 19th century.

One of the first novel contributions in American philosophy came from **Charles Sanders Peirce** (born 1839), who could be considered a polymath, and whose work was not well known in his own time. Peirce was educated in chemistry at Harvard University, but as the son of a Harvard professor of astronomy and mathematics, Peirce was well versed in these topics as well. Brent (1998) wrote in his biography that Peirce had a lifelong fascination with logic and philosophy, and it was ultimately his work in these areas for which he is best known.

Unfortunately for Peirce, he appeared to have had a rather abrasive and eccentric personality and formed several bad impressions with his professors. One of these was Charles Eliot, who would later become a longtime president of Harvard University and who actively opposed Peirce's attempts to secure an academic appointment there. Ultimately, Peirce landed a position teaching logic at Johns Hopkins University in Baltimore, where he began to write on topics that would be a significant influence on American psychologists. These included his treatment of a philosophy of ***pragmatism,*** later to be developed and popularized by William James. However, Peirce's personality again interfered with his academic success. He had apparently established an enemy in a prominent scientist named Simon Newcomb, and when Peirce was found to have separated from his wife and began living with another woman, to whom he was not married, Newcomb informed the university trustees of this arrangement, and Peirce was promptly terminated (Brent, 1998). Newcomb then blocked Peirce's attempts to obtain employment at other universities. Peirce retired to a rural home in Pennsylvania, where he continued to write about pragmatism and philosophy, but his only income were occasional stipends arranged by William James, who was perhaps his primary admirer. Peirce died in poverty in 1914.

Peirce's central philosophical contribution was what he called the *pragmatic maxim*. This was the principle that the meaning of any concept consists entirely in the conceivable practical consequences of acting on it. To ask what a concept means is to ask what difference it would make to our experience and our action if the concept were true rather than false. A concept that made no conceivable practical difference to anything we could observe or do was, in Peirce's view, not a genuine concept at all but an empty abstraction, a piece of what he called the philosopher's fog.

Applied to the definition of truth, the pragmatic maxim produced a position that was genuinely radical in the context of the epistemological tradition we have been tracing throughout this book. The *correspondence theory of truth* is the older the view that a belief is true if and only if it accurately repre-

sents or corresponds to an independent reality, and this had been the implicit assumption of the entire tradition from Descartes through Locke through Kant through Helmholtz. The veil of perception problem, as we have seen, arose precisely from the assumption that if truth requires correspondence between our beliefs and a mind-independent reality, and if our only access to that reality is through experience, then the question of whether our beliefs accurately correspond to what lies behind the veil becomes urgent and potentially unanswerable. Peirce's response was not to solve the correspondence problem but to dissolve it by arguing that truth should be defined not as correspondence to a mind-independent reality but as the conclusion that a community of inquirers would converge on in the long run if they continued to investigate a question with the best available methods. Truth, on this account, is the ideal limit of inquiry. It is what we would believe if we kept looking long enough and carefully enough. It is important to note that this is not a relativist position; Peirce was not saying that truth is whatever any individual or community happens to believe, rather it is a position that relocates truth from the correspondence between belief and mind-independent reality to the convergence of self-correcting behavior over time.

The implications for both perceptual realism and scientific realism are significant and connect directly to debates we have been tracing all along. On the question of perceptual realism, whether our perceptions accurately represent an independent external world, Peirce's maxim offers a pragmatist response. The question of whether our perceptions correspond to things-in-themselves is, on his account, a meaningless question if it is understood as asking about a correspondence that could in principle never be verified or falsified by any conceivable experience or investigation. The meaningful question is whether our perceptual beliefs are reliable guides to successful action and whether broader human knowledge converges on them under careful scrutiny. To both of these questions the answer is generally yes. This is not Gibson's direct realism, as Peirce was not claiming that perception gives us unmediated access to environmental structure, but it is, in a similar spirit, a position that sidesteps the veil of perception problem rather than trying to pierce it, by refusing to grant that the unanswerable correspondence question is a genuine question in the first place. On the question of scientific realism, whether scientific theories describe a mind-independent reality or merely systematize observations, Peirce's position was more robustly realist than the positivism of Mach. He believed that the self-correcting method of scientific inquiry was genuinely converging on truth rather than merely producing convenient summaries of experience. But his realism was chastened by the recognition that convergence was a long-run ideal and that no current theory could claim to have arrived at the final truth. Science was on the way to truth, always correcting itself, always open to revision, which is a position considerably more modest than the confident realism of the 19th century scientific naturalists but considerably more ambitious than the anti-realist positivism that refused to ask what lay behind the regularities of experience.

William James (born 1842) was an admirer of Peirce and pragmatism, but his path to this view was a bit circuitous. James had grown up in an unusual family. His father was an advocate of an unusual mystical philosophy called Swedenborgianism, and with his family's wealth, attempted to obtain the best possible education for his children by enrolling them in the best private schools. At one point the family moved to Europe for their children's education, and so William and his brother, the future novelist Henry James, bounced around between schools in the United States, Switzerland, France, Germany, and England (Hergenhahn, 2009). He developed talent as a painter, but his father disapproved, and when he switched to metaphysical philosophy his father criticized him for adopting the wrong kind of philosophy (Bjork, 1983; Hergenhahn, 2009). James ultimately settled on chemistry and

physiology at Harvard before earning his medical doctorate, but it seems as though he was uncertain, ambivalent, and unhappy with his career path.

Complicating matters was his familiarity with the determinism of certain forms of empiricism and materialism. For James, accepting these philosophies meant accepting determinism, and would entail that events in his life were beyond his control and there was no sense or purpose in doing anything. He had an increasing problem with depression and anxiety and spent some time recuperating in Germany, where he encountered the philosophy of Charles Bernard Renouvier, which gave him the insight that free will could be true because one could simply *choose* to believe in it. But James took this a step further and realized its alignment to Pierce's pragmatic maxim. James evaluated the belief in free will not by asking whether it corresponded to some metaphysical truth about the ultimate nature of causation but by asking what difference it made to believe it. And the difference it made was enormous — it was the difference between a life lived as if one's choices mattered and a life lived as if they did not. A belief that made that difference, James concluded, had a claim to be called true that no amount of abstract metaphysical argument could undermine. This personal resolution became the seed of his version of pragmatism, which was the conviction that the meaning and truth of a belief lay in its practical consequences for the life of the believer. Where Peirce had defined truth as the long-run convergence of a community of investigators, James made the definition more immediate and more individual. A belief was true if it worked, if it proved satisfactory in guiding the believer's experience and action. Truth was not a static property that beliefs either had or lacked but a process, it was something that happened to a belief as it proved itself useful in navigating experience. An idea becomes true, James wrote, insofar as it helps us get into satisfactory relation with other parts of our experience. This was James's famous *cash value* of an idea: its practical consequences for the believer's life. This formulation was deliberately relativist, as there was no single vantage point from which all truths could be surveyed and ranked, no mind-independent reality against which all beliefs could be measured. Different beliefs worked for different people in different contexts, and the diversity of truths that resulted was not a scandal nor a problem to solve, but a reflection of the genuine diversity of human experience and human need. But crucially, this formulation drew the most criticism from Peirce himself, who was sufficiently disturbed by what James had done with his maxim that he renamed his own version *pragmaticism* — a sufficiently ugly word, he noted with characteristic acidity, that no one would want to steal it.

THE FOUNDING OF PSYCHOLOGY IN THE UNITED STATES

The insights James had about freewill, pragmatism, and truth, spurred his recovery and his resurgent career in academics. He returned to the US and two years after reading Renouvier, he joined the Harvard faculty in 1872, initially teaching anatomy and physiology before moving into philosophy as the disciplinary home of psychology in American universities at a time when the discipline had no independent institutional existence. His title throughout most of his career was professor of philosophy, and it was from within that context that he taught psychology, established a demonstration laboratory in 1875, and eventually wrote the Principles of Psychology (1890) which was a work that was simultaneously an empirical survey of psychological findings and a philosophical investigation of the nature of mind. The blending of psychology and philosophy was central to James' work.

In his Principles, James drew heavily from Darwin, and he treated the concept of *instinct* not as an unconscious motivator as was an emerging popular idea among certain European thinkers at the time, but as something biologically determined. He also treated the idea of *habit* as being a learned modification of instinctual behavior, foreshadowing Pavlov, and wrote how neural connections become stronger through repetition, foreshadowing Hebb's views in 20th century neuroscience. He further argued that because of this effect of repetition, established habits can be difficult to break without great effort.

The foundations of James' view of mind were both pragmatic and Darwinian, and they ran in precisely the opposite direction from the European traditions of Wundt and Titchener that dominated experimental psychology at the time. If freewill was real, or at least if acting as if it were real made a genuine difference to how one lived, then consciousness could not be merely a passive theater in which sensory atoms were combined according to mechanical laws. It had to be doing something. It had to be causally efficacious, genuinely involved in the production of behavior rather than merely accompanying physical processes as an epiphenomenal shadow. And if consciousness was doing something, the appropriate questions for psychology were not what are the elementary contents of consciousness and how do they combine, but what does consciousness do, what purposes does it serve, and how does it help the organism adapt to the challenges of living in a world that is always changing and always demanding response. His concept of the *stream of consciousness*, the continuous, flowing, personal character of mental life was a direct rejection of the atomistic picture that structuralism presupposed. You could not cut the stream into moments and elements without destroying what was most essential about it, any more than you could understand a river by analyzing a bucket of water taken from it. The stream was always moving, always connected to what came before and what was coming after, always colored by the personal history and the forward-looking intentions of the person whose stream it was. Crucially for James, the stream was *selective*, it was an active agent that attended to some things and ignored others, and not a mere passive recipient of sensation. This insistence on the dynamic, purposive, selective, and personal character of mental life was the core of the school of functionalism that James's work inspired, and it pointed toward a psychology that was less interested in describing the structure of the human mind under controlled laboratory conditions and more interested in understanding how minds of all kinds, human and animal, adult and child, healthy and disordered, functioned to enable organisms to adapt to the demands of their environments.

Even though James had created his laboratory in 1875, a full four years before Wundt's Leipzig lab, its purpose for demonstration and teaching precludes it from being counted as the first psychology lab (in the US or elsewhere). That credit goes to **Granville Stanley Hall** (born 1844). Hall grew up and attended college in Masschusetts but also spent time studying physiology and philosophy in Germany. After returning to the US, he began studying psychology under William James and received his PhD in 1878. Curiously, while the degree was officially in philosophy, the entire subject matter of his research was psychology, and so it can be said that Hall was the first person to ever obtain a psychology PhD, a year before Wundt's lab began! But importantly, because James' lab was never formally considered a lab, Wundt's first student Max Friedrich, who completed his PhD in 1881 within the context of Wundt's formal institutional structure is also considered the first experimental psychology PhD. Regardless of who was first, Hall spent two years working alongside Wundt and Friedrich, learning more about the methods that Wundt was formalizing in his more extensive experimental lab.

Hall was then hired at Johns Hopkins University (replacing Peirce) in 1883 and immediately set up a psychological laboratory for research purposes. The creation of this lab is seen as the founding of the first psychology lab and department in the United States. Hall was also seen as the *Great Organizer* in American psychology, having played a key role in the creation of the American Psychological Association, serving as its first president. He also founded the *American Journal of Psychology*, which was the first psychology journal printed in English.

While Johns Hopkins can lay claim to being the first psychology lab, it cannot currently claim to be the oldest. Because Hall proved to be a great organizer and administrator, in 1888, Jonas Clark invited him to be the president of his new university in Worcester, Massachusetts. So in that year, Hall transferred his laboratory to Clark University. Psychology was not reestablished at Johns Hopkins until 1903. Hence, the honor of oldest psychology department in the United States seems to belong to Indiana University, where a full-fledged psychology department and laboratory was established by **William Lowe Bryan** in 1888, who had earned his PhD with Hall at Clark University (Hearst & Capshew, 1988). This claim is not without controversy, however, because the same claim of being the oldest continuously operating psychology department in the United States is made by the University of Pennsylvania, which was named by Bolles (1993) as the next department founded after Johns Hopkins. However, the dates claimed for the department at Penn vary. Bolles (1993) lists the date as 1888, while Hergenhahn (2009) lists it as 1889. Cattell (1928) himself wrote that he created the department even earlier, in 1887, clearly preceding Bryan at Indiana. However, he also admitted that a functioning laboratory was not set up until 1889, perhaps providing the basis for the date chosen by Hergenhahn.

Quibbles over who was first notwithstanding, the field of psychology was well established in the United States and departments were popping up around the country. Titchener arrived at Cornell in 1892, and there was Joseph Jastrow at the University of Wisconsin in 1888 and H. K. Wolfe at the University of Nebraska in 1889. In 1891, James McKeen Cattell moved from Penn to Columbia University to start up its psychology department; and there was E. B. Delabarre at Brown University, Frank Angell at Stanford University in 1892, Mark Baldwin at Princeton in 1893, and John Dewey at the University of Chicago in 1894.

The list of figures just surveyed shares a characteristic that is not incidental. They are all men, and they are all white. This was not an accident of history but the product of deliberate institutional design. Admissions policies, hiring practices, professional norms, and informal networks of exclusion collectively ensured that the new discipline of psychology would be built by, and largely for, a particular kind of person. This is where the second meaning of this chapter's title becomes visible. American

psychology in its founding decades was under pressure to adapt, not only in the theoretical sense of developing a functionalist account of mind as an adaptation to the environment, but in the institutional sense of accommodating the presence of people whose abilities and ambitions its founders had not recognized. That adaptation was slow, incomplete, and extracted at considerable personal cost from those who forced it. The women and Black scholars who entered psychology in this period did so not because the institutions welcomed them but because they were persistent enough, talented enough, and fortunate enough to find the occasional opening in a structure that was largely designed to keep them out. Their stories are not footnotes to the history of American psychology's founding but are evidence about what that founding actually was, and what it cost.

One of those openings was at Cornell University, whose founder Ezra Cornell had adopted the deliberately expansive policy that his institution would be a place where anyone could study anything — a vision that stood in pointed contrast to the restrictive admissions policies of institutions like Harvard, which did not admit women at all. It was at Cornell that **Margaret Floy Washburn** (born 1871) became the first doctoral student of Edward Titchener, and in 1894 the first woman to receive a PhD in psychology. Her path had not been straightforward. She had initially applied to study at Columbia University under James McKeen Cattell, who was willing to supervise her work but whose institution would not formally admit women as degree candidates, forcing her to attend as a hearer rather than a student before transferring to Cornell.

Washburn was not technically the first woman to work in psychology; that distinction goes to **Christine Ladd-Franklin** (born 1847), who was educated in mathematics at Johns Hopkins, and although completing all the requirements for a PhD in 1882, the degree was not granted because she was there only as an "unofficial student," since Hopkins did not accept women. She spent her career working alongside her husband, Fabian Franklin, himself a professor of mathematics at Johns Hopkins. Early on, during a sabbatical in Europe, she was able to work with Georg Müller and Helmholtz. As a result of this, she developed an important theory of color vision. Ladd-Franklin was finally given her PhD by Johns Hopkins in 1926.

Another important woman in early psychology was **Mary Whiton Calkins** (born 1863). Calkins had attended Smith College and began a career teaching at Wellesley College. When Wellesley decided to offer a psychology class, they needed someone to teach it. Calkins was their first choice because of her knowledge of philosophy, but she had no official training in psychology. In 1890, Calkins requested admission to Harvard to study with William James, who agreed to accept her to his class. At the time, women were only allowed to be "unofficial" students at Harvard, attending via an arrangement called the Harvard Annex, which allowed for women to be taught by Harvard faculty, but in a separate space. James insisted that she attend his graduate seminar on the main campus, and in a striking turn of events, all the male students enrolled in James' class were encouraged to withdraw, leaving Calkins in the enviable position of receiving a personal tutorial in psychology from James. During her time at Harvard, she also conducted research at nearby Clark University with Edmund Sanford, and later with Hugo Münsterberg, who had been hired by James to take over the psychology laboratory at Harvard, allowing James to turn to more philosophical matters late in his career. Despite James' and Munsterberg's assertions that her work was outstanding and that she was the strongest student in the department, Harvard still refused to grant her a PhD.

Calkins' efforts were pioneering in another sense, however. Her success in gaining access to a Harvard education for women opened the door for others. The Harvard Annex was not an official institution, but just a means by which Harvard faculty provided private classes to women. By 1894, enough

women were attending the Annex that it was incorporated as Radcliffe College. The administration at Radcliffe offered a PhD to Calkins in 1902, but this was unsatisfactory to her, and she rejected the degree because it was, as she viewed it, a means to allow Harvard to continue its policy of denying access to women (Thorne & Henley, 2001). Harvard finally came around to accepting women in 1963, at which time it absorbed Radcliffe College. It is now the Radcliffe Institute for Advanced Study, which has as its central mission the study of women, gender, and society.

Gender was not the only basis for discrimination in early science. Race was another. Nearly all schools were racially segregated in the 19th century, and few of the schools for Black students offered doctoral study in psychology. **Francis Cecil Sumner** (born 1895) was G. S. Hall's last doctoral student, and was the first Black psychologist to receive a PhD in the United States, doing so in 1920, at Clark University. Sumner spent the early portion of his academic career at West Virginia Collegiate Institute. In a controversial move, Sumner wrote two articles favoring the continued racial segregation in higher education, on the basis that Black Americans were "on a lower cultural level than the White race" (Sumner, 1926, p. 43, as cited in Hergenhahn, 2009, p. 359). More recently, however, Sawyer (2000) clarified Sumner's position, noting that this was not what Sumner truly believed, but was only saying what needed to be said at the time in an effort to gain more public support for improving the quality of the schools that we now call Historically Black Colleges and Universities. This interpretation appears valid, as Sumner moved from WVCI to create the psychology department at Howard University, which developed into one of the most prominent psychology departments in the United States. Most notably, the Psychology program at Howard was later staffed by Kenneth and Mamie Phipps Clark, who were pioneers in the psychology of race. They published the famous "doll studies" (Clark & Clark, 1940), demonstrating the negative effects of racial prejudice on children, which later had a significant impact on desegregation in schools, as it was used in the case of Brown v. Board of Education of Topeka, KS. Kenneth Clark became the first Black president of the American Psychological Association in 1966.

FUNCTIONALISM

John Dewey (born 1859) was the third major figure in the American pragmatist tradition, and along with William James can be considered the founder of the first American school of thought in psychology, which he developed at the University of Chicago and came to be known as ***functionalism***. Where Peirce had defined pragmatism as a method for clarifying the meaning of concepts through their practical consequences, and James had transformed it into a theory of truth grounded in the satisfactions of individual experience, Dewey developed what he called ***instrumentalism***, a version of pragmatism that placed the emphasis on the social and biological functions that ideas and inquiry served in enabling organisms to solve the problems they encountered in their environments.

Echoing Thomas Reid, Dewey rejected the philosophical trend of treating ideas as mental representations and considered them instead as instruments for action. Ideas are tools that organisms used to navigate and solve problems. This was a thoroughly biological and evolutionary framing of cognition. Just as a hammer is not a picture of a nail but a tool for driving one, an idea was not a picture of reality but a tool for acting on it. The truth of an idea, on Dewey's account, was its effectiveness as an instrument for solving the problem it was brought to bear on. An idea that solved the problem was justified by its results, provisionally reliable until a better instrument came along. This insistence on the provisional, problem-relative, and action-oriented character of knowledge was Dewey's contribution to the pragmatist tradition, and it connected his philosophy directly to Darwin's evolutionary framework. Organisms that could think were organisms better equipped to solve problems, and the history and evolution of human intelligence was the history of an increasingly sophisticated toolkit for transforming the environment in the service of human needs and purposes.

Dewey's most direct contribution to psychology came in a short paper published in 1896 that has become one of the most cited works in the history of American psychology. The paper was titled "The Reflex Arc Concept in Psychology," and its target was the stimulus-response foundation that had been the basic unit of analysis in both experimental psychology and physiological psychology since the work of the sensorimotor physiologists we traced in Chapter 7. The reflex arc, as typically conceived, described a simple causal sequence: stimulus triggers sensation, sensation triggers central processing, central processing triggers response. Each element was thought to be a discrete and separable event that could be studied independently of the others. This sequential, atomistic picture of the organism's engagement with its environment was, Dewey argued, fundamentally mistaken. He asked the reader to consider the example of a child reaching toward a candle flame, being burned, and withdrawing the hand. On the reflex arc account, this is a sequence of discrete events, the light of the flame is a stimulus, the seeing of the light is a sensation, the reaching is a response to that sensation, the burning is a new stimulus, the pain is a new sensation, and the withdrawal is a response to that sensation. Each element is separate, each causes the next, and the whole is a chain of stimulus-response links. Dewey argued that this description missed everything that was psychologically important about the episode. The child does not first see the light as a neutral stimulus and then decide to reach, rather the seeing is already a form of reaching, already organized by the child's interest and curiosity and prior experience with interesting objects. And the burning does not produce a new sensation that triggers a new response but instead transforms the meaning of the light, which now becomes something to be

avoided rather than something to be explored, and this transformation of meaning is what the withdrawal expresses. The circuit, Dewey insisted, was not a chain of separate links but a coordinated whole whose elements could only be understood in terms of their function within the whole. Stimulus and response were not independent entities that happened to be connected by a causal chain but were artificial distinctions within a continuous process of organism-environment interaction. Any attempt to separate the event into stimulus and response were an error that William James had already called the *psychologist's fallacy*, where the analytically minded psychologist confuses their own breakdown of the situation for a valid explanation of what happens in the mind of another.

The implications of Dewey's reflex arc critique set the agenda for the functionalist school. The fundamental unit of analysis for psychology inquiry is not stimulus and response but rather the continuous organism-environment circuit, the coordinated act, the purposive, environmentally embedded, temporally extended activity through which the organism engaged with its world. This was a thoroughly Darwinian picture of psychological activity. The organism was always acting in relation to its environment, always acting in terms of its needs and purposes, and always organizing its experience in the service of its adaptive goals. The separation between organism and environment that the reflex arc concept presupposed was, for Dewey, a holdover of Cartesian thinking that Darwin's theory had rendered obsolete. Readers who have followed the veil of perception theme through the preceding chapters ought to recognize in Dewey a foreshadowing of Gibson's dissolution of Cartesian dualism in his perception-action cycle and the affordance concept.

These views were taken up by the other functionalists whom Dewey attracted to the University of Chicago. **James Rowland Angell** (born 1869) argued that the goal of psychology was to study the operations of the mind, rather than its structure or elements. One way to view Angell's approach is to think of creating a "job description" for the mind. If the mind is a tool that helps us adapt to the world, then the goal of psychology is to identify the functions of that tool. A good analogy for the functional view of mind is a Swiss Army knife or similar multitool, and the goal is to figure out what tools the mind contains. **Harvey Carr** (born 1873) described behavior as an *adaptive act*. Carr introduced motivation into psychology and said that behavior begins with the motivating stimulus, such as hunger, followed by a sensory situation; an environment that offers food, and a response that satisfies the motivating stimulus; and obtaining and consuming the food.

Another group of functionalists arose at Columbia University. Cattell had created the department there, after leaving Penn. He was not an outright functionalist, but he established an atmosphere that fostered it by rejecting the reductionism of structural psychology (Boring, 1950). Key among this group was **Edward Thorndike** (born 1874) who conducted his famous puzzle box experiments with cats and presented the ***Law of Effect*** that he derived from them. The standard accounting of this is that behaviors followed by rewards will be repeated, which is accurate but incomplete.

We might ask what the cats were actually learning when they figured out how to pull a loop of string to escape the puzzle box. Did they actually learn about cause and effect, as in understanding that pulling the loop causes the door to open? We should remember Hume here, and his claim that the concept of causality cannot be derived from experience. Thorndike effectively agreed and concluded only that the repeated succession of one event after another (i.e., Hume's law of sequence), accounted for the declining learning curves of his cats.

Despite this, Thorndike was not a skeptic as Hume was, as he was working within the pragmatist tradition that established a different understanding of truth than the correspondence theory that

stymied human knowledge for Hume. From the pragmatic view, the persistent success of pulling the loop was for the cat, adaptive. It brought them a practical and functional outcome; it solved their problem (of being locked away in the box). This is the functional account of learning. Behaviors that get stamped in are functional, they achieve the organism's goals and solve problems. The rewarding consequence is a signal that the behavior was an adaptive act, and it succeeded where other actions had failed. Hence, the Law of Effect is the psychological mechanism through which organisms adapt their behavior to their environments within their own lifetimes, the complement at the individual level to natural selection's work across generations. Both are selection processes operating at different timescales. Natural selection retains adaptive traits across generations, and the Law of Effect retains adaptive behaviors within a lifetime. It was this Darwinian character of Thorndike's learning theory that made it significant for the functionalist school. He had provided an experimental demonstration of the mechanism through which adaptation occurred within individual lifetimes, grounding the functionalist emphasis on adaptive mental function in a specific and testable psychological principle.

It is worth noting here that there is dissent on how to interpret these findings. The Gestalt psychologist Wolfgang Köhler, whose work on chimpanzee problem solving we encountered in Chapter 9, argued that Thorndike's account missed the evidence for genuine insight in animal learning. His chimpanzee Sultan, confronted with the problem of fitting sticks together to reach an out-of-reach banana, appeared to pause, think, and then suddenly produce the correct solution. Köhler interpreted this as evidence that Sultan had grasped the causal structure of the problem and had understood the relationship between the sticks and the banana in a way that Thorndike's cats had not.

Robert Sessions Woodworth (born 1869) came next at Columbia. In 1899 he published his dissertation, done under the supervision of Cattell, which became an influential paper on the *speed/accuracy tradeoff* in human movement. The idea is that the faster one moves, the less accurate one's movements are. So, when accurate movements are needed, such as the precision required to thread a needle, one must move slowly. He pioneered techniques for analyzing human movements as part of this research. Woodworth also became known for formalizing the role of motivation in psychology, by aligning it with biological processes in the body. In this context, motivation was a biological **drive**, which as the term suggests, drives behavior. As part of the drive theory, Woodworth discussed the role of the mind as a *mediator* in behavior. Rather than a simple stimulus-response (S-R) version of psychology, which began to emerge in the behaviorist movement in the early 20th century, Woodworth proposed the ***S-O-R approach***, with the mediating mind of the organism, O, regulating the response to the stimulus. For example, when an animal is presented with a stimulus, such as food, the animal does not merely respond because it has been trained to do so, but rather the response depends on the internal drive state. If the animal is hungry, the response is more likely; if the animal is not hungry, the response is less likely.

SUMMARY

This chapter explored the emergence of functionalism, the first distinctively American school of psychology. Functionalism arose in the late 19th and early 20th centuries as a response to the reductionist and analytical approaches coming from the European tradition. Rather than asking *what* the mind is, functionalists asked *what the mind is for*. Heavily influenced by Darwinian evolution, functionalist psychologists emphasized the adaptive purposes of behavior and mental processes, focusing on how organisms function in their environments.

Functionalists were less concerned with introspection and more interested in studying real-world behavior, learning, and development. Their methods were often applied, believing that a truly pragmatic psychology should have practical application. Early applied psychology in education, industry, and clinical practice emerged amongst the functional psychologists.

Despite rejecting dualism, the functionalists did not completely abandon the use of mentalistic concepts in their theory. This came under criticism by the early behaviorists, leading to a major shift toward behaviorism that dominated most of the first half of 20th century psychology, at least in the United States. One way to understand the transition to behaviorism is to recall back to the early German psychologies, which were all very mentalistic and gave little consideration to the environment. Using the symbol O to stand for the mind of an organism, we could describe these approaches as pure O psychology. The evolutionary stance of the functionalists was to cast the role of the mind within an environmental context, so it must sit between the world (the stimulus, S) and our behavior within it (the response, R), giving Woodworth's S-O-R approach. As we will see in the next chapter, the behaviorists rejected the scientific validity of studying the mind, O, giving us the S-R approach.

KEY TERMS

Key Terms

- pragmatism, pragmatic maxim, functionalism, instrumentalism, Law of Effect, drive, S-O-R approach

STUDY QUESTIONS

Study Questions

1. Explain Peirce's pragmatic maxim.
2. Explain how William James used pragmatism to justify free will.
3. Explain Dewey's functional approach to psychology.
4. Describe how functionalism is different from the mentalistic German psychologies.
5. Outline G.S. Hall's accomplishments as the "Great Organizer" of American Psychology.

CHAPTER 13: BEHAVIORISM

INTRODUCTION

Learning Objectives
Understand:

- the reasoning behind whether to accept a comparative psychology or not
- Morgan's Canon and the contrast between the perspectives of Loeb and Jennings
- the steps used by Pavlov to demonstrate a conditioned reflex
- Watson's justification for the field of Behaviorism, and his goals for the field
- the steps used by Watson to demonstrate a conditioned emotional reaction and the importance of the Little Albert study
- the differences between behaviorism, neo-behaviorism, and radical behaviorism
- the difference between positivism and logical positivism
- the role of falsification in science
- the role of operationism in science
- Tolman's research and how it supports the existence of cognitive maps in rats
- Hull's drive reduction theory and his intervening variables
- Skinner's theory of operant conditioning and how it varied from classical conditioning
- the concepts of reinforcement and punishment, and the schedules of reinforcement
- the difference between reward and reinforcement

Is psychology the study of the mind and consciousness, or is it the study of behavior? It seems easiest to say that it is both; in fact, any number of textbooks for introductory psychology refer to both topics in their titles (e.g., Coon, 2006; Passer & Smith, 2007). You may have encountered this question before, but perhaps not given it much thought. Does it really matter? After all, aren't they really the same thing? Not if you are worried about the mind-body problem! We have already seen Descartes' failure to explain mind-body interaction, and the legacy of that work took philosophy and psychology to the very mentalistic approaches derived from Kant's transcendental idealism, such as the phenomenologists and Gestalt psychologists. When the functionalists came on the scene, they rejected this purely mentalistic psychology in favor of one that situated the mind into an evolutionary and environmental context.

But to further understand the role of the mind in controlling behavior, we should go back to Descartes and consider something else that he wrote. In discussing *animal behavior*, Descartes did not endow them with a mind, perhaps for at least two reasons. One is that he did not observe the pineal gland in the animal brains that he dissected. The other is that, dating back at least to Plato, philosophers had the tendency to equate the mind with the human soul. Animals were not believed to possess souls,

and so they therefore were not believed to have a mind. This reflected a deep divide between humans and animals that was reinforced by religious views that dated back centuries (Bolles, 1993). So how did Descartes explain the apparently purposive behavior of animals? His answer was the reflex. An animal's responses were nothing more than unconscious reflexes triggered automatically by stimuli. Animal behavior was not considered purposive at all, but automatic and mindless. They were treated as mere automata. This was thus fundamentally distinct from Descartes' treatment of human behavior.

In the Cartesian view, animal psychology is the study of behavior and human psychology is the study of the mind. It was thus not possible in this view to have a ***comparative psychology***, that is, a single psychology that allows direct comparison between human and animal behavior. The 18th century French sensationalist Julien La Mettrie was almost a lone voice of opposition, at least in his day. La Mettrie argued that it would be more parsimonious to posit the same explanation for what appears to be the same kind of purposive behavior in humans and animals. His solution was to apply the reflexive S-R approach to all. However, it was not until Darwin's ideas that humans were descended from other species, and that there was continuity across the animal kingdom, that opinions started to change (Bolles, 1993).

COMPARATIVE PSYCHOLOGY

Despite La Mettrie's advocacy for the simpler S-R approach to both human and animal behavior, **George John Romanes** (born 1848), took a radically different slant as he began to popularize animal psychology in the late 19th century. Romanes adopted an anecdotal and observational approach, noting how animals sometimes appeared to behave with complex intentions, that is, with an underlying mental content. Romanes anthropomorphized animals and attributed human-like emotions and reasoning powers to them. In a story published in his book *Animal Intelligence* (1882), he observed two housecats fighting and were then separated. Later, one of these cats was sitting under some furniture in a room, and when its rival later entered, the former suddenly sprang out and attacked. Romanes interpreted this as a case where the first cat was hiding and plotting its revenge, waiting in ambush for just the right moment to settle the score.

As unscientific as his approach was, it appealed to a growing public interest in the possibility that, owing to the recentness of Darwin's theory, that animals were more like us than had previously been thought (Bolles, 1993). **C. Lloyd Morgan** (born 1852) responded with a more scientifically sound approach. Like La Mettrie, he believed in parsimony. He offered a principle for interpreting animal behavior that came to bear his name, ***Morgan's Canon***. Reproduced in Hergenhahn (1990, p. 371), Morgan wrote, "In no case may we interpret an action as the outcome of the exercise of higher psychical faculty, if it can be interpreted as the outcome of the exercise of one which stands lower in the psychological scale" (Morgan, 1894, p. 53). The idea is that it is okay to assign higher cognitive abilities to animals if such abilities are required to explain their behavior, but otherwise we should resort to simpler explanations by default.

When considering Morgan's Canon, we might ask how simple can the explanation of animal behavior be? Recall how Descartes used a completely mindless, reflexive explanation. Can all animal behavior be explained in this way? According to the University of Chicago zoologist **Jacques Loeb** (born 1859), the answer was yes. For Loeb, everything could be brought down to the level of ***tropism***, which is a form of automatic movement toward a stimulus. In particular, a phototropism is observed in the moth that flies toward a flame, and even in a houseplant that grows toward the sunlight streaming through a window. These behaviors appear purposive, because surely the plant needs sunlight – though no one has a definitive explanation for the moth! But one need not invoke purpose, or intentionality, in explaining either behavior, as a simple mechanical explanation will suffice. In the plant, we can describe how photoreceptors on one side of a plant may trigger vascular changes that direct the flow of nutrients and water inside the plant stem, causing growth in one direction. In the moth, we can propose that an unequal distribution of light across the facets of its compound eyes triggers an unequal oscillation pattern in the neurons that control its wing beats, which in turn steer it toward the light.

There is no need to posit a mind in the plants to explain this action; it is but a "physical-chemical action" (Boring, 1950, p. 638). The action is nevertheless *goal-directed*, in the sense that it has a function and serves a purpose to the plant, but no intentional mind is needed to govern it. And if the mind is not needed to explain tropisms in plants, why is it needed to explain them in insects or other ani-

mals? Like La Mettrie, Loeb was arguing that all behavior could be reduced down to simple S-R reflex chains.

This view was opposed by the functionalists, of course. **Herbert Spencer Jennings** (born 1868) was a functionalist inspired biologist at Johns Hopkins who criticized Loeb's theory. Jennings argued that even ordinary behavior is too complex and variable to explain in terms of a simple reflex. He studied the behavior of protozoa and found that their behavior was variable and was modified by experience, that is, they learned. In his view, the reflexive tropism was insufficient to explain learning, because reflexes were understood to be fixed and unchanging responses. He did not disagree that mindless reflexes existed, but rather that they did not explain the bulk of learned, purposive, goal-directed behavior in animals.

In Europe during this time, the study of reflexes was gaining in popularity owing to the discoveries being made in physiological neuroscience. Basic reflexes can involve only two neurons, so they provide a simple neural circuit that can be used to reveal the properties of the synapse and neural transmission. Importantly, these reflexes do not even involve the brain but are localized entirely to the spine and peripheral nerves, as discovered by Sherrington (see Chapter 7), who had removed the cerebrum of cats and observed that the reflexes of their feet remained intact. Likewise, the Russian physiologists Ivan Sechenov, Vladimir Bechterev, and most famously, **Ivan Pavlov** (born 1849), all embarked on studies of reflexes.

Initially, Pavlov was interested in *digestive reflexes*. He knew that salivation and the secretion of stomach enzymes were triggered by stimuli in an S-R chain, and that a reflexive neural circuit must control these responses. His goal was to map out these connections by studying digestion in dogs. In order to do it, he had to find a way of measuring the gastric secretions of the stomach. He pioneered the surgical creation of a *gastric fistula*, which is a channel that leads from the stomach to a pouch on the outside of the dog's body, so that the secretions could be observed. One of his goals was to determine the stimulus that triggered the stomach secretions. Was it the food arriving at the stomach from the esophagus? Or was it triggered by the taste of food in the mouth? As an excellent surgeon, Pavlov invented a second surgical technique called *sham feeding*. The esophagus was severed from the stomach so that the food (meat powder) swallowed was diverted before reaching the stomach. Thus, if the dog, after swallowing the food, exhibited stomach secretions, Pavlov would know that the stimulus was triggered by nerves in the mouth, not from within the stomach itself. This turned out to be true! Pavlov won the Nobel Prize in Medicine in 1904 based on this research.

Like a good scientist, Pavlov had to make careful observations on the timing of both the stomach's secretions and salivation in the mouth. His famous discovery was that certain external events seemed to cause secretions. For example, the approach of the experimenter who performed the regular feeding would trigger secretions. Did this person signal the prospect of food? Was the dog aware that it was about to be fed? Were the secretions under conscious control? As Pavlov pondered these questions, he called this new response a *psychical reflex*, as it seemed to be governed by the mind. But, as a physiologist and scientist, he was not a great fan of mentalistic psychology, so he changed the term to *conditional reflex*, implying that the dog had learned the conditional relationship between the feeder and the food. This allowed Pavlov to study learning without having to speculate about unobservable mental processes that may not even exist. In the translation to English, the term was switched to ***conditioned reflex***, and this is still the term used to describe a *reflex that has been modified by experience*.

But Pavlov needed to an empirical demonstration to support his claim that the dogs' salivating to the

lab assistant was conditional rather than psychical. To do this, he next famously paired a completely neutral stimulus, one not involved in the feeding, with the onset of food. If the response was truly psychical, then he would expect the dog to never salivate to the neutral stimulus. But a conditional reflex would predict that salivation would happen regardless, as it is caused merely by the concurrence of the food and the new stimulus. In his famous experiment, Pavlov set a metronome to tick away slowly and noted that the dog did not salivate initially to this stimulus, demonstrating its neutrality. However, on subsequent trials, the ticking metronome was followed by presentation of meat powder to the dog, which salivated in response. In Pavlov's terms, the ticking sound began as a *neutral stimulus*, the meat powder was an *unconditioned stimulus*, and salivation was an *unconditioned response.* After a sufficient number of repetitions of this pairing of the sound to the meat powder, Pavlov observed that now the dogs would salivate just in response to the sound. Now, the ticking was no longer neutral; it had become a *conditioned stimulus*, and salivation, to the ticking, was a *conditioned response.*

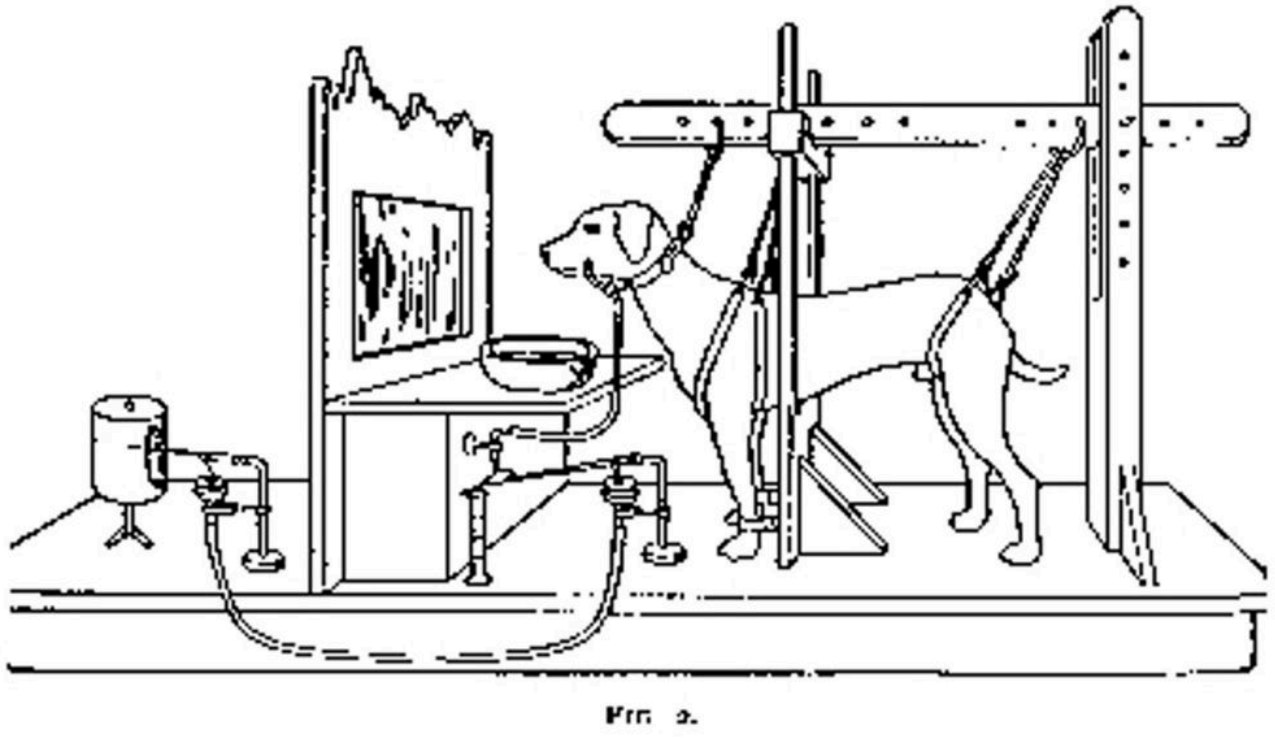


Figure 13.1. The setup of Pavlov's conditioning experiment. (Public domain, originally in Yerkes, R. M., & Morgulis, S. (1909). The method of Pawlow in animal psychology. Psychological Bulletin, 6(8), 257-273.)

BEHAVIORISM

Perhaps Jennings was wrong after all. Pavlov, it seemed, had demonstrated that it was possible to modify reflexes through conditional learning, and there was no need to bring the mind into the picture. This type of learning came to be called ***classical conditioning***, or ***Pavlovian conditioning***. One of the first to recognize the significance of this was **John Broadus Watson** (born 1878). Watson had studied under the functionalists Dewey and Angell at the University of Chicago, and he began by studying maze learning in rats, a procedure that had recently been invented by Willard Small at Clark University. He continued this type of work when he obtained a position at Johns Hopkins, and much of his early writing had a functionalist tone to it (e.g., Watson, 1907). However, while at Chicago, Watson had also studied for a time with Jacques Loeb, who taught him about tropisms and reflexes. This must have left an impression on Watson, for a few years later, Watson was ready to make psychology into an objective science, and to do this he had to adopt Loeb's analysis. It isn't clear if he was inspired specifically by Pavlov, whose work had started to be known in American psychological circles by 1909. What is clear is that Watson was well aware of the introspective and phenomenological tradition and was deeply unsatisfied by it, as he had already determined that animal behavior was amenable to scientific investigation without reliance on introspection. By 1913, Watson was ready to publish what came to be known as the ***behaviorist*** manifesto, titled *Psychology as the Behaviorist Views It*.

While Watson never explicitly invoked the positivism of Comte or Mach, the ideas he published reflect the same sort of thinking. As Mach had emphasized, any references to unobservable entities were meaningless metaphysical speculation. Applied to psychology, this would include consciousness and other internal psychological phenomena, and all the contents of the O in the S-O-R chain. If the response could be explained solely with reference to the stimulus, without mention of the mind of the organism, then this simpler explanation was not just simpler and sufficient, but scientific. The net result would be the ability of the experimenter to predict the subject's responses exactly, because the stimulus would be known, having been controlled by the experimenter, who thus controls the subject's response. For Watson then, the goal of psychology was to be able *to predict and control* behavior. The very first paragraph of his manifesto lays it out directly:

> Psychology as the behaviorist views it is a purely objective experimental branch of natural science. Its theoretical goal is the prediction and control of behavior. Introspection forms no essential part of its methods, nor is the scientific value of its data dependent upon the readiness with which they lend themselves to interpretation in terms of consciousness. The behaviorist, in his efforts to get a unitary scheme of animal response, recognizes no dividing line between man and brute. The behavior of man, with all its refinement and complexity, forms only part of the behaviorist's total scheme of investigation. (Watson, 1913, p. 158)

Now, if only Watson had a mechanism to explain the relation between the stimulus and a response that would allow him to fully exclude mental processes. That is where Pavlov comes in, because in the years following the publication of his behaviorist statement, Watson came to adopt Pavlov's thinking more obviously. He hypothesized that perhaps all of man's "refinement and complexity" could be explained away as conditioned reflexes. So, he tackled one of the most complex of human behaviors:

emotion. Nothing, it seems, is more human and mental than the feeling of fear or any other emotion, many would say. Watson set about demonstrating that fear, in particular, was nothing but a conditioned reflex, and to do so, he needed a subject who had no fear. The subject was a 9-month-old child volunteered by his mother, who was a wet nurse at the Harriet Lane Home for Invalid Children, affiliated with the Phipps Psychiatric Clinic at Johns Hopkins where Watson was working.

In 1920, Watson and his graduate student Rosalie Rayner demonstrated that the child, known only as Albert B., had no innate fear of animals, including a rat, dog, monkey, and rabbit. Albert, like all infants, had an instinctual startle reflex of crying that could be elicited by striking a steel bar with a hammer directly over his head. So, two months later, Albert was exposed to the conditional pairing of the rat followed by the striking of the steel bar. After only a few such pairings, Albert began to show signs of distress in response to the rat. On the fifth trial of the second day of testing, the rat was presented alone, and Albert appeared to make a puckered face and withdrew from the rat. Following two more conditional pairings, the rat was again presented alone, and now Albert cried instantly and began crawling away. Five days later, Albert continued to show trepidation to the rat, presented alone. To ensure that Albert's responses were not just to the experimental situation itself, but were directed toward the rat, Watson tested Albert's reactions to other stimuli. When presented with blocks, Albert made no unusual response and played with them. But every time the rat was presented, he attempted to flee. Similar reactions were exhibited now to a dog, rabbit, and fur coat, indicating stimulus generalization, that is, fear had become a conditioned response to anything sufficiently similar to the rat. Watson had succeeded in demonstrating classical conditioning of fear in a human infant. As he had stated in 1913, there was no distinction between humans and animals, behavior occurs in the same way, and Pavlov's method of the conditioned reflex was the explanation.

NEOBEHAVIORISM

If Watson's definition of behaviorist psychology was to be an objective natural science founded on the tenets of positivism, then any and all references to intervening mental processes need to be eliminated from psychology. According to positivism, the data of science are publicly observable events, but also these data *are* the science, because theorizing about data is not allowed. By definition, theories are general statements that go beyond the data, in an attempt to explain it.

In psychology, theorizing about data means developing psychological explanations, or constructs, that underlie the outward behavior of our subjects. Watching a rat solve a maze and reach the end, we might theorize that the rat had learned the spatial layout of the corridors and used this knowledge to solve the maze. But Watson would say instead that the rat had learned a sequence of left and right turns, and in particular had learned a sequence of steps. Each step was the stimulus for the next, reducing the apparent complexity of this behavior into a series of S-R steps, chained together in sequence.

Learning itself was a tricky concept, for if learning is a process happening inside the rat that we cannot see, then it is also unscientific to discuss. What we directly observe is the rat's performance in the maze. The scientific object of interest to behaviorism was performance, and for all intents and purposes *learning* and *performance* were the exact same thing to Watson. This distinction, or rather lack thereof, gives us a starting point for understanding ***neobehaviorism***. Many of those who came after Watson were less willing to refrain from theorizing about the data, and they used newer developments in the philosophy of science to support their claims.

Logical positivism was born out of a group of philosophers called the *Vienna Circle*. This group consisted of Otto Neuworth, Rudolph Carnap, and others. They were dealing with a scientific crisis that stemmed from Mach's emphasis on observation in science. By this time, modern physics had moved into the domain of atoms and field theory, and Mach himself doubted their existence. But is theorizing the existence of atoms equivalent to metaphysical speculation? Surely not, but there was at that time no way to distinguish scientific theories from other forms of speculative statements.

The logical positivists proposed the ***verification principle*** to help establish the scientific validity of any claim. This idea held that a theoretical concept was scientifically meaningful only if it could be specified in terms of observable conditions, either the observable antecedents that produced it or the observable consequences it generated. Pure speculation might never be verified and remain speculation, but scientific theories can be distinguished through testing and verification. Applied to psychology, this led to the trend of ***operationism***, which required that theoretical constructs like learning, drive, or anxiety be defined by the measurement procedures used to assess them. Importantly, this means that any psychological construct that cannot be operationalized in terms of a direct measurement is not valid.

Another contribution was the ***falsification principle*** of **Karl Popper** (born 1902). Popper was referencing Hume's problem of induction, by noting that theories are essentially inductive statements. Con-

sider the following, which would be entirely consistent with logical positivism. A naturalist observes ravens in the wild, noting that every raven so far observed is black. They logically conclude that all ravens are black. This claim is necessarily a theory, because it is a general statement about all ravens, including those that have been observed and those that have not been observed. By claiming that unobserved ravens are black, the naturalist has gone beyond the data of observation to make a universal generalization. But they can set about testing this theory by predicting that every raven that is observed in the future will be black. And hence, each newly discovered black raven verifies the theory. But is the theory ever proven true? According to Popper, the answer is no, and while verification might relate to the probability of a theory being true, it cannot be proven. He notes though that it may be possible to prove a theory false. All one needs to do is find a non-black raven and we would know conclusively that the theoretical claim is false. So, for Popper, the guiding principle of scientific research is falsification. A scientific theory is one that provides a means to be falsified, and if it does not do so, it is unscientific.

Both the verificationist and the falsificationist traditions shared a commitment to the ***hypothetico-deductive*** method, which is the procedure of deriving testable predictions (i.e., hypotheses) from theories and checking those predictions against observation. Together they gave the neobehaviorist generation a philosophical framework for thinking about theoretical construction in psychology that was considerably more sophisticated than Watson's original methodological behaviorism. Ultimately these positions raised difficult questions about the scientific status of Freudian theory, Gestalt theory, and other non-behaviorist approaches that were emerging in this same era.

And so the neobehaviorists set about identifying which psychological constructs could be grounded in strict measurement, and generate via hypothetico-deduction, falsifiable hypotheses. Learning became a construct that could be verified by observing performance. Performance was the *operationalization* of learning. The first neobehaviorist to consider is **Edwin Guthrie** (born 1886). He adopted the radical position of *one-trial learning*. The idea is a rejection of the principle of frequency proposed by Aristotle, James Mill, and echoed in Thorndike's Law of Exercise. According to the principle of frequency, learning occurs gradually as an association is strengthened by repetition. Consider Pavlov's dogs: after one pairing of the metronome click and the meat powder, the dogs do not salivate to the click. Several trials later, the dogs salivate. Watson would say that because no conditioned response was exhibited, no learning had occurred. Not until the performance of the conditioned response is learning said to occur. For Guthrie, however, learning occurs in one trial despite the lack of performance. But how could this be?

To understand the distinction between learning and performance better, consider the work of **Edward Chace Tolman** (born 1886) and his studies of *latent learning.* In one of his studies, he had rats wandering around a maze aimlessly, without being conditioned to take any particular path toward the end of the maze. According to Watson, this would be an example of purely random behavior, and that nothing was being learned because there was no specific stimulus and thus no specific response was performed. What Tolman found, however, was that once conditioning was introduced, the rats began solving the maze more quickly than naïve rats who had never experienced the period of free roaming within the maze. This reveals latent learning, meaning that the rats were learning even when they were not performing a conditioned response. The existence of learning became evident only when the situation provided the opportunity for performance.

What was it that the rats were learning during the free exploration period? Watson had claimed that maze learning in the rat was purely kinesthetic, that is, that rats were learning the *feeling* associated

with the number of steps they would take down a corridor, and the *feeling* associated with turning left or right at a junction (Goodwin, 2008). Clearly, in the free exploration period, Tolman's rats were not experiencing that specific sequence of steps, so they would never have learned the right *feeling* for solving the maze, hence their ability to solve the maze must be explained by some other mechanism. Tolman theorized that there must be an *intervening variable* between the stimulus, such as a junction in the maze, and the response; or whether to turn left or right. But Tolman's ***cognitive behaviorism*** was not a return to functionalism and the S-O-R chain, but rather an example of logical positivism, which allows theorizing about the data so long as the theoretical construct can be verified experimentally. Note that Tolman's theory is also consistent with Morgan's Canon. He is introducing a cognitive process in the animal so long as it is necessary to do so and still explains the data. The simpler explanation, without intervening variables, appears to be insufficient.

So, what was this intervening variable for maze learning and how did Tolman verify it? Tolman had theorized that the rats possessed a *cognitive map*, consisting of knowledge about expectations and possibilities for behavior in a situation. Tolman stopped short of saying the rats possessed a mental representation of the spatial layout of the maze, but in one way or another, the rats knew how to get where they wanted to go. In an ingenious test, Tolman repeated his technique of allowing rats to roam freely in the maze without reinforcement for entering the goal box. Then after introducing reinforcement, Tolman placed a roadblock in the maze that would prevent the rat from using the most straightforward route to the goal. Upon encountering the roadblock, the rat would have to double back and encounter a junction that allowed either a left or right turn. Either option would allow a detour past the roadblock and access to the goal, but one of the choices offered a much shorter detour. If the rats knew nothing about the layout of the maze, then they would be reduced to guessing and would go left 50% of the time and go right 50% of the time. Rather, the rats took the shortest path over 90% of the time!

Tolman's cognitive map experiments provide one of the clearest examples of what would later be called ***strong inference*** (Platt, 1964). The experimental strategy involved formulating two competing theoretical predictions. The behaviorist prediction of chance guessing was pitted against the cognitive prediction of a preference to the favorable detour. The findings both verified the cognitive map and falsified by the behaviorist trial-and-error prediction. Importantly, the cognitive map is the kind of theoretical construct that strict operationism would have difficulty accommodating. There is no procedure that directly measures the map. What you can do is derive predictions from the hypothesis that rats have cognitive maps – predictions about how they will behave in situations where such knowledge would be useful and where a movement sequence representation would be insufficient and test those predictions against the data. The lesson that psychology drew from Tolman was that theoretical constructs referring to internal representations could be scientifically legitimate if they generated distinctive and falsifiable predictions as the cognitive map had done.

Next, **Clark Hull** (born 1884) extended the neobehaviorist paradigm into a new set of intervening variables as part of his ***hypothetico-deductive*** and ***mathematical behaviorism***. He introduced the concept of the *reaction potential*, which measured the probability of a response. A problem in behaviorism was the challenge of explaining why an organism will sometimes respond to a stimulus, and sometimes not. If the response is but a conditioned reflex as the behaviorists held, then the decision to respond is not a voluntary one; one simply responds reflexively to a stimulus. But how can this explain the occasional nature of responding? Hull suggested that there were intervening variables that, if known, could be used to determine the precise probability of a response. This echoes Watson's goals of prediction and control, although now the prediction is not based just on the experimenter's control

of the stimulus, but also on the intervening variables. What were they? Hull theorized four of them: *drive*, *habit strength*, *incentive motivation* and *stimulus intensity.*

Hull's work on drive theory is one of his main contributions to psychology. He is famous for his ***drive reduction theory***. Extending Woodworth, he claimed that all organisms possess biological drives, referring to physiological needs that must be met. Hull focused on primary biological needs including hunger, thirst, pain avoidance, and sexual motivation. The term "drive" comes from the fact that when these needs are active, they *drive* behavior to the end of satisfying the need. Hunger is a classic example. When an animal is hungry, it is driven to eat. The drive state of the subject can then be used, in part, to measure the reaction potential. If a rat must solve a maze in order to get food, a rat that is not hungry may do nothing; it might just hang around the starting point licking itself. Again, recall that the behaviorist explains behavior as automatic and reflexive. The maze is the stimulus, and solving it is the response. Why doesn't the rat always respond? The neobehaviorist answers that it simply might not be hungry.

Drive is not the only predictor of behavior, however. Another is habit strength, which refers to the number of times a stimulus and response had been connected on prior trials. Habit strength increased as a function of the number of previous trials, which matches the observations of both Thorndike and Pavlov that multiple trials were often necessary before the animal performed a response. The third intervening variable was incentive motivation, which describes the strength of the reward. Chimpanzees prefer bananas to lettuce, although they will eat both. But when the reinforcer in a task is a banana, they are more likely to respond than if it was lettuce. Note that Hull, in accordance with logical positivism, is careful not to theorize too far beyond that data and suggest that the chimpanzee responds "because it likes bananas." Rather, it responds because bananas are powerful reinforcers. How do we know they are powerful reinforcers? Because the chimp responds to them. The last variable was simply stimulus intensity, corresponding to the claim that louder tones and brighter lights are more likely to elicit responses.

Hull had an organizing principle around all of these variables related to the concept of energy. He treated behavior as the product of energetic inputs that combine to produce a net excitatory potential, which is then discharged through the behavioral response. Drive contributes energy from within the organism, reflecting the physiological urgency of unmet biological needs. Incentive motivation contributes energy from without, reflecting the pulling power of the anticipated reward. Stimulus intensity contributes energy proportional to the physical intensity of the triggering stimulus. These energetic inputs combine multiplicatively to produce the total reaction potential.

RADICAL BEHAVIORISM

The last behaviorist we will consider is **Burrhus Frederick Skinner** (born 1904), whose approach shared Hull's mechanistic view of behavior but rejected the theoretical constructs introduced under logical positivism, such as intervening variables. Skinner proposed what he called ***radical behaviorism***, a framework that extended the definition of behavior to include private events, such as thoughts and feelings, so long as they could be analyzed in terms of observable contingencies and environmental control. In this way, Skinner's approach was highly operationist, and "radical" not because it was extreme, but because it broadened the scope of behavioral analysis to include internal processes, as long as they were not treated as causal agents outside the behavioral system and had a means of being measured. One prominent example of this is his analysis of language in his book *Verbal Behavior* (1957), where he argued that language is a form of operant behavior shaped by reinforcement, not a product of internal grammatical rules or mental representations. According to Skinner, children acquire language by imitating verbal behavior in their environment and receiving reinforcement for successful utterances. He applied a similar explanation to thought itself, treating it as *subvocal speech*, a covert form of verbal behavior subject to the same behavioral principles as spoken language.

Like Watson, Skinner was committed to empiricism, determinism, and the prediction and control of behavior. However, he differed from Watson in one important respect. Whereas Watson advocated the *passive* classical conditioning of Pavlov's conditioned reflex, Skinner took an *active* view of behavior, describing the organism as operating on its environment and receiving reinforcement or punishment as a consequence. Thus, Skinner's ***operant conditioning*** reversed the order of events from the classical theory. Instead of S-R, the theory is R-S; the response comes first, and the stimulus follows in the form of a consequence.

Skinner invented an experimental apparatus to test his ideas. The apparatus bears his name, the Skinner box, although he preferred the term *operant chamber*. The device was reminiscent of Thorndike's puzzle boxes. In fact, operant conditioning itself is reminiscent of the Law of Effect, except that Skinner was unwilling to consider terms like reward, which Thorndike had defined as providing a desirable outcome for the test subject. In contrast, Skinner's term reinforcement has no connotations about the desires of the subject. Skinner defined *reinforcement* operationally: a stimulus is a reinforcer if it increases the likelihood of the behavior it follows, regardless of whether it is subjectively pleasant. Similarly, a *punishment* is any stimulus that decreases the likelihood of a behavior. These definitions are not based on assumed desirability or aversiveness but solely on their observable effects on behavior.

The Skinner box was designed to allow rats to press a bar, which could be followed by any number of consequences. If the bar pressing was followed by the delivery of food, bar pressing tended to increase in rate. Thus, food was a reinforcer. If bar pressing resulted in a shock applied through the floor of the box to the rat's feet, then the rate of bar pressing decreased; shock was a punisher. Later, Skinner switched to pigeons, as he found them easier to train. He modified the Skinner box to allow pigeons to peck on a disk as a response.

Skinner distinguished between two different kinds of reinforcement and punishment: positive and negative. These terms refer to the addition or subtraction of a stimulus, respectively. *Positive reinforcement* occurs when a reinforcing stimulus is applied. As above, the delivery of food following bar pressing is a positive reinforcement. If the cage of the Skinner box is electrified and pressing the bar removes the shock, the rate of bar pressing will increase. The removal of shock is thus a *negative reinforcement*. Also, as above, the application of an electric shock following bar pressing is a *positive punishment.* If bar pressing results in the removal of access to a food tray or waterspout, bar pressing rates decrease, and the removal of the food or water is a *negative punishment.*

Skinner also found that in terms of the net effect on responding, reinforcement was more effective than punishment, and he set about manipulating different *schedules of reinforcement* to discover the most effective means of shaping behavior. He defined two general types of schedules. An interval schedule is based on reinforcements occurring at specific times. A ratio schedule is based on reinforcements occurring as a function of the number of responses made. Specifically, a *fixed interval schedule* means that reinforcement occurs on a set time schedule, say food is delivered every 90 seconds. On a *variable interval schedule*, food is delivered on a randomly set time schedule. After delivery of the food, the timer that controls the delivery is reset randomly. The reinforcement may occur after 90 seconds, but then it may occur 30 seconds after the first, followed by a delay of 100 seconds, and so on. The only requirement is that the rat, or pigeon, perform at least one response after the interval is up, and then the reinforcement is applied. The result of such schedules is that responding becomes tied to the timing of the schedule. Thus, on a fixed interval schedule of 90 seconds, the rat tends to respond once every 90 seconds or so and that is it. A similar example from the life of a typical student involves class schedules and exams. In most classes, exams occur about once every four weeks or so. As a result, studying also tends to occur once every four weeks or so!

A *fixed ratio schedule* refers to a delivery schedule based on a fixed number of responses. If a reinforcement occurs every 10 bar presses, that is a fixed ratio schedule. For a given time interval, the rat tends to press only as many times as required by the schedule. Most of the time the rat does not respond or does so only intermittently. But occasionally it will exhibit a brief burst of bar pressing, receive the reinforcement, and then return to its intermittent behavior. Last, a *variable ratio schedule* is one that bases reinforcement on a random number of responses. The rat may press the bar 10 times to get food on one trial but may have to press 30 times on the next trial to get food. As Skinner discovered, this schedule results in the highest rate of responding of all the schedules. The animal tends to keep pressing until reinforcement is received, and then continues on pressing, almost nonstop. With pigeons pecking on a disk to obtain seed, Skinner was able to elicit pecking sequences on the order of thousands of pecks! The birds were literally wearing down their beaks! In real life, we see the same behavior from slot machine gamblers. The slot machine also works on a variable ratio schedule, providing a payout every few pulls, but the number of pulls before the next payout is essentially random. So, the gambler just sits there pulling and pulling, waiting for the next payout.

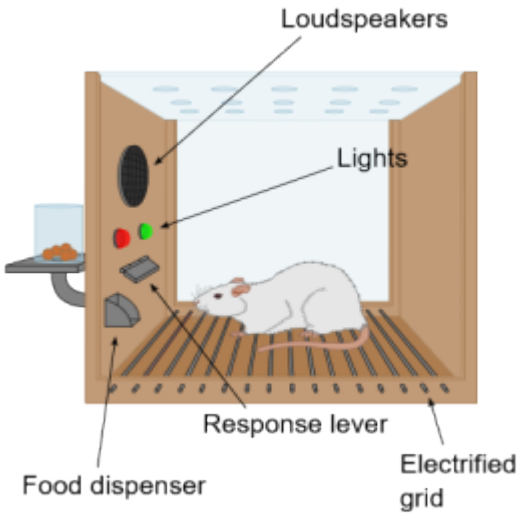


Figure 13.2. An example of a rat in a "Skinner box" or operant chamber, that can either reinforce or punish lever-pressing responses in the animal. (Original: AndreasJS Vector: Pixelsquid, CC BY-SA 3.0 via Wikimedia Commons, https://commons.wikimedia.org/wiki/File:Skinner_box_scheme_01.svg)

One interesting aspect of Skinner's work is that he felt that psychology, like all sciences, should exist for the betterment of human life. Thus, he felt that psychological knowledge ought to be applied where applicable to improve society. He used his technical know-how to develop several inventions. One of the first was the infamous *pigeon bomb.* During World War II, prior to the invention of guided missiles, air to ground combat was conducted mainly by carpet bombing large areas to ensure that the target was destroyed. Obviously, there was a lot of collateral damage. If only someone could ride along with the missile and steer it to the target. Skinner devised a means of using pigeons for this purpose. He crafted a missile nosecone with three compartments, each one housing a pigeon. In front of the pigeon was a disk upon which they could peck, just like in one of his operant chambers. However, this disk could rotate about an axis, and this rotation operated mechanisms in the missile that controlled the rudders, essentially steering the missile. The pigeon was trained to keep a set of crosshairs centered on the disk. If the crosshairs drifted to the left, the pigeon would peck on them, which would rotate the disk, recenter the crosshairs but also steer the missile, and bring it back on course. Skinner sought and received funding for the project from the U.S. government, and he was able to demonstrate the effectiveness of his design, unfortunately for the pigeons. However, before his project was fully mature, electronic guidance systems were developed that promised to be more reliable, and surely safer for pigeons. The funding dried up and the project was discontinued.

Next, Skinner applied his talents closer to home. What good is behaviorism if it can't improve child rearing, after all? If the goal of behaviorism is to predict and control, wouldn't it be nice to exercise this over one's children to ensure that they develop into happy and contributing members to society? Well, it's not exactly clear if behaviorism could achieve this goal. Famously, John Watson's two sons suffered from depression and one of them committed suicide. Was it wise for Skinner to push behaviorist child-rearing practices? The general public knew of Watson and behaviorism, so they were wary of such attempts. All Skinner had done, though, was invent a child-rearing aid called the *baby-tender*, later renamed the Aircrib. It was basically a climate-controlled enclosure that provided the child

with ample opportunities to operate on its environment, while making tending to the child easier on the parent. Was it a Skinner box for babies? Not exactly, but the public remained skeptical, and Skinner lost a healthy sum of money after his business partner in the venture skipped out with the investments. Eventually, Skinner found a reliable partner and sold approximately 1,000 Aircribs. Most reports are that parents were quite satisfied with them, and that Skinner's second daughter spent quite a bit of time in one and grew up to be a happy and well-adjusted woman (Thorne & Henley, 2001).

One of Skinner's most ambitious applications of psychology to society was his utopian vision described in the novel *Walden Two* (1948). As a behaviorist and mechanist, Skinner rejected the notion of free will. In his view, concepts such as personal responsibility, moral agency, liberty, and justice were cultural fictions that were not scientifically grounded. If all behavior is shaped by environmental contingencies, then even criminal acts result not from innate evil or personal choice, but from the histories of reinforcement and punishment an individual has experienced. This stood in stark contrast to hereditarian views such as those of Galton, who saw criminality as biologically inherited. In *Walden Two*, Skinner envisioned a society managed by behavioral scientists who carefully shape prosocial conduct through positive reinforcement. The result is a community free of crime, conflict, and suffering, but also largely devoid of individual freedom, at least as traditionally conceived. While some praised Skinner's vision as a blueprint for a more rational and humane society, many critics saw it as a threat to the values of liberty and democracy deeply embedded in American culture.

SUMMARY

The history of behaviorism reveals a sweeping transformation in the science of psychology. By eliminating various unscientific theories and methods, such as introspection, from psychology, we could say that the movement "wiped the slate clean" in terms of removing bad science. As the field matured, we saw that some theoretical constructs were gradually reintroduced, but only so long as they could either be verified or falsified, making psychology more consistent with modern philosophies of science.

While behaviorism dominated mid-20th century psychology, it gradually faced mounting criticisms. Researchers grew dissatisfied with its inability to account for complex phenomena such as language acquisition, planning, reasoning, and memory. The behaviorist framework struggled with behaviors that appeared internally generated or contextually flexible in ways that could not be reduced to stimulus-response chains or reinforcement schedules. This growing dissatisfaction set the stage for a transition into a new view of psychology that was better positioned to account for such complexity. Inspired in part by developments in computer science and information theory, psychologists began to conceptualize the mind as an information-processing system. The return to questions of mental representation, internal processes, and consciousness marked a turning point. Chapter 14 explores this cognitive turn, how it emerged, what problems it aimed to solve, and how it continues to influence contemporary psychological science.

KEY TERMS

Key Terms

- behaviorism, comparative psychology, Morgan's Canon, tropism, unconditioned stimulus, unconditioned response, conditioned stimulus, conditioned response, conditioned reflex, classical conditioning, neobehaviorism, logical positivism, verificationism, falsificationism, operationism, latent learning, cognitive map, cognitive behaviorism, strong inference, hypethetico-deduction, mathematical behaviorism, intervening variable, reaction potential, drive reduction theory, radical behaviorism, operant conditioning, reinforcement, punishment

STUDY QUESTIONS

Study Questions

1. Define Morgan's Canon and how it should be used to interpret animal behavior.
2. Compare and contrast reasons for accepting a comparative psychology.
3. Identify parallels between Watson's views on behaviorism and British empiricism.
4. Explain the difference between positivism and logical positivism.
5. Explain the difference between behaviorism and neobehaviorism.

CHAPTER 14: THE COGNITIVE REVOLUTION

INTRODUCTION

Learning Objectives
Understand:

- Kuhn's definition of paradigmatic science and paradigm shifts
- How digital computing and information theory represent a paradigm shift for psychology
- Chomsky's critique of Skinner's behaviorist approach to language
- How information theory and cybernetics are used in cognitive psychology
- What a Turing machine is
- What a neural network is
- the difference between strong and weak AI

Throughout the first half of the 20th century, behaviorism and neobehaviorism in their various forms became the dominant force in American psychology. Things began to change by the middle of the century when the occurrence of several events began to cast doubt on the success of the S-R chain to explain certain behaviors, especially complex ones. Recall that the functionalist Herbert Spencer Jennings had argued, contrary to Loeb, that most behaviors were too complex to be explained at the simple reflexive level of analysis. While behaviorism initially demonstrated the success of this approach, over time the necessity of invoking various intervening variables clarified the need for a more cognitive approach. This sets the stage for the cognitive psychology that still dominates as the current school of thought in psychology, and the events surrounding this transition are commonly called the *cognitive revolution*.

A SCIENTIFIC REVOLUTION?

A variety of writers and historians of psychology have referred to the events in the 1950s and 1960s that triggered this shift in psychology as a scientific revolution, using the phrase cognitive revolution to describe the overthrow of behaviorism (e.g., Baars, 1986; Gardner, 1985). Is this term accurate? To understand this, we need to consider the definition of a scientific revolution and determine whether the shift meets the definition.

The concept of a scientific revolution is credited to philosopher of science **Thomas Kuhn** (born 1922). The logical positivists and Popper had created a picture of science that promised objectivity. So long as the hypothetico-deductive methods were employed, and theories were verified and falsified, it was generally understood that science was gradually eliminating false ideas about reality and converging to the truth in an objective manner. Kuhn, however, was working from a social science perspective, and understood that science was done by people, and people can have biases. Just as we have already studied Bacon's distinction between the anticipating and interpreting scientist, Kuhn asked whether modern science had truly eliminated the anticipation of nature. He was not, however, providing a means of eliminating bias but instead wanted to describe and understand the way personal bias could influence scientific progress. Kuhn noted that in any era of science, there is a dominant paradigm that shapes the way scientists view their field. It affects the nature of the questions that are asked, and the methods used to answer them. In essence, the paradigm governs the progress that occurs during that era. Developments in such an era occur gradually, as scientists work within the paradigm. Kuhn called this *normal*, or ***paradigmatic science***.

However, there comes a time when a new set of ideas begins to take hold. These new ideas result in new questions, and new data, the kind which the old paradigm is not able to explain. At some point, a critical mass is reached when there is too much new that is inconsistent with the old paradigm, which must be rejected in favor of a new one. Kuhn coined the term ***paradigm shift*** in reference to this event, and it is synonymous with the idea of a scientific revolution. The term itself is perhaps overly dramatic, as it never happens that the new paradigm wins over all the proponents of the old one, with the revolution occurring overnight. We should not be tempted to imagine a marauding band of new-paradigm scientists invading university science buildings and throwing out the old guard! Rather, it usually takes a generation for the shift to be complete. The older scientists still hang around, defending their positions, until they eventually retire and are replaced by younger scientists who tend to follow the new paradigm. Kuhn's key example of a paradigm shift was Pasteur's work on bacteria and the formulation of the germ theory of illness, following the establishment of which it simply was no longer allowed to talk of disease as being caused by miasma (bad air, the previous belief dating back several centuries).

To apply this analogy to psychology, we need to characterize behaviorism as a dominant paradigm, and that the paradigm shift to cognitive psychology was marked by a lot of brand-new ideas and methods that could not be absorbed by previous paradigms. There are at least two problems with this analogy, as discussed in Goodwin (2008). The first is that behaviorism was never a dominant paradigm. During the behaviorist years, functionalists such as Woodworth were still active. Further,

behaviorism never caught on in Europe, which was still following various continental psychologies that were more mentalistic. One example of this was **Frederick Bartlett** (born 1886), working in England on studies of long-term memory and how ***schemas*** affect our ability to recall events and stories. Another was Jean Piaget, from Switzerland, who used the concept of schemas to develop a cognitive explanation of child development. But there was also cognitive work being done in America too; not everyone was a behaviorist convert. Goodwin (2008) listed as examples the discovery of the *Stroop effect* (Stroop, 1935), which demonstrated interference in attention-related processes, and the work of Jenkins and Dallenbach (1924) who demonstrated the role of interference in forgetting and memory.

The second problem with calling cognitive psychology a revolution is determining that the ideas introduced during the relevant time frame represent brand new ideas. This was only partly true. Much of the work that defines cognitive psychology centers on processes like perception, attention, memory, and problem solving. The earliest experimental psychologists in Europe, including Helmholtz and Fechner, Wundt, Ebbinghaus, and the Gestaltists, had previously studied all these topics. In some ways, it seems that cognitive psychology merely represented a revival of older research programs that had not been in fashion for a few decades.

So what exactly were the events in the 1950s and 1960s that inspired so many to call it a revolution? This largely stems from the invention of digital computers, and associated theories of information processing. The first key figure is **Alan Turing** (born 1912), a British mathematician and logician, who developed a formal model of computation now known as the ***Turing machine***. Designed as an abstract device to explore the limits of computation, the Turing machine could read and write symbols on an infinite tape according to a set of rules. Though simple in structure, it could simulate any computable process, making it a theoretical blueprint for digital computers. Turing's insight, that complex symbolic operations could be broken down into simple, rule-based steps, offered a powerful analogy for human thought. If machines could process information algorithmically, might the human mind do something similar?

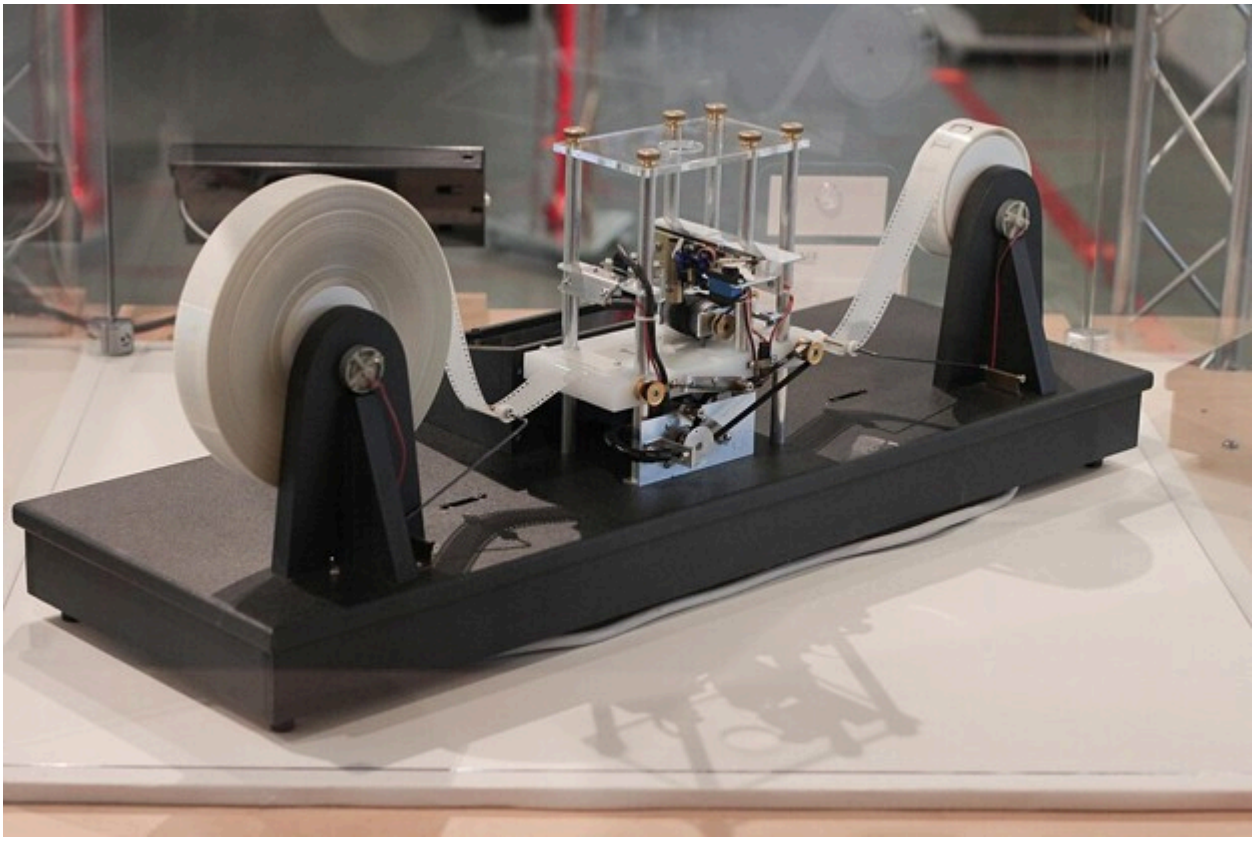


Figure 14.1. A model of a Turing machine that can read or write symbols on tape (Rocky Acosta, CC BY 3.0 via Wikimedia Commons https://en.wikipedia.org/wiki/Turing_machine#/media/File:Turing_Machine_Model_Davey_2012.jpg)

Meanwhile, **Claude Shannon** (born 1916), working at Bell Labs in New Jersey, laid the groundwork for ***information theory***. In his 1948 paper "A Mathematical Theory of Communication," Shannon introduced the idea that information could be quantified in terms of ***bits***, a contraction of the term binary digit, and which measures the reduction of uncertainty when a signal is transmitted. Though his work was initially intended to improve telephone and radio communication, psychologists soon saw its broader relevance. The brain was likened to a communication system, and neurons were envisioned as encoding, transmitting, storing, and decoding information. Memory, perception, and attention could now be conceptualized in terms of information flow, rather than mere behavioral responses.

These innovations provided cognitive psychology with two key ideas: that mental processes could be described in terms of computation, and that information itself could be measured and analyzed. Together, they offered an alternative to behaviorism's rejection of internal mental states. Cognitive psychologists began to explore the mind as a ***cybernetic*** system, treating it as an information-processing system that receives inputs, transforms them, and produces outputs. Thus, the cognitive revolution was not just a rebellion against behaviorism, it was also an embrace of new conceptual tools.

These tools proved useful in rebutting the behaviorist approach to a hallmark of human complexity, language. Cracks in the behaviorist approach were already showing before the cognitivists came to dominate. One of the first critiques came from the behaviorist **Karl Lashley** (born 1890), who was a graduate student at Johns Hopkins while Watson was still there. Lashley had spent some time exam-

ining the ability of the behaviorist S-R chain to explain complex human behaviors like language and playing a musical instrument. One problem with the S-R chain approach is the rapidity of these behaviors. In speech, for example, the behaviorist treatment starts with breaking speech down into phonemes, considered the smallest units in speech. The word /bat/, for example, consists of three phonemes, /b/, /a /, and /t /. They are not quite equivalent to letters but rather refer to the primary sounds made in a speech utterance. The S-R chain approach says that in order to say /bat/, the phoneme /b/ is the stimulus, while the /a/ is the response. In turn, the /a / becomes a stimulus and /t/ is the response. In this way, speech is uttered as a serially ordered act. Phonemes are produced in a serial order, or sequence, with each phoneme a response to the one that preceded it, and a stimulus to the one that follows. But in order to respond to a stimulus, we must detect the stimulus. The reaction time work of Donders and Wundt made it clear that this process takes time, but phonemes are produced in such rapid succession that there is no delay between them. In fact, they are co-articulated, meaning that while producing one phoneme, the vocal tract is preparing to produce the next one. Likewise, playing a musical instrument, depending on the nature of the music, the notes may occur at such a rapid pace that there is no time to detect the stimulus and process the response. The other major problem stemmed from a certain kind of speech error made famous, or infamous, by the Reverend William Archibald Spooner. These errors, called *Spoonerisms,* were hard for the S-R chain theory to explain. Spooner was famous for speaking lines like "You have hissed all of my mystery lectures," instead of, "You have missed all of my history lectures," and "It is kisstomary to cuss the bride," instead of "It is customary to kiss the bride." These errors arise because a phoneme from the end of the phrase has been transposed with one at the beginning. The S-R chain theory could explain why sometimes a stimulus is followed by an incorrect response, but not why that incorrect response would be an anticipation of a phoneme that would not occur until later in the phrase, and it especially could not explain why the omitted phoneme from the beginning was inserted at the end. Lashley published these arguments in his 1951 paper "The Problem of Serial Order in Behavior." The alternative must be that these phrases are planned in advanced, and then executed, not simply triggered as a series of stimuli and responses. A complete theory of language must account for these internal planning processes.

Shannon's mathematical theory of communication is well positioned to do this. The theory provided a way to describe messages abstractly, in terms of structure, redundancy, and transmission. Further, Turing's theory of computation outlined how we might imagine language and grammar as a computational process. These ideas offered an alternative vocabulary for describing mental processes: one based not on reflex chains, but on internal rule systems, representations, and transformations.

The decisive blow to behaviorism came from the psycholinguist **Noam Chomsky** (born 1928) who made a case for a nativist approach to language in 1959, in response to Skinner's 1957 book *Verbal Behavior*, an attempt to explain language learning in terms of reinforcement. Chomsky argued that while the words of a language might be learned by imitation and reinforcement, the rules of language, its syntax, and grammar were far too complex to be explained in this way. He made two arguments. The first was called the *poverty of the stimulus*. Children simply do not encounter a sufficient degree of grammatical variation within their first three years of life, but by then most children produce sophisticated and grammatically fluent speech. The second was called the *degeneracy of the stimulus*. This refers to the difficulty in mapping the surface structure of language (the actual word forms used) from the deep structure of language (the intended meaning of the statement). People often speak in metaphor or other figurative language, where the intended meaning does not match the literal words chosen. One example might be "The mother flipped her lid when she found that her son was playing baseball inside the house and broke a window." The phrase "flipped her lid" is an idiom that suggests

she became angry in a particularly notable way. Chomsky used a different example, less metaphorical, "Flying planes can be dangerous." We may notice an ambiguity in this phrase. Which is meant, that the act of flying a plane is dangerous, or that a plane flying around is dangerous? The mapping from surface structure to deep structure, from words to interpretation of intent, is ambiguous, and this is exactly what Chomsky means by stimulus degeneracy, sometimes called stimulus equivalence. Despite such ambiguities of language, children have little trouble decoding such messages. The upshot is that Chomsky concluded there was no way for simple behaviorist principles to explain this and so he argued that children must bring innate grammatical knowledge to the acquisition task. He called this the *Language Acquisition Device* which constrained the space of possible grammars and allowed convergence on the correct grammar despite both the quantitative poverty and the qualitative degeneracy of the available stimulus input. The nativist conclusion was the direct antithesis of Skinner's empiricist argument, and the force of the combined argument contributed decisively to the displacement of behaviorism by the cognitive and linguistic frameworks that followed.

THE CONTENTS OF COGNITIVE PSYCHOLOGY

One of the earliest cognitive psychologists was **George Miller** (born 1920). He wrote one of the first papers applying information theory to psychology (Miller & Frick, 1949) and in 1956 wrote a very influential paper on the capacity limits of short-term memory (STM) and other cognitive processes. He had noted that, in terms of limits on information we are able to attend to or retain in STM, the number 7, or some number very close to it, keeps recurring in all of the published reports. He estimated it as 7 +/-2, or 5–9 items. The significance for cognitive psychology is that his review reveals not only that processes like memory are measurable and quantifiable, but that the measurements are reliable. Miller used cybernetic concepts like *recoding* of information, which refers to our ability to organize data in flexible ways, and "chunk" items together in STM (Goodwin, 2008). Later, Miller, Galanter, and Pribram (1960) borrowed the cybernetic concept of *feedback control* from systems engineering to develop their Test-Operate-Test-Exit (TOTE) model as a cognitive version of the reflex arc. In the execution of a goal-directed movement, instead of referring to a sequence of stimulus and response, the person defines a goal state and tests to determine if the goal state has been achieved. If not, an operation is performed to bring the current state closer to the goal state, and the test is repeated to see if the operation achieved the goal. The Test-Operate-Test sequence is repeated indefinitely until the goal state is reached, at which point the system exits the loop. For example, in reaching to pick up a cup, the goal state is defined as the hand in contact with the cup. The current state is that the hand is not in contact with the cup, so an operation is performed to move the hand closer to the cup. During the reach, feedback information is used to test whether the hand is on target. Operations, in the form of minor corrections to the reach trajectory, are continuously performed until the goal state is reached, that is the cup is grasped. At that point the visuo-motor system exits the loop; the reach is completed.

Donald Broadbent (born 1926) was another early proponent of cybernetic psychology. Broadbent borrowed the concept of an electronic *filter* and used it as a metaphor for how attention works. Information processing theory was originally developed to describe communication in telephone systems, and treated concepts like the signal (e.g., the voice signal transmitted over phone lines) and noise (e.g., static in the phone lines unrelated to the signal). Concepts like the *signal-to-noise ratio* helped quantify an intelligible vs. unintelligible message. If the noise could be described separately from the signal, then filters could be designed that would separate the signal from the noise, decrease the noise, and thereby increase the signal-to-noise ratio. In considering human abilities like the *cocktail party effect*, where it is possible to "tune in" on a particular person's voice in a noisy room, blocking out the conversations of others in the background, Broadbent noted how this process works much like a filter, attenuating the background noise.

The idea that there are limits on our ability to process information is consistent with the cybernetic concept of *channel capacity*, or *bandwidth.* Like in an internet connection, there are high and low bandwidth connections, referring to the number of bits per second that can be transmitted over the connection. In 1954, **Paul Fitts** (born 1912) pioneered the application of the bandwidth concept to psychology. To understand his work, we first need to define exactly what a bit is, as a unit of information. To gain information means to remove some uncertainty from a previous situation, and the

amount of information gained is proportional to the amount of uncertainty removed. Consider flipping a coin. As the coin is tossed into the air, there is uncertainty about the outcome. Observing that it came up "heads" removes the uncertainty, gaining us some information. How much? In coin flipping, there are only two possible outcomes, and so the amount of uncertainty was directly related to the two possibilities. There cannot be any fewer than two possible outcomes and still have any uncertainty. If the coin was a cheat, and had heads on both sides, then there would be no uncertainty, and no information gained. We simply need a means of converting the number of uncertain possibilities into a measure of bits. There is an equation that will calculate the bits, H, associated with any event:

$$H = \log_2 N \qquad \text{(Eq. 14.1)}$$

where N is the number of equiprobable outcomes. In flipping a double-headed coin, no information is gained because $\log_2 1 = 0$ bits. In flipping a fair coin, $\log_2 2 = 1$ bit of information is gained.

Fitts was interested in measuring the information capacity of the human visuo-motor system in performing a simple pointing task. Fitts was influenced by Woodworth's (1899) early work on the speed/accuracy trade-off and how, when moving toward a smaller target, we tend to move slower to enable the required accuracy. Fitts realized that this could reflect a limited bandwidth in the system, such that pointing to smaller targets involves processing more bits of information, and that the slower movement results from the increased time needed to process the extra information. First he needed a way of measuring the bits involved in a simple pointing task, and to do this he needed to determine the factors that increase the duration of such movements. In his studies, he instructed subjects to tap back and forth, using a pencillike stylus, between two rectangular targets, as shown in Figure 14.2. They were instructed to move as fast as they could but without missing the target. Fitts found that two factors, the amplitude, A, of the movement and the width, W, of the targets, affected the movement time (MT). As A increased, MT increased, and as W decreased, MT increased. Thus, A was directly proportional to MT while W was inversely proportional to MT. Thus, the combined influence of A and W could be expressed as a ratio A/W. To convert this to bits, he simply used the formula $H = \log_2 2A/W$ (Fitts added the number 2 to the numerator for reasons we will not go into). If Fitts was correct about his limited bandwidth hypothesis, then the number of bits associated with a given task would determine MT. He performed a simple linear regression of MT against his ratio, which he abbreviated as the *Index of Difficulty* (ID) and found that the function was linear and accounted for over 95% of the variance. Such results are almost unheard of in psychology! The regression equation relating MT to ID became known as Fitts' Law:

$$MT = a + b \log_2 \left(\frac{2D}{W} \right) \qquad \text{(Eq. 14.2)}$$

where a and b are the experimentally determined coefficients relating to the y-intercept and slope of the regression line, respectively.

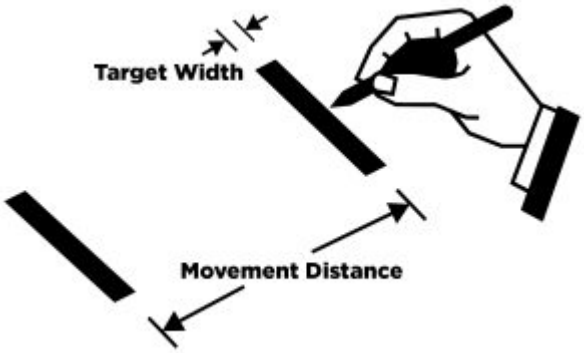


Figure 14.2 Testing apparatus used to discover Fitts' law.

Further on, **Ulric Neisser** (born 1928), working at Cornell University, established the name of this new field with his book Cognitive Psychology (1967), in which he laid out the scope of the new field in terms of the study of perception, attention, pattern recognition, and memory. Subsequently, **Richard Shiffrin** (born 1942) coauthored, with his doctoral advisor Richard Atkinson, the Atkinson-Shiffrin (1968) model of memory, which gave us the standard model involving sensory memory, short-term memory, and long-term memory that dominated at least until the contributions of **Alan Baddeley** (born 1934) and his theory of working memory (Baddeley, 1992). After establishing himself at Indiana University, Shiffrin also contributed to a key theory of attention which entailed the ideas of automatic and controlled processes (Shiffrin & Schneider, 1977).

COGNITION, COGNITIVE NEUROSCIENCE, NEURAL NETWORKS, AND ARTIFICIAL INTELLIGENCE

The success of the cybernetic approach generated a lot of interest in trying to understand the brain as a computer. Computers operate using logical operations, implemented through logic gates, tiny switches that can be in an ON or OFF state, representing binary code. Findings in neuroscience suggested something similar with neurons, which have an activation threshold and thus will either generate an action potential in response to a stimulus, or not. Neurons too seem to have ON or OFF states, like a computer's logic gates. This led McCulloch and Pitts (1943) to envision neural connections as enacting a sort of logic. For example, consider two neurons, Neuron A and Neuron B, and a third Neuron C that has an activation threshold with a value of 2 (this is an arbitrary value chosen for simplicity). If the signal from Neurons A and B both have individual strengths of 1, then neither A nor B can alone stimulate an action potential in Neuron C. However, if both A and B stimulate C simultaneously, then their combined input on C is sufficient to cross its threshold. This is an example of a logical function called AND. If we treat the activation of neurons as ON or OFF to correspond to logical values such as TRUE (ON) and FALSE (OFF), then Neuron C is TRUE only when Neurons A AND B are true, otherwise Neuron C is FALSE. If we increase the activation strength of Neurons A and B to a value of 2, and thus equal to Neuron C's threshold, then we have an OR logical circuit, such that Neuron C is true if Neuron A OR Neuron B is true. From this simple circuitry, a variety of more complex logical processes could be created, including AND NOT and XOR functions. Such a simple logic circuit, composed of neurons, is called a ***neural network***. When we use such logical computations as a model for how neurons might function, then it is called an ***artificial neural network*** (ANN).

But is it possible for neurons to increase their activation strength? The work of **Donald Hebb** (born 1904), published in his 1949 book *The Organization of Behavior*, shows how this is possible, giving us a famous principle in neuroscience now called Hebb's Law. As he put it, "When an axon of cell A is near enough to excite cell B and repeatedly or persistently takes part in firing it, some growth process or metabolic change takes place in one or both cells such that A's efficiency, as one of the cells firing B, is increased." A common adage that summarizes this finding is: *neurons that fire together, wire together*.

Approximately a decade later, Rosenblatt (1958) extended these ideas with the first trainable ANN, called the *perceptron*. This ANN was meant to be a model for how perception might work. A perceptron contains an input layer, which can represent the presence of certain visual features in a stimulus. Each input has an associated weight, or activation strength that it sends to the output layer. The output layer will respond with either TRUE (if the total activation strength crosses its threshold) or FALSE. If the output layer response is incorrect, then the perceptron will dynamically adjust the weights of the input layer until the output layer response is correct. Consider an example of training a perceptron to recognize photographs of dogs. Each photograph will contain certain visual features that will activate some of the neurons in the input layer, which then send activation to the output layer. If the output cell returns a value of TRUE, then the network has identified a dog in the image. But what if it is not a dog but a cat, and the response is incorrect? Then the input weights are dynamically adjusted until the perceptron returns a FALSE when given images of cats and only returns TRUE

when presented with actual dog images. In this way, we would say that the neural network has been trained in a classification task: to label pictures as either "dog" (TRUE) or "not dog" (FALSE).

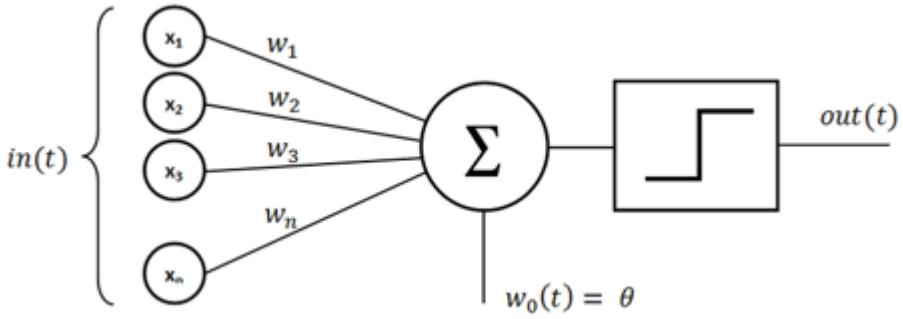


Figure 14.3. A diagram of the original perceptron neural network, showing an input layer that is summed according to a weighting scheme, followed by an output layer that responds with a TRUE/FALSE binary result. The input weights can be dynamically adjusted based on feedback about the decision outcome (Mayranna, CC BY-SA 3.0 via Wikimedia Commons https://commons.wikimedia.org/wiki/File:Perceptron_moj.png)

One limitation of the perceptron model was that it was a single layer network and could not solve more complex classification tasks. It took a while (a period sometimes called the AI Winter), but eventually the idea of backpropagation in ANNs was proposed (Rumelhart et al., 1986). This concept allowed for more complex, multi-layer neural networks to send error messages backward through the network, allowing for training of so-called deep networks. Such deep learning algorithms revolutionized ANNs and research in artificial intelligence (AI). Since then, the development of *convolutional neural networks* and *recurrent neural networks* have sparked a massive growth in AI, leading to the now widespread Large Language Models such as ChatGPT. These are based on even newer types of ANNs called *transformers*, which use a mechanism called attention (referring here to a mathematical operation that assigns importance to different words, not the cognitive process we commonly think of) to consider all the words in a sentence, or even an entire paragraph, at once. This allows them to model complex relationships between words and generate fluent and contextually appropriate responses. Whereas early neural networks struggled with long-term dependencies in language (like understanding a sentence where the meaning depends on something mentioned much earlier), transformers can keep track of much more information and learn from massive amounts of text. Models like ChatGPT are trained on billions of words from books, websites, and articles to predict and generate human-like text, making them especially powerful for tasks involving language, reasoning, and even creativity.

We have already discussed the challenges of understanding artificial intelligence (AI) in Chapter 8, with the contrast between the Turing Test and Searle's Chinese Room. For Turing, the test of intelligence is effectively behavioral: does the machine convincingly behave as an intelligent human? Searle, by contrast, argued that true intelligence requires more than surface behavior, it depends on what is happening internally. He emphasizes the absence of genuine understanding or semantics in the machine, regardless of its output. This distinction between outward behavior and inner processes also echoes the historical divide between behaviorism and cognitive psychology.

The AI debate also raises a deep philosophical question: is the human mind unique, or could it, in principle, be replicated by a machine? From a cybernetic or computational perspective, the brain is

often described as a kind of biological computer, with neurons and synapses serving roles analogous to circuits and logic gates. This view aligns with the position known as *Strong AI*[1], the idea that thinking and intelligence are the result of rule-based manipulation of information, and that a properly programmed computer could be genuinely intelligent. In contrast, *Weak AI* holds that machines can only simulate intelligent behavior without true understanding. This is the position endorsed by Searle in his critique.

Part of the debate over artificial intelligence recalls the traditional mind-body problem. Proponents of Strong AI argue that human intelligence is fully explainable in computational terms, as in the model of a Turing machine. A key feature of Turing machines is that their operations can be defined independently of the physical material on which they are run. In other words, the same computational rules, or "software", could, in principle, be implemented by a biological brain or a CPU, making the physical substrate, or "hardware", irrelevant to intelligence.

Searle challenged this view, arguing that it amounts to a form of conceptual dualism. If intelligence is entirely in the abstract computation, then it implies that the mind is independent of the brain. In contrast, Searle contends that genuine understanding depends on the specific causal and biological properties of the brain. Computation alone, he argues, is insufficient to produce a mind, and symbol manipulation lacks the semantics and subjective experience that define consciousness.

Searle's argument, particularly his emphasis on the biological and causal properties of the brain, has been seen as a challenge to purely computational models of mind. This emphasis resonates with more recent trends in cognitive science, such as ***embodied cognition***, which argue that cognition is not just implemented by the brain but deeply shaped by the body and its interactions with the world. Perhaps only time will tell as to how much this newer view will influence the field, but until then, the information-processing approach to cognition remains the current force.

1. Searle (1980) introduced the terms Strong and Weak AI as defined here. It should be noted that in modern technological discourse, these terms are used differently to describe narrow or single use AI systems from more advanced and flexible Artificial General Intelligence systems. We are sticking with Searle's original usage here.

SUMMARY

With this chapter, we complete our historical overview of the development of experimental psychology. From early philosophy of mind to the beginnings of a science of mind, and the laboratories of the functionalists and behaviorists, to the cognitive revolution and its use of information theory, we have traced a lineage of thought that has shaped psychology into a modern science of mind and behavior.

Cognitive psychology, in many ways, marks the culmination of these efforts. It offered a framework that preserved the empirical rigor of behaviorism while expanding the field's scope to include the rich internal processes once deemed unmeasurable: attention, memory, reasoning, perception, and language. Though the models have evolved, some becoming more mechanistic, others more biologically or computationally inspired, the basic premise of cognitive psychology remains central to the discipline today.

Indeed, the cognitive approach has proven remarkably adaptable. Cognitive theories and methods have infused nearly every area of psychology. In social psychology, cognitive theories help explain how people form impressions, make attributions, and manage biases. In clinical psychology, cognitive-behavioral therapies are built on models of thought patterns and belief structures. Emotional processing is now often understood in terms of cognitive appraisal and regulation. Even personality psychology has seen the integration of cognitive and cybernetic frameworks (e.g., DeYoung, 2015).

Thus, while psychology continues to diversify and evolve, the cognitive approach remains a dominant force. It has reshaped how we conceptualize the mind, how we design experiments, and how we intervene in human lives. The story of psychology does not end here, but with the rise of cognitive science, we arrive at the threshold of our contemporary moment. The remaining chapters in this book treat a different history within psychology, that of abnormal and clinical psychology.

KEY TERMS

Key Terms

- paradigmatic science, paradigm shift, schema, Turing machine, information theory, cybernetics, poverty of stimulus, degeneracy of stimulus, Language Acquisition Device, feedback control, channel capacity, Fitts' Law, neural network, artificial neural network, Perceptron, Strong AI, Weak AI, embodied cognition

STUDY QUESTIONS

Study Questions

1. Define the term cybernetics.
2. Describe Kuhn's concept of a paradigm shift in science.
3. Explain the difference between Strong and Weak AI.
4. Summarize Chomsky's critique of Skinner's approach to language.
5. Describe Fitts' discovery of the Index of Difficulty and the implications of his findings for cognitive psychology and cybernetics.

1.
2.
3.

4. .
5.

CHAPTER 15: THE DEVELOPMENT OF MIND

INTRODUCTION

Learning Objectives
Understand:

- Recapitulation theory and its historical significance, along with its flaws.
- Baldwin's concept of circular reactions and his theory of the Baldwin effect
- Piaget's constructivist theory of cognitive development, including schemas, assimilation, accommodation, equilibration, and the four stages
- How Vygotsky's sociocultural theory differs from Piaget's account of how knowledge develops, especially in its treatment of language and the zone of proximal development
- The core claims of ethology and what Lorenz's work on imprinting revealed about social development
- Harlow's surrogate mother experiments and what they demonstrated about the basis of infant-caregiver attachment
- Bowlby's attachment theory and the ethological and cognitive influences that shaped it
- Ainsworth's Strange Situation procedure and the attachment patterns it revealed
- What core knowledge research revealed about infant cognition, and how it challenged both Piagetian constructivism and the behaviorist blank slate
- The "amazing baby" phenomenon in developmental research and why scientific enthusiasm can become a source of bias
- How the dynamical systems approach reframed development as an emergent rather than pre-programmed process

The preceding chapters have told the story of how philosophers and psychologists came to understand the adult mind. We have traced arguments about where knowledge comes from, how perception works, what the mind is made of, and how it relates to the body and to the world. What we have not yet asked is perhaps the most obvious question of all: how does the mind get that way in the first place? Where does it start, and how does it arrive at the capacities we have been studying?

The question of psychological development might seem like a late addition to the history of psychology, and in some ways it is. But it is worth recognizing that the developmental question has been lurking in the background of almost everything we have covered. Recall that when we asked whether knowledge is innate or acquired from experience, we were already asking a developmental question: does the mind arrive equipped, or does it build itself up over time through contact with the world? Plato's reminiscence theory implied that the soul already possesses knowledge before birth. Locke's

blank slate claimed the opposite, that the mind begins with nothing and writes itself through experience. Kant took a different view still, arguing that the mind is born with innate organizing structures but that their full operation unfolds over time. Helmholtzian unconscious inference specifically requires a perceptual learning phase, and we previously hinted at Jean Piaget's contribution to that. Each of these positions carries with it an implicit claim about the developing child.

The study of development, then, is a return to these themes, this time with actual children as the subject of inquiry rather than the philosophical imagination of adult theorists. And as we shall see, what researchers found when they actually looked at developing children turned out to be considerably more interesting, and perhaps more surprising, than most of the prior theorizing had anticipated.

G.S. HALL AND THE INVENTION OF DEVELOPMENTAL PSYCHOLOGY

We have already met Granville Stanley Hall in Chapter 12 as the "Great Organizer" of American psychology, the person who established the first psychology laboratory in the United States, founded the American Psychological Association, and trained the first generation of American experimental psychologists. What we did not fully address is that Hall was also the person most responsible for turning the developing child into a legitimate object of psychological inquiry.

Hall's interest in child development grew directly from his reading of Darwin and Spencer. If the human mind was the product of evolution, then its development in the individual ought to reflect something of the history of the species. This was a popular idea in late 19th century biology, associated primarily with the German naturalist Ernst Haeckel, who proposed that *ontogeny recapitulates phylogeny*, that is, the developmental stages of the individual organism replay the evolutionary history of the species. Applied to psychology, this ***recapitulation theory*** meant that the stages a child passes through in its mental development ought to correspond, roughly, to the psychological stages that the human species passed through over evolutionary time. Hall adopted recapitulation theory enthusiastically. In his view, early childhood corresponded to a primitive, animal-like stage of human evolution; middle childhood to a more tribal, pre-civilized stage; and adolescence to a period of storm and struggle corresponding to humanity's turbulent emergence into civilization.

Recapitulation theory is, by modern standards, thoroughly wrong, and it carried ugly implications that Hall did not resist — the notion that certain "primitive" peoples represented earlier stages of human evolution was racism dressed up in scientific language, of a piece with the Social Darwinism we encountered in Chapter 11. But even with that concern firmly registered, Hall's contribution to developmental psychology was significant. He was the first to insist that children's minds were a proper subject for systematic scientific study, and he backed this insistence with one of the most ambitious data-collection efforts in the history of early psychology. Hall administered thousands of questionnaires to children, parents, and teachers in an effort to map out what children at various ages actually knew. The method was rough, and the interpretation was distorted by recapitulation theory, but the basic idea of studying the child empirically was the founding of developmental psychology.

ETHOLOGY AND BIOLOGICAL FOUNDATIONS

Although recapitulation theory remained controversial, the applicability of evolutionary theory and biology on development psychology was not. In Europe in the early 20th century, a new tradition emerged that first involved the study of animal behavior, which was at first distinct from the comparative psychology work we covered in Chapter 13. Rather than studying animal learning and generalizing the findings to human psychology, these researchers were interested in innate animal behaviors that could be observed very early in life and were thus considered to be *instincts*. Whether humans could be said to have instinctual behaviors remains a debate.

The notion of an instinct was developed through the Nobel prize winning work of **Konrad Lorenz** (born 1903) and **Niko Tinbergen** (born 1907). They observed many animal species exhibit specific, repetitive behaviors that could be seen to occur early in the lifespan, and even without the individual animal ever being exposed to a conspecific, that is, another of its species. Such observations suggest that the behavior could not have been learned and thus must somehow be encoded into their behavior genetically. And because these behaviors had some adaptive or survival value, such instinctual behaviors must have evolved. Such discoveries included the famous zigzag mating dance of male three-spined stickleback fish, egg rolling and retrieval behaviors of the Greylag goose (i.e., when an egg is removed from their nest, they perform a series of head bobbing movements over the egg, using their beak to push the egg back into the nest), and beak pecking responses in newly hatched European herring gulls (i.e., the hatchlings peck at a distinct red dot at the tip of the parent's long yellow beak, which causes the parent in turn to regurgitate food and feed the chick).

Because these behaviors were performed in the same way every time, they were called *fixed action patterns*. Such behaviors were said to be released in the presence of a *key stimulus*, and numerous studies were undertaken by Lorenz and Tinbergen to understand the relevant properties of the stimulus. A common finding was that a stimulus that contained highly exaggerated characteristics, dubbed the *supernormal stimulus*, elicited strong versions of the fixed action pattern. For example, a supernormal herring gull beak could be a long red stylus with a yellow stippling pattern at the end (i.e., an exaggerated version of a long thin red shape that had some patterning) elicited stronger pecking responses from herring gull chicks than a more accurate model. One of the more famous discoveries of supernormal stimuli was Lorenz's work with the Greylag goose. Newly hatched goslings normally stay close to their mother after hatching in the nest and follow the mother goose in single file, staying close for safety and to ensure getting fed. This behavior is called *imprinting*, and Lorenz found that it was an instinct that depended on exposure to the mother goose on the very first day of life. If the chick was kept alone in an incubator for their first day after hatching before being introduced to the nest, the chick would not imprint. Lorenz called this time frame the *critical period*, and exposure to the key stimulus was necessary during this time for the instinct to appear. Most surprising was his finding that if Lorenz himself was the first moving object the goslings saw, they would imprint on him. And further, once the imprint was formed, it was irreversible and the gosling would continue to treat Lorenz as the mother even if later introduced to its actual mother.

As noted above, the question of instinctual behavior in humans has attracted some controversy and

debate. While Lorenz was working with geese, many psychologists had begun to study something similar in humans, namely, the formation of an emotional bond between infant and parent that we know as attachment. Could it be the case that attachment in humans is merely an instinct? If so, this would suggest that attachment is elicited by a key stimulus during a critical period, just as Lorenz had concluded. But human attachment remains potentially a bit more complex, and more dependent on early life experiences. Attachment research became a major theme in 20th century developmental psychology.

ATTACHMENT THEORY

One alternative to the ethological account of imprinting and attachment came from Sigmund Freud, who we have not yet covered in depth. For now, we will note only his "cupboard theory", which holds that, at least in humans, infants are attached to their mothers for the simple reason that the mothers provide food. Neobehaviorists like Hull had proposed a similar account, as Hull had treated hunger as a primary drive, and thus attachment was driven by the need to reduce the drive state. Despite the similar emphasis on food as a key stimulus, Freud's account is rooted in his psychodynamic theory of unconscious instincts which has many commonalities with ethology, and Hull's account is based on learned associations (i.e., which stimulus is associated with drive reduction).

Perhaps the most consequential experimental contribution to the understanding of early attachment and social development came from **Harry Harlow** (born 1905), who conducted a series of now-famous experiments with infant rhesus monkeys that directly challenged the feeding-based accounts of attachment. Harlow raised infant monkeys in isolation, providing each with two surrogate "mothers", one constructed of wire mesh, which could be fitted with a bottle to provide milk, and one covered in soft terrycloth but providing no food. If the food-hypothesis was correct, the infants should have bonded to the wire mother that provided their nourishment. What Harlow found instead was that the infant monkeys spent the majority of their time clinging to the cloth mother, even though it provided no food. When frightened by a novel stimulus, they invariably fled to the cloth mother for comfort, not the wire mother. And infants raised with only a wire mother showed severe emotional and social deficits that persisted into adulthood, while those raised with a cloth mother fared much better, even without the social interaction of a real mother. What the infants needed, it seemed, was not feeding but what Harlow called contact comfort, the warmth and softness of a body to cling to. This was a direct refutation of both instinctual and behaviorist accounts of early social bonding. Attachment, at least in monkeys, was an emotional connection, not imprinting and not a learned association.

The work of **John Bowlby** (born 1907) further discredited the instinctual and behaviorist accounts and helped connect Harlow's finding to the emerging cognitive psychology of the mid-20th century. Bowlby was trained as a psychoanalyst, but his early clinical work with children who had been separated from their families (wartime evacuees, orphaned children, children in institutional care) convinced him that attachment was a primary biological and cognitive system. Children who were separated from their mothers showed distress responses that were far too intense and far too resistant to consolation by other caregivers, even feeding caregivers, to be explained as a secondary effect of food deprivation.

Bowlby proposed that evolution had equipped human infants with a set of behaviors, such as crying, smiling, clinging, and following, that function to keep the infant in proximity to a protective caregiver. He called this the attachment behavioral system. He considered it a biological system that is activated by threat (separation, fear, pain) and deactivated by the restoration of proximity and felt security. From an evolutionary standpoint, keeping an immobile infant close to a protective adult during the

period of maximal vulnerability is obviously adaptive, and Bowlby argued that natural selection had built the mechanisms for this into both infants and their caregivers.

As the infant develops, Bowlby argued, the attachment relationship becomes increasingly organized around a cognitive structure he called the *internal working model*, a mental representation of the self, the attachment figure, and the typical pattern of interaction between them. A child whose caregiver has been consistently responsive develops a working model in which the self is worthy of care and the world is generally reliable. A child whose caregiver has been inconsistent or rejecting develops a different working model. These internal models, Bowlby proposed, persist into adulthood and shape the individual's expectations and behavior in close relationships long after the original attachment relationship has ended.

Bowlby provided the theoretical framework and then **Mary Ainsworth** (born 1913), studying human infants, gave it empirical grounding. Ainsworth had worked with Bowlby in London before moving first to Uganda, where she conducted naturalistic observations of mothers and infants in their home environments, and later to Baltimore, where she began the work for which she is best known. Ainsworth's observational studies confirmed Bowlby's predictions that infants used their mothers as a secure base from which to explore the environment, venturing out when they felt safe and returning when threatened or distressed. But the most influential contribution she made was the development of the Strange Situation procedure, a structured, 20-minute laboratory observation designed to assess the quality of the attachment relationship between an infant and a caregiver.

The Strange Situation involves a series of brief separations and reunions between a mother and her infant (typically aged around 12 months), including an episode in which a stranger is introduced. The key moments are the separations and, especially, the reunions. How the infant responds when the mother returns after an absence reveals something important about the quality of the attachment. Ainsworth identified three primary patterns. Securely attached infants show distress when separated but are quickly and effectively comforted when the mother returns, using her as a base for renewed exploration. Anxiously avoidant infants appear relatively undisturbed by separation and tend to ignore or turn away from the mother upon reunion, an apparent indifference that Ainsworth suspected masked underlying distress. Anxiously resistant (or ambivalent) infants are highly distressed by separation and are difficult to comfort on reunion, simultaneously seeking and resisting contact. A fourth pattern, disorganized attachment, was identified later. Disorganized infants show no coherent strategy in response to separation and reunion, often freezing, approaching and retreating simultaneously, or displaying other contradictory behaviors.

The most important predictor of attachment security that Ainsworth identified was maternal sensitivity, the degree to which a caregiver was able to accurately perceive and respond appropriately to the infant's signals. Sensitive caregiving produced security; insensitive, inconsistent, or rejecting caregiving produced insecure patterns. This finding had enormous implications for clinical practice and public policy, shifting attention toward the quality of early caregiving as a determinant of long-term psychological development.

DEVELOPMENTAL CONSTRUCTIVISM

Returning the story back to the early days of American functionalist psychology, we next consider the work of **James Mark Baldwin** (born 1861). Baldwin was one of the first psychologists to study infants systematically through sustained observation of his own children. Baldwin's key finding was that infant behavior tends to repeat itself when it produces interesting effects. An infant accidentally kicks the side of the crib, notices the resulting rattle, and kicks again. It does this over and over, as if discovering and then practicing the connection between its own action and the world's response. Baldwin called these repeated, self-reinforcing cycles of action *circular reactions*. He saw them as active and constructive, the infant's first attempts to understand its own causal relationship to the environment.

Baldwin also thought deeply about how evolution and individual development interact, arriving at a theoretical position now called the ***Baldwin effect***. The idea is that the behaviors an organism learns during its lifetime can influence what traits natural selection favors in subsequent generations, even without any Lamarckian inheritance of those learned behaviors. If, for example, individuals who are good at learning to avoid a new predator survive better, then genes that support that kind of learning capacity will spread through the population. Learning, in this view, is not merely a product of evolution but can shape the direction of evolution itself. This is a subtle and sophisticated idea that was largely ignored in Baldwin's time and has only recently received serious attention from evolutionary biologists.

Baldwin's career came to an abrupt end in 1908 when he was found by police in a raid on a brothel in Baltimore. The racial dimensions of the incident are worth noting, as the establishment catered primarily to Black patrons, and Baldwin, a white man found in such company, was caught up in what was as much a racial policing action as a moral one. He resigned his professorship (and was replaced by John Watson who was later fired for a somewhat similar scandal after having an affair with his graduate student Rosalie Raynor) and spent the rest of his career in France, where his work directly influenced a young Swiss zoologist who was becoming increasingly interested in questions about the development of knowledge.

Jean Piaget (born 1896) was trained as a zoologist and came to psychology through an interest in epistemology. He was, in an important sense, a natural philosopher in the Baconian sense, someone who wanted to understand knowledge by observing how it develops and occurs in nature, rather than by reasoning about it like a philosopher. But the nature he chose to observe was the developing child.

Piaget is sometimes misunderstood as simply a champion of a particular set of stage descriptions, a kind of milestone chart for childhood intellectual development. This misses the deeper point. His primary goal was to develop what he called ***genetic epistemology***, a scientific account of how knowledge grows. Echoing Helmholtz, Piaget proposed that knowledge is *constructed*, or actively built, by the child through its ongoing interaction with the world. The basic building block of Piaget's theory is the schema, a mental structure, or organized pattern of action and knowledge, that the child uses

to interact with the world. The newborn infant arrives with a handful of primitive schemas, such as grasping and sucking.

Development proceeds through two complementary processes. The first is assimilation, in which the child fits new experiences into already existing schemas. When a child who knows what a dog is encounters a horse for the first time and calls it a "big dog," they are assimilating using an existing schema to make sense of new experience, even if imperfectly. The second is accommodation, in which the schema itself is modified to fit new experience. When the child is corrected and learns that the large four-legged creature is a horse, not a dog, they must create or modify a schema, and hence accommodate. The interplay of assimilation and accommodation is driven by equilibration, the tendency of the cognitive system to seek a balance, or equilibrium, between its existing schemas and the demands of experience. When experience doesn't fit the existing schemas, a state of disequilibrium arises, and this motivates the child to accommodate and grow.

Piaget proposed that cognitive development unfolds through four broad stages, each representing a qualitatively different way of understanding the world. The first is the *sensorimotor stage*, spanning roughly birth to age two. In this stage, the infant knows the world entirely through action (including Baldwin's circular reactions): reaching, grasping, sucking, looking, and listening. There is, at first, no symbolic representation; the infant has no capacity to think about objects that are not presently in view. One of the signature achievements of this stage is the development of object permanence, the understanding that objects continue to exist even when they cannot be seen. Early in the sensorimotor stage, an object that is hidden from the infant simply ceases to exist for her, cognitively speaking. If you cover a toy with a cloth while an infant watches, she will not search for it. By the end of the sensorimotor period, around 18 months, she will search, indicating that she now has a mental representation of the hidden object. This connects directly back to the themes of Chapter 5: the developing mind is constructing its own sense of a permanent, continuing external world, something the empiricists and skeptics took to be deeply problematic for adults, yet here it develops, apparently spontaneously, over the first two years of life.

Next is *preoperational thinking*, spanning roughly ages two to seven. The child has now acquired language and can engage in symbolic play, using one object to represent another, or pretending that a banana is a telephone. But the child's thinking is limited in characteristic ways. One of the most well-known is egocentrism, which refers not to selfishness but to the cognitive inability to take another's perspective, reminiscent of the Problem of Other Minds covered in Chapter 8. In Piaget's famous three-mountains task, a child is seated at a model of three mountains and asked to say what the scene would look like from the perspective of a doll placed on the other side of the model. Young preoperational children typically describe what they themselves see, not what the doll would see. Another limitation is centration, the tendency to focus on one salient feature of a situation while ignoring others. This is demonstrated in the classic conservation tasks. If you pour water from a short, wide glass into a tall, thin glass in front of a preoperational child, she will typically say that the tall glass now has more water, because it looks taller; she is centered on the height and cannot simultaneously attend to the width.

The third stage is the *concrete operational thinking*, spanning roughly ages seven to eleven. Here the child acquires logical operations, mental procedures that can be applied to concrete objects and events. Conservation is now mastered: the child understands that the amount of water does not change when poured between containers, because she can now mentally reverse the pouring. She can

classify objects, arrange them in series, and understand the logical relations between classes. But her thinking remains tied to concrete reality. Purely hypothetical or abstract reasoning still eludes her.

The fourth and final stage is *formal operational thinking*, beginning in early adolescence and, in Piaget's account, constituting the pinnacle of cognitive development. The formal operational thinker can reason about hypothetical possibilities, engage in systematic hypothesis testing, and think about abstract concepts such as justice, freedom, and infinity. This is the kind of thinking that the rationalist philosophical tradition we have traced in this book has always valued most highly, and Piaget, like the rationalists, placed it at the apex of cognitive development.

To investigate these stages, Piaget developed what he called the clinical method, a form of structured conversation in which the researcher asks children probing questions, follows up on their answers, and tries to understand the logic behind their responses rather than simply scoring them right or wrong. This was quite different from the psychophysical methods of Wundt and Fechner or the introspective methods of Titchener. It was closer in spirit to the phenomenological approach of Brentano and Husserl, in that it sought to describe the child's experience from the inside, rather than to measure behavior from the outside.

A final important point about Piaget's philosophical commitments: he saw himself, explicitly, as reconciling Kant and Darwin. Like Kant, he believed that the mind contributes structure to experience and that understanding is not just the passive absorption of sensory data but an active construction. Unlike Kant, he believed this structure was not innate but developed. Like Darwin, he saw cognitive development as an adaptive process, driven by the organism's need to maintain a functional relationship with its environment. In this sense, Piaget's theory is an evolutionary and developmental extension of the Kantian and Helmholtzian tradition.

VYGOTSKY AND THE SOCIAL CONSTRUCTION OF MIND

The work of **Lev Vygotsky** (born 1896) provides a fascinating contrast and complement to Piaget. Vygotsky was a Russian psychologist who developed his ideas in the Soviet Union during the 1920s and early 1930s, roughly the same period in which Piaget was developing his theory in Geneva. The two men were contemporaries who never directly interacted, partly because Vygotsky died of tuberculosis in 1934 at the age of 37, before completing much of what he had planned, and partly because his work was suppressed in the Soviet Union after his death for political reasons (despite the fact that Vygotsky was explicitly attempting to build a Marxist psychology) and was not translated into English until the 1960s. His influence on Western developmental psychology therefore arrived well after that of Piaget.

Where Piaget saw cognitive development as primarily a solitary process, the child as a lone, naïve scientist testing hypotheses by interacting with the world, Vygotsky insisted that cognitive development is fundamentally a ***sociocultural*** process. For Vygotsky, the child does not construct knowledge independently and then use language to express what it already knows. Rather, social interaction and language are the primary engines of cognitive development. We first encounter ideas in conversation with others, then gradually internalize those conversations, and only then do we "possess" them as individual cognitive abilities.

The central concept in Vygotsky's theory is the zone of proximal development (ZPD). The ZPD is defined as the difference between what a child can accomplish independently and what the same child can accomplish with the guidance of a more capable partner, e.g., a parent, teacher, or more experienced peer. For Vygotsky, this zone is where the most important learning happens. Instruction, he argued, should be targeted at the ZPD rather than at what the child has already mastered. A task the child can do alone teaches nothing new. A task the child cannot approach at all teaches nothing either. But a task that is just beyond current independent ability, supported by a capable partner, is where development occurs. A term sometimes used to describe the support provided in the ZPD is *scaffolding* — providing just enough assistance to enable success and gradually withdrawing that assistance as the child's competence grows.

Vygotsky's account of the relationship between language and thought also differs sharply from Piaget's. For Piaget, language follows thought, the child first develops the cognitive capacity for a concept and then acquires the word for it. For Vygotsky, language and thought have separate developmental origins that eventually merge. Early speech is social and external. Children talk out loud as they play and work, narrating their actions and organizing their activity verbally. Gradually, this external speech becomes abbreviated, whispered, and eventually internalized as the inner speech that adults recognize as their internal monologue. Inner speech, for Vygotsky, serves as the primary medium of higher-order thinking. Thought, in this account, is not something that precedes language, rather it is something that grows out of language and could not exist, in the form we recognize it in humans, without it.

Vygotsky's emphasis on the cultural and social environment as the medium of cognitive development

connects his theory to several threads already woven through this book. Recall that Wundt, in his *Völkerpsychologie*, had argued that higher mental processes could only be understood by studying the cultural products (e.g., language, myth, and literature) through which minds were expressed and shaped. Vygotsky was making a closely related argument but grounding it in developmental observation rather than cultural analysis. And as we shall see in Chapter 20, his emphasis on the role of cultural artifacts and social interaction in constituting cognition resonates with the extended mind thesis and other aspects of 4E cognitive science.

CHALLENGING PIAGET: KNOWLEDGE AND ABILITIES IN INFANCY

Do infants perceive and understand depth? Let's consider first how Piaget's theory addresses this. On that view, infants would not have innate knowledge of depth but would gradually construct it through sensorimotor interactions with the environment. In particular, as children start crawling, typically around 6 months of age, Piaget would predict an interplay of assimilation and accommodation eventually leading to the maturation of the depth schema.

Imagine an experiment involving the visual depiction of a cliff. The apparatus consists of a large table covered with a sheet of heavy glass. On one side of the table, a checkerboard pattern is placed directly under the glass, creating the visual impression of a solid surface. On the other side, the checkerboard is dropped several feet below the glass, creating the visual impression of a steep drop, a "visual cliff", even though the glass surface itself is perfectly solid and supportive. An infant is then placed on the shallow side of the cliff, with its mother beckoning from the other side. Will the 6-month-old crawl over the cliff? We could reasonably use Piaget's theory to predict that the child might in fact do so, because they are too young, too inexperienced, to have fully developed the depth schema. Thus, we would expect some milestone to appear after sufficient crawling experience, when the child finally learns to avoid the cliff.

But this experiment was in fact performed by **Eleanor Jack Gibson** (born 1910) and her colleague Richard Walk in 1960. Gibson had spent her career developing an ecological approach to perceptual learning as a complement to the ecological theory of her husband J.J. Gibson, who we learned about in Chapter 10. Crucially, in the visual cliff experiment, even newly crawling infants would refuse to cross the cliff. Subsequent work showed that even newborns and pre-locomotor infants showed differential heart rate responses to the cliff side compared to the shallow side, suggesting that some sensitivity to depth was present even before the experience of self-locomotion could have shaped it. Infants, it seemed, could perceive depth and respond appropriately to the danger of a drop, even before they had extensive sensorimotor interaction with the world.

This finding had obvious implications for Piaget, and even behaviorist accounts, of development. It suggested that depth perception was not something that had to be constructed through experience or shaped by reinforcement. Even before they can crawl independently, infants have accumulated perceptual experience through passive movement, such as being carried or rocked by caregivers, allowing them to become attuned to information already present in the optic array. For E.J. Gibson, perceptual development involves becoming increasingly attuned and calibrated to this information through active engagement with the environment. Pre-locomotor infants may therefore detect depth changes, although their perception is not yet fully calibrated to their own abilities for action. Once infants begin self-produced locomotion, they gain new opportunities to explore the relationship between visual information, body movement, and environmental affordances, supporting increasingly sophisticated perceptual and motor skills.

By the 1980s and 1990s, a new set of research methods extended the logic of the visual cliff and transformed much about how the field understood infant cognition. Rather than the gradual refinement

of schemas leading to developmental milestones, developmental psychologists revealed that infants' conceptual knowledge was functioning at a surprisingly young age and was more advanced than Piaget's theory could accommodate.

The key methodological innovation was the *violation-of-expectation paradigm*, which exploited the fact that infants look longer at events they find surprising than at events they find unremarkable. If you can design an event that should violate a particular belief the infant holds about the world, such as solid objects cannot pass through other solid objects, and show that infants look longer at the "impossible" event than at a matched "possible" event, you can infer that the infant expected the physically possible outcome and was surprised at the impossible version. The method was clever because it required no motor response from the infant and no language. It worked on the assumption that looking time is a sensitive, if indirect, measure of surprise and expectation.

Using this technique, **Renée Baillargeon** (born 1954) produced a series of striking findings suggesting that object permanence was present far earlier than Piaget had claimed. In her classic experiments, infants as young as three to four months appeared to represent hidden objects, showing longer looking when an object that should have been blocked by a hidden barrier appeared to pass through it. On Piaget's account, infants at this age had no mental representation of hidden objects at all. Baillargeon's results suggested otherwise and that the Piagetian stage sequence had seriously underestimated the cognitive capacities of young infants.

Elizabeth Spelke (born 1942) developed these findings into a broader theoretical framework she called ***core knowledge theory***. Spelke proposed that human infants are born with a small number of domain-specific systems of knowledge about objects, number, agents, and space (which you may notice sounds like a modern variation of Kant's innate intuitions and categories) that are not learned through experience but are part of our evolutionary inheritance. These are computational systems that organize early perception and action, providing a foundation of expectations about the world onto which subsequent learning can build. In her view, the blank slate is simply wrong; the mind does not begin with nothing. But the mind does not arrive fully equipped with the rich conceptual knowledge of the adult, either. It arrives with a structured starting point defined as a set of core systems, and development consists of building upon and reorganizing those systems through experience.

It would be fair to say that this research tradition generated considerable excitement within the field. Laboratories across the world were demonstrating that infants could do something remarkable. They understood numbers and quantity, tracked hidden objects, recognized faces, responded to the physics of collisions, and distinguished a variety of possible from impossible events. The culture of developmental psychology in this era has sometimes been described informally as the "amazing baby" phenomenon. It was a period in which the prestige of the research program was tied to demonstrating ever-earlier, ever-more-impressive infant competencies, and in which the violation-of-expectation paradigm seemed capable of finding evidence of almost any capacity you looked for.

This enthusiasm is worth pausing over, because it illustrates a recurring hazard in the history of science that we have encountered repeatedly. Recall that Bacon warned against the anticipation of nature, the tendency to find what you expect to find because your methods and your theoretical commitments are closely aligned. The violation-of-expectation paradigm required researchers to design stimuli that should, in their judgment, look surprising to an infant if it held certain beliefs about the world. The interpretation of longer looking times as evidence of violated expectations required a chain of theoretical assumptions. And the cultural climate and paradigmatic nature of the "amazing

baby" era may have made it easier than it should have been to conclude that positive results confirmed infant competence, while negative or ambiguous results were set aside.

A telling example is the history of neonatal imitation. In a landmark paper, Meltzoff and Moore (1977) reported that newborn infants, some as young as 12 to 21 days old, would imitate specific facial gestures such as tongue protrusion and mouth opening when shown these gestures by an adult experimenter. The finding was widely celebrated as evidence of a sophisticated innate interpersonal capacity, with obvious implications for theories of social cognition and the evolutionary origins of empathy. It seemed to show that the human infant arrived in the world already attuned to other human faces in a remarkably specific way.

Later research raised serious doubts about this interpretation. Jones (1996) showed that tongue protrusion in newborns was not specific to the imitative gesture but was a general arousal response; infants stuck their tongues out in response to any interesting or arousing stimulus, including a moving pen or a flashing light. The behavior was nonspecific, she argued, and what had been interpreted as selective facial imitation was better understood as a generalized orienting response. This critique gathered further force from a large, preregistered replication study by Oostenbroek and colleagues (2016), which tested neonates longitudinally across multiple time points and found no evidence of selective imitation of any specific gesture. The burden of proof, at least for neonatal imitation, shifted considerably.

The story of neonatal imitation is not just about one finding being replicated or not. It is a story about how theoretical enthusiasm and methodological ambiguity can interact in ways that make a field vulnerable to producing results it very much wants to see. Further, it highlights the value of the operationism favored by the neobehaviorists. Looking time is not a direct measure of knowledge, but the beginning of an inferential chain from looking, to surprise, to expectation, to belief, and each link involves theoretical commitments that are not directly measured. Munakata and colleagues (1997) raised a related concern about the object permanence findings, arguing that infants might look longer at "impossible" events simply because they are visually unusual or more salient, not because the infant has a stored representation that the event violates. On this account, the paradigm was measuring something real, but not necessarily the thing it claimed to measure.

None of this invalidates the core knowledge research program, which remains productive and has contributed genuine insights. But it suggests that the "amazing baby" era, for all its excitement, was also an era in which psychology's tendency toward theoretical enthusiasm was operating in full force. The corrective impulse embodied in Jones' work, and in later calls for preregistered replication in developmental research, reflects the same scientific values that drove Morgan's Canon, logical positivism, and Popper's falsificationism. Science corrects itself, but the correction takes time, and the history of developmental psychology provides a vivid recent illustration of why the correction is necessary.

SUMMARY

This chapter has traced the development of developmental psychology as a field, from Hall's child study movement to the dynamical systems approaches of Thelen and Smith. Several themes emerge that connect to the book's larger concerns.

The nature versus nurture debate, which we first encountered as the rationalism versus empiricism debate in the ancient Greeks, runs through every section of this chapter. Hall's recapitulation theory was an extreme nativist position. The behaviorist accounts of learning and attachment were extreme empiricist positions. Piaget's constructivism sought a middle ground, and Vygotsky's sociocultural theory emphasized the role of social experience in shaping cognition. Bowlby grounded attachment in biology while acknowledging the role of caregiving experience; and the core knowledge theorists revived a sophisticated nativism, only to face the corrective skepticism of the replication movement.

The question of what the infant and young child already know, before extensive experience can have shaped them, is ultimately the developmental version of the epistemological questions that opened this book. Is there knowledge before experience? If so, what kind? If not, how does so much seem to appear so quickly? These questions have not been resolved, and they are unlikely to be resolved anytime soon. But the study of development has given us far better tools for asking them than the armchair philosophizing of the ancients could provide.

Finally, it is worth noting how many of the developmental themes in this chapter will resurface in Chapter 20. The emphasis on the body in perceptual development, the emphasis on action and environment in the dynamical systems approach, and the emphasis on social interaction in cognitive development, all prefigure the embodied, embedded, enacted, and extended cognition that we will consider as possible directions for the field's future.

DEVELOPMENT AS EMERGENCE

We shall conclude this chapter with a theoretical framework that challenges both the nativist and the constructivist traditions, and that connects developmental psychology to the broader themes of Chapter 20. **Esther Thelen** (born 1941) and **Linda Smith** (born 1951) argued that the development of motor skills, and by extension, cognitive abilities, should be understood not as the unfolding of a genetically pre-programmed sequence of stages, not as the gradual accumulation of learned associations, nor as the unfolding of core knowledge, but as the *emergent* product of a dynamical system composed of many interacting components: neural, muscular, motivational, and environmental.

Their argument found one of its most elegant illustrations in the case of the newborn stepping reflex. It has long been known that newborn infants, when held upright with their feet touching a surface, will make rhythmic stepping movements that look remarkably like walking. This reflex disappears around two months of age, only to reappear as voluntary walking around twelve months. The standard interpretation was that the reflex was suppressed by the maturation of higher cortical control, and that its reappearance later reflected the development of cortical walking circuits. Thelen and her colleagues showed that this interpretation was wrong. The stepping reflex does not disappear because of neural maturation but because infants' legs are growing heavier faster than their muscles are growing stronger. If you submerge a two-month-old infant's legs in warm water, thereby reducing the effective weight of the legs, the stepping reflex reappears immediately. It was never gone but was merely masked by the mechanical demands of heavier limbs. And if you hold young infants upright on a treadmill, they produce coordinated alternating stepping movements that look very much like mature walking, long before they can walk independently.

What this reveals, Thelen and Smith argued, is that walking is not a behavior that matures inside the brain and then gets expressed outward. It is an emergent property of the interaction among many contributing systems including the rhythmic neural circuits that generate stepping, the strength and weight of the legs, the mechanical properties of the joints, the friction of the ground surface, the motivational state of the infant, and the support provided by a caregiver. Remove or change any of these components and the behavior changes. The behavior does not live in any one place, it rather emerges from the interaction dynamics of the whole system.

This ***dynamical systems*** perspective on development has implications far beyond motor development. Thelen and Smith argued that cognitive development, too, should be understood in these terms. It is the emergent organization of a complex, self-organizing system. In this they draw on Gibson's ecological approach, on the 4E cognitive science perspectives we will examine in Chapter 20, and on a broader reconceptualization of the relationship between brain, body, and environment.

KEY TERMS

Key Terms

- recapitulation theory, Baldwin effect, genetic epistemology, sociocultural theory, Zone of Proximal Development, ethology, attachment theory, imprinting, instinct, critical period, core knowledge theory, dynamical systems theory, emergence

STUDY QUESTIONS

Study Questions

1. Explain how Piaget's theory of cognitive development can be understood as a synthesis of rationalist and empiricist ideas.
2. How does Vygotsky's sociocultural theory differ from Piaget's account of how children learn?
3. What did Harlow's surrogate mother experiments demonstrate, and why were they significant for our understanding of infant-caregiver attachment? What did they suggest was wrong with the behaviorist account?
4. Explain how the violation-of-expectation paradigm challenged Piagetian views on development?
5. Explain how E.J. Gibson's work on perceptual development extends J. J. Gibson's ecological approach to perception. What does this connection suggest about the relationship between perception and development?

CHAPTER 16: ABNORMAL AND CLINICAL PSYCHOLOGY

INTRODUCTION

Learning Objectives
Understand:

- the distinction between abnormal behavior and mental illness
- the supernatural explanation of mental illness and associated treatments
- the ideas behind vitalistic and naturalistic explanations of illness and associated treatments
- Mesmerism, how it was discredited, and how hypnosis subsequently evolved
- the humoral theory of behavior and associated treatment
- modern biological explanations of mental illness and associated treatments
- the psychological explanation of mental illness and associated treatments
- how these broader perspectives on abnormal behavior relate to the mind-body problem
- the biopsychosocial model and how it resolves mind-body concerns
- the broad history of the reform and deinstitutionalist movements
- the broad history of the classification of disorders

The history of abnormal psychology is slightly different from the one we have outlined for the philosophy of mind leading up to experimental psychology. As before, we need to go way back to some sort of beginning and find the earliest traces of human thought regarding ***abnormal behavior*** and its treatment.

Before we do that, we might want to pause and consider what we mean by abnormal behavior. The word abnormal simply means "not normal" and is technically a statistical term. In other words, deviating from the normal distribution, represented by the average, or what most people do. What we are talking about here are the outliers of behavior. If human behavior fits some sort of normal distribution, then abnormal behavior represents what is happening in the tails of that distribution. Abnormal does not imply wrong, or evil, nor does it even necessarily mean sick. Abnormal behavior does not need to be equated with mental illness, or ***psychopathology*** (Szasz, 1960). Although it might be that physical or structural problems in the nervous system cause symptoms of abnormal behavior, this has yet to be definitively established for many examples. Further, since normal is defined as what most people in a society are doing, when societal standards change, the definition of abnormal changes. What has been in the past considered abnormal may be normal now. What is normal in one culture may be abnormal in another. History will help us see this in action.

SUPERNATURAL EXPLANATIONS

Based on archaeological findings, psychologists and anthropologists have concluded that early humans explained abnormal behavior in terms of the supernatural. In fact, they may have treated any illness, mental or physical, in supernatural terms. Such explanations could include possession by an evil spirit or punishment for offending the god(s). Correspondingly, treatments were designed to redress these specific causes. If the perceived cause was divine retribution, the treatment might involve prayer, offerings, or ritual purification to appease the deity. If the cause was believed to be possession, exorcism rituals were often employed.

A striking example of ancient supernatural treatment is the practice of trepanation, one of the earliest forms of neurosurgery, in which a hole was drilled or scraped into the human skull. Archaeological evidence shows that this procedure was practiced across many ancient cultures. While the procedure can be performed to reduce swelling around the brain, it is presumed that the motivation behind ancient cases of trepanation was to release evil spirits thought to be trapped inside the skull, causing abnormal thoughts or behavior. While this treatment seems primitive by modern standards, it is notable that ancient practitioners recognized a connection between the brain and behavior, suggesting an early intuitive understanding of the brain's importance in mental life.

In the west, supernatural explanations for mental illness persisted well into the Middle Ages and beyond, often intertwined with religious and moral beliefs. In some contexts, individuals displaying abnormal behavior were accused of witchcraft or demonic possession, leading to persecution or execution. Despite the evolution of medical and psychological understandings, supernatural interpretations remain influential in some cultures and communities today, highlighting the importance of considering diverse explanatory models in understanding mental health.

VITALISM AND ENERGETIC NATURALISM

Not all early theories of health and illness attributed disease to supernatural forces. Many cultures instead developed ***vitalistic*** or ***naturalistic*** systems that sought to explain health through the operation of underlying energy sources believed to govern the body. These often had supernatural aspects, but the traditions are distinct because they proposed that health depended on maintaining balance among internal bodily energies or external physical energies, while illness resulted from imbalance or disruption. Although many of these theories incorporated broader philosophical or religious beliefs, they represented systematic attempts to explain disease through lawful processes rather than through the actions of gods, spirits, or demons. As a result, they encouraged interventions aimed at restoring balance, such as through diet, herbs, exercise, rest, or other behavioral practices, rather than relying solely on ritual or divine intervention.

In traditional Chinese medicine, mental illness may be understood as a disruption of one's vital energy, or Qi. While there may be supernatural aspects to this idea, it is distinct because of its focus on natural processes in the body. Treatments for problems with Qi include a variety of herbal medicines, acupuncture, and Qigong. The latter emphasizes meditation and mindfulness with the practice of breathing techniques and slow flowing movements thought to regulate the flow of Qi.

On the Indian subcontinent arose the tradition known as Ayurveda, from the Sanskrit words ayus meaning life and veda meaning knowledge or science, giving a literal translation of something like the science of life. Ayurvedic medicine proposed three fundamental biological energies or doshas, which were Vata, associated with air and space and governing movement and nervous system function, Pitta, associated with fire and water and governing digestion, metabolism, and transformation, and Kapha, associated with earth and water and governing structure, stability, and fluid balance. Health was the harmonious balance of the three doshas, and illness, including mental illness, was their imbalance, produced by improper diet, lifestyle, sensory overload, moral transgression, or the disruption of the organism's relationship to its natural and social environment. Ayurvedic texts described treatments that combined herbal medicine, dietary modification, purification procedures, yoga, and what might be called counseling or talking interventions. This makes Ayurveda one of the earliest medical traditions to treat mental and physical illness as continuous manifestations of the same underlying organismic imbalance rather than as categorically separate domains requiring separate explanatory frameworks.

By the late 18th and early 19th centuries in Europe, a variety of new and experimental treatments were offered as alternatives. One of the more famous, or infamous, was the approach of **Franz Anton Mesmer** (born 1734). Using an idea strikingly similar to Qi, Mesmer had proposed that mental health was affected by the body's magnetic fields which served as a vital life source. He believed that everyone possessed *animal magnetism,* and distortion of one's magnetic fields resulted in bad feelings, unhappiness, and general poor health. He began his career of treating people for such maladies by placing magnets over their bodies, claiming to align the magnetic poles of the body. Later, he abandoned the magnets in favor of waving his hands over the patients themselves, now claiming that he himself was a powerful animal magnet and was capable of effecting the cure himself. He was known to sit

before seated patients, staring deeply into their eyes, sometimes passing his hands over their body, or pressing his hand into their chest for hours on end. Ultimately, the patients would have a convulsion and *crisis*, a type of emotional breakdown, after which they would report being cured. Mesmer would accompany his treatments with a little wine and spooky music on a glass armonica.

Mesmer had begun to develop quite a reputation in France, and he trained several apprentices, claiming to pass on his animal magnetism to them, where they could set up their own mesmerist clinics. He and his followers were making a lot of money. Ultimately, King Louis XVI appointed a commission, even involving the then U.S. ambassador to France, Benjamin Franklin, to investigate Mesmer's claims. This commission set up controlled tests and found that blindfolded patients reported improvements when they were told the magnetic treatments were being applied, regardless of whether they really were or not. This was among the earliest cases of controlled scientific testing of health interventions, and it demonstrated something very similar to what is now called the *placebo effect*. The commission attributed their results to the *power of suggestion.* The patients believed the treatments would help, and so they did. Mesmer was ultimately driven into exile to Austria, where he lived in obscurity for the remaining years of his life.

But the idea that people could alter their behavior based on the power of suggestion began to intrigue more serious scientists and physicians. **Abbé Faria** (born 1756) was one of the more prominent of Mesmer's critics and refined the techniques to explore what he called *autosuggestion*, reflecting his belief that the effects of the treatment originated solely within the subject, not from the "magnetizer". His work was followed by that of **Jean-Martin Charcot** (born 1825), who investigated why some people seemed susceptible to hypnotic suggestion while others were not. Charcot's claim was that those who suffered from a disorder called ***hysteria*** were the ones who were hypnotizable. The term derives from the Greek word *hystera* (uterus), reflecting the ancient belief that the disorder resulted from disturbances of the womb and therefore affected only women. Charcot rejected this explanation, arguing that hysteria was a legitimate functional disturbance of the nervous system that could also occur in men. One of Charcot's students was someone who would forever change how society views mental illness and abnormal behavior. Sigmund Freud would come to reinterpret hysteria as the expression of unconscious psychological conflict, and he used hypnosis (and other techniques) as tools to probe the unconscious mind of his patients. Even more apt is that Freud saw *psychical energy* as the driving force of his new ***psychodynamic theory***, which will receive fuller consideration in Chapter 18.

The energetic model has continued to generate new expressions in contemporary Western culture, most visibly in the diverse collection of practices and beliefs that are loosely grouped under the label of New Age spirituality. Reiki is a Japanese energetic healing practice developed in the early 20th century which draws on Chinese and Japanese traditions of vital energy cultivation (e.g., chakra balancing, therapeutic touch, crystal healing, etc.). It works on a foundational energetic assumption that health is a function of the proper flow and balance of a vital energy, and that skilled practitioners can detect, channel, and rebalance that energy therapeutically. These practices entered Western mainstream awareness largely through the Theosophical movement of the late 19th century, which introduced Eastern concepts to Western audiences, and also through the human potential movement of the 1960s and 1970s. The New Age energy tradition is thus a contemporary expression of a conceptual lineage that runs from ancient energetic medicine to the present day.

It is worth being clear about the evidentiary status of contemporary energetic claims, since the traditions in this broad category differ considerably in their theoretical detail and scientific support. Ancient systems like Ayurveda and traditional Chinese medicine have been practiced and refined

over millennia and have been the subjects of substantial scientific research investigating their clinical efficacy. The specific energy mechanisms proposed by most New Age healing modalities have not been demonstrated to exist by any controlled scientific investigation, and several well-designed studies have found no evidence that practitioners can detect the energies they claim to work with (e.g., Rosa et al., 1998[1]). This does not necessarily mean that all practices within these traditions are therapeutically inert, as some may produce genuine benefits through mechanisms including the relaxation response, the placebo effect, and the therapeutic quality of the practitioner-patient relationship, but it does mean that the energetic explanation for any observed effects remains scientifically unsubstantiated. The distinction between a practice producing genuine effects and the proposed mechanism being correct is an important one that the history of medicine repeatedly illustrates, as we recall that Mesmer's patients sometimes genuinely improved, but not because of any magnetic response.

1. It is worth mentioning that the first author of this paper, Emily Rosa, was, remarkably, nine years old when she designed and conducted this study, presenting it at a fourth-grade science fair before publishing it in JAMA. This made her the youngest person at the time to publish in a peer-reviewed medical journal.

BIOMEDICAL EXPLANATIONS

Although biological explanations of abnormal behavior can be found in several ancient cultures, Greek physicians developed one of the earliest systematic theories linking health to bodily processes. **Hippocrates** (born ca. 460 B.C.) is generally considered the forefather of Western medicine and is famous for his ***humoral theory*** of illness. He defined four bodily humors, or fluids: blood, yellow bile, black bile, and phlegm. Hippocrates emphasized balance and harmony and described illness as an imbalance between the four humors. This is remarkably similar to Ayurveda, and could potentially be categorized under vitalism as well, but it is distinct in its focus on a straightforward biological explanation of health.

One of his proponents, **Galen** (born A.D. 129), extended the humoral theory to four basic human temperaments, making it one of the earliest examples of personality type theories. The *sanguine* temperament is associated with the blood. Such a person is cheerful and light-hearted. The *choleric* temperament, associated with yellow bile, is considered fiery and passionate. The *melancholic* person, associated with black bile, is introspective and creative. Imbalance may be akin to depression and was associated with prolonged sadness and withdrawal from others. Finally, the *phlegmatic* personality is unemotional, calm, and resistant to stress.

If abnormal behavior results from imbalance of the humors, then the treatment is aimed at restoring balance. Galen promoted *bloodletting* as a treatment, on the basis that many illnesses were attributed to too much blood (fever, redness, inflammation, rapid pulse) and so draining it reduced pressure and restored proper circulation of the humors. The choice of vein was designed to draw blood away from the site of the diseased region. While humoral theory declined in popularity over the centuries, bloodletting as a practice continued well into the 19th century, along with various other balancing techniques such as purging and vomiting. It was not until the emergence of a better understanding of the pathophysiology of illness, the functioning of the vascular system, and the understanding of science and pseudoscience did the practice finally fade out.

Although the humoral theory has been rejected, biomedical explanations of mental illness have not. In fact, they are central to modern psychiatry. Today, many abnormal behaviors are described using the language of "mental illness" or *psychopathology*, under the assumption that such behaviors reflect underlying biological dysfunction. This may involve structural abnormalities in the brain, imbalances in neurotransmitters or hormones, or genetic vulnerabilities. This approach is also known as the ***disease model*** of mental illness. Mental disorders are viewed similarly to physical illnesses such as diabetes or heart disease, and treatments aim to correct the biological dysfunction. While now-discredited practices like lobotomy were once used to treat mental illness, modern biomedical treatments include electroconvulsive therapy for severe depression, transcranial magnetic stimulation, and a range of psychopharmacological medications designed to alter neurotransmitter activity.

PSYCHOLOGICAL EXPLANATIONS

Among the more recent developments in explaining abnormal behavior is to assign it a psychological cause. The concept may have some ancient roots, but its modern form originates primarily from behaviorism. The idea is that, if one claims that all behavior is learned rather than innate, then abnormal behavior is learned as well. Behaviorists claim that abnormal behavior has either been reinforced or strengthened by classical conditioning, and so the appropriate scope of treatment should focus on *behavior modification*. Examples include shaping via reinforcement and the extinction or counterconditioning of conditioned responses. *Behavioral therapy* is designed around this perspective. Fear conditioning is a classic example, if we recall Little Albert. While we don't know if Albert developed a phobia of rats, **Mary Cover Jones** (born 1897) realized that such events could be the basis of phobias, and so the appropriate response would be to use the extinction procedures Pavlov had developed to eliminate conditioned responses. She effectively used it to treat her patient Peter, who had a phobia of rabbits and other furry things. She pioneered the use of *systematic desensitization*, the process of gradually exposing the patient to a non-threatening version of the fear-object while in an otherwise safe environment.

A more cognitive variant of this approach is called *cognitive behavioral therapy,* developed by **Aaron Beck** (born 1921). The goal of this therapy is identifying and restructuring maladaptive thought patterns. **Albert Ellis** (born 1913) and his Rational Emotive Therapy worked similarly, focusing on how people thought about themselves and how irrational expectations caused psychological problems. Although best known for his work on observational learning and social cognitive theory, **Albert Bandura** (born 1925) also helped shape the cognitive movement in psychotherapy. Bandura argued that people's beliefs about their own capabilities, called ***self-efficacy***, influence how they think, feel, and behave. His emphasis on the interaction of cognition, behavior, and environmental influences provided an important theoretical foundation for modern cognitive-behavioral therapies. These approaches acknowledged the role of learning but also emphasized thinking and were closely tied to the cognitive move away from behaviorism.

THE BIOPSYCHOSOCIAL MODEL

One might imagine a sort of philosophical tension between the biomedical and the psychological models of abnormal behavior. For example, the biomedical approach tends to emphasize the role of the body and nervous system in a way that is reminiscent of the materialist take on the mind-body problem. Meanwhile, the proponents of the psychological approach might focus on cognitive distortions without much concern for what is happening in the brain, potentially reminiscent of mind-body dualism. This divide contributed to mid-20th century critiques from the anti-psychiatry movement, which rejected the disease model. Thomas Szasz (1960), for instance, argued that many psychiatric diagnoses pathologized ordinary struggles of living. Another anti-psychiatric view came from Rosenhan (1973), who employed associates to fake hallucinations in order to get admitted to psychiatric hospitals. Upon admittance, these "fake patients" began to act normally, but were nevertheless diagnosed with disorders such as schizophrenia, and were kept in hospital for nearly three weeks.

However, a more integrative approach has deep historical roots. As noted above, Ayurveda combines biological approaches like diet with sensory and social factors. The Islamic philosopher Avicenna, introduced earlier in Chapter 3, also made significant contributions to medicine in his work *The Canon of Medicine*. He proposed a holistic model that combined humoral theory with clinical observations of brain injury and its behavioral consequences. He also emphasized the role of emotions, beliefs, environment, and social relationships in shaping health, recommending changes in lifestyle and living conditions as part of treatment.

In the modern era, **George Engel** (born 1913) advanced a comparable vision with the ***biopsychosocial model***. In response to the limitations of the biomedical model, Engel (1977) argued for an integrated understanding of mental illness that includes biological, psychological, and sociocultural factors. His framework emphasized the importance of social support, cultural norms, family systems, and economic conditions in both the etiology and treatment of mental disorders. The biopsychosocial model thus offers a comprehensive and flexible approach that dissolves the rigid boundaries between competing paradigms.

HISTORY OF THE DIAGNOSIS AND TREATMENT OF "MENTAL PATIENTS"

The establishment of an institutionalized approach to treating those who exhibit abnormal behavior began with the emergence of insane asylums during the Dark Ages in Europe. The understanding of the behavior was a mixture of humoral theory with various supernatural explanations, combined with fear and misunderstanding. The asylums were not hospitals but were instead comparable to dungeons. Treatments involved bloodletting, but also whipping, dowsing in ice water, spinning chairs (thought to improve circulation), and many other treatments that bordered on torture. It was not until **Philippe Pinel** (born 1745) pioneered the concept of moral therapy that the prisoner-model of treatment began to be abandoned. Instead of torture and shock, he engaged in conversations with the patients, he unchained them and gave them access to fresh air and exercise. Despite the reservations of his colleagues, Pinel obtained positive results and his methods began to spread throughout Europe.

In the United States, the physician **Benjamin Rush** (born 1745) echoed Pinel's opinions. Being a contemporary of the Founding Fathers and a signer of the Declaration of Independence, concepts such as liberty were *in the air* during Rush's career, and he advocated this approach to the treatment of mental patients. He also pioneered occupational therapy, noting that those who were allowed to work while in the hospital showed great improvement. Later in the 19th century, **Dorothea Dix** (born 1802) lobbied for ending the imprisonment of mentally ill persons and was instrumental in creating the first public mental hospital in the US, the Harrisburg State Hospital in Pennsylvania.

While the modern hospitals dramatically transformed the treatment of the severely mentally ill, they also became the subject of concern, associated with their use of restraints and straightjackets, padded seclusion rooms, locked wards, and insulin coma therapy. One of the most consequential developments in the history of mental health treatment in the United States was the deinstitutionalization movement of the 1960s through the 1980s, resulting in the large-scale discharge of patients from state psychiatric hospitals and the simultaneous reduction in the number of psychiatric beds available for long-term care. The movement had multiple and somewhat contradictory origins that are worth distinguishing. The intellectual origins lay in the antipsychiatry movement already discussed. Among the criticisms were the ideas that the psychiatric hospital itself, through its rules, hierarchies, and often unpleasant treatments, produced much of the disturbed behavior it claimed to treat. The practical impetus came from two sources that were somewhat in tension with each other. The first was the introduction of chlorpromazine, the first effective antipsychotic medication, in the mid-1950s, which made it possible to control the most florid symptoms of psychosis and therefore seemed to make long-term institutionalization medically unnecessary. The second was fiscal and political rather than therapeutic, as state governments found the maintenance of large psychiatric institutions enormously expensive, and the deinstitutionalization movement provided a politically appealing rationale for reducing those costs. The Community Mental Health Centers Act of 1963 provided the legislative framework for deinstitutionalization by establishing a network of community mental health centers that were supposed to provide outpatient treatment, crisis intervention, and support services for the patients being discharged from state hospitals. Unfortunately, the community mental health centers were never adequately funded to fulfill this mandate. They were chronically understaffed,

underfunded, and poorly coordinated with the housing, social service, and substance abuse treatment systems that discharged patients also needed. The result was not the humane community-based care that reformers had envisioned but a new and arguably more chaotic form of neglect. Former psychiatric patients were discharged into communities that had neither the resources nor the infrastructure to support them, and which responded to their presence with a combination of indifference and criminalization. By the 1980s it was clear that a substantial proportion of the homeless population in American cities consisted of people with serious mental illness who had been discharged from psychiatric hospitals without adequate community support, and that the jails and prisons of the United States had effectively become the largest psychiatric institutions in the country. Historians and mental health advocates have described this as the *transinstitutionalization* of the severely mentally ill rather than their genuine liberation (Scull, 1977; Torrey, 1997). This may seem a recurring pattern in the history of mental health treatment.

There is one figure whose work did more than any other to shape the way that modern psychiatry classifies and diagnoses mental illness. **Emil Kraepelin** (born 1856) was a German psychiatrist whose systematic approach to the description and classification of mental disorders established the framework within which virtually all subsequent psychiatric diagnosis has operated, including the Diagnostic and Statistical Manual of Mental Disorders that remains the standard classificatory system in American psychiatry and clinical psychology today. Kraepelin insisted that psychiatric diagnosis should be grounded in careful longitudinal observation of patients over time, tracking the course and outcome of their conditions rather than merely describing their symptoms at a single point in time. This longitudinal emphasis led him to propose what became one of the most influential distinctions in the history of psychiatry, the distinction between dementia praecox, the condition we now call schizophrenia, and manic-depressive insanity, the condition we now call bipolar disorder. The distinction was based not on the presence or absence of particular symptoms at the time of examination (both conditions could present with similar symptoms including delusions and hallucinations) but on their characteristic course and outcome over time. Dementia praecox typically followed a deteriorating course toward chronic disability, while manic-depressive insanity typically followed an episodic course with periods of recovery between episodes. This emphasis on course and outcome as the basis of diagnostic distinction was a major scientific advance as it moved psychiatric diagnosis beyond the symptom-counting of earlier classification systems toward something more like the etiological classification of physical medicine, in which diseases were distinguished by their underlying course and mechanism rather than merely by their surface presentation.

The DSM was first published by the American Psychiatric Association in 1952, initially as a variant of a World Health Organization classification system, and its early editions were heavily influenced by psychodynamic concepts that owed more to Freud than to Kraepelin. The third edition DSM-III (1980) represented a decisive shift back toward the Kraepelinian tradition, replacing the psychodynamic etiological accounts of the earlier editions with a descriptive, symptom-based, atheoretical classification system that deliberately avoided committing to any particular account of the underlying causes of mental disorders. The DSM has continued to evolve through subsequent editions, with each revision reflecting new research findings, changing clinical consensus, and occasionally the kind of political and social pressures that a diagnostic system used for legal, insurance, and social policy purposes inevitably attracts. The most famous example of the latter was the removal of homosexuality from the DSM in 1973. The decision reflected a growing recognition within psychiatry that homosexuality itself was not associated with the distress or dysfunction that characterize mental disorders, and that its classification as a disorder reflected prevailing cultural assumptions rather than estab-

lished clinical evidence. This episode illustrates the aforementioned subjectivity of normality, and a tension that has run through the history of psychiatric classification since before Kraepelin — the tension between the aspiration to a purely empirical, value-neutral, scientifically grounded system of disease classification and the reality that what counts as a mental disorder is never entirely separable from the social, cultural, and political context in which the classification is made. The DSM in all its editions has continued to negotiate the same tension between scientific aspiration and social reality.

KEY TERMS

Key Terms

- abnormal behavior, psychopathology, vitalism, naturalism, Mesmerism, animal magnetism, hysteria, psychodynamics, humoral theory, behavior modification, self-efficacy, Biomedical model, Biopsychosical model,

STUDY QUESTIONS

Study Questions

1. Explain Galen's theory of personality.
2. How are biomedical explanations of abnormal behavior different from psychological explanations?
3. Outline the mind-body problem as is relates to our understanding of the causes and treatment of abnormal behavior.
4. What is the difference, if any, between the terms abnormal behavior and psychopathology?
5. Outline the history of the institutionalization of mental patients.

CHAPTER 17: PHILOSOPHICAL PRELUDE TO THE MODERN SELF

INTRODUCTION

Learning Objectives
Understand:

- the general theme of romanticism
- how and why romanticism influenced artistic movements
- Schopenhauer's theory of the Will to Live and how he suggests people should deal with instinctual needs
- the general theme of existentialism
- Nietzsche's theory of the Will to Power and how he suggests people should deal with instinctual needs
- the centrality of free will in existential philosophy
- Heidegger's notion of being-in-the-world and Dasein
- Heidegger's concept of authenticity
- Sartre's notion of being precedes essence

By the late eighteenth century, many European intellectuals had grown dissatisfied with the Enlightenment's conception of human nature. Rationalist philosophers had emphasized reason as the defining characteristic of humanity, while British empiricists argued that knowledge arose from sensory experience and the association of ideas. Together, these traditions greatly advanced philosophy and science, but critics argued that they left too little room for the emotional, imaginative, creative, and deeply personal dimensions of human life. Humans seemed increasingly portrayed as rational calculators or passive recipients of experience rather than as individuals struggling with passion, purpose, and identity.

Romanticism emerged as both a philosophical and cultural response to these perceived limitations. Closely connected with literature, art, music, and politics, it emphasized emotion, imagination, individuality, and authenticity, while celebrating nature and the uniqueness of personal experience. Rather than treating reason as the sole path to understanding, Romantic thinkers argued that the richest truths about human existence were often found in feeling, creativity, and lived experience. These themes profoundly influenced later existentialist philosophers, who retained Romanticism's concern with individuality while shifting their attention toward freedom, responsibility, anxiety, and the search for meaning. In this chapter, we explore these two closely related traditions and their enduring influence on psychology's understanding of the person.

ROMANTICISM

According to the romantics, people are more than the sum of their sensory experiences, and yet they are also more than just an intellect. The human condition is one of struggle for the freedom to live out one's passions and needs. As **Jean-Jacques Rousseau** (born 1712) wrote, "Man is born free and yet we see him everywhere in chains" (1762/1947, p. 5). A central theme of romanticism is human free will, as is evident by Rousseau's quote. Everyone has their own instinctual needs, and everyone is inherently good. It is only the restrictions on our liberty that come from living in society that causes us to be unhappy, and that causes evil in the world. A human untouched by society would be found living in accord with their own feelings and needs, and would not be selfish, but rather fulfilled. Rousseau called such a person the *Noble Savage* and he wrote extensively about the social contract, the nature in which people surrender some degree of their liberty in order to live in society.

Johann Wolfgang von Goethe (born 1749) extended the notion of freedom and the need to fulfill one's passions and needs, to grow personally. He characterized living as a source of strain and stress, of suffering, and our instinctual needs provide us with the means to overcome this suffering. He was more than a philosopher; he was also a writer and poet, publishing his famous *Faust* in 1818, about a man willing to sell his soul to Satan in exchange for an end to suffering. In the end, Faust realizes that freedom is the path away from suffering. Goethe's work illustrates the connection romanticism had with art. Romantic notions were expressed often in literature (Goethe, E.T.A. Hoffman, and later Edgar Allan Poe, Nathaniel Hawthorne, Mary Shelly, and J.R.R. Tolkien), poetry (Samuel Coleridge Taylor, William Blake, and William Wordsworth), music (Ludwig van Beethoven), opera (Richard Wagner), and painting (Eugène Delacroix, Thomas Cole).

Arthur Schopenhauer (born 1788) provides one of the most important contributions. He was heavily influenced by Kant, but had a different idea about the noumenal world, or thing-in-itself. For Schopenhauer, this world is not an objective material world, but rather is an irrational, blind, striving force that he called *will*. This is not the same personal or individual will that was studied by Wundt, rather it is an impersonal drive that permeates all reality and ultimately generates all being. Amongst animal life, it manifests as the ***Will to Live***, creating a primal instinct toward survival. Human judgment is not based on reason, but rather this unconscious need to stay alive. Schopenhauer also described the will as the source of all suffering, because it creates deficiency (i.e., need), and then desire, and then striving to satisfy that desire, leading only to temporary satisfaction and then more deficiency and desire. The more one gives in to it, the stronger the need becomes, creating an endless cycle of suffering.

One way to prevent this could be to deny the will entirely, leading to *asceticism*, which means a lifestyle devoid of all comforts and pleasures, eating and drinking only the minimum necessary to avoid death, but otherwise avoiding all indulgence. However, Schopenhauer understood how unpleasant this was and here revealed the degree to which he had been influenced by early Hindu and Buddhist teachings. In those systems, the "middle way" is the path that avoids the extremes of both asceticism and completely giving in to desire and attachment. Schopenhauer echoed such ideas, including in his work an idea later called *sublimation*, which means to channel the energies of the will into non-need-based

behavior, such as aesthetic and creative experiences. By refocusing mental effort on non-need-based activities, one can *transcend* need and desire and thus avoid suffering.

For Schopenhauer, the ability to rise above desires and needs is what separates humans from the animals, and thus, in order to be fully human, one must exercise this ability. By doing so, one can release the energies associated with need into behaviors like art and scholarly endeavors. The ability to create art is uniquely human because it happens only by sublimating instinctual energies. In contrast, nonhuman animals are beings of pure instinct, driven entirely by their Will to Live. An interesting side effect is that the topics of our art, arising through symbols and metaphor, reveal the contents of our needs, desires, and ultimately the Will to Live. Hence, the romantic art listed above bursts with symbolism regarding the struggles of the unconscious mind. In this era, music, painting, and literature became much more emotional and personal than the neoclassical era that preceded it, which tended to feature calm, idealized figures, moral and religious messages, and reason.

EXISTENTIALISM

The difference between romanticism and existentialism is subtle, and Schopenhauer represents a bridge between these philosophies. As a romantic philosopher he emphasized the irrational needs arising from the Will to Live, but as an existentialist, he focused on the nature of being – what it means to be, or to exist. As noted above, the will generates all being. These questions about existence motivate one of the big questions in philosophy: What does it mean to be, or more famously *What is the meaning of life*? That is, why are we here and what are we supposed to do with ourselves and existence?

Traditionally, people have looked to religion to find an answer to this question. **Søren Kierkegaard** (born 1813) criticized religion. To be fair, he did not criticize religion so much as he criticized the way people practiced it. He believed that one's spirituality could be used as a way to find meaning in life, but he felt that many were too reflexive and dogmatic in their religion. That is, they just did what their religious leaders told them to do, rather than having a deep and personal relationship with God. Kierkegaard felt that *truth was subjective*, and thus there was little to be gained from practicing a mechanical and ritualized ceremony as prescribed by others.

Perhaps the most famous existentialist was **Friedrich Nietzsche** (born 1844). He agreed with Kierkegaard that truth was subjective and that dogmatic religions could not provide a universal truth, because there was no universal truth. But Nietzsche was openly hostile to religion, proclaiming, "God is dead," and thus stating that the meaning of one's existence can only be found within oneself. No external agency, whether it is God, religion, society, government, or any other person can tell you what is true and right for your own life. You must determine it for yourself. The means for finding this truth hearkens back to romanticism, for Nietzsche felt that it resided within our instinctual needs.

Nietzsche felt that everyone possessed a ***Will to Power***, in contrast to Schopenhauer's Will to Live. Our needs are not based in suffering and deficiency, but from a need to become something more—to achieve our full potential and become whatever it is we are destined to become. Nietzsche saw the human mind as composed of competing drives and instincts but also influenced by external societal and religious dictates. He proposed that one must master the self, understanding one's own needs vs. what society expects of us, and that true psychological maturity comes when one lives in alignment with self-created meaning and purpose. Doing so would allow us to become the *Superman* (or *Übermensch* in the original German, which translates also as Overman, or even Beyond-man), the fully evolved and maximized human being. Such a person is reminiscent of Rousseau's Noble Savage; it is one who is living independently of societal standards of morality and instead is living according to their own personal moral code. Rather than sublimating one's instincts as Schopenhauer prescribed, Nietzsche says that one should give in to them fully and live completely in accord with them. It is only in this way that we can overcome our base animalistic needs and become fulfilled. Echoing Rousseau and Goethe, one has to live with complete freedom and liberty to achieve this goal.

Nietzsche had used philosophy to confront the need for individuals to create meaning from within. In his view, the self was not given but had to be forged through struggle and the exercise of the will. But even Nietzsche left certain questions open. What *is* the self that struggles? What does it mean

to exist, to choose, to be? These are precisely the questions taken up by **Martin Heidegger** (born 1889), who marked a turning point in 20th century existential phenomenology. Where Nietzsche had asked what one *should* become in a world without foundations, Heidegger asked what it *means to be* in the first place. His work moved psychology's interest in the self away from instincts or drives, and toward ***being-in-the-world*** — a situated, embodied, finite mode of human existence that must take responsibility for its own being.

Heidegger was somewhat critical of metaphysics, because as he saw it, the field was overly focused on what exists (i.e., ontology), and that this had obscured the more important question, what is existence in the first place? He felt that only Parmenides and Heraclitus had correctly recognized the importance of this question. A fragment from Parmenides claims "For it is the same thing to think and to be" inspired Heidegger to conclude that being reveals itself through thought. He felt that philosophy then took a wrong turn, with Plato and Aristotle misunderstanding the question of *thinking of Being*, and they instead focused on beings (entities) rather than Being itself.

Heidegger saw human existence as a special kind of Being, which he termed ***Dasein***, or *being-there* (and sometimes interpreted as *presence*). He coined this term to demonstrate how human existence is embedded in, and cannot be separated from, its lived context. We are always already in relationships, in culture, in time, and in situations that shape who we are and what we care about. This notion challenged the idea that the mind is a container of thoughts looking out at the world; instead, our very mode of being is active engagement with the world. This relates also to his idea of thrownness – in our lives we are thrown into situations without the chance to reflect on them and we must always go with the flow and rely on instinct. Being born is just the first case of being thrown into something unexpected.

A central feature of Dasein is that it is aware of its own finitude. Humans are the kind of Being that knows it will die. Heidegger called this ***being-toward-death***, and while he saw it as a source of deep anxiety, he also viewed it as a gateway to ***authenticity***. Most people, Heidegger argued, live inauthentically, absorbed in social roles, distracted by trivialities, and avoiding the reality of their mortality. But in moments of existential crisis, especially in facing death, we can confront our responsibility for our own being. This confrontation opens the possibility of living authentically, guided not by convention but by our own chosen values and commitments.

No account of existentialism and its psychological implications would be complete without two figures whose work brought the existentialist tradition to its widest influence and whose personal and intellectual relationship was itself one of the most complicated, and perhaps controversial, partnerships in the history of modern thought. **Jean-Paul Sartre** (born 1905) and **Simone de Beauvoir** (born 1908) were both students in Paris in the late 1920s, and together they shaped the popular understanding of existentialism more than any other figures in the tradition, by extending it into literature, political engagement, and the analysis of concrete social situations including gender, race, and colonialism.

Sartre's existentialism is organized around a single foundational claim, which is *existence precedes essence*. The claim is most readily understood by contrast with the traditional philosophical and theological picture it was rejecting. In the traditional picture, the essence of a thing, what it is, what it is for, what constitutes its nature, precedes and determines its existence. We have treated versions of this sort of essentialism in both Plato and Thomas Aquinas. This, as it turns out, is a form of teleology, human beings have a nature and a purpose that defined what they were and what they should become before any individual person made any choices. Sartre rejected this picture entirely. He rejected God,

determinism, nativism, and any sort of fixed essence. Human beings simply exist, and they find themselves thrown into a world they did not choose, in circumstances they did not select, without any prior specification of what they are or what they should become. Existence comes first, and essence, what a person is, what their life means, what kind of person they have made themselves, is the product of the choices they make in the course of that existence. We are, in Sartre's formulation, condemned to be free, condemned because the freedom is not chosen and cannot be escaped, free because there is no nature, no God, no social role, and no historical necessity that can relieve us of the responsibility for what we make of ourselves.

If human beings have no fixed essence and are radically free to choose what they become, then psychological suffering cannot be fully explained by reference to biological drives, unconscious conflicts, or conditioned behavioral histories. Rather, suffering is always in part a response to the human condition itself, to the anxiety generated by freedom, by the absence of any pre-given meaning or purpose, and by the awareness of mortality that Heidegger had identified as the defining horizon of human existence. Sartre called the characteristic response to this anxiety *bad faith*, the attempt to deny one's own freedom by treating oneself as a determined thing rather than a free subject, by hiding behind social roles or historical necessity in order to escape the burden of responsibility that freedom imposes. The person who explains their behavior by reference to their character, "I cannot help it, I am just an anxious person, I was made this way by my childhood," is in bad faith, treating themselves as a fixed thing with determined properties rather than as a free subject capable of choosing differently. Authenticity, the existential ideal that Sartre shared with Heidegger, was the difficult achievement of acknowledging one's freedom, accepting responsibility for one's choices, and refusing the consolations of bad faith even when they were readily available.

Simone de Beauvoir extended this existentialist framework particularly in the analysis of gender and social identity. She applied the existentialist concepts of freedom, situation, and the other to the analysis of women's social and psychological condition. Her most famous formulation is that one is not born, but rather becomes, a woman. This is the existentialist claim applied to gender: femininity is not a biological given but a social construction, not an essence that precedes existence but a set of characteristics that are imposed on women by a patriarchal culture and that women internalize through the process of socialization. What others had described as the biological destiny of women, passivity, the orientation toward others rather than toward one's own self, was, on de Beauvoir's account, the product of women's social situation rather than their biology, the result of a culture that systematically denied women the status of free subjects and defined them instead as Other, as the object against which the male subject defined himself rather than as subjects with their own projects, their own freedom, and their own claims to authentic existence. Liberation, on de Beauvoir's account, required not therapy but transformation of the social conditions that produced the psychological characteristics that therapy was designed to treat, a political rather than a clinical response to what was fundamentally a political rather than a psychological problem.

SUMMARY

The ideas in this chapter represent significant influences on later psychology. The concepts of instinctual needs and sublimation arising from the romantic philosophers have definite effects on Freud's later views on instinct and his pleasure principle (Chapter 18). The existential views of self, becoming, and existence were highly influential for the psychologists of the third-force movement, such as Abraham Maslow and Carl Rogers (Chapter 19).

KEY TERMS

Key Terms

- romanticism, Noble Savage, Will to Live, sublimation, existentialism, Will to Power, being-in-the-world, Dassein, being-toward-death, authenticity

STUDY QUESTIONS

Study Questions

1. Why is freedom so important to the romantic and existentialist traditions?
2. How do Schopenhauer and Nietzsche differ in terms of their views on instinct?
3. Identify parallels between Rousseau's Noble Savage and Nietzshe's Superman
4. Explain the philosophical problem and context that romanticism was responding to.
5. Explain Sartre's idea of existence precedes essence and contrast it with Platonic thought.

CHAPTER 18: THE PSYCHODYNAMIC TURN

INTRODUCTION

Learning Objectives
Understand:

- the role of instinct in Freud's theory
- the nature of the id and the role of the pleasure principle
- the role that frustration plays in development, including the primary process and secondary process
- the nature of the ego and the role of the reality principle
- the difference between the fantasy principle and reality principle
- the nature of the superego, and how the conscience and ego-ideal develop
- the 5 stages of psychosexual development and the role of the eros/libido instinct in this process
- The common themes of NeoFreudian thought

The preceding two chapters have provided significant developments that set the stage for Freud and his psychodynamic theory. First, Charcot theorized a connection between hypnotizability and hysteria. We also saw the romantics struggle over the role of instinctual needs in human life. One of the unusual aspects of these instincts is that many people do not seem to be aware of them, or rather, it takes some effort to separate one's own needs from those imposed by society. Why is it so difficult? Why are we not clearly aware of our own needs and why do we not always live by them?

When **Sigmund Freud** (born 1856) came on the scene, he was one of the first to suggest an explanation for this. After studying with Charcot, Freud came to the realization that the psychological problems associated with hysteria must be buried deep in the unconscious mind, and hypnosis works because it clears away the conscious mind and allows the therapist to access directly the unconscious mind. In his reflection on this, Freud had to develop a complete theory on the nature of the unconscious mind. What is it for? What kinds of things are stored in it? Why is it needed? It was then that Freud suggested that the unconscious mind is the source of our instinctual needs and urges that the existentialists had discussed.

FREUD'S PSYCHODYNAMIC THEORY OF PERSONALITY

Freud was trained as a neurologist in an intellectual environment heavily shaped by German physiology and Biological Kantianism. Two major influences on Freud were Hermann von Helmholtz and Ernst Brücke, who agreed that all physiological processes, including mental processes, must be explained by physical and chemical forces governed by the law of conservation of energy. The latter idea originated from the emerging science of thermodynamics and its first law stating that energy may neither be created nor destroyed, but only transformed. The study of energy flows is called dynamics, and Freud wished to extend these notions into the mind, so he envisioned the idea of *psychical energy*, which is transformed from bodily energy, and the study of its flows and laws was ***psychodynamics***.

To develop a psychodynamic theory, Freud needed to start with a definition of psychical energy. He argued that it was transformed from bodily energy but also described it as taking the form of instinctual needs, and he defined two core such needs, a life need called *Eros*, and a death and destruction need called *Thanatos*. The energy level associated with the former is called *libido*, and for the latter, *destrudo* was a term coined later. From this basis he developed his famous theory of self and personality.

These instincts are generated into an unconscious part of the mind called the ***id***. We can consider the id as akin to a reservoir that contains the energies created by instinctual needs. Further, the id operates according to the ***pleasure principle***, because echoing Schopenhauer, need creates suffering and desire, or for Freud, *frustration* and *psychological tension*. When needs are not met, the energy associated with the instinct begins to increase, creating a feeling of tension and frustration. The goal of the pleasure principle is to always minimize the levels of such need and frustration, which is then pleasurable.

In some instances, the pleasure principle can be achieved by reflexive action. One example of this is the blink reflex in infants. Light shining in the eye creates a buildup of neural energy, and blinking closes the eye and allows the visual system to return to a quiet state. However, most of our instinctual needs cannot be met by reflexive action, so the infant, whose personality consists of nothing but the id, will soon begin to experience frustration. The frustration builds, creating unpleasant feelings that lead to crying and fussiness. Eventually, this behavior brings the attention of a caregiver, who attempts to soothe the child by bringing food, or a dry diaper, or whatever the caregiver believes the child wants.

Considering that perhaps the child was hungry, and that their instinctual needs for minimizing the tension associated with hunger were not being met, then if the caregiver brought food, the tension would decrease. The child remembers this. The child learns the relation between crying and achieving satisfaction. The very first instance of learning has occurred. Further, the child remembers exactly what it was that satisfied the need, whether it was the bottle or breast. The next time the child feels hungry, they will remember the bottle or breast and begin to fantasize about it. This growth in what the child is capable of cognitively (i.e., learning and memory), is called the *primary process.* It never would have happened were it not for frustration. Thus, in Freud's account, frustration is the cause of psychological development. If one never experiences frustration, one will remain in an infantile state of mind forever.

The primary process has limitations, though. Learning and memory are not enough to always satisfy the pleasure principle. Eventually, more frustration will occur. Another problem is that the id operates using the *fantasy principle.* It is not able to tell the difference between reality and fantasy because it can make no distinction about reality. To the id, fantasizing about the desired object is the same as having it. However, fantasy does not decrease tension and does not satisfy the pleasure principle.

To continue with the reservoir metaphor, frustration leads to a buildup of energy within the reservoir so that it risks overflowing its banks. We might also imagine a dam at one end of the reservoir, and such a dam could release the metaphorical floodgates to help temporarily reduce the pressure. This can happen, for example, through processes like *displacement* or *shunting*, which are *defense mechanisms* designed to distract from the frustration.

Ultimately, these measures are insufficient, and the reservoir must overflow, leading to the creation of a second reservoir, and thus a new layer to the personality called the ***ego***. The ego forms the conscious mind and operates according to the *reality principle.* It can tell the difference between fantasy and reality, so its development serves the purpose of letting the child interact with the real world so they can go and get whatever it is that will satisfy the id. However, certain skills must be acquired before this can happen. The child must be able to perceive the real world. Developmental psychologists know that infants are born with poor vision. Freud suggests that the ego triggers the development of vision and other perceptual abilities, for the sole goal of interacting with the world and achieving the needs of the id. Further, the motor skills need to be developed, such as learning to operate one's hands and arms to reach and grab for things, plus learning to crawl and eventually walk. This perceptual and motor development is part of the *secondary process*, which also involves the development of language, reasoning, and problem-solving abilities. Like the primary process, the secondary process occurs because of frustration.

So now, the child is older and getting into the toddler years. Personality wise, it is an ego and an id. The id has its wants and needs, and it wants them right away. The ego can go get the things that satisfy these needs. At this stage of development, the ego is little more than a slave to the id. However, something new is about to happen. Toddlers are notorious for getting into all kinds of stuff, a time many parents call the "terrible twos". They crawl up on cabinets. They open doors and drawers. They are always getting into something they should not be. Freud would say the ego is exploring and looking for the things that will satisfy the id. But a new source of frustration arises when the parents or other caregivers come around and say, "No!" The ego has no conception of right and wrong; it only understands achievement, that is, getting what the id needs. The discipline of the parent creates frustration and a buildup of excess psychical energy so that a third layer of the personality forms.

The ***superego*** is created to deal with the problem of right and wrong, and yes and no. It creates a list of morally correct behaviors known as the *ego-ideal*, and a list of morally wrong behaviors known as the *conscience.* It is part of the unconscious mind, and like the id, works on the fantasy principle. Working behind the scenes much like the id, it exercises control over the ego. Now the ego must perform a balancing act between the needs of the id and the moral dictates of the superego. It should be noted that the content of the superego comes from other people, and from society. Further, because it works according to the fantasy principle, it does not understand the difference between doing bad deeds and thinking about them. It causes us to stop thinking about any of our needs that society tells us are immoral. Hence, we have discovered the reason why our instincts are so hard to know. If we learned as children that some of our instincts are morally objectionable, then the superego will always be at work to *repress* these needs, another defense mechanism.

The superego exercises control over the ego through reward and punishment. When the ego violates the conscience, the superego punishes it by creating unpleasant feelings like guilt, shame, or embarrassment. If the ego adheres to the ego-ideal, the superego rewards it by creating pleasant feelings like pride and contentment. As Freud might say, there is no such thing as an accident. A child who sneaks a cookie when they know they are not supposed to may run outside and trip, dropping the cookie in the dirt and skinning their knee. Freud would say this is the superego's unconscious punishment for doing something wrong.

To summarize, Freud developed a theory of the conscious and unconscious mind based around the concept of psychical energy. The name of the theory, psychodynamics, emphasizes the interplay of instinctual energies between the various parts of the personality. As noted, the Eros, and its energy, libido, are a major component of instinct, and Freud's ideas on this topic spurred one of the more controversial aspects of his theory.

THE STAGES OF PSYCHOSEXUAL DEVELOPMENT

The sexual needs of the Eros are said to originate from bodily sources, namely the erogenous zones. Thus, as levels of the libido increase, we are driven to satisfy these various erogenous zones in various ways. Freud identified three erogenous zones which are differently active at different stages in life: the mouth, the anus, and the genitals.

Stage 1: The Oral Stage

Infants are born in the oral stage. Their libido drives them to stimulate their mouths by biting, sucking, and in general taking something into the mouth. Failure to satisfy this urge results in frustration. A child who does not sufficiently satisfy its oral needs will leave this need buried in the unconscious. As adults, these needs are still in there, wanting to be expressed and satisfied, so they manifest themselves in various ways. Echoing the concept of sublimation, the needs are not always manifested literally as oral behaviors, but as metaphorical oral behaviors. Any behavior that is metaphorically oral may thus be seen in the adult personality.

Examples can include being very talkative, or very quiet, eating disorders, or smoking, which are more obviously oral. But the oral behavior of "taking in" can be manifested as anything the person "takes in" in a more figurative sense, such as learning and gaining new experiences. A child who was frustrated during the oral stage may develop a *fixation*, wanting to make up for such lack by maximizing "taking in" as an adult. This could manifest as a lifelong love of learning in an attempt to meet unsatisfied needs for taking in. Conversely, a *retaliation* may occur, in which the child now rejects "taking in" and abhors school and learning.

Stage 2: The Anal Stage

Coinciding with the development of the superego, one of the child's first major encounters with authority and discipline are the toilet training years of early childhood. During these years, the child has moved into the anal stage, where it takes pleasure from stimulating the anus with defecation. When the urge comes, the id wants immediate gratification by moving the bowels immediately. However, the parents step in with discipline, telling the child they cannot go right away, but must *delay gratification* until they can get to the toilet. Resolving this stage depends on how the child responds to the authority of the parents. The ideal goal is to develop the superego and incorporate the discipline of the parents into oneself, developing self-discipline. If the parent is too strict and authoritarian, the child might rebel against the authority, developing a *reaction formation.* This involves coping with authority by developing an overly strong sense of self-discipline. In the adult, this manifests as the *anal retentive* personality trait. The adult is always extremely organized and neat, punctual for appointments, and stingy with money. On the other hand, the child might react strongly against discipline, which is another example of retaliation. This would entail rejecting authority in the adult *anal expulsive* personality. Such a person would develop with a lack of self-discipline, being slovenly, late to appointments, and always disorganized.

Stage 3: The Phallic Stage

Moving further into the early childhood years (about ages 4–6), the libidinal energy switches to the genitals. Children in this stage first begin to understand the difference between the sexes. They learn about the difference in anatomy between males and females and ultimately begin to understand gender identity and gender roles/concepts. In order to achieve this, they must satisfy the libidinal urge to stimulate the genitals through masturbation. Young children play with themselves in the process of learning about their own anatomy and developing an understanding of it.

Freud makes a controversial move in this part of his theory. Boys and girls pass through the stage differently. Boys develop the *Oedipus Complex*, named after the Greek tragedy *Oedipus Rex*, by Sophocles. Oedipus was the son of King Laius, who had been told by an Oracle that he would be killed by the hand of his own son. The King ordered his son executed, but the servants could not bear to murder the child, so they sent him into exile. Oedipus was raised far away but as an adult had consulted the same Oracle as his real father. The Oracle had repeated the prophecy told to his father, that Oedipus was destined to kill his own father and wed his mother. In an attempt to escape this fate, he left his home, on the belief that Polybus and Merope, the parents that raised him, were his real parents. While traveling in what was his original homeland, he encounters, by chance, Laius, with whom he has an argument and kills, fulfilling half of the prophecy. Meanwhile, the kingdom had been under a curse, and by solving the Riddle of the Sphinx and removing the curse, Oedipus was rewarded with the kingship and the hand of the Queen, who also happened to be his mother, fulfilling the rest of the prophesy. In the spirit of any good tragedy, more bad things happen, as his mother, Jocasta, commits suicide when the truth is revealed, while Oedipus, horrified, stabs himself in the eyes.

Freud suggested that, in the spirit of sublimation, this story reflects repressed, unconscious needs. So, he theorized that male children pass through a so-called Oedipal phase where they sexually desire their mothers and fear their fathers. They fear that if the father knew about these feelings, he would castrate the child in retaliation. So, a component of the Oedipus complex is *castration anxiety*: fear of losing one's genitals.

Girls pass through the Oedipus Complex differently. Note that the name of this phase is phallic, with an emphasis on the male phallus. Hence, the primary component of the female experience in this stage is *penis envy*. They become aware that males have a penis, and they do not. They also realize that their mother lacks a penis just like they do, so according to Freud, they blame the mother, concluding that perhaps they used to have one but were castrated by the mother so that they would be alike. The father then becomes a love object for the girl and desires a child by him as a symbolic replacement for the penis.

Stage 4: The Latent Stage

During the middle childhood years following the phallic stage, libidinal energies are quieted. This is called the latent stage because the libido is quieted until the fifth stage.

Stage 5: The Genital Stage

Like the phallic stage, the genital stage involves a desire to stimulate the genitals, but unlike the masturbatory self-discovery of the phallic stage, adolescents in the genital stage desire sexual intercourse. Much of human behavior during this phase is driven by the desire for sex. Dating and socialization, and ultimately marriage, is caused by the desire for sex. Sexual imagery becomes prevalent in art created by adults as well, again echoing the romantics and sublimation. We remain in the genital stage for the remainder of our sexually active years.

PSYCHOANALYSIS

Freud, of course, did more than generate a psychodynamic theory, because his goal ultimately was to help people overcome their psychological problems, which he felt were often repressed traumas and frustrations, retaliations and reaction formations, buried in the unconscious mind. The goal of his psychoanalysis was to probe the patient's unconscious mind in order to discover the original source of the problem, so that it can be confronted, culminating in the emotional release of ***catharsis***, which is somewhat reminiscent of Mesmer's therapeutic goals.

This is a challenge, though, because, by definition, the unconscious mind is not available to introspection, so the patients could not be asked to describe these hidden problems explicitly. But having learned hypnosis under Charcot, Freud hypothesized that the effect of the technique was to assist in laying aside the person's conscious mind, allowing the hypnotist to access their unconscious mind. Unfortunately for Freud, he found himself struggling to consistently induce hypnotic states and he eventually abandoned the method. In its stead, he developed *dream analysis* and interpretation, believing that the symbols and metaphors in dreams reveal the influences of the unconscious. *Word association* was another technique, as Freud suggested that speech errors, now sometimes called Freudian slips, reflected a subtle influence by the unconscious mind. Using this method, the analyst states a word, and the patient is instructed to say the first thing that comes to their mind, quickly without thinking too much about it. The goal of this process is to prevent the patient from inhibiting the slips that might reveal the source of their problem.

THE NEO-FREUDIANS

While Freud's theory of psychosexual development and psychodynamics revolutionized the understanding of human behavior, his work also generated significant debate, especially among his own followers. Many of those closest to Freud eventually broke away and presented their own revisions. These thinkers, often referred to as the *Neo-Freudians*, retained Freud's basic emphasis on unconscious processes and early childhood but expanded the theory in new directions, emphasizing social, cultural, and interpersonal forces more than Freud himself had done.

Alfred Adler (born 1870) was the first major figure to break with Freud, and his departure marked an early turning point in the evolution of psychodynamic theory. Although Adler initially worked closely with Freud, he came to reject the centrality of sexual drives in favor of what he saw as a need for social connection and overcoming feelings of inferiority, creating the notion of the ***inferiority complex***. At the heart of Adler's theory is the concept of striving for superiority, a universal drive not for dominance in a hostile sense, but for self-improvement and fulfillment. He argued that all individuals grapple with feelings of inferiority, particularly in childhood, and that personality is shaped by the unique ways people compensate for these early vulnerabilities. Adler also emphasized the importance of a person's capacity to cooperate with others and contribute to the well-being of society. In contrast to Freud's focus on internal conflict and unconscious impulses, Adler offered a more optimistic and socially embedded view of human development, highlighting the creative and purposive nature of the self.

Next, **Carl Jung** (born 1875) took an even more expansive departure from Freud, proposing a theory that blended psychology with mythology, spirituality, and cultural history. While Jung agreed with Freud on the importance of the unconscious, he believed Freud's view was too narrow and overly focused on repressed sexuality. Jung introduced the concept of the ***collective unconscious***, a shared reservoir of memory traces inherited from our ancestors and expressed through universal symbols he called ***archetypes***. These include figures such as the *Persona*, *Shadow*, the *Anima/Animus*, and the *Self*, each representing fundamental aspects of identity. The Persona is the person we present to the outside world; it reflects how we fit in within a social environment. The Shadow is the darker part of the mind, that is less socially acceptable, including feelings of greed, envy and hate. The Anima represents an unconscious feminine image that exists in men, and its counterpart the Animus represents an unconscious masculine image in women. The Self represents what Jung considered to be the result of psychological maturation, or *individuation*, a cohesive identity that balances all the archetypal identities.

One example of how Jung modified Freud is in his treatment of the female Oedipus Complex. Jung coined the term *Electra Complex*, naming it for another Greek tragedy by Sophocles (a similar play was also told by Euripides), about a girl named Electra who blames her mother for the death of her father, and so vengefully orders her assassination. For Jung, the nature of this stage is not about sex and incestuous desires, but rather about the formation of identity, specifically the Anima and Animus. Through the development of these archetypes, boys and girls are able to understand both genders and ultimately develop their own gender identity.

Karen Horney (born 1885) was one of the first major voices to challenge Freud's theories from a feminist and cultural perspective. She broke from Freud on several key points, most notably his theory of penis envy, which she argued reflected patriarchal biases rather than psychological truths. Horney proposed instead that feelings of inferiority in women often stemmed from social and cultural oppression. More broadly, she shifted the focus of psychodynamic theory away from unconscious sexual drives and toward interpersonal relationships and anxiety. According to Horney, the central motivational force in personality was the need to cope with basic anxiety, a feeling of helplessness in a potentially hostile world. She described three primary coping strategies: moving toward people (compliance), moving against people (aggression), and moving away from people (withdrawal). Horney emphasized that healthy personality development depended on warm, secure early relationships, and that distorted self-images often underpinned neurotic behavior.

Finally, **Erik Erikson** (born 1902) reimagined Freud's psychosexual theory by placing greater emphasis on social and cultural influences. Rather than limiting development to early childhood, Erikson proposed a ***psychosocial theory*** encompassing eight stages, or crises, across the entire lifespan. Each crisis is marked by a central conflict (e.g., identity vs. role confusion, intimacy vs. isolation) that individuals must navigate to develop a coherent sense of self. One of his more influential contributions was the concept of the adolescent *identity crisis*, where he explored the importance of social roles, exploration, and commitment in forming a stable self-concept.

SUMMARY

There is little doubt that Freudian ideas have had a massive impact on psychology, psychotherapy, and popular culture. But over the course of the 20th century, these ideas faded from popularity as more scientific approaches began to emerge. Recalling Popper's argument that a scientific theory must be falsifiable, Freudian theory fails in this regard. Claims about the formation of various personality problems are never predictive; rather, they are only explained after-the-fact. An adult exhibiting signs of the anal-retentive personality, for example, is explained only after visiting a psychoanalyst, who then suggests to the patient the source of their problem as having been spanked following a bathroom accident. At best, such accounts are stories about behavior, not scientific predictions that can be verified or falsified. Further, the Freudian notion of frustration being at the heart of all psychological development was considered by some to be a pessimistic view of humanity and was challenged by the psychologists considered in the next chapter.

KEY TERMS

Key Terms

- psychodynamics, Eros, Thanatos, libido, destrudo, pleasure principle, id, ego, superego, primary process, secondary process, fantasy principle, reality principle, defense mechanism, frustration, fixation, reaction formation, Oedipus Complex, psychoanalysis, catharsis, inferiority complex, collective unconscious, archetype, Electra Complex, psychosocial theory

STUDY QUESTIONS

Study Questions

1. According to Freud, what is the role of frustration in psychological development?
2. Outline the flow of instinctual energy from the id to the other parts of the personality during development.
3. Explain the difference between the fantasy principle and the reality principle.
4. Define the primary and secondary processes, and what function they serve in development.
5. Contrast Freud's personal unconscious with Jung's collective unconscious.

CHAPTER 19: THE THIRD-FORCE IN PSYCHOLOGY

INTRODUCTION

Learning Objectives
Understand:

- the general theme of the third-force movement and what it was a reaction against
- the 4 tenets of the third-force movement
- the difference between normal and neurotic anxiety
- Frankl's Will to Meaning and the purpose of Logotherapy
- the meaning of self-actualization
- Maslow's hierarchy of needs
- the difference between unconditional positive regard and conditional worth
- Carl Rogers' organismic valuing process and what he felt was necessary for self-actualization
- the themes and goals of positive psychology

During the 1950s and 1960s, two main schools of thought, or forces, dominated psychology. One was behaviorism, with its view of people as passive, reflexive robots (cognitive psychology was still very young and not yet a dominant force). The other was Freudian theory, which viewed everyone as neurotic, with their entire personality shaped by early frustrations of instinctual needs. During this time, a group of psychologists came to view these two forces as incomplete and sought to create a *third force* in psychology. The third force has variously been called ***Humanistic Psychology*** or ***Existential Psychology***. Like the romantic and existentialist philosophers before them, they viewed people as inherently good and healthy, driven by instinct, emotion, and intuition, and possessing the free will to govern their lives for themselves. In their view, any complete and correct psychology must account for this aspect of humanity.

TENETS OF THE THIRD-FORCE

There are four main tenets of the third force. The first is that people have *free will.* We choose our lives and determine our own destiny. Courage and responsibility are required for growth and happiness, because it takes courage to take charge of your life and make difficult decisions. The second tenet is *subjective reality.* Everyone is different and is born into unique circumstances that no one else is born into. Therefore, one's needs and the decisions and challenges that one will face in order to achieve those needs will be completely unique to the individual. Life is subjective. This is influenced by Heidegger's concept of thrownness. We are thrown into this world alone, and despite what happens during our lives here, we will die alone. It is up to us to figure out what we are supposed to do with the life that occurs between those two critical endpoints; no one else can decide that for us because no one can live our life except ourselves.

The third tenet is that *psychology is not a science*, at least not in the sense of the physical sciences like physics, biology, or chemistry. Science involves the search for universal principles or laws that govern the system being studied. Given the first two tenets of free will and subjective reality, there clearly cannot be any such universal laws to discover. The only method for psychology, rather than science, is *phenomenology*, and that is the fourth tenet of the movement. The way to understand the human, especially since everyone is unique, is through a holistic understanding of an individual's life, thoughts, and feelings.

A forerunner of this movement was the existential psychologist **Ludwig Binswanger** (born 1881) who spoke of *being beyond the world.* For Binswanger, life is full of suffering, and much of it is spurred by the fear of death. Being beyond the world means rising above the suffering. However, he meant more than just rising above it; he also meant finding meaning within it. It is through the trials we face and how we face them that we can find meaning in our lives. Binswanger was the first to introduce existential ideas into psychotherapy, giving rise to the idea of ***existential therapy***.

Rollo May (born 1909) also wrote about existential crises and dilemmas in life faced by the individual, and about how anxiety can prevent personal growth. He wrote of the *duality of existence*, in which we can be simultaneously aware of two opposing facts. The first is our subjective view of the world, in which we are the center of the universe, in the sense that we see everything from our own point of view. However, a little insight can lead us to the opposite idea that the universe is vast, even infinite, and compared to that, we are a mere speck within it. We must find a way of reconciling these two perspectives. Focusing only on the personal side would be too much like narcissism, in the sense that our own self is the only thing that matters. However, focusing too much on the idea of being a speck in the universe leads to the view that nothing one does matters, which is akin to nihilism.

Feeling that nothing that one does matters leads to what May called *neurotic anxiety*. It arises from a fear of our own freedom and from the sense of *self-alienation* that occurs when we let other people tell us how to live our lives. It is important that we find meaning in life for ourselves and rely on our instincts to guide us. When we let other people tell us how to live our life, we are living their life, not ours. That is the essence of self-alienation. On the other hand, May said there was also *normal anxiety*,

which is what we experience when we are exercising our free will to make decisions over our own life. May said that it requires courage to take charge of your life, and that such responsibility is necessarily and normally accompanied by some degree of anxiety.

Viktor Frankl (born 1905) was a psychiatrist and Holocaust survivor who brought a distinctive voice to existential psychology through his development of ***logotherapy***, a therapeutic approach grounded in the idea that the primary drive in human beings is the *search for meaning*. For Frankl, even in the face of unimaginable suffering, people retain the capacity to choose how they respond and to find purpose in their experiences. Frankl's insights were born from his years in Nazi concentration camps, where he observed that those who survived were often not the physically strongest, but those who could find some reason to keep going, a future goal, a loved one, or a sense of moral purpose. This led him to argue that the ***Will to Meaning*** is a fundamental human motivation, and that psychological health depends on the ability to live a life oriented toward values and significance.

In logotherapy, the therapist's role is not to solve problems for the client, but to help them clarify what gives their life meaning. Frankl believed that meaning can be found through creative work, loving relationships, and even suffering, so long as one can approach that suffering with the attitude that it serves a higher purpose. Frankl's emphasis on freedom and responsibility places him firmly in the existential tradition, but his work also resonates with the humanistic psychologists' focus on growth and authenticity. Frankl reminds us that the human spirit is not only resilient but also purposeful, and that even in our darkest hours, we retain the freedom to make meaning of our lives.

The humanistic tradition in psychology is generally associated with **Abraham Maslow** (born 1908). The goal of humanistic psychology is to understand what it means to be human, and ultimately to assist in the ***self-actualization*** of individuals. By self-actualization, Maslow meant achieving one's full potential or maximizing one's personal growth. We may note that Maslow's thinking is deeply connected to Nietzsche's concept of the Superman, and even Heidegger's authentic life. For Maslow, self-actualized individuals are not perfect, but they tend to be psychologically healthy, motivated by purpose rather than deficiency, and guided by inner truth rather than external approval. Contrasting with both Schopenhauer and Freud, Maslow described self-actualization as the fulfillment of *"being needs"* (or *B-values*), such as truth, beauty, goodness, autonomy, and meaning, rather than *deficiency needs* like food or security.

Maslow did define needs, however, as part of his famous ***hierarchy of needs***. Maslow's hierarchy is often mistakenly thought of as a rigid ladder in which one must fully satisfy lower-level needs, such as food, safety, or belonging, before even beginning to pursue higher-level ones like self-esteem or self-actualization. But this interpretation oversimplifies Maslow's actual views. Maslow himself emphasized that the hierarchy was not a strict sequence, but rather a dynamic system in which needs can be pursued simultaneously and fluctuate based on individual circumstances and life history. For example, an artist might still create deeply meaningful work while struggling with material insecurity, or a parent might sacrifice personal comfort to meet a child's needs—demonstrating that higher values like meaning, love, and purpose can remain motivationally salient even when lower needs are unmet. In this sense, Maslow's framework is better understood as a set of motivational priorities that often, but not always, follow a rough progression. As he noted in his later writings, especially in his discussions of self-actualizing individuals, people can and do strive for fulfillment in complex, non-linear ways.

Carl Rogers (born 1902) was another one of the central figures in humanistic psychology. He believed

that every individual has a natural tendency toward growth, fulfillment, and *becoming*. For Rogers, *"becoming a person"* meant moving toward greater authenticity, self-awareness, and alignment between one's self-concept and lived experience. At the heart of Rogers' theory is the concept of the *actualizing tendency*, a built-in drive to develop one's personhood. In psychologically healthy individuals, this drive is supported by *unconditional positive regard* from others, especially in early relationships. When people are accepted without judgment, they are free to explore and grow. The opposite of this is *conditional worth*, in which people will love you if you behave in a way that meets their expectations. That is, their love is conditional upon whether you meet some expectation of the kind of person they want you to be. Unfortunately, living to meet the expectations of others means living the goals of someone else rather than your own, very much like Heidegger's concept of an inauthentic life and May's idea of self-alienation. People must live their own lives to self-actualize and must have self-respect before they can do that. They must feel that their own needs have value, and so they must feel that they themselves have value, what Rogers called the *organismic valuing process.* Rogers' ***client-centered therapy*** was developed as a way for the therapist to be nonjudgmental and provide unconditional positive regard for the client. The goal of the therapy was the personal growth and empowerment of the client.

The humanistic psychology we have traced in this chapter represented the first sustained attempt within psychology to study what was right with human beings rather than what was wrong with them. But humanistic psychology paid a significant price for its resistance to the quantitative and experimental methods that dominated mid-20th century psychology, and it remained largely outside the mainstream of scientific psychology. It was influential in clinical practice and in popular culture but marginal in the research universities that determined the discipline's scientific agenda. The question of whether the humanistic tradition's concerns with flourishing, meaning, happiness, and the fully functioning person could be pursued within the methodological framework of mainstream scientific psychology rather than in opposition to it was left largely unanswered by the humanistic movement itself. It fell to a later generation of researchers, working in a quite different institutional and cultural context, to attempt that synthesis.

POSITIVE PSYCHOLOGY

Martin Seligman (born 1942) was elected president of the American Psychological Association in 1998, and used position to argue that psychology had been captured by a pathology model, a framework that defined its subject matter almost entirely in terms of mental illness, disorder, and dysfunction, and that this had produced a discipline that knew a great deal about what went wrong with human psychological life and almost nothing about what went right. The discipline had, in his account, neglected the positive end of the psychological spectrum, the conditions that produced happiness, resilience, meaning, and flourishing. Seligman called for a reorientation of psychological science toward what he called ***positive psychology***, the scientific study of positive subjective experience, positive individual traits, and positive institutions, and he used his presidential platform to direct resources, attention, and graduate students toward this research agenda.

Ironically, his own earlier work had contributed importantly to the pathology model he was now challenging, as he had pioneered learned helplessness research in the late 1960s and 1970s. In those studies, Seligman had demonstrated that animals exposed to uncontrollable aversive events developed a generalized expectation of helplessness that impaired their ability to learn that control was available even when it subsequently became so, and this work had been influential in the development of cognitive accounts of depression. But Seligman had also been struck by a question that this research raised could not answer: why did some organisms exposed to uncontrollable adversity develop learned helplessness while others showed resilience, maintaining their motivation and their capacity for learning despite the aversive experience?

Seligman's framework evolved substantially over the first decade of positive psychology. His initial formulation came to emphasize *flourishing*, which replaced the simpler construct of happiness with a broader five-element model he called PERMA: Positive emotions, Engagement, Relationships, Meaning, and Achievement. The PERMA model has become the most widely cited framework in positive psychology and has been applied in educational, organizational, clinical, and public health contexts around the world.

The positive psychology movement grew rapidly and generated a large and diverse research literature on topics including happiness and subjective wellbeing, the character strengths and virtues that enabled flourishing, the conditions that produced positive emotions, and the institutions and social structures that promoted human thriving. One of the movement's earliest thinkers was **Mihaly Csikszentmihalyi** (born 1934), whose concept of the *flow state* became one of positive psychology's most studied constructs. Flow was Csikszentmihalyi's term for the state of complete absorption in a challenging activity that people across cultures and across domains consistently reported as among the most satisfying experiences of their lives. The rock climber fully engaged with a difficult ascent, the chess player absorbed in a complex position, the surgeon in the midst of a demanding operation, the musician lost in an improvisation all were in flow states. The flow state was characterized by complete concentration on the task, loss of self-consciousness, distortion of time perception, a sense of effortless control, and intrinsic motivation, the activity was experienced as rewarding in itself rather than as a means to some external end. Flow research connected the positive psychology program to a

rich tradition of research on intrinsic motivation and optimal performance that had been developing independently, and it gave positive psychology a recognizable and applicable concept.

Positive psychology's rapid growth and its considerable popular success attracted significant critical attention from within academic psychology, and some of the strongest criticisms came from James C. Coyne, one of Seligman's own colleagues at the University of Pennsylvania. Coyne was a health psychologist and expressed concern over the quality of positive psychology's empirical evidence and what he saw as the field's tendency to overstate its findings and understate their limitations. He argued that the field had developed a culture of confirmatory research, of designing studies to demonstrate the benefits of positive psychological states and interventions rather than to test them rigorously against competing hypotheses, which we recognize by now as the anticipating scientist.

Coyne reserved particular skepticism for the positive psychology intervention literature, as expressed in multiple studies claiming that brief psychological exercises designed to increase gratitude, optimism, or positive emotions produced lasting improvements in wellbeing, health, and life outcomes. He argued that many of these studies were underpowered, used inadequate control conditions, relied on self-report outcomes susceptible to demand characteristics, and failed to demonstrate that effects persisted beyond the immediate post-intervention assessment period. The popular dissemination of positive psychology interventions, through books, corporate wellness programs, school-based curricula, and public health campaigns, had, in his view, far outpaced the quality of the evidence supporting them, creating a situation in which millions of people were being encouraged to adopt practices whose benefits were considerably more modest and more contingent than the popular presentations suggested.

These criticisms do not invalidate the positive psychology program as a whole, as the field has produced genuine insights about the conditions of human flourishing that would have been difficult to generate within the pathology-focused framework that preceded it, and its insistence that psychology attend to the positive end of the psychological spectrum as well as the negative was a legitimate and important corrective. But they do illustrate a tension that has recurred throughout the history of psychology. The positive psychology movement was born from a legitimate insight about the limitations of the pathology model and a commitment to expanding psychology's vision of human possibility. Whether it has consistently maintained the scientific standards required to fulfill that commitment is a question that the field itself is still working to answer.

It is also worth noting, in closing, the relationship between positive psychology and the humanistic tradition from which it drew inspiration while also differentiating it. While it shared the conviction that flourishing and human potential were legitimate subjects of psychological inquiry, it was committed to studying those subjects with the quantitative and experimental methods of mainstream scientific psychology rather than through the phenomenological and clinical methods that humanistic psychology had favored. Whether the operationalization required by those methods, the reduction of flourishing to scores on wellbeing scales, of meaning to responses on questionnaire items, of positive relationships to self-reported satisfaction ratings, captured what Maslow had meant by self-actualization or what Rogers had meant by the fully functioning person is a question that connects the positive psychology debate to the construct validity problem. The risk, as several critics have noted, is that the scientific operationalization of flourishing produces a construct that is measurable and manipulable but that has lost the existential depth and the irreducible subjectivity that the humanistic tradition had insisted were its most essential features and that in making flourishing scientific, positive psychology has made it something other than what the humanists were pointing at.

SUMMARY

The third force in psychology emerged as a response to the perceived limitations of behaviorism and psychoanalysis. Humanistic and existential psychologists brought a renewed focus to the subjective experience of the person. emphasizing growth, authenticity, freedom, and meaning. Their work helped re-center psychology around the lived experiences of human beings, not just as mechanisms or bundles of unconscious drives, but as intentional, forward-looking creatures striving to become themselves. As we turn to the final chapter, we will explore how these themes continue to evolve in contemporary frameworks, especially those that seek to overcome the mind-body dualism of the past. In particular, we will consider how recent developments in embodied, embedded, enactive, and extended cognition (4E cognitive science) may represent an emerging paradigm, one that echoes the spirit of existential-humanistic psychology, perhaps blended with Dewey's functional psychology, while reimagining the mind as a dynamic process inseparable from the body, environment, and culture.

KEY TERMS

Key Terms

- humanistic psychology, existential psychology, free will, normal anxiety, neurotic anxiety, logotherapy, Will to Meaning, self-actualization, hierarchy of needs, unconditional positive regard, conditional worth, client-centered therapy, positive psychology, PERMA, flow

STUDY QUESTIONS

Study Questions

1. List the four tenets of the third-force movement.
2. What did Maslow mean by self-actualization?
3. What did Carl Rogers think was an important precondition for being one's true self?
4. Contrast normal and neurotic anxiety.
5. Define the Will to Meaning.

CHAPTER 20: THE PRESENT AND FUTURE OF PSYCHOLOGY

INTRODUCTION

Learning Objectives
Understand:

- how methodological problems in psychology research contributed to the replication crisis
- how theoretical problems in psychology contributed to the replication crisis
- the themes of 4E cognitive science
- how radical interpretations of 4E cognitive science reject mental representations
- the role of dynamical systems theory within 4E cognitive science
- the difference between allonomous and autonomous systems
- how enactive psychology can redefine the nature of self

Way back in Chapter 3, we learned of Francis Bacon's distinction between two kinds of scientist, the interpreter of nature, who collects data without theoretical prejudice and allows the evidence to speak, and the anticipator of nature, who approaches the evidence with prior expectations that shape what is collected, what is reported, and what conclusions are drawn. We encountered the anticipating scientist repeatedly in the chapters that followed, with Goddard's pre-selection of immigrants who looked feebleminded to observers trained to expect feeblemindedness, in Sheldon's unblinded ratings of somatotype and temperament, in the amazing baby researchers whose paradigms were designed to confirm the competence of infants rather than to test it, and in the positive psychology intervention literature whose effect sizes shrank dramatically under more rigorous scrutiny. What these episodes shared was not dishonesty; most of the researchers involved were acting in good faith within the norms of their field. Rather this was a systematic tendency for the expectations embedded in research designs, measurement choices, and publication practices to produce findings that confirmed those expectations at rates higher than the truth could support.

THE REPLICATION CRISIS

By the second decade of the 21st century, the cumulative weight of this pattern had become impossible to ignore. In 2015 the Open Science Collaboration — a consortium of 270 psychologists coordinated by Brian Nosek at the University of Virginia — published the results of an ambitious and sobering project in the journal Science. The project had attempted to replicate 100 psychology studies published in three leading journals, using the original authors' materials and methods where possible and pre-registering the replication procedures before data collection began. The results were striking. Only 39% of the studies replicated at acceptable effect sizes, which is to say they produced results consistent with the original findings in terms of both direction and magnitude. The average effect size in the replications was approximately half that of the original studies, suggesting that even the studies that replicated were substantially inflated in their original reports. High-profile findings that had been widely cited and enshrined in textbooks, e.g., social priming effects suggesting that subtle environmental cues could shape behavior without conscious awareness, ego depletion effects suggesting that self-control was a depletable resource, power posing effects suggesting that adopting expansive physical postures altered hormonal levels and risk-taking behavior, were all in question. The ***replication crisis***, as it came to be called, was not a crisis in the sense of a sudden unexpected failure but was the gradual surfacing of problems that methodologists had been identifying for decades, now made undeniable by the scale and rigor of the replication effort.

The contributing factors were multiple and intersecting, and understanding them is more important than cataloguing the specific findings that failed to replicate. The first was publication bias, or the systematic tendency of journals to publish positive results and to reject or ignore negative ones, producing a published literature that represented only the confirmatory subset of all studies conducted. If a true effect is present in only 20 percent of studies but only the positive results are published, the published literature will appear to show a robust effect while the file drawer of unpublished negative results tells a quite different story. The second was underpowered studies, associated with the widespread practice of conducting studies with sample sizes too small to reliably detect effects of the magnitude that actually existed, producing noisy estimates that appeared significant by chance at rates substantially above the nominal 5 percent false positive threshold. The third was *questionable research practices*, the set of researcher degrees of freedom that Simmons, Nelson, and Simonsohn (2011) identified, including optional stopping of data collection when results became significant, selective reporting of dependent variables that showed effects while omitting those that did not, and the post-hoc construction of hypotheses to fit data that were presented as if they had been predicted in advance, a practice that came to be called HARKing, for Hypothesizing After Results are Known. None of these practices required dishonesty. They were often employed unconsciously, within research cultures that rewarded positive results and punished null findings, by researchers who genuinely believed in the importance of their work and the reality of the effects they were studying. But their cumulative effect was to produce a published literature systematically biased toward confirmation of theoretical expectations, creating a large-scale instance of the anticipation of nature that Bacon had identified as the fundamental obstacle to genuine scientific knowledge 400 years prior.

The response to the replication crisis is still unfolding. Preregistration, the practice of publicly com-

mitting to hypotheses, methods, and analysis plans before data collection begins, making it impossible to present post-hoc analyses as if they were pre-specified, has become increasingly standard in psychological research and is now required or strongly encouraged by many journals. Registered reports, a publication format in which journals commit to publishing a study based on the quality of its design and rationale before results are known, should help eliminate the publication bias against null findings and have been adopted by journals across psychology and related fields. Open data and open materials requirements, such as making raw data and experimental materials publicly available for independent verification and reanalysis, have increased the transparency and reproducibility of psychological research substantially. And adversarial collaboration, the practice of having researchers with opposing theoretical commitments jointly design and conduct studies to which both sides commit in advance to accepting the results, has been proposed and practiced as a way of ensuring that the design of decisive tests is not influenced by the theoretical preferences of any single research group. These reforms represent an attempt to make psychological science more interpretive and less anticipatory and to bring the actual practice of research into closer alignment with the Baconian ideal.

Perhaps more aligned to the themes in this text, the replication crisis raises questions that go beyond methodology to touch on the theoretical foundations of psychological science (Green, 2021). Many of the findings that failed to replicate were not merely empirically weak, they were theoretically shallow, built on constructs whose operational definitions were so loosely specified that almost any result could be accommodated within the theory. A theory that can explain any result is, as Popper argued, not a scientific theory at all but is a framework for organizing observations post-hoc rather than a framework for generating specific testable predictions. The replication crisis was therefore both a methodological and theoretical crisis, revealing that much of psychological science had been operating with constructs that were insufficiently constrained to generate the specific, falsifiable predictions that genuine science requires. The construct validity problem is another dimension of the same problem and points to the need for a psychology with better-specified theories, more ecologically valid methods, and a research culture that rewards rigor over novelty and replication over discovery. It is against this background of methodological and theoretical crisis that the approaches we are about to examine take on their full significance. They represent not merely a new theoretical framework but a response to the limitations of the framework they are replacing and an attempt to build a psychology that is grounded in the study of actual organisms in actual environments, generating theories specific enough to be genuinely tested and findings robust enough to be genuinely replicated.

4E COGNITIVE SCIENCE

The present state of experimental psychology continues strongly in the cognitive paradigm described in Chapter 14. While comparisons of the mind/brain to a digital computer are less popular than they once were, the idea that the brain processes information and uses this information to build complex mental representations remains a common refrain in current research. The cognitive processes of perception, attention, memory, language, and more are still highly active research topics, and still influence much of clinical and other applied psychologies.

Speculating about the future of psychology is a risky business. Predictions are often guided more by the current intellectual climate, or by personal biases, than by critical scientific reasoning. What seems like the "next big thing" may later be dismissed as a historical curiosity, while ideas once considered fringe may eventually reshape the entire field. History reminds us that psychology has always been shaped by cultural, technological, and philosophical trends, and that what counts as scientific or credible has shifted repeatedly over time. While there is value in envisioning possible futures, there is also danger in mistaking speculation for science.

In that spirit, the purpose of this final section is not to forecast the future of psychology with certainty, but to identify and contextualize several emerging frameworks, especially those associated with what is called ***4E cognitive science*** (embodied, embedded, enacted, and extended). These views differ in fundamental ways from the traditional information-processing model of cognitive psychology. Yet they also resonate with important strands of psychology's past. We will consider how 4E cognition connects with Dewey's functionalism, Gibson's ecological psychology, Lewin's field theory, and even aspects of existential and humanistic thought. Rather than representing a paradigm shift away from psychology's past, these frameworks may reflect a reweaving of its earlier insights into a broader and more integrative vision of the mind.

One of the earliest and most important forerunners of 4E cognitive science was the French phenomenologist **Maurice Merleau-Ponty** (born 1908). His major contribution was the idea that perception is not a passive reception of information, nor is it a process of internal mental representation. Rather, he argued that perception is a lived, bodily engagement with the world. Merleau-Ponty argued that the body is not merely an object in the world, but the subject through which the world is experienced. This reverses the traditional Cartesian view of the mind as a detached observer and instead situates cognition as arising through the sensorimotor activity of a living body in a meaningful environment. Meaning emerges through action, rather than being imposed on the world by a disembodied intellect.

This resonates with the ideas of J.J. Gibson in Chapter 10. While Gibson was not directly influenced by Merleau-Ponty, his ideas of information in the world, rather than in a disembodied mind, and the importance of affordances and the perception-action cycle, all echo Merleau-Ponty's views. Similarly, recall how the functional psychologists of Chapter 11 incorporated Darwinian thinking by emphasizing the importance of natural selection, which reflects the role of the natural environment on cognition, and how Dewey's holistic treatment of the reflex arc presaged Gibson's ideas.

The conclusion one may reach by integrating these various approaches is that cognition must involve a body, not just a brain. Further, it must include an environment. So, it follows that cognition is said to be constituted of brains, bodies, and environments. This is the definition of ***embodied cognition*** (Chemero, 2011). But importantly, bodies do things (recall Gassendi's "I move therefore I am" from Chapter 7). Cognition thus occurs as bodies interact with their environment and can be said to emerge from brain-body-environment interactions. This is the definition of ***enactive cognition***, which means that meaning is created when an organism interacts with its environment, a process called ***sense-making*** (Varela et al., 1991). Additionally, when organisms interact with conspecifics, they create shared, or social, meaning, via a process called ***participatory sense-making*** (De Jaegher & Di Paolo, 2007). Again, the reader ought to note how this recalls Lewin's social psychology and person-environment interactions in Chapter 9, as well as the inherent social character of cognitive development described by Vygotsky.

Because the structure of the environment is important, as it provides meaningful information for perception (e.g., Gibson, 1979), and because all cognition must occur within such an environment, then cognition is also said to be ***embedded*** into the environment (Barsalou, 2008; Clark, 1997). And last, because these views suggest that meaning, and cognition, can only be understood as spanning the brain-body-environment system, cognition is also said to be ***extended*** (Clark & Chalmers, 1998). Unlike Descartes' pineal gland, cognition does not reside within any of these components in isolation but emerges from their ongoing interaction.

A BREAK FROM INTERNALIZED COGNITION

While some embodied views remain compatible with the representationalist and information processing views of cognitive psychology, others reject core assumptions of the cognitive paradigm. How so? To start, let's consider one view of embodied cognition, which may be amenable to traditional cognitive psychology. Here, body states are said to influence the nature of one's mental states. For example, in one study, participants were asked to either think about the past or the future while standing blindfolded. The effect of the blindfold increased their postural sway, but the direction of this sway was also connected to their task. Participants thinking about the past tended to sway a little more backward, while those thinking about the future leaned a little forward (Miles, et al., 2010). In another example, wearing heavy backpacks made hills look steeper, suggesting that the heavy load is an alteration of one's embodiment, and this affects how the mental representation of the hill is constructed in the mind (Bhalla & Proffitt, 1999).

While these examples suggest that embodiment influences cognition, other theorists argue for a far more radical revision: that cognition is not just influenced by the body, but is *constituted* by embodied, action-based processes that do not rely on internal representations. **Anthony Chemero** (born 1969) proposed a radical embodied cognitive science that emphasized this view (see also Wilson & Golonka, 2013). Similarly, **Daniel Hutto** (born 1965) rejects the existence of internal mental content and mental representations entirely (Hutto & Myin, 2012). Instead, he argues that perception, action, and especially social interaction, can be fully explained as dynamic and embodied agent-environment interactions.

Another way these ideas diverge from cognition is found in Hutto's comment on social interaction. Cognitive psychologists claim that social understanding depends on one's ability to mentalize others, that is, to take an intentional stance (see Chapter 8) and understand the minds of others. This is commonly called ***Theory of Mind***, which represents our ability to understand another's mental states. This approach to social interaction is heavily dependent on mental representation. **Shaun Gallagher** (born 1948) has proposed the possibility of ***direct social perception***, which relies on the Gibsonian notion of direct perception (see also Wiltshire et al., 2015). The claim is that if cognition is truly embodied and enacted, then observing the acting bodies of others is akin to observing their cognition. Thus, the cognitive states of others can be directly observed via their embodied actions, rather than inferred using Theory of Mind.

Finally, **Andy Clark** (born 1957) challenged the assumption that cognition is confined within the brain (Clark & Chalmers, 1998). Consider his example of Otto, a man who suffers from Alzheimer's disease and relies on a notebook to store important information, such as directions to a museum. When Otto wants to go to the museum, he consults his notebook. This contrasts with a person named Inga, who stores the same information in her biological memory. The key argument is that Otto's notebook plays the same functional role for him that internal memory does for Inga. If we accept that Inga's biological memory is part of her cognitive system, then it is arbitrary to exclude Otto's notebook just because it is external. In both cases, information is reliably stored, accessed when needed, and used to guide behavior. Therefore, the notebook should be considered part of Otto's mind, just

as Inga's memory is part of hers. This idea challenges the traditional view that cognition happens entirely inside the head and supports the broader extended cognition perspective: that cognitive processes can span the brain, body, and world. Similar views were expressed by the noted physicist **Richard Feynman** (born 1918), who claimed that his notes were not merely a record of his thoughts but were the very act of thinking itself.

A RESEARCH PARADIGM

These ideas are provocative but may hold little value if they cannot be tested empirically. What would a research program inspired by 4E cognitive science look like? One example is found in the work of **J.A. Scott Kelso** (born 1947) who has pioneered the application of ***dynamical systems theory*** to the study of human movement. Dynamical systems theory studies how systems change over time under the influence of internal and external forces. For example, a pendulum is a system in which a weight, attached to a string or rod suspended from a pivot point, swings back and forth in a regular manner. The period of a pendulum (how long it takes to complete one cycle of a swing) depends on its length and gravity. The significance of this is that the behavior of this system is a function both of its own properties (pendulum length) and the environmental properties (the gravitational constant). Dynamical systems exhibit *stability*, and the pendulum's stability is an ***emergent*** property of the interaction between these two variables. This feature is referred to as ***self-organization***, which refers to the spontaneous emergence of ordered behavior from the interactions of system components, without the need for a central controller. This contrasts with classical models of cognition that posit internal symbolic or rule-based control structures akin to software in a computer. The latter is an example of an *allonomous* system, that is, operated by an external controller, while the former is an *autonomous*, or self-controlled, system.

Another feature of stability is that the pendulum will return to its normal periodic behavior following a perturbation. Consider a pendulum swinging at its normal frequency which is then perturbed by injecting some energy into it (say, by giving it a little push), thus increasing the frequency of oscillations. This increase is only temporary, as restoring forces will soon return the pendulum to its natural frequency of oscillation. The tendency to return to the same stable state is called an *attractor* dynamic and directly parallels Lewin's use of attraction in the psychological field. As an oscillating system, the pendulum is a *limit cycle attractor*. Another dynamical system is a mass-spring system. Consider a spring suspended from a rigid board, with a mass attached to the bottom. The spring will stretch to a specific length, which is a function of the mass, the stiffness of the spring, and gravity. If a perturbation is applied, say the mass is pulled downward and then released, this system will oscillate for a time but will eventually settle and return to its prior resting length. This is called a *point attractor*, which is another form of stability.

The relevance of these ideas to psychology is that we can use the equations and concepts of dynamical systems to model both the changing and stable characteristics of human behavior. In Kelso's work, he notes that human muscles exhibit spring-like properties, and limb segments often exhibit pendulum-like properties, and he has successfully used dynamical equations to model human movements. A compelling demonstration is the HKB model, named for the initials of its authors (Haken, Kelso, & Bunz, 1985). The HKB model addressed a deceptively simple question about bimanual coordination: when you move your two index fingers back and forth rhythmically, you can do so in two stable patterns. Either both fingers moving in the same direction at the same time, called in-phase coordination, or both fingers moving in opposite directions at the same time, called anti-phase coordination. What happens when you gradually increase the speed of movement? Kelso's experiments showed that at low frequencies both patterns were stable, but as movement frequency increased beyond a critical thresh-

old, the anti-phase pattern became unstable and spontaneously switched to the in-phase pattern, a phenomenon called a *phase transition*. Crucially, the reverse transition did not occur, once you were moving in-phase you could decrease frequency indefinitely without switching back to anti-phase. The HKB model captured this behavior using a single nonlinear differential equation describing the relative phase between the two hands as a function of movement frequency, predicting not only that the phase transition would occur but the specific frequency at which it would occur, the critical slowing down (the tendency of the system to recover more slowly from small perturbations as the transition approached) that preceded it, and the *hysteresis* (the asymmetry between the two transition directions) that characterized it. All of these predictions were confirmed experimentally, making the HKB model one of the most precisely confirmed quantitative models of human movement. Its significance for the 4E cognitive science program is that it demonstrated that the behavioral repertoire of a biological system, in this case the discrete inventory of stable coordination patterns, could be explained entirely in terms of dynamical self-organization without invoking any central controller, any internal representation of the movement pattern, or any computational process analogous to running a computer program. The stability of the in-phase pattern and the instability of the anti-phase pattern at high frequencies were emergent properties of the nonlinear dynamics of the coupled oscillator system formed by the two hands and the neural connections between them — properties that arose from the system's dynamics rather than being specified by any internal representation or rule.

While dynamical systems theory provides a powerful mathematical framework for modeling change over time in individual systems, ***complexity science*** expands this view to include systems composed of many interacting parts. These systems, such as the brain, the perception-action system, or a social group, can exhibit emergent behavior that is not reducible to any single component. In psychology, this opens the door to viewing cognition, development, and behavior as emergent properties of complex adaptive systems.

Favela (2023) argues for a new way of understanding brain activity by applying principles from complexity science. Rather than treating the brain as an isolated information processor, Favela draws on ecological psychology and dynamical systems theory to frame the brain as part of a larger brain–body–environment system. He emphasizes that brain dynamics exhibit complex, self-organizing patterns that cannot be reduced to linear cause-and-effect mechanisms or modular functions like attention, memory, etc. Instead, cognition emerges from the coordinated interactions of neural, bodily, and environmental processes across multiple time scales. Favela proposes that researchers analyze brain activity using tools from complexity science, such as measures of entropy (which capture the variability of neural activity), fractal analysis (which describes the *self-similarity* of neural activity over multiple time scales), and synchronization (which studies how different parts of the brain coordinate their activity over time), so that we can better understand the dynamic, adaptive nature of real-time cognition. These tools allow researchers to model the brain as a *nonlinear* system, one whose behavior cannot be predicted simply by analyzing its parts in isolation. His approach thus rejects computational and representational views in favor of studying the brain as embedded within a living, behaving organism engaged with the world.

THE THIRD-FORCE REVIVED?

One final development worth highlighting is the convergence of 4E cognitive science with philosophical traditions that challenge conventional Western notions of the self. **Evan Thompson** (born 1962) explored the intersection between the enactive view of cognition and Buddhist philosophy. For Thompson (2011), the enactive mind is a living, embodied process of sense-making, a dynamic, self-organizing system that arises through interaction with the world. What is especially provocative in Thompson's work is his alignment of the enactive model with the Buddhist concept of *anattā*, or "no-self." Rather than seeing the self as a fixed inner entity, both Buddhism and enactivism describe the self as emergent, as a process that unfolds over time, dependent on bodily action, social context, and environmental engagement. The self, in this view, is not a thing we *have* but an activity we *do*. It is a fluid, relational pattern of habits, narratives, and bodily feelings, a process more than a possession. These ideas also resonate with the ***process philosophy*** of **Alfred North Whitehead** (born 1861), who argued that what we think of as solid matter, such as atoms, should instead be understood as dynamic processes or events arising from interactions between fundamental forces. Whitehead proposed that reality is constituted by these processes of "becoming," rather than by enduring substances. In modern physics, this view finds a parallel in the discovery of the Higgs field, which shows how particles acquire mass through their interaction with this quantum field. This discovery supports Whitehead's metaphysical claim that properties emerge from relations and interactions, rather than existing independently. Such thoughts even connect with the ancient ideas of Heraclitus in Chapter 2 when he claimed that one can never step into the same river twice, not just because the river is different but also because so is the self.

This perspective invites a reconsideration of the self that resonates deeply with existential and humanistic psychology. Thinkers like Jean-Paul Sartre, Carl Rogers and Viktor Frankl emphasized authenticity, choice, and meaning-making as essential aspects of being human. While they operated within a Western framework that often took the self as a given, their work treated the self not as a static structure, but as something that develops in relationship to the world, through becoming, through values, and through action.

The enactive view provides a new language to articulate these ideas. It replaces the notion of a sovereign, isolated ego with a picture of the self as open, contingent, and interdependent, always co-constituted by experience, place, culture, and other people. This has implications for psychology, especially clinical work, where rigid ideas about oneself may be at the heart of suffering. Rather than seeing mental illness as a malfunction of an inner agent, it may be more fruitful to see it as a breakdown in patterns of self-world interaction. In this way, the emerging 4E paradigm not only offers new tools for empirical research but also circles back to timeless psychological questions: What is the nature of self? Why do we suffer? And what does it mean to live meaningfully?

KEY TERMS

Key Terms

- replication crisis, questionable research practice, 4E cognitive science, embodied cognition, enactive cognition, embedded cognition, extended cognition, sense-making, participatory sense-making, Theory of Mind, direct social perception, dynamical systems theory, emergence, self-organization, complexity science, process philosophy

STUDY QUESTIONS

Study Questions

1. What are the methodological reasons for the replication crisis?
2. What are the theoretical reasons for the replication crisis?
3. Explain how radical interpretations of 4E cognitive science differ from traditional cognitive psychology.
4. Explain how dynamical systems theory treats behavior in contrast to the cybernetic approach of traditional cognitive psychology.
5. Identify parallels between enactive psychology and humanistic psychology?

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Some but not all of these classic works are cited within the text, but for brevity and ease of exposition, direct mentions were kept at a minimum. The interested reader is encouraged to read the primary sources, and they are listed here. The sources are listed by chapter, roughly in the order they are covered in the text, which is largely but not exactly chronological. Many classic texts are available for free online, which are linked where possible. Modern texts that are not available online are listed with full reference information. This is surely not a comprehensive list of all sources relevant to the work covered in this book, but it is at least a heavy start!

Another indispensable repository of primary sources relevant to the history of psychology is Christopher D. Green's Classics in the History of Psychology.

Chapter 2.

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https://campuspress.yale.edu/keithderose/files/2021/04/Reid-Inquiry-selections-21.pdf

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https://archive.org/details/elementsofpsycho0001gust

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Chapter 12.

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https://www.peirce.org/writings/p119.html

William James' The Principles of Psychology (1890) is his key contribution

https://www.gutenberg.org/files/57628/57628-h/57628-h.htm

The work of the functionalist school is represented on the Classics in the History of Psychology site

https://psychclassics.yorku.ca/topic.htm#functionalism

Chapter 13.

Romane's infamous account of animal behavior is in Animal Intelligence (1883)

https://www.gutenberg.org/cache/epub/40459/pg40459-images.html

C. Lloyd Morgan presents his canon for the interpretation of animal behavior in Introduction to Comparative Psychology (1894)

https://archive.org/details/in.ernet.dli.2015.174177

Pavlov's original work Conditioned Reflexes, An Investigation of the Physiological Activity of the Cerebral Cortex (original in Russian, English translation published 1927) is not available online but his later Lectures on Conditioned Reflex (1928) contains a good overview of the work

https://archive.org/details/lecturesoncondit0002pavl/page/n1/mode/2up

Behaviorism and neobehaviorism on the Classics in the History of Psychology site

https://archive.org/details/lecturesoncondit0002pavl/page/n1/mode/2up

There are many sources for logical positivism, but an accessible entry is Ayer's Language, Truth, and Logic (1936)

https://archive.org/details/ayer-language-truth-and-logic/page/16/mode/2up

Popper's contributions to science are found in

Popper, K. (1934/2005). *The Logic of Scientific Discovery*. Routledge.

Skinner's social theory is found primarily in the following two sources

Skinner, B. F. (1948). *Walden Two*. Hackett Publishing.

Skinner, B. F. (1971). *Beyond Freedom and Dignity* (1971). Bantam.

Chapter 14.

A few early papers in cognitive psychology are found on the Classics in the History of Psychology site

https://psychclassics.yorku.ca/topic.htm#cognition

Kuhn's contribution to philosophy of science is The Structure of Scientific Revolutions (1962)

https://archive.org/details/thomas-s.-kuhn-the-structure-of-scientific-revolutions/page/18/mode/2up

Chapter 15.

Early developmental psychology publications on the Classics in the History of Psychology site

https://psychclassics.yorku.ca/topic.htm#development

Baldwin's core work is Mental Development in the Child and the Race: Methods and Processes (1906)

https://archive.org/details/mentaldevelopmen00baldiala/page/2/mode/2up

A key primary source for **Piaget** is The Origins of Intelligence in Children (1936)

https://archive.org/details/in.ernet.dli.2015.458564/page/n19/mode/2up

and also The Construction of Reality in the Child (1937/1955)

https://www.marxists.org/reference/subject/philosophy/works/fr/piaget2.htm

Vygotsky presented his ideas in Thinking and Speech (1934), this is direct link to a PDF file of an English translation of that work

https://www.marxists.org/archive/vygotsky/works/words/Thinking-and-Speech.pdf

Chapter 16.

An excellent history of psychiatry that covers the work of **Emil Kraepelin** in term is

Berrios, G., & Porter, R. (1995). *A History of Clinical Psychiatry: The Origin and History of Psychiatric Disorders*. Athlone Press.

Chapter 17.

Goethe's Faust (1808/1832) is a classic romantic text

https://www.gutenberg.org/cache/epub/63203/pg63203-images.html

Schopenhauer's The World as Will and Idea (also known as The World as Will and Representation) (1818) is published in three volumes and is the definitive statement of his ideas.

https://www.gutenberg.org/cache/epub/38427/pg38427-images.html

https://www.gutenberg.org/cache/epub/40097/pg40097-images.html

https://www.gutenberg.org/cache/epub/40868/pg40868-images.html

Nietzsche produced numerous works. Thus Spake Zarathustra (1883-1885) is his famous presentation of the Superman.

https://www.gutenberg.org/cache/epub/1998/pg1998-images.html

The Birth of Tragedy (1872) presents the tension between emotion and logic in the human mind

https://www.gutenberg.org/cache/epub/51356/pg51356-images.html

Beyond Good and Evil (1886) presents his work on authenticity

https://www.gutenberg.org/cache/epub/4363/pg4363-images.html

His critique of religion can be found in The Gay Science (1882)

https://www.gutenberg.org/cache/epub/52124/pg52124-images.html

Rousseau's ideas on the Nobel Savage are found in The Social Contract (1762)

https://www.gutenberg.org/cache/epub/46333/pg46333-images.html

Heidegger's existentialism is found in the challenging reading of Being and Time (1927)

https://archive.org/details/pdfy-6-meFnHxBTAbkLAv/page/n21/mode/2up

Of the more widely cited of **Sartre's** works is Existentialism is a Humanism (1946)

https://www.marxists.org/reference/archive/sartre/works/exist/sartre.htm

Simone De Beaovoir's classic contribution to existentialism is The Second Sex (1953)

https://archive.org/details/dli.ernet.507749/page/17/mode/2up

Chapter 18.

Freud has many books, and even more have been written about him. Perhaps his most significant is The Interpretation of Dreams (1900)

https://www.gutenberg.org/cache/epub/66048/pg66048-images.html

The psychosexual theory is found in Three Contributions to the Theory of Sex (1905)

https://www.gutenberg.org/cache/epub/14969/pg14969-images.html

The structural model of id, ego and superego is presented in The Ego and the Id (1923)

https://archive.org/details/in.ernet.dli.2015.218607/page/n29/mode/2up

Perhaps the main source for **Jung's** writing is The Collected Works, a 20-volume set published by Princeton University Press.

Jung, C. G. (1953–1979). *The Collected Works of C. G. Jung* (20 vols.). Princeton University Press.

Chapter 19.

Frankl's classic work is Man's Search for Meaning (1959)

https://archive.org/details/viktor-emil-frankl-mans-search-for-meaning/mode/2up

The primary source for **Maslow's** hierarchy of needs is Motivation and Personality (1954)

https://archive.org/details/in.ernet.dli.2015.198216/page/n1/mode/2up

One of **Carl Rogers**' most widely read works is

Rogers, C. R. (1961). *On Becoming a Person: A Therapist's View of Psychotherapy*. Houghton-Mifflin.

Chapter 20.

Merleau-Ponty's key work that anticipates embodied cognition is

Mearleau-Ponty, M. (1954). *Phenomenology of Perception*. Routledge.

Whitehead's work on process philosophy is found in

Whitehead, A. N. (1978). *Process and Reality: An Essay in Cosmology* (Corrected ed.). The Free Press. (Original work published 1929)

J.S. Kelso has numerous publications on dynamical systems theory may be found at his Google Scholar page

https://scholar.google.com/citations?user=-VlkX4YAAAAJ&hl=en&oi=ao

His book on the subject is an excellent entry to the field

Kelso, J. S. (1995). *Dynamic Patterns: The Self-Organization of Brain and Behavior*. The MIT Press.

Key works in the history of complexity science and 4E cognitive science

Prigogine, I., & Stengers, I. (1984). *Order Out of Chaos: Man's New Dialogue with Nature*. Bantam Books.

Kauffman, S. (1993). *The Origins of Order: Self-Organization and Selection in Evolution*. Oxford University Press.

Clark, A. (1997). *Being There: Putting Brain, Body, and World Together Again*. The MIT Press.

Gallagher, S. (2005). *How the Body Shapes the Mind*. Oxford University Press.

Thompson, E. (2007). *Mind in Life: Biology, Phenomenology, and the Sciences of Mind*. Harvard University Pres.

Chemero, A. (2009). *Radical Embodied Cognitive Science*. The MIT Press.

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