

Chapter Three

The Relation Between Language and Experience

Language is the tool that we as human beings use to communicate and express ourselves. It holds the key to our happiness, success or failure, and to our ability to get things done. Without language we would be unable to express ourselves or communicate even the simplest requests to other people. Language is the most original and fundamental of human tools.

Of course, even to speak of “language” as if this were one universal thing is misleading. In fact, there are thousands of languages in the world, and there is no single language that encompasses them all. Even the term “language,” meaning “human language,” needs to be qualified. Besides human languages, animals have their own language for communication. For example, the means by which bees communicate with each other is well documented. Dolphins have been studied extensively for their advanced means of communication.

It is interesting that most studies of animal languages focus on how animals use their languages to communicate to each other. It would also be interesting to understand how animals use language to communicate with human beings. This type of inter-species communication is very difficult, since two radically different points of view are involved. For example, what is in the mind of your cat when he stares up blankly at you? It is easy to understand a cat’s requests for food in the form of what we call “meows.” But how much of cat language are we missing because we have no idea what is in the mind of a cat? Can cats be subtle? What is their “I want to play” signal? These are questions for cat-lovers to ponder.

Another aspect of animal language is the language we use to communicate with animals. This is the other side of the “inter-species” question. Many people treat animals as if

they were simply another human being who speaks their language, addressing lengthy monologues towards their cat or dog. This makes sense in that it allows us to express our feelings towards the animals and to communicate with them through intonation. What is less usual is for a human being to adopt animal language in “speaking” to animals. For example, if someone were to study cat communication, could they effectively communicate with cats by adopting some form of their “Meow” language?

What is it about language that is so fundamental? A language is a system of representations used for the purpose of communication. For example, the English language consists of a very large number of words and rules that govern how those words can be combined to express thoughts. It is really the thoughts that are universal, while language is the medium for expressing thoughts. For example, a German boy might look at an English girl and say “I liebe dich” (I love you). She might reply “I love you too.” They both have the same thought, only it is being expressed in two different languages. So if we are to understand language, we need to understand the nature of thoughts, and how it is that language expresses thoughts.

This chapter discusses the nature of language, and what we can learn from this about the nature of our experience. It includes a discussion of the following:

- The nature of thoughts
- What is a rule?
- The merits of behaviorism
- How our mental language develops
- What is love?
- The problem of other minds
- The nature of sensors
- The nature of the human mind
- How our minds shape reality

The Nature of Thoughts

What is a thought? A thought is a group of concepts organized so as to represent an idea. Let us analyze this expression.

First of all, a thought is made up of concepts. A concept is what a word stands for. For example, the word ‘red’ stands for the concept of red, or redness. The word “circle” likewise stands for the concept of a circle. The group of qualities used to define the word defines the concept the word stands for. For example, the words “unmarried man” define the concept of “bachelor”.

How do words and concepts come into being? In his Philosophical Investigations, Ludwig Wittgenstein proposed the idea that rules are fundamental to language, and that language comes into being when rules are adopted for the use of signs and terms. Wittgenstein also argued that language is a public thing and that no “private language.” According to him, there cannot be a private language because in a so-called “private language” there would be no distinction between correct and incorrect use of a sign or term. This is Wittgenstein’s famous “private language argument.”

Could a Robinson Crusoe, born and raised on a deserted island without the benefit of human companionship, develop a language? This is a very interesting question, and there have been some actual cases of children raised by animals. One aspect of this question that is usually not taken into account by those defending Wittgenstein’s position is that a Robinson Crusoe might rely on animals to provide feedback on his use of language. Possibly animals could help provide a standard of correctness for Robinson Crusoe’s language. For example, suppose Crusoe could find a way to signal to the animals that food is ready for them. If he makes a certain sound before feeding them every day, they would come to associate this sound with food. This sound, to them, means “Food is ready.” In a more contemporary context, anyone who regularly taps on a can of food before feeding their cat finds that the cat comes to associate this sound with food. So a Robinson Crusoe could develop at least a primitive language for communicating with the animals on his deserted island.

Wittgenstein was not interested in his private language argument as a commentary on inter-species communication, however, but as a comment on the public nature of language. His argument turns on the nature of a rule. According to Wittgenstein, rules are by nature public, so rules of language are by nature public. Since the very possibility of language depends on the existence of rules, there could be no private language.

What is a Rule?

The concept of a rule involves three components. A rule is fundamentally a pattern of correctness. For a rule to exist, the following conditions must be met.

1. It has been promulgated (publicly made known)
2. It is at least occasionally followed.
3. It is at least occasionally enforced.

No rule can exist unless it is promulgated, or publicly made known. In promulgating a rule, someone with authority publicly lays down a certain pattern of behavior as being a standard of correctness. For example, the presence of a “No Smoking” sign in a library, when a proper authority places it there, serves notice that smoking behavior is incorrect or “illegal” within the library. Sometimes rules are promulgated by public announcements. Rules in the form of laws in the United States require an act of Congress. Thus there are many methods for promulgating a rule, but this is a fundamental requirement for the existence of a rule.

A rule must at least occasionally be followed. A rule that is never followed loses its status as a standard of correctness. In order for someone to follow a rule, they must use the rule as the reason for their behavior. Simply conforming to a rule is not following a rule. Someone who never smokes and is not aware of the “No Smoking” rule in the library is not following the rule when she refrains from smoking, she is merely in conformity with it. On the other hand, if everyone in the library consistently behaves as if the rule is not there, and smokes freely when they want to, over time the rule will die

out. In this example, the rule no loner serves as a reason for anyone's behavior. This might happen, for example, if it became known within the school that smoking is now allowed anywhere on the premises, but no one bothered to take the sign down.

A rule must be at least occasionally enforced. A rule that is never enforced loses its force as a pattern of correctness, or rule. If students find that they can smoke freely in the library, and this behavior is never corrected, over time the rule dies out. A similar example applies to a "No Swimming" sign put up many years ago. If kids learn that no one ever pays attention to this rule and that it is never enforced, the rule will lose its status as a pattern of correctness.

What are implications of this analysis of a rule for Wittgenstein's private language argument? Could a Robinson Crusoe promulgate, follow, and enforce a rule, all by himself? It has already been argued that a Robinson Crusoe could establish a rule to animals about when food is ready. In this case, he promulgates the rule by making a certain sound when food is about to be served. He follows this rule when he then serves the food. This following of the rule serves as a kind of enforcement of it. A similar example is the rule "No eating my food." If Crusoe reprimands or punishes animals that try to eat his food, and he does so regularly, he has established the "No eating my food" rule to the animals.

The Merits of Behaviorism

Wittgenstein is really arguing against Descartes' concept that our minds are a private, inaccessible area. According to him, if this were the case, mental terms could never succeed in referring to anything. For example, the word 'pain' cannot refer to a private mental state because if it did, the word 'pain' would not meet the minimum requirement for it to be a word. This requirement is that there be a genuine distinction between correct and incorrect applications of the term. If pain is a private mental state, then this distinction does not exist because an individual trying to apply the word 'pain' will have no objective way to tell if the word is being correctly applied or not.

Wittgenstein used his private language argument to argue for behaviorism. According to behaviorism, what we perceive to be private mental states are really just forms of behavior. So instead of pain being a private mental state, pain is identified with the expressions of pain. Pain becomes identified with expressions of hurt and agony, and with the saying of the word “Ouch.” B. F. Skinner took up the mantle of behaviorism and erected it into a powerful school of psychology in the 1960s and 1970s.

The chief problem with behaviorism is that it takes the expression of a mental state and claims that the mental state is not the phenomenon underlying the mental state but nothing more or less than the public expression itself. Thus, according to behaviorism, anger is not a private feeling I have, but the collection of ways I express this feeling. This might include pounding my fist, grimacing, or staring in anger. But an actor can reproduce all these forms of behavior without actually being angry. Also, it is easy to fool someone into thinking you are angry when you are not by simulating angry behavior.

This example is all too real when applied to love. It is fairly easy to simulate the behavior of love without having the feeling. A friend of mine once told me that, after being married for many years, he recently discovered that his wife never loved him at all. This sort of revelation should not be possible if behaviorism is true. If the behavior is there, according to behaviorism, so is the feeling or emotion. So, turning Wittgenstein’s argument on its ear, in behaviorism there is no objective criterion to distinguish between a feelingfaker and someone who genuinely has the feeling.

I have had the same experience. At times I’m not sure if my wife loves me or not. All I know is that she says “I love you” periodically when it would seem suspicious if she didn’t say this, like after I tell her that I love her. What I’d like to know is if she really has any feelings for me. But she is so good at concealing her emotions that I really can’t figure this out. Yet there is all the difference in the world between pretend-love and the genuine article.

This is an area where society has made life very difficult for very many people. In the 1950s, in the United States, children were taught to behave in a very proper fashion and not to express their feelings. In the 1960s, a revolution occurred against the strict rules against the expression of feelings and emotions. The revolution of the 1960s was fundamentally a revolution in self-expression. It was not only the so-called “sexual revolution,” it was about the fundamental right for people to express their feelings and live their lives as a form of self-expression.

Despite the revolution of the 1960s, it is still very difficult for people to honestly express their feelings for each other. It is often dangerous to express strong feelings for married friends of the opposite sex, for example. It is also difficult for men to express their feelings for each other without being labeled “gay,” “fag,” or some similar term. Society boxes us in and prevents us from expressing our strongest feelings for each other.

If feelings and emotions are private mental experiences, where does Wittgenstein’s argument go wrong? Is our mental language really a private language? If so, how do we define the distinction between correct and incorrect applications of mental terms?

In answering this question, it is important to look back at the Cartesian idea that Wittgenstein is arguing against. This is sometimes represented as the idea that nothing is better known to us than the contents of our own minds, and that hence we always know what our own mental state is. In reality, we often don’t know how we feel. For years I lived with someone and couldn’t decide if I really loved her. Often how we feel is a complex mix of emotions that is not characterized with a single word. We may feel both love and hate for someone, and also be angry at them. So if we interpret the Cartesian idea to mean that we always know how we feel, then the Cartesian idea is wrong.

There is another way to take the Cartesian idea about our knowledge of our mental states. This is to say that there are certain basic mental states that serve as the bedrock of our emotional life. About these mental states, there can be no mistake when they occur in certain contexts. Physical pain is one example. When someone drops a rock on my foot,

there is no mistaking the feeling of pain that results. Likewise, there is no mistaking the feeling of anger that results from an insulting remark. Falling in love is an equally unmistakable feeling, as is the feeling of sexual attraction. These feelings serve as the bedrock of our emotional life, paradigms in terms of which our entire mental and emotional life is defined.

Because there are some mental and emotional experiences about which we cannot be mistaken, Wittgenstein is wrong in thinking that there can be no standard for correctness in naming these experiences. If someone has an experience of intense pain, then no evidence could be brought to show that he is not in pain. Hence the application of the word 'pain' to him in this situation cannot be wrong. So Wittgenstein's private language argument fails for certain mental states that have the quality of indubitability.

How Our Mental Language Develops

Wittgenstein's private language argument actually presents a somewhat misleading model of how our language develops. We do not learn language in an isolated situation in which we privately name our own experiences. Instead, we learn language in a public context in which we can observe others applying terms at the same time we are learning them. Because mental language presents special challenges, I will discuss specifically how mental language develops.

Philosophers have discussed the concepts of feeling and emotion at some length. The Cartesian view of a private mental experience is often opposed to the behavioristic concept that our feelings and emotions are nothing more than the behavior we display in expressing them. Since the concepts of feeling and emotion are so fundamental to understanding our minds, I will discuss specifically how these concepts develop.

What is a feeling? We have many types of feelings, and they seem to be very closely related to emotions. Some of the most common feelings in human experience are love, hate, anger, pain, happiness, and excitement. Are feelings private inner experiences, as Descartes said, or are they nothing more than our behavior?

In fact, both Descartes and the behaviorists have captured an element of the truth. Human emotions contain three components:

- A private, subjective mental state
- A felt impulse towards action
- Behavioral expression

These three elements are present in most emotions. Each of these three components has a unique manifestation for each emotion. For example, consider the emotion of anger. Anger consists of the following three components:

- A private, subjective feeling that the object of anger has behaved in a way that is somehow unjustified.
 - A felt impulse to strike back in some way at the object of anger
 - An outward expression that is directed towards striking back in some way at the object of anger.

Of course, people can hide their feelings of anger, in which case the third element will may not be visible to others. In reality, our emotions vary greatly in intensity. Sometimes our feelings are very weak, and other times they are very strong. But in most cases of anger, all three elements are present to some degree.

Are all three elements present in every case of anger? Wittgenstein has taught that many terms have a family resemblance, and that it is not always possible to state necessary and sufficient conditions for their application. I prefer to say, therefore, that in paradigmatic cases of anger, all three elements are present. But because people can hide their feelings, and because someone might even train themselves not to feel certain negative impulses, some examples of anger may occur even though not all three elements are present. Or, they may all be present, but only to a limited degree.

What is Love?

Let us consider the emotion of love. Love consists of the following three components;

- A private, subjective feeling of attraction for the object of love.
- A felt impulse to pursue the object of love.
- An outward expression that is directed towards being with or near the object of love.

Much has been written about love, what it is, what it means, how to get it, how to keep it, etc. Love in fact may be the greatest motivating force within our experience. Because of its fundamental importance, I will discuss this analysis in more detail.

The above analysis explains much about love. It shows, for example, how it is possible to be in love with someone and yet conceal this love. We can have a private, subjective feeling of attraction for someone and yet conceal our impulse to pursue this object and conceal any outward expression that this love may take. At the same time, it shows how it is possible for someone to pretend that they love another person when they really don't. They simply display the appropriate behavior associated with love, including making the appropriate remarks. Some people base their entire lives on their ability to carry out this complex form of deception. The first example shows how love can be present even though there is no evidence of the accompanying outward behavior. The second example shows how the appropriate behavior can be present even though love is not.

One of the most wonderful things about love is that the object of love can be almost anything. Besides loving other people, we can love activities, pets, cars, television shows, computers, food, etc. There is virtually no limit to what the object of love can be. My love for philosophy has been the strongest motivating force in my life. I still remember my first philosophy class as an undergraduate at the University of Maryland, where I would say I "fell in love" with philosophy. This was more than 30 years ago, and my feelings of love for philosophy continue unabated today. In fact, I have no reason to believe that I will ever "fall out of love" with philosophy or lose interest in it.

In the case of loving an activity, the three components of love still apply. I would say that I have a feeling of attraction for philosophy, that I have a felt impulse to pursue philosophy, and that my behavior, such as obtaining a PhD in philosophy, is an outward expression of this felt impulse. In the case of an activity, the third component takes the form of engaging in the activity, or perhaps watching someone else engage in it. Someone who loves ballet, for example, may spend much time watching ballet but may not actually take up ballet themselves. Likewise, someone who loves certain music may spend much time listening to it, but may not actually play music themselves. Of course, if this person is a viewpoint pluralist, they may take up music to experience it from a different point of view. But they need not actually play music in order to love it.

The Problem of Other Minds

Much has been made in philosophy about the so-called “problem of other minds.” This problem consists in asking the question “How do we know that other people have minds?” or “How can we know what is in another person’s mind?” The problem is sometimes stated in terms of feeling and emotion, such as “How can we know that someone else has the same feeling that we have when we have a certain feeling or emotion?” Skeptics have argued that we can never really know how someone else feels because we can never have the same feeling they do; we can only infer from their behavior how they are feeling. And such inferences are often notoriously wrong. It is then argued that if we can be wrong in some cases, we can never be completely certain in any case how another person is feeling.

This is a difficult problem, and it goes beyond the simple fact that in many cases we really don’t know how someone else is feeling. Skeptics want to claim that since we can never actually have someone else’s feelings, we can never know how they really feel. For example, I cannot know that when you feel pain, you feel anything like how I feel when I feel pain. Perhaps pain for you is a completely different experience, and you feel something completely unlike what I feel.

While this problem is easier to state than to solve, I believe it does have a solution. This solution is pointed to by the above analysis of human emotions. Because emotions have a private, subjective element, a motivational element, and a behavioral element, we can infer where we see the appropriate behavior and motivation that the subjective element is there as well. This does not mean that we cannot be fooled, as has already been noted. We may in some cases need to look closer at the behavior, or even subject another person to various “tests” to see if the feeling is really there. In some cases, we may not be able to determine the correct answer to the question “Does so and so love me?” because they are so good at hiding their feelings. Of course, asking them doesn’t always help because the verbal responses are simply part of the behavior and can be faked as well as anything. But just because we cannot know in every case does not mean that we cannot know in any case.

No doubt a philosophical skeptic will be unimpressed with this argument. A skeptic will reply “I concede that behavior and motivation can be effective guides to how someone else is feeling. But you still haven’t shown that their feeling of love, of pain, or of anger is the same as your feeling. In other words, maybe you can infer from their behavior and motivation that they are in love, in pain, etc. It is still possible that their experience of pain or love is still fundamentally different from your own. And this is what the problem of other minds is all about.”

I believe that there is an effective response to this argument. The response to this argument is to appeal to the argument from analogy. If I have certain feelings and emotions under certain conditions, and these feelings and emotions are expressed in certain characteristic ways, then it is reasonable to believe that other people have the same feelings and emotions as I do when they exhibit the same motivations and behavior. But, responds the skeptic, even if they use the same language that you do, you still don’t know that other people’s feelings feel the same to them as they do to you. For that matter, how do you even know that when they see red, they have the same color experience you do?

I believe the correct answer to the skeptic at this point is to point to our scientific knowledge and understanding. It is an established scientific principle that like causes yield like effects. What this means is that if someone else's underlying biology, physiology, and psychology is the same as my own, then this underlying biology, physiology, and psychology will produce the same effects in them as they do in me. And one of the great joys of human nature is that, as people say, "we are all the same underneath." All human beings, by virtue of being of the same species, have certain biological, physiological, and psychological features in common. Think of how difficult life would be if other people were fundamentally different from ourselves. Perhaps what makes us laugh would make them cry, or they might have virtually no emotional life at all. If this were the case, it would be very difficult to share experiences with others. Fortunately, human beings share the same biology, physiology, and psychology, and this hasn't changed since the dawn of time. Even today we can read the Iliad and the Odyssey, or the ancient Greeks, and empathize with their feelings.

If we ever meet beings from outer space, then we face a problem like the skeptic imagines. Unless these beings share our fundamental features, their mental experiences may be totally unlike our own. This does not mean we could never understand them, but it would require a great deal of work to understand how their biology, etc., differs from our own. Anyone who has watched Star Trek or Star Wars is familiar with this possibility. Perhaps alien beings will have no emotions, like Spock, or will have a completely different range of emotions from our own.

We do face a similar problem to that the skeptic imagines when we look at the inner experiences of animals. Thomas Nagel addresses this question in his article "What is it like to be a Bat?" Nagel defends a skeptical position, according to which we really can't understand what animal experience is like. This view is plausible when applied to animals because they have a fundamentally different point of view from our own. The underlying biology, physiology, and psychology of animals is very different from our own. At the same time, there are also many similarities between humans and animals. Part of the plausibility of Nagel's case stems from the fact that he has chosen an animal

with a sense we don't have – the ability to sense objects at a distance through a type of sonar. It is very difficult to imagine what this experience is like because it is so fundamentally different from our own. On the other hand, animals we are more familiar with, like dogs and cats, clearly exhibit similar behaviors and motivations to our own. In particular, it is very clear that animals experience pain, and their underlying physiology is somewhat like our own. Hence it is reasonable to believe that their experience of pain is not completely unlike our own.

In many ways, animals share our own physiology; only they are less complex than we are. This is not always true; for example cats can see at night, and dolphins have a sophisticated system for communicating with each other under water. In general, however, human biology, physiology, and psychology is more complex than animal biology, physiology, and psychology. Humans also have the added dimension of possessing a full-blown language in terms of which to conceptualize their experiences, while most animals have a very limited form of communication. Hence in looking at animals, it is reasonable to suppose that they may share certain fundamental feelings and emotions with us, such as pain, love, fear, and anger, but that they don't experience the same complex range of emotions that we as humans do. This doesn't mean that we can know exactly what pain feels like to a cat or a dog, but we can get a pretty good idea. For example, a cat when held up to a flame probably experiences a sharp, burning sensation that is not unlike the experience we have when our flesh is exposed to fire. What cats lack is the capability we have of describing this experience to us, or to each other. Or if they can describe this experience to each other, it is using a language completely unlike our own.

In this context, it is worth commenting on Descartes and his own view of animals. While Descartes did hold a view very much like the “Cartesian” view that feelings and emotion are private mental experiences, he unfortunately did not extend this view to animals. Descartes in fact viewed animals as being a type of mechanism, or machine, and as a result did not attribute emotional experiences to them. While I cannot believe that Descartes ever knowingly tormented or tortured animals, or deliberately inflicted pain on

them, some of his followers were accused of doing this very thing. If nothing else, this perhaps shows the danger of taking one's own philosophical views too seriously, to the callous disregard of human and animal life.

Let us return now to the fundamental question posed by the skeptic: "How can I know that someone else's experience of pain or of the color red is like my own?" The answer to this question is that like causes yield like effects, and the biology, physiology, and psychology of other human beings is so similar that we can know that their inner experience is very much like our own. For example, the same types of physiological receptors in normal human beings mediate the experience of pain. There are some people who do not experience pain in certain parts of their bodies, and this is usually because the relevant receptors have been damaged. Far from being a blessing, this is a curse because our experience of physical pain is a signal to us that our body is being damaged in some way. Likewise, the same types of receptors in our eyes mediate the experience of vision. Even animal vision is similar to human vision, although there are also some very big differences.

Another way of looking at this question is to say that humans have the same sensors and the same sensor processing system, so since like causes yield like effects, the experiences these sensors generate are the same, or at least very similar. I believe that this is a sufficient answer to the skeptic, although one property of certain skeptics is that they never give up their position no matter how completely they are refuted. Some skeptics hold their beliefs as strongly as anyone holds religious beliefs, and will never be convinced otherwise. Such people can be compared to conspiracy theorists who always invent some additional explanation to account for any evidence against their own theory. These people will never be convinced, and it is better to let them have their own beliefs and move on to other things than to try to convince them of the error of their ways. This is as futile as trying to convince an atheist of the existence of God.

The Nature of Sensors

Since the solution to the problem of other minds rests on the idea that feelings and emotions have a component that is a private, subjective experience, it is worthwhile to take a closer look at the nature of private, subjective experience. It is the nature of private, subjective experience that has made the nature of mind so difficult to grasp. The motivational and behavioral aspects of mind and experience are very well documented, but many people and also philosophers seem spooked when trying to account for the nature of feeling and subjective experience.

The problem of accounting for the nature of subjective experience is so fundamental that entire schools of philosophy are defined by what they claim subjective experience is to be identified with. For example, materialists are defined by the claim that private, subjective experiences are identical to or somehow reducible to brain states. Behaviorists are defined by the claim that private, subjective experiences are identical to or somehow reducible to behavior. And functionalists, who are the contemporary materialists, claim to be able to account for private, subjective experiences in terms of functional diagrams that resemble computer flowchart diagrams.

Many people who write about the nature of mind focus on our ability to intellectualize and make decisions, and try to account for the mind by looking at our decision-making powers. This is especially true of those who try to account for the nature of mind in terms of artificial intelligence (AI), or artificial intelligence programs. Marvin Minsky is an example of such a person. Because computers can be programmed to make decisions, members of the AI community become very optimistic about claiming that human beings are nothing more than very sophisticated types of computers. This claim also has the merit of satisfying their fundamentally materialistic leanings without resorting to the crude sort of materialism of the 1960s that philosophers such as D. M. Armstrong espoused.

The problem with philosophers who focus primarily on the decision-making power of our minds is that they neglect the ability of our minds to sense and perceive the world. It is

through sensing and perceiving that we come to know the world, and it is here that the most fundamental nature of mind is revealed. Philosophers who do not address or cannot account for the sensing and perceiving nature of mind have simply failed to provide an adequate account of mind. And I would claim that neither materialists, behaviorists, nor functionalists can adequately account for the sensing and perceiving nature of mind.

To understand why this is the case, let us consider the nature of sensing and sensors. Over the past ten years, I have spent a great deal of time studying and writing about mechanical and electronic sensors in hopes of finding some insight that will shed some light on the nature of mind. While much of this work was done while writing market research studies, I have also tried to understand at a very fundamental level how sensors work. In particular, I have studied flow, temperature, pressure, and level sensors to try to understand what is common to sensors. I have also looked carefully at artificial intelligence claims and programs, artificial vision systems, proximity sensors, alarms, and other related subjects.

I have concluded from my study of sensors that there are some fundamental properties that sensors share. In particular, sensors have the following features:

1. Sensors are usually designed to sense some particular quality or property, and this defines the type of sensor. For example, a flow sensor is designed to measure flow, usually flowrate, while a pressure sensor is designed to measure pressure. Not surprisingly, temperature sensors are designed to measure temperature, etc.
2. When a sensor exists, it is usually because some quality or property of the sensor varies in a predictable way with changes in the quality or property that is being sensed. For example, thermocouples are pairs of wires composed of different metals and joined at either end. Thermocouples are used to measure temperature because they put out a voltage that is proportional to the temperature at the junction of their component wires. Likewise, vortex flowmeters can be used to measure flowrate because the number of vortices generated by their bluff bodies

is proportional to flowrate. In many cases, there is a physical law or principle that accounts for the correlation between a physical property and the property of the sensor.

3. There is normally some predictable way of formulating the relation between variations in the sensor's states and the changes in the quality or property that is being sensed. This relationship is not always linear, but nonetheless it is normally possible to formulate it in the form of a rule or criterion. This is very interesting because it sounds very much like Wittgenstein's "rules of language" that describe the correct and incorrect applications of a term.
4. Sensors normally have an output that goes to a conditioner or transducer that takes input from the sensor and converts it to a more useable form. For example, the output from thermocouples is so small that it needs to be amplified in order to be useable and transmittable. A sensor that puts out a signal that cannot be read, or that is so small that it can't reach a device that is making use of the sensor input, is of little value. Hence devices called transmitters are commonly used to take sensor input and convert it into a form that can be used by computers or other electronic or mechanical devices. A very common type of signal used by many transmitters today is the 4-20 mA signal. Many electronic devices in industrial environments today have standardized on the 4-20 mA signal. Other conventions are 0-5 volts, 3-16 psi, and other digital outputs.
5. Transmitters associated with sensors have to be able to read the input from the sensor before converting it to another form. This function is very closely associated with the power of perception. In fact, in human vision and hearing, there is a series of transducers that convert an incoming signal into something very different. Yet there is still a link between the original variation in the sensor and the final resulting interpreted signal.

The Nature of the Human Mind

In trying to understand the nature of the human mind, philosophers often draw the distinction between subject and object. This is, in fact, one of the most fundamental distinctions in philosophy. Mind is “subjective,” while the world we perceive through our minds is “objective.” The mind is viewed as passive, taking in what is objectively out there and perceiving it. When we perceive the world as it is, we perceive correctly. When we perceive the world as it is not, we perceive incorrectly.

There is, of course, something subjective about the human mind, and there is something objective about the world “out there,” beyond our minds. On the other hand, there is also something misleading about this model. What is misleading is that our minds contribute a great deal to the entire process of perception because of the nature of our sense organs. If we had different sense organs than we do, the world would appear very different to us, and yet we would still view that appearance as “the way things really are.” Animals have completely different minds from us, and the world looks very different to them. No doubt if they could conceptualize their perception, they would conceptualize that their view of the world is “the way things really are.”

There is a normative element built into our minds that is usually not taken into account when discussing the nature of mind. Our minds contain an implicit standard of correctness that is built into the very nature of our minds. This standard of correctness consists in the normal operation of our minds. Anyone who is nearsighted, or who wears corrective lenses, does so because they have found that their eyes are not operating quite as they should. Drug experiences and hallucinations provide other examples in which our minds are not operating correctly, and we do not perceive things “as they really are.” We see the world through rose-colored lenses.

Of course, the world looks very different to a cat or a bird than it does to us. Are these views any less correct than our own? The answer to this question is that the animals have their own standards of correctness built into their own minds. What is correct for a cat mind or a bird mind is relative to the species in question. Just as we can perceive things

incorrectly, so can cats or birds. Cats can have poor vision, be nearsighted, etc. But when their eyes are working properly, they are seeing the world as it really is – from the point of view of a cat.

What this means is that we should qualify many of our claims about how the world “really is,” with the statement “from a human point of view.” In fact, the entire world that we perceive is perceived as it is as a result of our human minds. We happen to have the five senses of seeing, hearing, touching, tasting, and smelling. If we had ten senses instead of five, or if we had five very different senses, then the “objective world out there” would seem very different to us indeed. This is part of what is compelling in Thomas Nagel’s thought experiment “What is it like to be a bat?” Bats do have a sonar sense that is completely different from our own, so no doubt the world seems very different to them. Our minds contribute a great deal more to the nature of “the world as it really is” than we normally realize.

Our Minds Shape our Reality

How much of the world as we perceive it is “the world as it really is,” and how much is a result of the nature of our minds? Is the world “out there,” somehow apart from us, or is it simply a creation of our own minds?

The truth is that the world is neither completely independent of us nor purely a creation of our own minds. The truth lies somewhere in between. Obviously when I perceive a tree, there is something independent of my mind that is causing me to perceive a certain shape and color. At the same time, this experience is heavily influenced by the nature of my eyes, and by the fact that I am a human being with human eyes. A tree looks very different to a cat than it does to me, yet the cat’s view is no less correct for a cat than my view is for a human being.

Let us consider the example of seeing a tree more closely to see what is “objectively out there” and what is contributed by our human minds. When I see a tree, light waves from the tree are reflected to my eyes. My eyes, which are human sensors, sense these light

waves and convert them via retinal receptors into a form that can be processed by my brain. This occurs through a series of conversions in which the information is processed and converted into a form that our brains can process.

How Our Eyes Work

How do our eyes work? Our eyes work somewhat like a camera. The lenses of the eyes form an inverted image of an object in front of the retina, which corresponds to the film in a camera. This image is carried to the brain through retinal fibers, which are contained in the optic nerve. Conscious processing of the image occurs in the primary visual cortex.

Our sense of hearing works in a way that is similar to vision. Just as the appearance of a tree is carried in patterns of light waves, so sounds are carried by means of sound waves that are perceived by our ears. For a normal human being who can hear, the sound waves impact the fluid inside the ears. The motion of the fluid inside our ears stimulates the cilia, which are the roots of the hairs contained within the ear. The pattern of motion of these cilia sends a pattern of impulses to the brain that corresponds to the sound whose pattern is contained in the sound waves that our ears perceive. These neural patterns from the cilia are processed in the auditory cortex, and we hear the sound that has been transmitted to the brain through our ears.

The processes of seeing and hearing are far more complex than many philosophers realize when they write about this subject. The retina is a complex layer, made up primarily of nerve cells. The cells consist of rods and cones that are packed together somewhat like the way matches are stacked together in a box. A small, yellow-pigmented spot exists behind the pupil. This spot is called the macula lutea. At the center of the macula lutea is the fovea centralis, which is the area of greatest visual acuity of the eye. Both rods and cones are present around the fovea, although cone-shaped cells become fewer toward the edge of the sensitive area. Only rods exist at the outer edges.

When we focus on an object, we bring it to focus on the retina. A flattening or rounding of lenses accomplishes this focusing. We see with greatest clarity in the region of the fovea. Cone-shaped cells in the retina are individually connected to nerve fibers. These nerve fibers reproduce the stimuli to individual cells, enabling us to see fine details. Rodshaped cells work somewhat differently from the cones. Rodshaped cells are connected in groups so that they respond to stimuli over a general area. The rods respond to a general image but don't have the capability of distinguishing the small details of a visual image. As a result of these different structures, the visual field consists of a central area of great sharpness surrounded by an area of decreasing sharpness.

Subjectively, people may not be aware that the visual field consists of a central area sharpness surrounded by an increasingly fuzzy area. Our eyes are constantly in motion, bringing first one and then another part of our visual field to the central region of the fovea as we shift our attention from one object to another. These motions are controlled by six different eye muscles that move the eyeball left, right, up, down, and obliquely. These eye movements are very precise, and it is estimated that our eyes can focus on 100,000 different points in the visual field.

It is also a fundamentally important fact about our vision that we have two eyes. These two eyes work together as the eyes focus on any particular point, so that the images formed by the eyes on the retina coincide. When this capability is not present, double vision results. The stereoscopic nature of our vision also helps us judge size and distance. When I look at something, my eyes are taking two separate images of it and joining them into one, enabling me to see the object from what appears to be a single point of view. It is easy to distinguish the two images formed by our two eyes by relaxing the eyes when looking directly at an object. When the view is relaxed, as when we focus on a point beyond the object we are looking at, the two different images formed by our eyes appear. When we focus back on the object, and our eye muscles cause the images from both eyes to converge on the retina, we once again see only a single image of the object.

Viewpoint Pluralism is Built into the Eye Itself

It is interesting that viewpoint pluralism is built into the nature of the eye itself. When we see an object, we do so by using our eye muscles to bring slightly different images of the object to bear on the retina. These images are slightly different because they exist from two slightly different perspectives, or points of view. Because the right eye is physically located at a different point from the left eye, the image it forms of an object is slightly different than the image formed by the left eye. The joining of these images into one, which gives us the experience of seeing the object from what seems like a single perspective, is done by the brain or mind when these two images are processed.

The concept of visual field, and the idea of what we are focusing on, is of fundamental importance in understanding the nature of consciousness. When we use our eyes to see, our eyes are constantly shifting the area of vision that appears in the fovea, or the central portion of the retina. This process corresponds to the taking of a point of view of an object. When we see an object, we focus on it. Physiologically, we bring both images together on the retina. This corresponds to what we are looking at.

Point of view is selective in this way. When we look at something, we pick it out from its surroundings and focus on it. When I look at a telephone on my desk, I am also aware to a lesser extent of the objects surround the telephone. But I am not looking at these surrounding objects; I am looking at the telephone. In order to see the surrounding objects, which might be a lamp, a thermometer, or a stapler, I need to shift my attention to these other objects. Physiologically, I bring the images of these other objects into my fovea, or central retinal area, so that I can focus on or see these objects.