A COMPLETE AND EXTENSIVE LOOK INTO THE FIELD OF PSYCHOLOGY

A long-form analysis of scientific methodology

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Chapter 1

Hippocrates Tries Deduction

In Aristotle's *Posterior Analytics*, he outlines the rules and benefits of deductivism, the scientific methodology that he believes to be superior to all others. Although deductivism employs deduction, which is logically sound and always yields undoubtedly true information, science cannot rely solely on this method. While deduction may be used to certain instances, there is an additional need for observations, evidence, and inferences in science.

Aristotle's deductivism, as the name implies, relies on the process of deduction. In its simplest form, deduction takes different premises, and using the information found in these statements, produces an undoubtedly true conclusion. It is the only scientific method that always yields true knowledge every single time it is employed, assuming the given premises are also true. If premise A is true, and premise B is also true, then a deductive argument uses logic to prove that C is also true. No guesses or hypotheses need to be made about the conclusion. It is easy to visualize deductivism as the method that argues from the broad to the narrow, as opposed to a method like induction, which argues from the specific to the general.

The beauty of deduction is that it uses logic to reason down to a specific piece of certain knowledge, but this also acts as the methodology's biggest downfall. The conclusion is always a narrower claim than either of the premises. It reduces previous knowledge to a certain fact, but never actually produces new knowledge. Take the famous "All men are mortal. Socrates is a man. Socrates is mortal." syllogism for example. Deduction produces the fact that Socrates is mortal. Although it does make this fact more apparent, it was already contained in the premises that were known to be true. The fact was already technically known.

If deduction only produces knowledge that is contained in the subset of the premises, then one might wonder how the original premises were formulated. Aristotle's account of deductivism quells this fundamental problem about deduction. He acknowledges this concern about deductivism when he says, "But we are faced with this paradox of a student whose belief rests on demonstration has not prior knowledge; a man must believe in some, if not in all, of the basic truths more than in the conclusion (8)." If deduction reasons from the broad down to the narrow, and there needs to be justification for the argument's original claims about the world, then the justification would have to be on a level more general than the world itself . The only thing more broad than how the world functions (physics) is metaphysics, which decides the fundamental truths about the nature of reality. Aristotle claims that these metaphysical truths justify the premises of a deductive argument. "All men are mortal" is an indemonstrable statement, but has to be taken as true because being mortal is just the nature of man. Without these original overarching truths, then deduction could never even be used as a viable form of reasoning.

It is not enough for the premises to be backed by metaphysical knowledge alone, argues Aristotle. While this is true, the information contained in the premises must be regard the "essential attribute" of the object or concept in question. Essential attributes "belong to their subject as elements in their essential nature…" and "... the subjects to which they belong are contained in the attribute's own defining formula (9)." In the example that is being used, mortality is an essential attribute of man. One of the defining features of men is that they eventually die. While it is true that other animals and plants die, one can not be a considered a man without being mortal. It is always true for every man, and there are no exclusionary instances, so therefore it is an essential property. If we were to say that "All men have facial hair. Socrates was a man. Socrates had facial hair," this would be a faulty deductive argument because possessing facial hair is not an essential attribute of men. There are plenty of men who do not have facial hair, so it is not a defining characteristic of men. And if we were to say that "Most men have facial hair. Socrates is a man. Socrates probably had facial hair," then this is no longer a deductive argument.

The first person to try to study psychology in a systematic way was Hippocrates, a Greek who would have lived at the same time as Aristotle. Hippocrates was a physician who after carefully studying the human body, theorized about the causes of certain diseases. He prefaces his theory by immediately claiming that the human body is made up of four different elements: blood, phlegm, yellow bile and black bile. Because they make up the body, they must also account for the pain and pleasure that humans feel. When there is a proper balance of these four materials, then we feel healthy, but when there is an imbalance, (either in absence or excess,) we first begin to exhibit symptoms, and then acquire a disease.

Hippocrates argues that every disease can be explained by the characteristics of the materials that are involved. Blood is hot and wet, phlegm is cold and wet, yellow bile is hot and dry, and black bile is cold and dry. When there is an excess of black bile in the system, for example, then that person can expect to suffer from melancholia (depression). This reasoning explains sicknesses like seasonal depression. We are colder and drier in the winter than we normally are, so this increases the amount of black bile (the cold and dry humor) in our brain and body, and we become depressed as a result. He also uses the example of somebody having a nightmare. In this situation, there is too much blood in the brain that the person becomes hot and crazed. The symptoms include a burning face, sweat all over the body, and bloodshot eyes, all things that make sense when considering the warm and wet nature of blood in Hippocrates' four humor theory.

Instead of using mysticism, religion, or any type of pseudoscience, Hippocrates used observations and reasonings to defend his theories. From the first paragraph of his text, it is clear that even if he was not directly influenced by Aristotle's account of deductivism, Hippocrates' attempted to adhere to the same principles while arguing his claims. Hippocrates informs his readers that he will "produce proofs and demonstrate" (342) his theory. These words are exactly the same words that Aristotle uses to explain what deduction is. Deduction is synonymous with demonstration and proof. Hippocrates does not say that he will be hypothesizing, inferring, or guessing. He claims that, through deduction, he can prove his theory as fact.

Most of what Hippocrates says follows the exact same format for a deductive argument that Aristotle laid out. For example, Hippocrates says that the body is made up of blood, phlegm, yellow bile, and black bile, and the body can experience pain and pleasure, so therefore pain and pleasure are caused by different combinations of those four elements. He claims that when our brains are disturbed our thoughts are disturbed, and that the four humors disturb our brain, so therefore the humors disturb our thoughts (and cause mental illnesses). He also argues that blood is the only warm and wet material in the body, and that nightmares cause us to become warm and sweat, so nightmares are caused by too much blood in our systems. Most of Hippocrates' argument can be built from connecting simple deductive strings like these.

The four humor theory is proven wrong by modern medicine, and most of the problems plaguing Hippocrates' theory stem from the somewhat outlandish premises, especially his major premise that the body is in fact comprised of four humors. Although this is incorrect, Aristotle would still agree that Hippocrates is following this part of the deductive process properly. He is believing in a certain metaphysical idea that he holds to be true. Without this initial belief, then nothing else could naturally follow in the way that it does.

So far it seems as though Hippocrates is using deduction at every step, but by analyzing his method closer, it can be seen that he is not strictly following the deductivist approach. He occasionally reaches conclusions that cannot be completely derived from the preceding premises. For example, when he describes the symptoms of a nightmare (red eyes, profuse sweating, and shaking) and attributes the cause to an excess of blood, there is no way that he could make this argument deductively. Here he is observing a phenomenon and making an inference. There is no way to know for a fact that this is caused by an excess of blood. Using his four humors reasoning, it could be a combination of yellow bile and phlegm in a way that produces a warm/wet excess. Or it could be caused by another unknown material entirely.

In this case, the symptoms act as physical evidence that back up Hippocrates' initial theory. Deduction never needs any evidence or observations to support the claim. When using the deduction example with Socrates, it does not read "All men are mortal. Socrates is a man. I saw Socrates stop moving after drinking a cup of poisoned hemlock. Socrates is mortal." In a purely deductive argument, all of the necessary information is contained in the premises. In Hippocrates' case, his premises carry him pretty far, but he sneaks in some observations to support his claim, thereby making his argument no longer a deductive one, even if the rest of it fits the deductivist format.

Hippocrates’ attempted deductive approach to psychology, although ultimately incorrect, created a strong foundation for the field and his observations can still be seen as useful today. The logic in his demonstration holds up, and there were very few reasoning errors in his work. Most of the problems in his argument originate from the premise that the body is made up of four humors, which is unfortunate because his reasoning is actually extremely sound. For example, if the original premise were changed to “the brain is made up of different neurotransmitters,” his argument would more or less be correct. The brain is made up of neurotransmitters, the brain is responsible for what we think and feel, neurotransmitters affect what we think and feel, an imbalance of certain neurotransmitters correspond to different illnesses. This, in a basic sense, is how most diseases are caused. Depression is caused by low levels of serotonin for example, and sufferers of Alzheimer's disease are known to be deficient in acetylcholine.

Obviously this does not explain every disease and there is a lot more science going on that just that, but it does show two of the most important points about this case study and deduction in general. The first is that the logic of deduction, if done properly, is flawless, and this causes the conclusion to be always be correct. Although this is not the most thorough explanation for what causes mental illnesses, it is still right. The other point is that one false premise can result in a false conclusion, even if anything else is done properly.

The original premise seems silly to imagine for those reading about it today, but without modern technology and other knowledge about how our body works, Hippocrates’ claim may not have been that unbelievable back then. The Greeks believed in four elements: earth, fire, water, and air. Theses corresponded to blood, phlegm, yellow bile, and black bile, respectively. Aristotle advocated that the premises of a deductive can only be derived from metaphysical truths. Being comprised of four elements was an essential attribute of the universe to the Greeks. Considering this metaphysical dogma that was in place at the time of Hippocrates' theory, it is much easier to forgive the use of such a faulty premise.

Ultimately, as this case study in psychology shows, science can not be done in a purely deductivist way. Hippocrates outlines his argument in a deductivist way, and reasons through it similarly, but strict deduction only takes him so far. There is a need for observations and gathering of data as evidence. Whether or not Hippocrates realized he was deviating from this format, it was necessary for him in order to reach the conclusion he did. Just like Hippocrates could not explain the causes of nightmares using only deduction, there are many things in the world that are beyond the reach of deduction alone. The metaphysical-backed premises can only take scientists so far. At some point there is a need for inferences, and a possibility for incorrectness. Deduction alone is not enough.

Chapter 2

Weber Makes a Difference

John Stuart Mill was a proponent of inductivism, the belief that induction should be the main process of the scientific method. By analyzing Weber's just noticeable difference tests in psychology as a case study, it can be seen that inductivism resembles a proper scientific method more than deductivism, but is still not perfect. Induction unlocks and generalizes information that deduction never could, but ennumerative induction, and even Mill's methods, can be misleading and provide faulty information

Mill neatly outlines how he thinks inductivism should be employed in the sciences. He begins by generously offering an explicit definition of induction, calling it, "the operation of discovering and proving general propositions (57)." The key word in this definition is "general". Unlike deduction, which argues from the broad down to the narrow, induction starts with the specific, and reasons to the general. It generalizes pieces of information so that they can be applied to other, similar areas of a scientific field.

A simple example of induction would be saying "I leave Servo at 8:50 every day to get to my 9:00 class. I have never been late to my 9:00 class. If I leave Servo at 8:50, then I will not be late to my 9:00 class." This is what is known as ennumerative induction. This has held true every Monday, Wednesday, and Friday for the past month. Induction says that if I do this again, it will (most likely) hold true. Additionally, for every time that it does hold true, the likelihood of the conclusion being true increases.

This example contains all of the essential parts of an inductive argument. The first step is to observe the world. In this case, I observed that I always leave Servo at 8:50, and that I am never late to my 9:00 class. The next step is to use induction to formulate a causal law about the observations. Again, in this case the causal law connects the two observations by saying that I am not late to my 9:00 class because I leave Servo at 8:50. After a possible causal law of nature is established, the third step would be to use this law to predict an outcome. In the example I would predict that if I leave Servo at 8:50 next Monday, I will arrive at my 9:00 class on time. The final step would be to test this prediction. Let's say that my prediction was successful; I left Servo at 8:50 and was not late for class. This is evidence for the existence of the causal law. If this continues to hold true, the likelihood that our causal law is also true increases. If my prediction was unsuccessful, and I left Servo at 8:50 but did not get to my class on time, then we can deductively say that the causal law is false. If it doesn't hold true every single time, then it is not true.

In many ways, induction serves as the opposite of deduction. The strengths of deduction are the weakness of induction, and the strengths of induction are the weaknesses of deduction. For example, (if the premises are true,) deduction is never wrong, because the conclusion is contained within the premises. Induction on the other hand, is not always wrong, but has the chance of always being wrong. In the example above, while the premises are true, they do not guarantee the conclusion will also be true. It is possible that, even if I do leave at 8:50, I could not make it to my class on time. Maybe I forgot my book in my room and had to go back for it, or bad weather slowed me down. The conclusion of induction is never an undeniable truth.

What induction lacks in certainty, it makes up for in applicability. Most things about the world cannot be broken down into deductive proofs. Phenomena must be observed, data must be gathered, and inferences must be made. With only limited knowledge about how the world functions, deduction can only give us finitely many conclusions. Induction on the other hand, can give us infinitely many conclusions, and increase our knowledge of what we know. The conclusions of inductive proofs overtake the premises to reveal additional knowledge about the world.

The one issue Mill has with enumerative induction, however, is that it basically relates correlation with causation, which is not always the case. For example, it is known that shark attack rates increase at the same time that ice cream consumption increases (Ozel). These two events are correlated, but it is obvious that one does not cause the other one. The underlying factor in the example is that they both occur in the summer, the season where shark attacks are more prevalent and people are more likely to buy ice cream. Mill argues that we need a better justification for believing in our causal law, and even provides four different methods scientists can use to ensure this justification happens: The method of agreement, the method of difference, the method of concomitant variations, and the method of residues.

The method of agreement states that if causes A, B, and C result in effects a, b, and c while causes A, D, and E result in effects a, d, and e, then it is likely that A causes a. It is possible that B causes a in the first case and that D causes a in the second case, but the most probable scenario is that A caused a in both cases. For example, say I ate at Servo on Friday night, came back to my room, drank some juice from my fridge, and then woke up Saturday morning with a stomach ache. Then the next Friday, I ate at Pizza House that night, came back to my room, drank some juice from my fridge, and then again woke up the next day with a stomach ache. It is possible that the Servo and Pizza House food were to blame for my illness, but it is much more likely to think that the juice, the factor in common with both instances, is responsible.

The method of difference states that if causes A, B, and C result in effects a, b, and c, and causes B and C result in effects b and c, then it is likely that A causes a. In the previous example, say that two friends also ate Pizza House with me that Friday night, but only one of them drank the juice with me. If that friend and I both woke up with stomach aches, but the friend who didn't drink any juice did not wake up with a stomach ache, we could conclude that the cause of the stomach ache was the juice, not the pizza. Again, this could turn out to be false. Perhaps the friend who did not drink the juice eats Pizza House all the time and has built up a tolerance to the high levels of grease, preventing him from getting sick.

The method of concomitant variations states that if causes A, B, and C result in effects a, b, and c, and modifying cause A only changes effect a, then A is linked to a in some way. Say my friends and I all ate four slices of pizza house and an order of wings. The next morning, my friend who drank no juice felt no illness, my friend who drank some juice felt moderately sick, and I, who drank a whole bottle of juice, felt the most sick. It can be reasoned that the juice caused the sickness, and an increase in juice consumption lead to a more severe illness.

The method of residues states that if B is known to cause b, and C is known to cause c, then if causes A, B, and C result in effects a, b, and c, then it can be assumed that A causes a. I know from previous trips to pizza house that their pizza makes me extremely tired, and their wings give me heartburn. When I went to bed early from being too tired and with heartburn, I attributed both of these symptoms to the pizza, and wings respectively. After waking up with a stomach ache the next morning, I could conclude that this symptom was specific to my consumption of juice the night before.

In one of the first ever psychological experiments, Heinrich Weber set out to find the minimum change in a medium needed for a human to perceive a difference, a concept he called the "just noticeable difference." He first tested to see how much weight must be added to a half ounce before the person could notice that there was a change in the weight. He then tested again, this time starting with one ounce. Although this time more weight needed to be added for the participant to notice a difference in the two sensations, the ratio between the original weight and the added weight remained the same. Weber continued to test different with different weights, and noticed the ratio always remained constant. He even tested different senses this way, such as figuring out how much louder a sound must be, or how much brighter a color much be, before a person noticed a difference. For each sense, their respective ratio stayed constant. Weber concluded that this ratio would hold true regardless of the original stimulus.

If Weber's process fits the inductivist model properly, then it should be able to be broken down into the four steps necessary to all inductive arguments. First, Weber observed that in both the half-ounce and ounce cases that he tested, the ratio between the original weight and the weight added to make a perceivable difference remained constant. Based on these observations, he inductively proposed a causal law that claimed that if the correct amount of weight was proportionally added, then a person could, 50% of the time, perceive a difference in the weights (and if less than this were added then the person would not be able to distinguish a difference.) With this possible causal law devised, Weber used it to predict (calculate) how much weight must be added to any given weight to create a “just noticeable difference.” Finally, he tested his predictions, with every experiment reinforcing his causal law, making it continually more likely to be true.

So far, Weber’s operations have hit all the essential marks of induction. He used empirical evidence to support his theory. Although a hallmark of the scientific method now, Weber was one of the first in the field of psychology to gather evidence to defend his theory.

Mill would still say that Weber’s procedure is not truly inductivist. It seems to fit the inductivist mold, but it is still ultimately just ennumerative induction, which Mill argues does not give us good reason to believe in a causal law. The only way that Mill would be satisfied is if one of his namesake methods were employed, but Weber does not seem to use any of them. He sticks solely to ennumerative induction, which according to Mill, basically relates correlation to causation, which is a logical fallacy. Weber never goes beyond this step to provide sufficient justification that increasing a stimulus by the appropriate ratio actually causes the person to perceive the difference.

Mill’s derision of ennumerative induction is harsh. It is still perfectly rational to think that if something happens the same way every time, then it will likely continue to behave in that same way. After Weber’s multiple tests all yielding the same result, it makes sense that his “just noticeable difference” theory accurately describes the world. Of course correlation does not imply causation, but it does indicate that a causal relationship might exist. Basing a theory on some evidence, even if it is not very strong evidence, is better than creating one based on no evidence at all. This is why induction is essential, because even if the theory created is incorrect, it is based on something points towards the truth.

While ennumerative induction is useful, Mill is correct in claiming that his methods are necessary in harnessing the full power of induction. Psychology, and science and general, is always focused on having independent/dependent variables and establishing control/experimental groups to eliminate possible confounding variables. This is exactly what Mill's methods are used for. By not employing any of Mill's methods, Weber ran the risk of overlooking other things that could have been directly affecting the person's ability to perceive a difference, which turned out to be the case, at least to some degree. It is now known that "the law is accurate over most of the usable ranges for most sensory modalities… but it breaks down at the extremes (Coleman)." If Weber would have tested his theory in these extreme conditions, and the person could not tell the difference despite the same ratio being added, then Weber could have deductively disproved his theory (by failing the method of difference) or modified it to account these specific circumstances.

Weber's inductivist approach definitely moved the scientific method in the right direction. Doing science without making observations and collecting data seems almost unthinkable now, but as a founder of experimental psychology, Weber was the first to do this in his field. If Weber were to rely on deduction alone, and not use any empirical evidence to support his theory, then he would never be able to reach the conclusion that he did. There are no metaphysical truths about weights and perceptions that can be funneled down into Weber's Law. Deduction alone can never explain how the world works, so induction, although usually flawed, is necessary. So far, the inductivist approach is the best way to model how science should be done.

Chapter 3

Falsificationism

Falsificationism, developed by Karl Popper, is a philosophy that believes that conjectures are only scientific if they can be falsified. This does not mean that falsificationists want scientific claims to be false, but rather capable of being proven false. If something can not be proven false (such as the tautology "It is raining or it is not") then it can not contribute to our understanding of the world. Pavlov’s experiments demonstrate that falsificationism is the most efficient scientific method in the field of psychology.

As a method, falsificationism begins the same way as hypothetico deductivism. The first step entails an observation about some phenomenon, which could be anything about the world that one might find intriguing. Then one must form a hypothesis that explains the observed phenomenon. The hypothesis and the observation are part of the hypothetico deductivist and falsificationist free context of discovery. This means that an individual can observe anything and create a prediction however she would like. There are no rules or guidelines that must be followed. Unlike the beliefs of the inductivists, there is no need for induction in this step. The hypothesis is acceptable regardless of the means by which it was derived, but a conjecture that has a stronger rational foundation will have a better chance of being justified.

After the free context of discovery, the method of falsificationism shifts to the context of justification. The first part of this involves deductively deriving a prediction from the hypothesis. If one hypothesizes that if heat is added to water, then it will boil, the prediction would be something like, "If heat is added to this specific pot of water, then it should boil." This part is deductive because the hypothesis follows the format "If x, then y" so one can always deductively predict "If I have this particular x, then I will get this particular y."

The final step of this process is to test the prediction, which also happens deductively. The prediction says "If x, then y" so if the test results in y, then one knows, deductively, that her prediction is correct. If the test fails to result in y, then the prediction is wrong, and therefore the hypothesis is false. If the prediction is that a pot of water will boil when heat is added to it, and it boils when heat is added to it, then the prediction is right. If the water does not boil then there is something wrong with the original hypothesis.

Both the hypothetico deductivism and the falsificationists agree that if the prediction is incorrect, then a new hypothesis must be created. The consequences of correct predictions are what differentiate the two groups. Hypothetico deductivism thinks that if the prediction is correct, then this increases the degree of belief of the original hypothesis. They use induction to say that if the hypothesis is right this time, then it is likely to be right again in the future. The more times the predictions come true, the more likely it is that the hypothesis is correct. Falsificationists, on the other hand, think that a correct prediction makes the hypothesis better, but not necessarily truer. Falsificationists eliminate all induction from the scientific method, so just because a prediction is right one time, they do not think that this provides any supporting evidence for the hypothesis. By eliminating induction, falsificationists successfully avoid the problems outlined by Hume, Goodman, and Hempel.

There are two criteria that falsificationists use to determine the strength of a hypothesis: the amount of corroboration and the degree of falsifiability. When a prediction is correct, falsificationists do not say that the hypothesis is supported or more likely to be true, but instead, say that it is corroborated. If more predictions turn out to be true, then the hypothesis is more corroborated, and therefore even better.

The degree of falsifiability describes the number of things which could prove a theory wrong. The higher degree of falsifiability that a claim has, that is the more possible things that could prove it wrong, the better it is. If the hypothesis is that "If heat is added to this specific pot of water, then it will boil," then there is only one thing that can prove it wrong, which is heating up that specific pot of water and it not boiling. If the hypothesis was more general, like "If I add heat to any water, then it will boil" then this could be proven wrong by millions of different things. Any and all water in the universe could be tested with the possibility of proving the hypothesis wrong. For this reason, falsificationism pushes scientists to create bold universal claims.

In the 1920s, Ivan Pavlov studied the saliva and digestion of canines. The dogs would salivate when they ate the food or when there was an unwanted substance in their mouth (such as acid) to dilute it and wash it out. Pavlov noticed that the dogs would salivate at the sight of their food, or even when they heard the footsteps of those carrying their meals. This observation intrigued Pavlov, as an unconditioned, natural physiological response to a stimulus seemed to be paired with some natural stimulus.

Pavlov then formulated predictions and tested them. First, he preceded the delivery of the food with a certain frequency of sound multiple times. This pairing was repeated enough times to the point where the sound alone would also make the dogs salivate. He tried other pairings like this too, such as a ticking metronome and just the sight of the food itself (Pavlov). In all cases, as long as the stimulus preceded the actual delivery of the food to the dogs, and it was paired enough times, it would elicit the natural reaction of the dogs, and they would salivate. The more times it was paired, the longer it would take for the dogs to lose this cognitive connection between stimulus and response.

Pavlov also made it a point to seek out and eliminate possible confounding variables. He used results from fellow scientist Dr. Zitovich that showed that dogs who were taken away and only ever given milk did not salivate when they saw food like bread or meat. “It is evident, therefore,” remarked Pavlov, “that the sight of food does not in itself act as a direct stimulus to salivary secretion.” This experiment strongly supported what Pavlov believed to be the truth, that the pairing of stimuli was the essential part of his theory of classical conditioning.

Like any falsificationist would Pavlov used his experience to notice that the dogs were salivating at times that they normally should not salivate, specifically when they sensed things that normally preceded their meals. From this observation, he formed a hypothesis. He hypothesized that when some natural stimulus is paired with an unconditioned stimulus enough times, this causes the unconditioned response to become a conditioned response. This is a universal conjecture because it applies to any stimulus and response possible. It also follows the free context of discovery that falsificationists believe in. It is not exactly clear how Pavlov specifically arrived at this hypothesis, but no matter what method he used to reach it, it coincides with the falsificationist model.

After Pavlov had his hypothesis, he created predictions and tested them. Everything he tested seemed to support his hypothesis. No matter what stimulus he used, whether it be a specific sound frequency, the speed of the metronome, or the food itself, his hypothesis held. In this sense, his hypothesis was corroborated. It stood up against the possible falsifying experiments and can be seen as a good hypothesis.

The key part of this case study that makes it fit into Popper's philosophy is the falsifiable hypothesis. According to Popper, "it must be possible for an empirical scientific system to be refuted by experience" (Gimbel 147). In order for a statement, theory, or conjecture to be scientific, it must be falsifiable. Pavlov's hypothesis is falsifiable. As soon as a stimulus and response pairing takes place, but the conditioned stimulus does not elicit the unconditioned response, then his hypothesis is falsified.

Like the other case studies that have been examined so far, the scientific method in question seems to apply, at least superficially. There are a few small things that the falsificationism philosophy does not account for perfectly. One of these is the difficulty of ascertaining whether or not Pavlov's hypothesis is better explained by the falsificationists or the inductivists. It makes sense that Pavlov's hypothesis could have been made inductively. He observed two things and connected them together to make a causal law. Pavlov first observed that his assistant's footsteps always occurred right before the dogs received food which made them salivate. He then observed that just the sound of his assistant's footsteps made the dogs salivate. He then hypothesized that the first observation caused the second one. Here it seems that the inductivists are correct. There may have been more, in the words of Whewell, "stringing together pearls" (Gimbel) in his conception of the theory than there appears to have been, but this part does seem to follow the inductivist model just as well, if not better.

The most essential part of a good theory, according to falsificationists, is the amount of corroboration it has, but, while Pavlov does carry out multiple demonstrations, these do not corroborate his theory as well as they could. He claims that, "It is obvious that the reflex activity of any effector organ can be chosen for the purpose of this investigation since signaling stimuli can get linked up with any of the inborn reflexes," (Pavlov) but never actually shows classical conditioning working with an unconditioned response different from salivating. He does prove that many conditioned stimuli work, but only ever shows one conditioned response. He should have done experiments to condition things like barking or tail wagging, and they should have definitely been run on more organisms than just dogs. All that Pavlov's experiments actually show is that dogs can be trained to salivate by performing various actions in a certain order. Although his hypothesis is universal, general, and as far as we know correct, his experiments do a rather poor job of actually supporting and corroborating it.

Although Pavlov himself did a lackluster job of corroborating his theory, this is made up for by the other criterion of a good hypothesis, which is a high degree of falsifiability. His theory can easily be proven wrong. All one has to do is find a case where some natural stimulus does not elicit the unconditioned response after being paired with the unconditioned stimulus or find some unconditioned stimulus that never turns into a conditioned stimulus. There are infinitely many possible things that could prove Pavlov's theory wrong, but not a single falsifying case has been discovered since the theory's inception over nearly a century ago. It has only ever been corroborated since its inception, which explains why it is such a good theory.

Although this case study could be explained by the inductivists, the falsificationists can explain it just as well, if not better. Falsifications do a better job than the inductivists of explaining why Pavlov's theory can be considered well-founded and believable. Falsificationists do not encounter any of the problems of induction and still provide corroboration as the reason for why his hypothesis is such a great one. The free context of discovery also allows for any hypothesis and does not restrict any ideas just for arbitrary reasons. Falsificationism is the superior scientific method in the field of psychology.

Chapter 4

Freud’s Revolutionary Science

Thomas Kuhn believes there are social influences and human aspects that affect the scientific process. His holistic approach argues that new paradigms appear to challenge existing framework, but that scientific progress is never actually made. Freud’s founding of the psychoanalytic theory, and specifically his therapy sessions with the Rat Man, show that Kuhn’s general outline of science is correct, but contains a few misconceptions regarding necessary conditions for his theory to apply and predicted consequences.

Kuhn claims there are several stages that every scientific field undergoes. Science starts off as a kind of "pre-science,” like the first chapter of this book. Kuhn remarks that, "One somehow hesitates to call the literature that results [from this period] scientific” (Gimbel 184). This is essentially a philosophical stage of science, in which the some of the metaphysical and foundational questions are answered. While Hippocrates' scientific methods weren't the best, his contemplation of the relationship between the mind and the body gives us some basis for what psychology should attempt to answer. When the fundamentals of the field and how it should be done are are finally agreed upon, then this is a paradigm.

A paradigm is basically a way of looking at, thinking about, and doing science. It has its own defined sets of tools, theories, and problems, that a group of scientists agreed on. These paradigms tell us what legitimate questions are, what legitimate ways of answering these questions are, and what legitimate answers to these questions could be. Paradigms appear all the time in psychology. Behaviorism, humanism, and psychoanalysis are all examples of these paradigms, because they each choose to look at their science through their own unique lenses.

Pre-science then transitions to normal science, which describes the work of scientists employed at labs and universities. They carry out experiments in an attempt to find answers, or teach others about the paradigm they are in. Here is where the problem of paradigms becomes very apparent. They are like prestigious clubs or social cliques; you must follow their rules or leave. The only way to "prepare the student for membership in a particular scientific community" (Gimbel 182) is by accepting this paradigm, and learning its rules. If you want to graduate, you must study and do well on the tests. Those who get the best jobs are the ones that get the best grades. In other words, those that understand and adhere to the paradigm the best are rewarded.

The obvious problem with this is that the studying scientist will "seldom evoke overt disagreement over fundamentals" (Gimbel 183). They are indoctrinated to a point where they will not question anything, which seems to be the opposite of what a scientist should do.

It seems that no person can disagree or challenge an existing paradigm, but science itself can. There eventually arises a phenomenon that is unexplainable by a paradigm. Scientists will sometimes desert science altogether, or wait for this apparent anomaly to be proved wrong, but will usually "devise numerous articulations and ad hoc modifications of their theory in order to eliminate any apparent conflict"(Gimbel 191). They will slightly change their rules so that it explains the anomaly, but still maintains their core beliefs. This method works in the beginning, but more and more anomalies are eventually discovered. At some point there are too many anomalies for the paradigm to account for, or there is one that is too big. It is during this crisis that ensues, Kuhn argues, when scientific revolutions occur.

Scientific revolutions are extremely similar to political revolutions. Just as political revolutions occur when the needs of the masses aren't being met by the governing body, scientific revolutions take place when the "existing paradigm has ceased to function adequately" (194 Gimbel). Similarly, in both cases, there will be those that side with the institution in charge, and there will be in favor of creating a new form of rule: a new paradigm Both parties disagree, and because the are arguing in favor of two completely different things, there is no way of determining who is more "correct". Kuhn uses the term incommensurable to describe the impossibility of comparing different paradigms.

The incommensurability of paradigms implies two things. The first is that because there is no criteria for deciding which paradigm is better, there is no rational way to pick which paradigm should be believed in. Adherents either choose to follow a new paradigm for some aesthetically appealing aspects, or just shift paradigms for no logical reason at all. There may be no reason to change to a new paradigm, but as more and more people switch over, the paradigm will grow in power and numbers, to the point where a revolution has occurred, and there is a brand new, scientifically competent way of thinking about the world. The second, and most surprising implication of incommensurable paradigms, is that no scientific progress is ever made. New paradigms can be created in times of crisis, but if their truth and accuracy can't be compared to other paradigms, then it is also impossible to know if science is heading in the right direction It can't be known which is more right, so all measurement of concept of progress must be disregarded.

To analyze the applicability of Kuhn's claim, consider an episode in the works of Sigmund Freud, the founder of the psychoanalytic perspective. Freud was a neurologist that thought certain mental illness such as hysteria, neurosis, and OCD could be treated through communication with the patient (Burton). He thought that letting the patient talk about whatever came to his mind, free association, would lead to identification of the root of the problem. This root, according to Freud, stemmed not from any physical/neurological abnormalities, but from tension between the patient's consciousness and unconsciousness, often due to repressed of conflicting sexual desires, especially those that occurred at a young age. These general ideas can be clearly seen in one of Freud's most famous cases, that of the Rat Man.

Ernst Lanzer, or the Rat Man as Freud called him, was a 29 year old lawyer who came to Freud for treatment (Wertz 49). The reason he was called the Rat Man by Freud was that he had an intense obsession with rats, brought about by a story of punishment that Ernst heard during his time in the military. For this punishment, "pots of rats were turned upside down on the prisoner's buttocks and the rats bored their way into his [the victim's] anus" (Wertz 51). After hearing this story, Ernst could not help but think that this was happening to his father and his love, Gisela. These obsessive thoughts caused him great anxiety and uncontrollable guilt.

To explain this obsession, Freud dug deeper into Ernst's earlier life, getting him to recount stories of his childhood. Ernst admitted to having "sexual experiences from his fourth through seventh years in which his intense precociousness was both stimulated and thwarted by his respective governesses" (Wertz 50). These repressed feelings disrupt normal behavior, causing him to believe that loved ones would die when he had these sexual feelings. To Freud, this was the key to understanding the mind of his patient. Everything else can logically be explained because of these early sexual encounters.

Ernst's thoughts about his father dying made perfect sense now according to Freud, because his death could potentially lead to erotic gratification that he longed for his whole life. Freud's reasoning is that if his father died. Then Ernst would inherit all of wealth, and therefore become more attractive to other ladies, including his love Gisela. These early memories of repressed sexuality can also easily explain other strange habits that Ernst often exhibited, such as attempting to slit his own throat, but deciding that he should first kill Gisela's grandmother, whom she cared for. Freud concluded that ernst unconsciously believed that Gisela's grandmother was standing in the way between him and sexual pleasure, and killing her would eliminate this barrier. The patient's fascination with rats is also accounted for. Among other things, the rat is symbolic of anal eroticism, the penis as a carrier of syphilitic infection, the desired punishment and death of loved ones, and the procreative desire to impregnate both his father and Gisela (Wertz 50).

After about a year of therapy, Freud declared that his method of free association and communication cured his patient. Although most people agree that the Rat Man was cured of his neurosis, there are still many that are skeptical of the actual effectiveness of Freud's treatment (Thapaliya). Either way, this case study not only clearly demonstrates the major aspects of Freud's theory and approach to science, but helped establish psychoanalysis as a major perspective in psychology.

Freud's work is permanently ingrained in today's culture, but does it actually coincide with Kuhn's philosophy? Obviously, Freud's founding of psychoanalytic perspective was a paradigm shift. It explained emotions, thoughts, and behaviors of people in a fundamentally different way than other schools of thought in psychology. Previously, the Rat Man would have been explained by and cured with much different reasoning. The behaviorists, for example, would have explained his actions through environmental stimuli (being rewarded for his thoughts) and the evolutionary paradigm would have based it on biological factors (such as an instinctual, inborn fear of rats). Freud's new way of thinking changed all of this by basing things on the constantly conflicted levels of consciousness, and repressed sexuality, as evidenced by the Rat Man's confessions. This paradigm explains science in a way that previous paradigms couldn't or didn't.

Kuhn would undoubtedly agree that it was a paradigm shift, but he would not actually label it revolutionary science. Kuhn claims that "when… an anomaly comes to seem more than just another puzzle of normal science, the transition to crisis and to extraordinary science has begun" (193 Gimbel), but in the case of Freud, he was not rebelling against, or trying to fix any anomalies with his new paradigm. Psychology as a whole was not suffering any crisis at the time. Clinical methods used to treat illnesses like those found in the Rat Man were working fine. Freud was not desperate to save a crumbling science, his new approach to psychology was just influenced mainly by literature he read and his time studying his hypnosis (Burton). So while Freud's central tenets were in fact different than those previously found in psychology, his theory was not created to actively challenge what was already established.

Both of Kuhn's implications of incommensurability make sense in the case of the Rat Man and Freud's approach in general. The first consequence, that there is little more than mere aesthetic value in determining which perspective to choose, is justified. There is no justified reason in believing Freud's explanation of the Rat Man's neurosis instead of other psychologists.

His theory is however very appealing, which explains its sizable following that eventually expanded to include notable psychologists like Jung and Adler. Even today, neo-Freudians like Horney and Fromm keep the paradigm alive, a consequence predicted by Kuhn. The theory is appealing because people are mystified and intrigued by invisible conflicts, sex, and repressed feelings. During Freud's own life, he was an extremely influential and popular psychologists, and his thought even permeates culture today (eg Freudian slip).

Kuhn's other point, that there is no scientific progress, also seems to be validated by the case study. It is very difficult to tell if Freud's paradigm shift aided scientific progress. It is not clear if his way of diagnosing or curing the patient was better than the methods before him. The actual results of the Rat Man's treatment are rather shaky and inconclusive, with a substantial number of people who argue for both sides. There are even a few anomalies that present themselves in this theory, just in the case study alone, such as potential falsehoods in what the Rat Man was saying.

Kuhn accounts for many things, but his theory is not perfect. Just because paradigms are different, this does not mean they are automatically incommensurable or incomparable. Although it is difficult to tell which perspective is better in this case study, this is because of the questionable evidence, not because the perspectives aren't comparable. If there were overwhelming consensus that Freud's methods were effective, then it would be safe to say that this perspective was better. It is still possible to compare different paradigms, at least in the field of psychology, because they are not so drastically different. Although most psychologists subscribe to a certain perspective, many often take an eclectic approach, drawing from many paradigms simultaneously. This would not be possible if Kuhn's theory of incommensurability held.

Kuhn's prerequisites for a paradigm shift are also slightly skewed. There are instances where crises do occur, and new paradigms are created from this occasion. In fact, this is usually the case. But, like in the case of Freud, this is not always a necessary condition. Sometimes new paradigms can be created without a scientific crisis. Even if science seems to be working smoothly, somebody's experience or the general culture of the time can lead to new paradigms being created.

Kuhn's holistic view of the scientific method, with these two minor exceptions, explains psychology very well. Different paradigms and perspectives exist all over the place. This view also is not mutually exclusive with other scientific methods. Falsificationism, which was decided to be the go-to scientific method in the last chapter, can still exist within Kuhn's theory of science. While falsificationism remains the most accurate scientific method used in psychology, Kuhn's philosophy of paradigms and stages of science still applies.

Chapter 5

Monkey Models

The semantic view of theories claims that science consists of sets of models, and the use of these models helps describe the real world. Philosophers like Spector, Black, and Giere outline the types, characteristics, and the general necessity of models in science. Harlow's psychological experiments demonstrate that models are extremely effective at aiding our understanding of natural phenomenon, but upon further reflection on past case studies, it becomes apparent that the applicability of such models in psychology seems severely limited.

The semantic view of theories holds that science consists of sets of models, but to understand what this means, the term model needs to be explicated. Although no formal definition is ever given by the semantic theorists, a model is just a representation of systems in the real world. There are different kinds of models, but they all serve the purpose of describing the underlying workings and fundamental mechanics of the world in ways that help us understand it. There is also "no such thing as a perfectly faithful model; only by being unfaithful in some respect can a model represent it's original" (Gimbel 257). Whether it be from our limited understanding of the world, the infinite complexity of nature, or just the design of the model itself, it can never be mapped one to one on reality. There will always be some part of it that can not be translated onto the world, but this does not prevent it from being practical.

Unlike the syntactic or holistic view of theories, the semantic philosophers do not believe science consists of testable propositions. Models, they say, can not be true nor false. Enlarged replicas of microscopic cells or mathematical equations used to describe electrical circuits aren't correct or incorrect. Because these aren't statements, they cannot ever have any truth values, so thinking of them in terms of right or wrong is nonsensical. They can be used to help predict and describe how systems and phenomena in the real world will act, but never will definitely determine any scientific law or facts about reality.

According to Max Black, there are three types of models. A scale model shows the "likenesses of material objects, systems, or processes that preserve relative proportions," (Gimbel 258) whether this is a spatial, temporal, or other relation. A miniature version of the solar system or a slow-motion collision of particles serves as a scale model. Another type of model is the analogous model, which reproduces "more abstractly, the same structure or pattern of relationships." (Gimbel 258). Using the flow of water acts as an analogous model to help understand electrical current because although they are different processes, they function in a similar way; by understanding one, one can understand the other.

The final model is the theoretical model, which consists of equations, numbers, and other terms. Examples like the Hardy-Weinberg principle or Kirchhoff's laws attempt to describe the world is a useful way. Even more so than the other types, these theoretical model tends to be oversimplified and idealized (Gimbel 259-260). The world is extremely complex and messy, and therefore practically impossible to model totally accurately. The more detailed and precise an equation becomes, the less useful and understandable it becomes. The tradeoff between applicability and accuracy has created a debate between the realists, and the instrumentalists, respectively.

Harry Harlow was a psychologist in the early 20th century who thought that the way his field studied love was flawed. Other than psychoanalytic theory, the only major way that love and attachment were explained was by the behaviorists, who believed that all subject behavior can be explained by environmental stimuli. They explained love as a derived, secondary behavior stemming from an infant's need for food and water (Harlow 673). They postulated that when it receives these things from a mother, it is positively reinforced to stay close and attached. This reinforcement, according to the behaviorists, eventually leads to the feeling we know as love. Harlow, knowing information like the persistence of affection towards a mother even when she does not directly provide for the instinctual drives of her children anymore (Harlow 673), thought this view was not quite right and set out to verify his intuition.

Harlow and his team removed infant monkeys from their mothers at birth and placed them in a small container with two wireframe mother monkey replicas. One of these was left bare, while the other was covered in cotton terry cloth with a light bulb implemented behind resulting in a mother that was "soft, warm, and tender" (Harlow 676). He proceeded to set up two scenarios, one where the cloth mother was engineered to artificially lactate, and another where the wire mother had this ability. In both cases, although the baby monkeys received sustenance from the breastfeeding mother, they spent overwhelming time on the cloth model. By twenty-five days of age, the monkeys spent, on average, 16-18 hours a day on the cloth mother, and only around 1-2 hours on the wireframe, making it "obvious that contact comfort is a variable of overwhelming importance in the development of affectional responses, whereas lactation is a variable of negligible importance" (Harlow 676). Not only was contact a factor, but seemed to be the major factor in determining and fostering love.

Harlow continued to run experiments testing other facets of infantile love and attachment. He set up a scenario where a sudden, loud stimulus was introduced in the monkey's presence, which immediately caused the monkey to rush to the cloth mother for protection and comfort, even when she was not the one nursing. Another test, labeled the "open field test" placed the monkeys in a six feet by six feet box with varying stimuli to explore, along with the cloth mother in the center. The monkeys felt safe to explore this new area with the mother around, but returned to her and grasped for comfort after each new thing explored. When the cloth mother was not there, however, the monkeys would throw tantrums, running around furiously and anxiously clutching themselves while crying. The introduction of the wire mother did nothing to quell this anxiety (Harlow 679). These experiments were replicated and adapted to show that these relationships were “highly resistant to forgetting and that it can be retained for very long periods of time by relatively infrequent contact and reinforcement,” (Harlow 682) directly challenging what the behaviorists had posited.

The compatibility between the semantic view of theories and Harlow’s experiments seems clear. Along with obvious ethical problems that would arise from using human babies in such an experiment, these tests would be near impossible to carry out with humans because of their poor sensorimotor capabilities (Harlow 674). For this reason, Harlow used baby monkeys, which served as accurate, analogous models for human babies. Monkeys are such excellent models because they imitate all of the core functions of a human that would be necessary for trying to measure and study love. Apart from differences in the rate of maturity, “the basic responses relating to affection, including nursing, contact, clinging, and even visual and auditory exploration, exhibit no fundamental differences in the two species,” and even emotions like fear and frustration are similar (Harlow 674). Because all these are the essential aspects in figuring out what love is and how it is formed, the baby monkeys are suitable models for how babies would act naturally in reality. It does not take much convincing to see the suitability of monkeys as substitutes for babies. Just like toddlers who stick to comfort blankets and cuddly toys, the monkeys preferred soft cloth over anything else.

Even the wire monkeys could be considered models in this experiment. They would also be considered analogous models. The wire monkeys were inanimate objects with the same functionality as real monkeys, so were able to act as suitable replacements. Although they were only built with a single lactating unibreast (Harlow 675), the baby monkeys were still able to breastfeed, cuddle, climb onto, and grasp these model mothers just as they would their biological mothers.

The models in this experiment can be neither true nor false, another aspect that is explained by and bolsters the semantic view philosophers. They are not, as Giere would say, “linguistic entities” (Gimbel 266), and therefore not testable propositions. The monkeys only serve to represent humans, so although they reveal no definitive truths about the world, they have strong explanatory power. Information and knowledge about how our species functions is apparent from these experiments and the use of the models aids our understanding in a way that nothing else could.

By analyzing the validity of the semantic view of theories through the case study of Harlow’s experiments, there seem to be virtually no flaws. The system created in the experiments models the relationship and behavior of newborn babies accurately, with both the baby monkeys and model frames being a type of model accounted for by Black. It works perfectly in this case, but the occasions where this approach fits well seems limited.

Not everything can be broken down into models the same way. Psychologists and semantic view philosophers alike are fortunate that humans have such a similar biological counterpart that conveniently shares all of the core functions that make emotions like love testable. What if somebody wanted to test some capacity in humans like motor skills? What model should be used then? It has already been shown that monkeys are superior in this respect, so using them as models would be inaccurate. With the most similar species out of the question, the remaining analogous models would be even more ridiculous and unfaithful. It is doubtful that the way we write our names can be modeled by a turtle, or the way we drive by a giraffe. Scale models would not be helpful and would only make things more unnecessarily abstract. The only other type of model, the theoretical model, does not seem to work well either. An equation or algorithm that is supposed to model human motor skill appears just as unlikely as the other two options. What variables or constants could even be used in this framework? Something like this can simply not be described by any kind of formula. There is simply no model that could realistically be employed.

Reflecting on case studies in previous chapters further emphasizes this point. Instances like the dogs in Pavlov's experiment are good models because they share the same cognitive functionality as humans, so the resulting information can be generally applied to the human race. In other cases, however, the semantic view seems nearly impossible to incorporate. How would the Rat Man's situation be modeled? No other being has been through the same (or even similar enough) situation for the Rat Man's behaviors and obsessions to be modeled and consequently explained. Again, a scale model would be silly to employ in this circumstance, and an expression that can formulaically outline his feelings and neurosis does not exist. No model of any kind would be useful in this situation.

In conclusion, when models work, they work. Harlow's use of monkeys to showcase human development of love and affection is, as discussed, extremely accurate, and the reason why it still considered a landmark study in the history of psychology. When models do not quite fit a situation, however, it is nearly impossible to make them fit. Some things appear to be incompatible with the semantic view of theories, so while this definitely should not be the only approach to the scientific method, it can be applied when necessary.

Chapter 6

A Critical View

The critical view of theories believes that science is a socially and politically influenced practice. Science is not some special academic field that is isolated from the rest of society. It exists in a world that is constantly shaped by the different beliefs and actions of the people that inhabit it. This impact naturally shifts science from the purely objective process in which it is typically viewed, to a more subjective, biased, and at times untrustworthy system. Ruth Hubbard, a feminist and professor of biology at Harvard, wrote about these aspects of science in her piece "Science, Facts and Feminism." By analyzing the debate over the inclusion of homosexuality in the DSM-II, Hubbard's points of social bias among scientists, the enforced power structures, and the transient nature of facticity become apparent in psychology.

The subjectivity of science stems mostly from underlying systemic flaws. Similar to Kuhn's critique of science, the critical view philosophers point out how science is basically an elitist club, where the only way to join is to play by the specified rules. One must educate themselves with knowledge that has been espoused by the scientists in control, graduate with good grades, and try to land a job with like-minded people. According to Ruth Hubbard, if somebody is able to "follow proper procedures, they become accredited fact-makers" (Gimbel 295). It is this assimilating process that gives a person the power to say what is true about the world and what is not.

Because "science is made, by and large, by a self-perpetuating, self- reflexive group by the chosen for the chosen," (Gimbel 296) this leads to the majority of scientists being upper-class, straight, white men. Historically, the type of education needed to get to this level was only available to this subset of the population. Now that there is a large imbalance, it becomes even more difficult for members that do not fit into this group to be recruited into the scientific community. There is an inherent bias to accept people of your own kind, and reject those that differ from you, especially if they disagree with what you are saying.

This discrimination is unfortunate, but ideally, it should have no effect on the way science is done. If there are objective truths in science, and there is a uniform scientific method, then regardless of who is in charge, the end results should be same. Again, this is seldom the case. Human beings bring unique experiences and different perspectives with them, which consequently affect their scientific practices, at least in some way. It is impossible for every person to operate identically and remain completely impartial at all times.

Hubbard, a feminist, provides examples to demonstrate her point, specifically in terms of the subjugation of women. In the nineteenth century, biologists "proved" that the women's brain was smaller than the men's brain, and that the ovaries needed plenty of rest and energy to function properly. Because this was then a scientific fact, there was good reasoning to keep women away from universities and the workforce, especially when menstruating. To account for the fact that poor women were able to work so hard (out of necessity), scientists just claimed that they were less than human (Gimbel 299). Similarly, Franz Gall developed phrenology which attempted to scientifically explain the inferiority of other races based on the shape of their skull. It is now known that these once respected facts are clearly untrue, and while scientific credibility seems to have increased greatly since these pseudo-scientific times, it is impossible for science to be a truly objective enterprise. It will always reflect the culture of the time.

Science, ultimately, is all about power. “The sociology of laboratory life,” remarks Hubbard, “is structured by class, sex, and race, as is the rest of society” (Gimbel 303) Just like in other areas, those in control want to secure the control for themselves. Scientists will deny others entry into the organization, discriminate against those in the community, disseminate false or biased information to the public, and continue to carry out their business in the way that they wish to. Science is an entirely political matter, with social influences deciding everything from who is in charge, to what even gets funded, and thinking that it is only focused on finding objective truths is naive.

In the 1970’s, there was a debate regarding the inclusion of homosexuality as a mental illness in the DSM-II. In the first edition, homosexuality was listed as a mental illness, which meant that “sufferers” were characterized by abnormal or deviant behavior. Because of its planned inclusion in the DSM-II, there were riots by gay activist in San Francisco, where the APA convention was being held.

The opponents of the inclusion were outraged from the first time around, and came prepared with evidence to back up their claims. They pointed out the work of Alfred Kinsey, a noted psychologist whose studies showed that homosexual tendencies were not actually abnormal, with 37% of men reporting to have engaged in some sort of gay behavior. Evelyn Hooker’s data, which demonstrated that there was no noticable difference between the psychopathology of heterosexual and homosexual men, was also brought to the attention of the APA (Zachar and Kendler).

Even when confronted with this evidence, there were still those that remained steadfast in their original opinion. With the majority of Americans being Christian, there was a dominating subscription to the belief that homosexuality was immoral and sinful, and therefore an illness. Homosexuality being natural was just not something that could coincide with most people's beliefs. This religious reasoning also caused legal codifications that supported homosexuality as a sickness. Sodomy was illegal, and this long-ingrained connection only served to reinforce the rationale that it was also consequently abnormal.

Psychologists at the time were split on the issue. Both Sigmund Freud and Havelock Ellis believed homosexuality was an inborn characteristic, and therefore was not a mental illness, and definitely not something that could be clinically classified. Still, psychologists like Rado, Socarides, and Kraft-Ebbing viewed any deviation from heterosexuality as a pathological sickness (UC Davis). Even with much scientific evidence supporting the removal of homosexuality from the DSM, there was staunch opposition, and any kind of consensus seemed unlikely. Eventually however, a compromise was reached, "defining homosexuality as an irregular sexual behavior, not a disorder, but not normal either" (Horwitz and Mayes 12). After a vote by the APA in 1973, homosexuality was replaced by the category "Sexual Orientation Disturbance."

The debate did not stop after the publication of the DSM-II. When it was time for the third edition to be released, psychologists knew that they needed to be more objective and specific with how they defined the symptoms and characteristics of mental illnesses. Robert Spitzer, a psychiatrist who helped write the DSM, formed a study that found that different psychologists could diagnose the same person with different illnesses, a result of the illnesses being poorly and too broadly defined. New criteria was then formed to create a more concrete operational definition for a mental illness.

This episode in the history of psychology is explained perfectly by the critical view philosophers. Regardless of the end result, the fact that there was even a debate about what should be considered a mental illness shows that there is room for subjectivity in science. Those who adamantly wanted homosexuality to be seen as a mental illness were influenced by years of religious and legal precedent. They already viewed homosexuality in a negative way, and because virtually every psychologist and psychiatrist in the APA was straight, there was no hesitation in their decision. This was a clear instance where the scientific majority in power was discriminating, whether intentionally or not, against others. Even with no evidence of their own, there was overwhelming reluctance to give in to change. They were more focused on their own agenda, or just personal opinion, rather than scientific facts or reasoning.

"The debate over homosexuality demonstrated how difficult it would be to entirely remove social and political considerations from any process of defining mental disorders" (Horwitz and Mayes 11). The only reason that change was enacted, and in turn scientific truth was engendered, was because of public protests. Gay activists were able to present a compelling argument backed by other scientific evidence. The coincides with Hubbard's wish to put the validation of scientific facts "under more public scrutiny" (Gimbel 305). It took the force of people from outside the scientific community to expose the inaccuracies of the organization, and demand change. The social climate of the time, with the rise of the counterculture movement and the increased prevalence of non-heterosexual behavior, is most likely responsible for, or at least helped strengthen the effectiveness of the protests. Science was at the whim of the culture.

This case study is not meant to highlight just the homophobic tendencies of psychologists in the 1970's, but more importantly the overall fragility and turbulent nature of knowledge. It is not very reassuring to know that scientific facts can be changed just because a newer edition of a book is published, or because some people voted on in a different way. The rigor of science, and the presence of undeniable facts seems like a myth in the field of psychology, at least when discussing mental illnesses. The illnesses are difficult to define, and come down to the personal opinion of the fact-makers in charge. Spitzer claimed his implementation of "narrow, symptom-based definitions could make diagnostic criteria seem more objective and, therefore, avoid political conflicts that exposed the field to widespread ridicule" (Horwitz and Mayes 11). It was a direct reaction to the crisis caused by subjectivity.

Psychology itself that tells us that it is in human nature to have a bias towards things, whether we notice it or not. Scientists have surely stretched the truth on some studies, or selected only certain data to support their hypothesis, or ran experiments that they knew would support their intuition. It is impossible for humans to remain completely impartial, so Hubbard is right in claiming this, at least to some extent.

Science is not a totally anarchic enterprise though, as Feyerabend claims, because as we have seen, there is some sort of structure, format, or model of how science is done. Scientists do not just do whatever they want, and claim whatever they want; they are held somewhat accountable for their actions and words. They are often peer reviewed, and put under much scrutiny before they are published. Although Hubbard is correct in saying that most of these scientist in the reviewing process would be similarly educated, rich white men, this does not mean that they would let anything get published. There is some level of accountability here.

There is subjectivity in science, and it is used, at least occasionally, to maintain some kind of power over others. This case study is an undeniable example of this. The APA, a mainly heterosexual organization, made a decision that negatively impacted homosexals all over the nation. There are countless historical examples of those in power trying to keep control at all costs. Human nature does not magically change when one becomes a scientist. While there is undoubtedly much science that is socially motivated by some means or another, this does not mean all science is like this. It is just difficult to tell when one is dealing with the truth or not.

Chapter 7

Psychology's Scientific Method

After exploring the strengths, weaknesses, and overall applicability of the various scientific methods and views of science, one question still remains: What scientific method is used in psychology? By comparing the effectiveness of each method to the science as a whole, some methods seem to work better than others. Psychology predominantly employs hypothetico-deductivism as the standard scientific method, but modified versions of the holistic, semantic, and critical view of theories can be applied simultaneously to explain certain aspects of the scientific material or the field itself.

Deductivism, the first method discussed, has its place in psychology, but is certainly not the main method that should be used. There are not many metaphysical truths that can be deduced from in psychology, and the use of deduction alone limits the scope of the field to a narrow range of problems that could actually be solved. It should be used in conjunction with another method, like induction, to be utilized effectively.

Induction is a handy method in psychology that lets scientists use observations, make inferences, and predict future events. Everyone from Weber, to Pavlov, to Hippocrates, has employed induction in their work. Without it, psychology is not able to make much progress. The downside of induction, however, is made clear by the paradoxes expressed by Hume, Hempel, and Goodman.

The falsificationist approach works very well to bypass these problem of induction, and most instances in the field are falsifiable. As noted before, Weber’s and Pavlov's claims can (but have yet to be) proven wrong, and most biological and behaviorist claims in general can be proven wrong by a simple experiment. This does not account for everything though, as falsificationism runs into some problems of its own too. Many obvious counterexamples exist that can not be falsified, like the entirety of psychoanalysis, the very thing that Popper was rebelling against when forming his philosophy.

Hypothetico-deductivism, on the other hand, takes all of the strengths of inductivism and deductivism without demanding that a claim be falsifiable to be scientific. Scientists, especially psychologists, use their experience to form a general intuition about how something in the world works, and subsequently form a conjecture. The free context of discovery gives psychologists the liberty and ability to observe anything, and arrive at their predictions in any way they would like. They then set up experiments, or case studies, or surveys to collect data that either support or refute their predictions. This is how science is done. Every case study examined employed hypothetico-deductivism in some form. Freud talked to his patients as a means of obtaining data to enforce his theories of repressive sexual emotions and unconscious conflict. Data from Kinsey and Hooker was used to try to influence the decisions of APA members during the debate on homosexuality as a mental illness. Even Hippocrates, who tried to stick exclusively to deductivism, relied on observations to support his claim. It can explain most of, if not all of psychology, and although it runs into the problems of induction, psychology doesn't much care. It still provides good reason to believe things, and many of the conclusions that were arrived at inductively still hold up and are respected today.

Hypothetico-deductivism is definitely used as the scientific method in psychology, but there is still a place for the holistic, semantic, and critical view of theories More so than any other scientific field, psychology is full of different perspectives, like the psychoanalytic, behaviorist, gestalt, humanistic, and cognitive schools of thought. A slightly altered holistic view can account for all of the different perspectives, or paradigms, that exist. Each of these perspectives have unique fundamental beliefs that they use to shape their respective frameworks and structure their approaches to science as a whole. Unlike Kuhn's philosophy however, while paradigms could appear as a result of a revolt against a pre-existing paradigm, they do not have to. Humanistic psychology's individualist and free-willed approach was a reaction to the psychoanalysts and behaviorists schools, while the rise of the psychoanalytic school for example, was not trying to challenge anything in particular. The paradigms in psychology are also not incommensurable. It is common for psychologists to stick mainly to one school of thought, but they do not have to. Eclectic approaches that combine different parts of various perspectives exist in the science too.

Hypothetico deductivism and the holistic view are not mutually exclusive. The holistic view is not enough to explain science on its own because although it accounts for the different groups nicely, it does not explain how exactly science is done within these groups. These groups still have to employ some method when trying to make scientific progress, which is hypothetico-deductivism. The different perspectives have different beliefs and attitudes towards psychology, but they all still hypothesize, make predictions, and test them.

The semantic view's main tenant of science consisting of sets of untestable models is clearly not true in psychology, but this does not mean that models themselves serve no purpose.

Models in psychology generally, or at least stereotypically, take the form of animals, which serve as analogous models to humans. Pavlov and Seligman used dogs, Tolman and Skinner used rats, Thorndike used cars, and Harlow used monkeys. Due to either ethical or practical reasons, these animals act as substitutes for humans because they share fundamental structures and abilities. Animals are not the only models in psychology either. Theoretical models, like the Atkinson-Shiffrin model of memory for example, help us understand what is actually going on inside something as complex as the human brain.

Similarly to the holistic view, a slightly modified semantic view is still compatible with hypothetico-deductivism. Take the case study of Harlow for example. He may have been using monkeys to model human behavior and functioning, but he was still following the hypothetico-deductivist mold. He hypothesized what would happen in select situations, made predictions, and collected data to see if his predictions were supported. The modelling aspect coincides with the experiment itself. The models aid our understanding, but the method used is still a hypothetico-deductive one.

The critical view also can be used in conjunction with hypothetico-deductivism, but it only applies when hypothetico-deductivism is neglected or improperly used. Just like in the last case study, there are times when science seems like an anarchic, politically and socially influenced system. Also, like the case study, this only happens when no other method is being employed. The debate regarding homosexuality was based on personal opinions and ultimately came down to a subjective vote. Unfortunately science does sometimes function without a scientific method, but this certainly does not mean this is the way it should be done. When hypothetico-deductivism was employed by the opposition in the form of Kinsey and Hooker's studies, it guided psychology in the right direction. It helped create a much more accurate depiction of actual human behavior and thought, and informed both the scientific community and public population.

There is no singular view of theories that describes psychology perfectly. Clearly hypothetico-deductivism was applied in nearly all past events in psychology's history, but it is not fair to claim that this is the only view needed to explain entirely how the field operates. Individual parts of the syntactic, holistic, semantic, and critical view of theories are needed to explain different things, like the basic procedures implemented, the existence of different perspectives, the use of models to represent the world, and the occasional lack of methodology to maintain power.

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