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The Mechanics of Scientific Belief

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INTRODUCTION

In "Science: Conjectures and Refutations," Karl Popper establishes a criterion for the scientific character or status of a theory: its falsifiability. And in one move, he turns a host of common scientific postulates—like the Ideal Gas Law, the Law of Conservation of Mass, Newton's First Law, and the Theory of Evolution—into "metaphysical research programs" whose nature renders them impossible to disprove though observable experiment ("Natural Selection and the Emergence of Mind"). According to Popper, the nature of such postulates transcend the physical world; making them just as unfalsifiable as a spiritual power, or a god. In this way, they concern belief rather than reality, and thus he does not deem them scientific because their credibility is predicated on an inherent faith in the theory's accuracy. However, despite Popper's assertion, scientists continue to use these respective laws and theories. And thus, assuming that Popper's claim is valid, what he would call "metaphysical research" permeates science today.

If Popper's division is assumed to be true, what does this mean for science? Does it matter if scientists need to have faith in theories? If a scientist practices science in the same manner that a cleric practices theology, then what separates these two? If a scientific community practices a level of belief, or even faith, does it lose its secular credibility for explaining reality?

In making his criterion for scientific theory, Popper transforms much of modern science into a faith-based system. However, while modern scientific communities may use unfalsifiable beliefs to explain reality, the difference between clerics and scientists lies in the formation and function of their respective unfalsifiable theories. Remarkably, acknowledging scientific belief actually delineates the practice of unfalsifiable science from the practice of theistic religion, illuminating a path to faith-based secular discovery.

FALSIFIABILITY

What is falsifiability? In "Science: Conjectures and Refutations," Karl Popper says: "A theory which is not refutable by any conceivable event is nonscientific. Irrefutability is not a virtue of a theory (as people often think) but a vice" (Popper 7). In addition, he says: "Every genuine test of a

theory is an attempt to falsify it, or to refute it. Testability is falsifiability" (Popper 7). In short, Popper says that whether or not a person can test a theory, and potentially (all theories could *potentially* be disproved) disprove it, determines whether or not it is science. If a person cannot potentially disprove a theory, it is instead metaphysical: It is a belief beyond physical description, or testability, and beyond the scope of what Popper calls 'good' science.

So what type of "scientific" theories would Popper consider beliefs? Take Isaac Newton's first law, for example: "Every body perseveres in its state of rest, or of uniform motion in a right line, unless it is compelled to change that state by forces impressed thereon" ("The Mathematical Principles of Natural Philosophy"). More simply, a body will stay in motion unless acted upon by an outside force. No matter how rigorous the test—it is impossible to disprove this law. Imagine an object in space: If the object moves, a person can say a force (detectable or undetectable) has moved it. If the object stops, a person can say a force (detectable or undetectable) has stopped it. Regardless of how an object behaves, a scientist can explain its behavior in reference to Newton's law. Newton's first law is thus unfalsifiable.

According to Popper, an unfalsifiable theory is as untestable (the research done on theories has the capacity to both prove or disprove the theory) as an omnipotent god. Imagine another object in space: If the object moves, a person can say that God has moved it. If the object stops, a person can say that God has stopped it. Regardless of how an object behaves, a cleric can explain it in reference to a god. Like Newton's first law, God is unfalsifiable. Both, in fact, are beyond physical testability. In order to employ God, a person has to believe that God exists. And, in order to employ Newton's first law, a person has to believe that the law exists.

SCIENCE AND RELIGION

Who are clerics, and who are scientists? For the purpose of comparison, this paper refers to clerics as people who operate under theism; namely the doctrine or belief in the existence of a God or gods. This paper refers to scientists as people who operate under unfalsifiable scientific theories; namely, the doctrine or belief in the existence of a scientific theory or theories (like Isaac Newton's first law). Furthermore—though not every cleric believes in the same god, nor every scientist in the same theory—this paper uses the title religious community to denote a group of clerics who believe in the same God or gods, and uses the title scientific community to denote a group of scientists who believe in the same theory or theories. Reference to any further religious terms (i.e. layperson, prophet, clergy) extrapolate from the definition of cleric and religious community above, in order to provide a frame of reference for

their scientific counterparts, and to diagram the mechanics of scientific belief. This comparison realizes that neither science nor religion is a monolithic institution. Both contain a diverse and nuanced culture, outside the scope of this paper to aptly classify. Keeping this nuance in mind, the following comparisons between science and religion serve only the sects of each that subscribe to unfalsifiable belief. And if examples do call on the larger body of science or religion, it is only in an attempt to discover the respective scientific or religious tools at each communities' disposal when working with theory or belief.

FAITH-BASED SYSTEMS

A faith-based system refers to a group, whether religious or scientific, that operates under theism or unfalsifiable scientific theories. Given Popper's criterion, a scientific community may resemble a religious community, in basis and in structure, as observers of a particular belief or set of beliefs.

A religious community of clerics believes information about God. Clerics cannot falsify their beliefs about God, and thus, like Newton, their theories fall outside of Popper's criterion. Ignoring Popper, pious clerics devote their lives to scriptures that hinge on these very unfalsifiable theories. They then communicate their ideas to other clerics or laypeople within their religion. Not quite as immersed, laypeople also consult scripture, but perhaps more sporadically as a basic foundation for how to live. In order to enact change, a religious community may use prophets (like Jesus or Buddha). These prophets might think differently than everyone else initially, but eventually turn the course of communal belief. And to safeguard against too much change, clerics can employ dogma. Take the prophet Jesus for example: though Jesus' ideas serve as the foundation for one of the largest religions today—his contemporary clerics employed dogma to reject his then "radical" religious ideas and prevent change of their established religious traditions (Zeitlin 9).

A scientific community that ascribes to unfalsifiable theories believes set information about the universe. Like clerics, scientists devote their time to theories. Scientists interpret mainstream scientific beliefs, and then convey their ideas to common people, or students, who might not concern themselves with the theory as much as the scientists. In fact, these common people, or students of science, might consult scientists' unfalsifiable theories about as much as a layperson might consult a religious scripture.

In order to enact change, a scientific community may employ paradigm shifters. In comparison to a religious prophet, a scientific community can use what Thomas S. Kuhn might call a “scientific revolutionary”, someone who operates outside of the currently accepted scientific paradigm (Kuhn 53). These are innovators like Newton or Albert

Einstein, who fundamentally change the course of scientific theory. Similar to religion's safeguard against too much change, science may also use dogma to maintain standards and protect agreed upon knowledge. In conjunction with a critical method, Popper deems dogma essential to science: "this dogmatism allows us to approach a good theory in stages, by way of approximations: if we accept defeat too easily, we may prevent ourselves from finding that we were very nearly right" (Popper 24). Imagine a fellow sixteenth- century astronomer reading Galileo's work for the first time, or an established twentieth-century physicist first reading Einstein's theory of special relativity. In each case, these ideas will be met with dogmatic resistance and loyalty to established ideas, showing even scientists operating under falsifiable theories hold tightly to traditional models before adopting new ones.

So if scientists use "metaphysical research programs" much like a clergy might use scripture, why would a secular person rely on science and not religion? Since scientists believe in theories about the universe—like clerics may believe in God—are they void of a secular method to describe the universe? The answer is no. And the difference between scientists and clerics lies in the mechanics of their respective unfalsifiable theories and in their formation and their function.

THE MECHANISM OF SCIENTIFIC BELIEF

In the formation of a religious theory, clerics often take on a passive role in relation to God. For example, though religious communities (sometimes) allow for clerics to ask questions about God, the clerics have to wait on God for a response. In a religious pursuit of knowledge about the world, clerics might question the universe in the form of prayer. It is God's universe after all, so as humans they respect his knowledge on the subject and wait for revelation. In this respect, clerics acting with interrogative forms of prayer—for example, Why does the earth move around the sun, God?—need a response (or what they may interpret as a legitimate response) in order to answer their question. Therefore, in their pursuit of knowledge, God is the active party and they are passive. God creates knowledge, and they receive it. In such communities where an omnipotent god holds the key to knowledge, if God wants to hide or withhold ideas, humans can do little to stop God. In addition, if new human experience contrasts with existing religious theory, clerics have to wait for God to modify that theory. Their experience requires approval from God before it can contribute to religious theory. This method of passive inquiry is in keeping with many religious communities' prophets, who in turn do not discover new theories or beliefs, but rather reveal new beliefs through their dialogue with God.

In the formation of scientific theory, scientists take on an active

role relation to the universe. Concerning modern science, Popper says: "we actively try to impose regularities upon the world. We try to discover similarities in it, and to interpret it in terms of laws invented by us" (Popper 19). Scientists question the universe, like clerics do God. But in contrast to religion, their answers do not hinge on the response from an elusive divine power. Instead of waiting for the universe, or a prophet to speak to them, scientists impose tests, or devise mathematical language to decode the mysterious aspects of the universe themselves. Even in a hypothesis test—a method of inquiry that might seem to hinge on passive waiting— scientists are active: they arrange a time and a place in which they expect to see a reaction from the universe, the subject of their test.

What about uncertainty concerning a theory? In contrast to religion, if a theory is unfalsifiable, scientists do not have to fatalistically accept that God will give them information in the future. Instead, a scientist can accept the current boundaries of human comprehension; or trust that, someday, thanks to subsequent human progress, he or she may understand the theory enough to render it falsifiable. Consequently, pertaining to prophets, scientific paradigm shifters —like Charles Darwin, Newton, and Einstein—do not reveal theories, or pass them on from universe-dialogue. Rather, they engage in dialogue with other humans or their own minds to discover theories, even unfalsifiable ones, which they then choose to believe.

Though Popper might say, "It is easy to obtain confirmations, or verifications, for nearly every theory—if we look for confirmations", both scientists and clerics do look for evidence to support their respective unfalsifiable theories (Popper 7). They distinguish themselves from one another in the ways they compare evidence: while a religious community may allow evidence to come in the form of private experience, a scientific community requires that evidence come in the form of public, measurable experience. In a religious community, members share experiences with each other. And they often share these experiences with other members in their religious communities to support their common beliefs. What distinguishes a religious community, however, is that the community may allow for private, immeasurable experience to contribute to the body of evidence supporting a religious theory. In such a community, if a religious theory does rest on private experience, new evidence concerning that belief may have a muted effect within the community. For example, consider a hypothetical cleric named Joseph. In a religious community, Joseph has a private experience that captures God's attitude toward hedonism, and this experience has a profound effect on Joseph's beliefs. Even after a vivid description of his experience, his fellow clerics may remain privately unfazed by his retelling. How do Joseph's fellow clerics reconcile their own theory of God's attitude toward hedonism with his? If Joseph's experience contradicts their established

theory, they can easily decide that their private experience trump's Joseph's. In turn, the rest of the clergy can keep on believing as they did before. Joseph's evidence may be forgotten. And the religious communities' communal theory about hedonism can remain mostly unaltered.

The immeasurability of religious accounts makes evidence difficult to communicate. At the present time, religions lack a mathematical standard for religious experience, a miracle- meter, or God-o-meter, which would help them communicate evidence about common beliefs. If they did possess such a tool, clerics who witnessed God's attitude toward hedonism would be able to inform the rest of the group (of perhaps a seven on their God-o-meter); thereby making a meaningful contribution to religious theory, and, most importantly, changing the relationship of their fellow members to their God. Contrary to clerics, scientists stress the measurement of evidence in their community. Unlike religious theory, scientific theory rests on public, measurable evidence in the form of observable facts which inform theories. Scientists also share experiences, like clerics, but if a scientist has a private experience and wants it to contribute to scientific theory, she has to present measurable evidence for the rest of her fellow scientists to witness. Only then will scientists appreciate her evidence and will her account contribute to the public store of data that informs a theory. For example, a scientist may collect facts that contribute to the Theory of Evolution. These observable facts may not make the Theory of Evolution any less unfalsifiable, as Popper would note, but say a scientist notes genetic mutations in a thousand of the same species and sees that a specific mutation proliferates more each year. His raw numerical data would allow other scientists to measure the change in gene prevalence along with him and, subsequently, transform his enterprise from a private to a public one—all without compromising his initial experience. It is exactly this transfer of information that differs most from religious evidence. Within a scientific community, even one seemingly inconsequential scientist's measurable evidence can inform a theory for all scientists—and thus change the relationship of the other scientists to the universe.

In addition to science's preoccupation with measurement, the function of scientific theory differs from that of religious theory. A religious belief often concerns itself with governance, while a scientific belief concerns itself with description. A theory in a religious community often governs. In this respect the metaphor of a law fits well. Clerics might believe that God makes laws for their world, and these metaphysical laws can manifest themselves within the community in the form of physical rules. These rules may control laypersons, and dictate the behavior of God as well. For example, in a house of worship, be it a chapel, mosque, or synagogue, clerical theories about God's clothing preference often form dress codes. People in the religious community

then follow the dress codes—and, in turn, represent their belief making a physical law: their belief enforcing standards on reality.

Religious beliefs also make rules that shape God's behavior. Consider Keith Ward's discussion of divine acts in The Big Questions in Science and Religion. He says that many divine acts have to "surpass nature's regularities" in order for a religious person to consider them Godly (Ward 246). Consider a religious community living in Hawaii: If the community experiences a light rainstorm, clerics will probably think little of it. However, if the same community experiences a massive hurricane that sweeps through the islands and tears down homes, clerics may very well attribute the storm to an act, whether good or bad, of divinity. Because the latter experience broke certain "natural regularities," this weather then takes on the label of divine, or supernatural. This type of theory illustrates religious convictions' preoccupation for governance. Beliefs make rules. And, in this case, if a god wants to act in the universe, he or she has to break those rules.

Rather than governing, a theory of science describes. In this respect the metaphor of a law is misleading. Once again take Newton, the quintessential "lawmaker," but note the diction in his first law. He says, "Every body perseveres in its state of rest, or of uniform motion in a right line, unless it is compelled to change that state by forces impressed thereon ("The Mathematical Principles of Natural Philosophy"). Upon close examination, Newton's theory does not dictate nature or the universe in any way. He does not say that every body must persevere, or else it goes to a universe prison. His belief outlines nature and the manner in which it seems to act. This descriptive rather than judicial quality highlights a reoccurring distinction between scientists and clerics. Imagine a synagogue, for example, full of people on the Shabbat. A clerical belief may very well dictate: God's law necessitates that here men wear their yarmulkes. However, in the same scenario, a scientific belief would only describe: on Saturdays, men fill this place and wear yarmulkes. Here, the scientist's theory does not make a rule for the physical world, though the cleric's does.

The same principle of description applies to Popper's metaphysical research programs. Popper contrasts Darwin's descriptive theory with a religious alternative in "Natural Selection and the Emergence of Mind." In a religious theory, Popper says: "It is the Creator who, by His design, molds matter, and instructs it which shape to take" ("Natural Selection and the Emergence of Mind"). In contrast, Darwin's theory does not instruct animal life. When Darwin coined the term "Survival of the Fittest," nature did not start to behave any differently. Darwin may have changed the human perception of nature—but Darwin's theory placed no rule on the natural world. Nature carried on, and animals continued to reproduce in the same patterns they had for centuries.

CONCLUSION

In making his criterion for scientific theory, Karl Popper transforms much of modern science into a faith-based system. And much of theistic religion also operates as a faith-based system. At first glance, therefore, Popper renders scientific theory similar to mysterious, theistic religious belief. However, by acknowledging the underpinning mechanics of scientific belief, the practice of unfalsifiable science distinguishes itself from the practice of theistic religion. In contrast with the passive, private, and dictatorial theories manifested in veins of theistic religion —faith-based, unfalsifiable science devotes itself to active, measurable, and descriptive theory. A scientific theory may therefore, superficially, resemble theism, but still direct a course for wholly secular discovery, preserving some separation between the two schools of unfalsifiable belief.

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